DETAIL PROJECT REPORT

VISHWAKARMA YOJNA: VIII

AN APPROACH TOWARDS RURBANISATION

Derdi Kumbhaji: Village

Rajkot: District

PREPARED BY

STUDENT NAME	BRANCH NAME	ENROLLMENT NO
Hirapara Krutik	Civil Engineering	180893106019
Padmani Maharshi	Civil engineering	180893106037
Nakum Chirag	Electrical Engineering	180893109038

Shri Labhubhai Trivedi Institute
of Engineering & Technology
Kalavad Road, Rajkot.

Prof. Mehul M. Chavda
Assistant Professor
Dept. of Civil Engineering

YEAR: 2020-21

GUJARAT TECHNOLOGICAL UNIVERSITY
Chandkheda, Ahmedabad – 382424 Gujarat

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ON

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Chandkheda, Ahmedabad – 382424 Gujarat

CERTIFICATE

This is to certify that the following students of Degree Engineering successfully submitted

Detail Project Report for,

VILLAGE: DERDI KUMBHAJI
DISTRICT: RAJKOT

Under

Vishwakarma Yojana: Phase-VIII

In partial fulfillment of the project offered by

GUJARAT TECHNOLOGICAL UNIVERSITY, CHANDKHEDA

During the academic year 2020-21

This project work has been carried out by them under our supervision and guidance.

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Hirapara Krutik	Civil Engineering	180893106019
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Nakum Chirag	Electrical Engineering	180893109038

Date of Report Submission:	
Principal Name and Signature:	**Prof. Dr. B.M. Ramani**
VY-Nodal Officer Name and Signature:	**Assi. Prof. Mehul M. Chavda**
Internal(Evaluator) Guide Name and Signature:	**Assi. Prof. Mehul M. Chavda**
College Name:	**Shri Labhubhai Trivedi Institute of Engineering and Technology**
College Stamp:	

ABSTRACT

Vishwakarma Yojana provides special scheme for development of village by GTU and Government of Gujarat in which students and faculty members work together and collect data And information regards village development with the help of gram panchayat and stake holders. Village have some basic facilities likes drinking water, drainage system, pucca road, and other Facilities like primary school, primary health centre, community hall, library, public latrine Block, are sufficient so that village can develop. So we will give proposal regarding sustainable Energy sources and solution related to infrastructure problems. Efforts have been made in this Project work to identify and plan some of the above facilities for sustainable development of Village and to meet need of future population.

The major population of our country is living in villages. Which is around 833.1 million. In India major group of people in village is farmer and very few other group. Some essentials and market centers are not near by the village and some basic facilities are also not there. Arable land is one of the major reason why they cannot go city for permanent base.

Vishwakarma Yojana gives us a chance to show our gratitude to our nation development with the help of our knowledge and guidance by our professor we can give some basic important amenities which are not available in village like library, solid west management drinking water etc.

According to Census 2011 information the location code or village code of Derdi Kumbhaji village is 513270. Derdi Kumbhaji village is located in Gondal Tehsil of Rajkot district in Gujarat, India. It is situated 30km away from sub-district headquarter Gondal and 72km away from district headquarter Rajkot. As per 2009 stats, Derdi village is also a gram panchayat. The total geographical area of village is 3169.64 hectares. Derdi Kumbhaji has a total population of 8,450 peoples. There are about 1,770 houses in Derdi Kumbhaji village. Gondal is nearest town to Derdi Kumbhaji which is approximately 30km away.

The existing condition of village is adequate main source of drinking water like tap water, well, bore well etc. To serve water in entire village it has one water tank with sufficient capacity. It has quit good condition closed drainage system and good condition road network.

For village development we design for public facilities are like public toilet and garden, Public Health Centre, Community hall, Public library, Transport system etc.

For future development of village we will give best design of public facilities for villagers.

Keyword: Primary school, Library, Public toilet, overhead water tank, Road network, Transportation system, Irrigation system.

ACKNOWLEDGEMENT

We are highly indented to **Gujarat Technological University**, Ahmedabad for providing us such opportunity to work under Vishwakarma Yojana to get real work experience and applying our technical knowledge in the development of Villages.

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ABBREVIATIONS

SHORT NAME / SYMBOL	FULL NAME
PHC	Primary Health Care
PMGSY	Pradhan Mantri Gram Sadhak Yojana
IRDP	Integrated Rural Development Programs
NREP	National Rural Employment Program
JRY	Jawahar Rozgar Yojana
NIRD	National Institute of Rural Development
HVAC	Heating Ventilation and Air conditioning systems
ICT	Information and Communications Technology
ULB	Urban Local Bodies
UDA	Urban Development Authority.
MSBT	Multi Stage Biological Treatment Solution
MOUD	Mission of Ministry of Urban Development
SCP	Smart City Proposal
EIA	Environmental impact Assessment
GNP	Growth National Product

Chapter: 1
As ideal village we visit Shapar
Dist.: Rajkot

1.1 Background and study area location

AS a part of our project to understand the facilities and necessity required in our allocated village we have to compare our village with ideal village. By comparing both village we can identify the lack of facilities in our allocated village. We collect the data regarding village condition, population, for Techno-Economic survey, transportation facilities, etc.

(Fig-1 Location of ideal village)

We visit the ideal village SHAPAR which is near to Rajkot district. The distance of shapar from Rajkot district is about 16 Kilometre. As per census 2011, it has over 2,602 houses and has a population of 9263. Out of which 5430 are male and 3891 are females. It has literacy rate of 78.23%. Which is situated 18 km from our collage Labhubhai Trivedi institute of engineering and technology. Election are held in village in every 5 years to select ward representative. Population of Children with age of 0-6 is 1164 which is 12.59 % of total population of Shapar (CT). In Shapar Census Town, Female Sex Ratio is of 703 against state average of 919. Moreover Child Sex Ratio in Shapar is around 899 compared to Gujarat state average of 890. Literacy rate of Shapar city is 78.28 % higher than state average of 78.03 %. In Shapar, Male literacy is around 82.73 % while female literacy rate is 71.73 %. The area of village is approximate 3835 Hector. All decision which is for progress of shapar was taken government body, in village it is called grampanchyat. The village progress is fast than other village because the industrialization of Rajkot district nearby shapar. Village has pacca road. Good transportation system.

Shapar Census Town has total administration over 2,602 houses to which it supplies basic amenities like water and sewerage. It is also authorize to build roads within Census Town limits and impose taxes on properties coming under its jurisdiction.

SHAPAR VILLAGE

Coordinates	22.158439, 70.797764
Country	India
State	Gujarat
District	Rajkot
Talukas	Kotda Sanghani
Government Body	Shapar Gram Panchayat
Population 2011 / 2001	9263 / 2786
Languages	Gujarati, Hindi
Time zone	IST (UTC+5:30)
Elevation	196
Telephone code	02827

1.2 Concept: Ideal Village, Normal Village

An ideal village has almost all the facilities and sanitation. It shall have houses with good lightening and enough spaces for people that that live in the house. As an ideal village it has grampanchyat for village development and administration. It shall have facilities for at least secondary education. It shall contain all necessary Health facilities. For children it shall have child health care center. For villagers it shall have Primary Health Care center. There is also facilities for pregnant women. It shall have good water supply system with good and drinkable quality water. It shall also have to good sanitary and system. Street are not weather or in rough condition. Village shall be connected to nearest city or taluka with good transportation facilities.

1.2.1 Objective

⇒ To improve standard of living of rural area people and educate them for new technology.
⇒ Provide basic amenities for healthy life.
⇒ Connect village with urban area for social as well as economical development.
⇒ Prevent distress migration from rural to urban areas, which is a common phenomenon in India's villages due to lack of opportunities and facilities that guarantee a suitable standard of living.
⇒ Basic Social Infrastructure – Health and Education facilities should be provided and ensure proper delivery of facilities to village dwellers.

1.2.2 Example/Live Case studies of ideal village of Gujarat

Shapar village is very close to the Rajkot district due to that transportation facilities in shapar are very good. NH27 is passing through shapar. Shapar has industial hub for Rajkot city. There is a GIDC that located in shapar which is of Rajkot district. Due to nearest to Rajkot and gidc at shapr its progress is very impressive in last few months. Geetaben dharmendrabhai Tilala is the currently serpanch of Shapar. P. L. Vasoya is the tlati mantri of the Shapar village. Shapar has primary school with good and workable condition. Shapar has street light, drinkable water at good condition. Streets road are of concrete and at workable condition. Every house in shapar has toilet at their home. Every house in shapar has toilet at their home. Shapar has 24/7 electricity for all houses and government buildings. Shapar has good transportation facilities, has panchayat building and has post office also. It has a population of 9263. There are 2602 houses in village (2011). Out of which 5430 are male and 3891 are females. It has literacy rate of 78.23%. Which is situated 18 km from our collage Labhubhai Trivedi institute of engineering and technology. In Shapar Census Town, Female Sex Ratio is of 703 against state average of 919. Literacy rate of Shapar city is 78.28 % higher than state average of 78.03 %. In Shapar, Male literacy is around 82.73 % while female literacy rate is 71.73 %. The area of village is approximate 3835 Hector. All decision which is for progress of shapar was taken government body, in village it is called grampanchyat.

(Fig-2 Interaction with Ideal village Tlatikam Mantri)

The village progress is fast than other village because the industrialization of Rajkot district nearby shapar. Village has pacca road. Good transportation system.

1.2.3 The Idea of a Smart Village

In a way, Mahatma Gandhi conceptualized smart villages. A champion of participatory democracy and grassroots development, he believed that making villages self-contained and sustainable was the first step towards empowering India. Contrary to popular belief, he wasn't against industrialization, markets and competition as long as they did not lead to the passive or active exploitation of villagers. Yet, seven decades after independence, we are nowhere close to realizing Gandhi's vision of empowered villages. Rural India remains in a deplorable state. One reason for this is institutional neglect. While the phrase 'Smart Village' has become a buzzword in policy and rural development discussion, there is no universal definition of such villages. Two things that are common to all Smart Villages are the extensive use of technology and integration of several key interventions in infrastructure and service delivery. It's an integrated approach of delivering access to skills and quality basic services including education, e-health, 24x7 power, and safe food, among others. There are numerous initiatives supported by the government, and spearheaded and supported by corporate social responsibility (CSR) initiatives and philanthropic institutions.

(Fig-3 smart village)

The Government of India launched the Shyama Prasad Mukherji Rurban Mission (SPMRM) in 2016, with the objective to spur social, economic and infrastructural development in rural areas. The mission aims at making villages smart and growth centers of the nation. In its first phase, it targeted to develop a cluster of 300 Smart Villages over the next three years across the country. Sansad Adarsh *Gram Yojana*, which envisages integrated development of selected villages was another step taken by government in this direction.

While the government-led initiatives rely on integration and convergence of the existing central and state government schemes to develop these Smart Villages or clusters, the CSR initiatives are generally more innovative in terms of implementation and use of technologies. For example, smartphone-maker Nokia has launched a Smartpur project which aims to create a sustainable ecosystem where community members can leverage digital tools to bring efficiency in daily lives. It aims to bring transparency in governance, economic prosperity for households and ease of access to various government services and information.

We suggest learning from the Smart Cities mission, but we also caution that these learnings must be contextualised and synthesised, as Smart Villages are very different from Smart Cities. The latter are more focused on increasing the overall efficiency and improvement in civic infrastructure, while Smart Villages envisage the need of building the facilities from scratch. One of the key challenges in developing Smart Villages is ensuring their sustainability. This can only be addressed if we build our Smart Village strategy with entrepreneurship at its core. Thankfully, India has one of the most vibrant entrepreneurial ecosystem that is working towards addressing rural development challenges using innovative technologies and business models.

⇒ Smart Village refers to a concept developed in rural area that provides solutions to problems occurred and improves the quality of life.

⇒ The 'smart village' is a model in which, energy access acts as a catalyst for a range of development outcomes. If managed correctly, technology 'leapfrogging' could lead to rapid improvements in healthcare, nutrition, education, and economic security.

⇒ According to Mahatma Gandhi's philosophy and thoughts smart village project provides, "Global means to the local needs."

1.2.4 Ancient History Civil / Electrical concept about Indian Village / other Countries Perspective about village and its new Development

India is a vast country with a majority of its total population living in the villages. The Indian society is predominantly divided into two divisions like the rural society and the urban society. Villages have always been an integral part of society in India. No specific timeframe can be mentioned about the conception of villages in India. However, the concept of village was not present there in the ancient period. The Indus Valley civilisation is so far known to be the ancient civilisation in India and it mainly comprised two cities of Harappa and Mohenjodaro. However, the concept of village seems to be absent during this era. The history of Indian villages, in fact, goes back to the Vedic era when the kingdoms comprised a major city and several villages. The villages were a cluster of houses and the surrounding land was cultivated by the villagers. The concept of villages in India flourished during the late Vedic era or during the reign of the Mauryas. The Maurya Dynasty was founded by Chandragupta Maurya during 323 BC and the villages were a predominant part of the Indian social system at that time. The villages were administered in a structured way, through a Gram Sabha during the Maurya Dynasty. The religious and cultural scenario of the villages was primarily dominated by the Hindus, especially the Brahmans. The caste system of Hinduism was strictly maintained during that period.

Structure of Indian Village System

However, the social structure of the Indian villages changed drastically during the reign of Muslim emperors like the Mughals or Afghans. This period in the history of Indian villages saw the villagers being influenced by Islam and the equality for religious practice, among all parts of the society was also maintained. During the British period, the Indian villagers got influenced by the Christian religious culture and a rich diversity of several religions was seen during that period. The social structure in the Indian villages also changed accordingly with the change of religious and cultural scenarios.

⇒ Civil engineering is a professional engineering discipline that deals with the design, construction, and maintenance of the physical and naturally built environment, including public works such as roads, bridges, canals, dams, airports, sewerage systems, pipelines, structural components of buildings, and railways.

⇒ The earliest practice of civil engineering may have commenced between 4000 and 2000 BC in ancient Egypt, the Indus Valley Civilization, and Mesopotamia (ancient Iraq) when humans started to abandon a nomadic existence, creating a need for the construction of shelter.

1. Smart security.	7. Functional bank account.
2.Efficient public transportation system.	8. Facilities regarding to the agriculture.

3. Improving sanitation conditions
4. Solid and liquid waste management.
5. Safe drinking water facilities.
6. Energy conservation.
9. E-governance.
10. Use of modern technologies for improvement of locality.
11. Educational facilities.

1.3 Detail study (Socio economic, Physical, demographic and infrastructure details) of Ideal village SHAPAR with photograph

- **Socio economic**

⇒ Shapar has vary near to Rajkot so that nearby shapar there are many industrial activity and part of that shapar has good economic growth.

⇒ Shapar has population 9263. Out of which 5430 are male and 3891 are females. It has literacy rate of 78.23%.

⇒ Population of Children with age of 0-6 is 1164 which is 12.59 % of total population of Shapar (CT). In Shapar Census Town, Female Sex Ratio is of 703 against state average of 919. Moreover Child Sex Ratio in Shapar is around 899 compared to Gujarat state average of 890. Literacy rate of Shapar city is 78.28 % higher than state average of 78.03 %.

⇒ People of shapar has easy to find work within they area.

⇒ Due to many industries at shapar transportation facilities are also good.

⇒ Major public work in shapar has stay in good society's labors also have good facilities for living.

- **Physical and demographic**

Sr. no.	Description	Information/Details	Unit
1	Area of village	1551.969	Hector
2	Total irrigation area	444	Hector
3	Major occupation group	Industries, Farmers	-
4	Total population	9263	-
5	Male	5437	-
6	Female	3826	-
7	Total no. of household	2370	-

(Table-1 Physical &demographic detail)

- **Infrastructure**

⇒ Panchayat building with two small offices.

⇒ One child health centre (CHC).

⇒ One post office and milk co-operative society.

⇒ Government authorized school building.

⇒ 100% village houses in pakka with personal toilet.

⇒ CCTV camera and Announcement system.

⇒ Bank, ATM, Pharmacy and medical shops, Small scale industries.

1.4 SWOT analysis of Ideal village

SWOT stands for Strengths, Weaknesses, Opportunities, and Threats. Strengths and weaknesses are internal to your company—things that you have some control over and can change. Examples include who is on your team, your patents and intellectual property, and your location.

Opportunities and threats are external—things that are going on outside your company, in the larger market. You can take advantage of opportunities and protect against threats, but you can't change them. Examples include competitors, prices of raw materials, and customer shopping trends. A SWOT analysis organizes your top strengths, weaknesses, opportunities, and threats into an organized list and is usually presented in a simple two-by-two grid.

Positive	Negative
Strength ⇒ Education facilities ⇒ Good roads ⇒ Good transportation system ⇒ Street lights	**Weakness** ⇒ Partial water logging ⇒ Maintenance is not periodically ⇒ Socio-cultural activities ⇒ Health facilities
Opportunities ⇒ Disposal of different waste ⇒ Green infrastructure ⇒ Traffic control ⇒ Solar street light	**Threats** ⇒ Pollution ⇒ Less sustainable development

(Table-2 SWOT analysis)

1.5 Future prospects of Development of the Ideal village

⇒ Green and sustainable development
⇒ Improvement of some facilities like, Drainage, waste management.
⇒ Repair and maintenance of existing facilities.
⇒ Improve and maintenance health and educational facilities.
⇒ Use of renewable energy.
⇒ We gave some suggestion for built new facilities like, Biogas Plant, Cold storage, etc.

1.6 Benefits of the visits of Ideal village

⇒ We learn to differentiate different facilities according to their importance.
⇒ Identify different aspect of development of allocated village.
⇒ Improve our communication skill.
⇒ Different Yojana that are working in the village.

1.7 Electrical / Civil aspects required in Ideal village

⇒ For rural energy supply and management, the element of 'smart' refers to creation and management of mini, micro and Nano grids within the energy eco-system of a village or a group of villages. It is particularly relevant to rural areas with no or unreliable grid connectivity. These micro / Nano grids bring in the element of self-reliance in energy for rural community and create a possibility of giving back the surplus to the grid. Developing a village with this approach can usher in a new developmental model.

⇒ The vision for a smart village revolves around energy security. Energy is the golden thread that connects economic growth, increased social equity, and an environment that allows the planet to thrive.

⇒ We find not such big civil aspect but as per villagers some maintenance work are needed in public building, community hall. And some new facilities are suggested by villagers are Biogas plant, any recreational facilities and cold storage.

Chapter: 2
Literature Review

2.1 Introduction: Urban & Rural village concept

- **Urban village concept**

The term "Urban Village" is currently being used by developers, governments, and the planning profession to describe a new patterning of human settlement. This paper will review the manner in which the concept "Urban Village" is being employed, will come to suggest that developers, governments, and planners are moving in the right direction but are not going far enough, and will finally propose the characteristics and qualities of a version of "Urban Village" that is a genuine synergy of ecology and urbanism.

Urban villages in Indian cities are urbanized villages, that is, original villages that have conformed themselves to the urbanization around them. In India, they are existing pockets of old villages that have gotten cramped among the rapidly rising city around them. They largely lack basic civic services such as roads, water and sanitation and new construction is mostly haphazard as a result of flouted planning norms. These places have come into being when the surrounding agricultural and farm lands that were once the principal source of livelihood were sold or taken away for urban development. Some village dwellings and 'villagers' continued to stay in these new urban villages by engineering ways of livelihoods in their new urban milieu.

1. Small and intimate

⇒ The area can comfortably be covered on foot
⇒ The scale of the buildings and spaces is suitable and comfortable
⇒ The residential density can sustain a range of key services

2. Unique

Spatial identity and Traditions and collective memory
⇒ The area has defined boundaries and an identifiable center
⇒ The area has its own atmosphere and sense of place
⇒ There are community landmarks
⇒ There are regular community events and festivals
⇒ Residents create collective memory

3. Designed for social interaction

⇒ There is ample public and green space, which is used in many ways
⇒ Facilities are provided for community events and everyday activities
⇒ The central hub generates social interaction, and there is a network of walkable routes

4. locally driven and locally responsive

⇒ Residents are involved in managing the life of the village
⇒ There is a long-term vision that residents support
⇒ Leaders represent the community and reflect its concerns

5. Functional

⇒ The community is well served by both public and private transport
⇒ Core services are available locally
⇒ There is a mix of uses

6. A mixed community

⇒ There is a mix of ages, backgrounds, incomes and housing tenures
⇒ Residents know and trust each other
⇒ There are long-term residents who provide continuity.

An urban area or urban agglomeration is a human settlement with high population density and infrastructure of built environment. Urban areas are created through urbanization and are categorized by urban morphology as cities, towns, conurbations or suburbs. For the Census of India 2011, the definition of urban area is a place having a minimum population of 5,000 of density 400 persons per square kilometre (1,000/sq. mi) or higher.Urban areas are created through urbanization and are categorized by urban morphology as cities, towns, conurbations or suburbs.

- **Rural village concept**

Rural areas are also known as the 'countryside' or a 'village' in India. It has a very low population density. In rural areas, agriculture is the chief source of livelihood along with fishing, cottage industries, pottery etc.

According to the Planning Commission, a town with a maximum population of 15,000 is considered rural in nature. The quest to discover the real rural India still continues in great earnest. Almost every economic agency today has a definition of rural India.

⇒ Rural is noticeably agricultural, its settlement system consists of villages or homesteads Socially it signifies greater inter dependence among people, more deeply rooted community life and a slow moving rhythm of life built around nature and natural phenomenon; and occupationally it is highly dependent on crop farming, animal enterprises, tree crops and Related activities.
⇒ A minimum of 75% of male working population involved in agriculture and allied activities.
⇒ An area with a population density of up to 400 per square kilometer.

2.2 Importance of the Rural development

Concept of Rural Development

The concept of rural development is a comprehensive aspect, which takes into consideration, number of factors. This term is used to mean organizing things, which bring about changes in the existing conditions in favor of a better state. For several decades, the concept of rural development focused solely upon economic change. But at a later stage, the concept got extended to take into account, economic, political, social, cultural, technological and psychological frame of the society. In other words, when focusing upon rural development, it not just takes into consideration, the development of rural infrastructure, individuals and their overall living conditions, but it focuses upon the development of social, economic, political, cultural, technical and religious aspects as well. In promoting development of these aspects, it is vital to put into operation, modern and innovative strategies, methods and approaches that are considered essential in augmenting progress in the overall quality of life of the individuals. In addition, individuals should be trained in terms of usage of technology to bring about technical progress.

The term ‘rural development’ is of major concern, particularly when one is focused upon promoting effective growth and development of the country. In India, rural areas are still in a backward state and number of programs and schemes need to be formulated to bring about improvements. The term ‘rural development’ can be used in a divergent state. As a concept, it can promote overall development of rural areas. It has been acknowledged on a comprehensive basis that improvements in the overall quality of life of the rural individuals can lead to augmentation of rural communities. Apart from enhancing the overall quality of lives of the individuals, the other areas that need to be taken into consideration are, agriculture, farming practices, industries, factories, craftsmanship, skills and abilities of the artisans, health care facilities, medical centers, socio-economic infrastructure, and financial and human resources. Development primarily takes place, when there is interaction between various physical, technological, economic, socio-cultural and institutional factors. It is necessary for rural individuals to generate awareness and put into practice the measures that would promote effective growth and development.

Rural development is a strategy to enable a specific group of individuals to acquire opportunities for themselves for the purpose of sustaining better livelihoods for themselves and their families. The poverty stricken and underprivileged sections of the society cannot accomplish their desired goals and objectives on their own. They do need help and support from other individuals, organizations, agencies and programs. Hence, making provision of assistance to rural individuals to bring about improvements in their living conditions and in the promotion of welfare and goodwill is regarded as rural development. When improvements need to be made in rural areas, it is essential to develop and utilize natural and human resources, technologies, infrastructural facilities, institutions and organizations, and government policies and programs. These aspects are wholeheartedly dedicated towards promoting economic growth, employment opportunities, education, technical knowledge, participation in social, economic, political, cultural and religious activities and bringing about transformations in the overall quality of life. Alleviation of the conditions of poverty is an important concern. For this purpose, it is essential for the farmers and agricultural laborers to possess adequate knowledge and information in terms of usage of modern and innovative strategies and methods in agricultural and farming practices.

Approaches to Rural Development

There are not any universally accepted approaches to rural development. It is a choice that is influenced by time, space and culture. Rural development is a comprehensive and a multi-dimensional concept. In rural areas, there are number of aspects, which need to be improved. These include, agriculture, small-scale industries, village and cottage industries, community resources and facilities and above all the living conditions of the rural individuals. In the Indian framework, the development of rural areas promotes the production of the agricultural sector. Research has indicated that farmers and agricultural laborers are in a deprived state and experiencing problems in the adequate sustenance of their living conditions. Hence, number of programs and schemes need to be introduced to generate awareness among them in terms of modern and innovative strategies and methods that would augment productivity and profitability.

The main purpose of approaches to rural development are to acquire information in terms of the programs and schemes that have been initiated. Since 1951, there have been formulation of approaches, with the main purpose of bringing about development of rural areas. The main areas that have been taken into account, are, rural prosperity, equality and employment of rural individuals.

⇒ Rural development involves the building of human life, which includes social, cultural, religious, political and economic conditions.
⇒ The basic needs approach gives primacy to the needs for a minimum standard of living of the poverty stricken individuals, as a major concern for development planning.
⇒ The main objective of this approach was focused upon the removal of unemployment, and poverty, through sectorial and area integration.

➢ **Programs Initiated by the Government for Rural Development**

⇒ Pradhan Mantri Gram Sadhak Yojana (PMGSY)
⇒ Swaranjayanti Gram Swarozgar Yojana (SGSY)
⇒ Rural Housing (Indira Awaas Yojana)
⇒ DRDA Schemes
⇒ Training Schemes
⇒ Integrated Rural Development Programs (IRDP)
⇒ National Rural Employment Program (NREP)
⇒ Jawahar Rozgar Yojana (JRY)

2.3 Ancient Villages / Different Definition of: Rural Urban Villages

Village Community in Ancient India

According to Apastamba Dharma Sutra, state officials (Adhyaksas or Adhipals) were to be appointed by the kings for towns and villages with well-defined jurisdictions. In Visnu Smrti, it is written that a chain of officials is to be placed by the king in charge of 1, 10, and 100 villages as well as of the whole rural area. According to Kautilya, three tiers of officials were to be in charge of the rural as well as the urban areas. The Samaharta or the Pradesta was in charge of the janpada or the rural area. Each of its four divisions was entrusted to a Sthanika, and units of five or ten villages were in charge of Gopas.

The officers were primarily concerned with the protection of the lives and property of the subjects. The officer of lower rank was required to report to his superior officer if he failed in the tasks assigned to him. Kautilya reports that the officers were individually responsible for protecting people’s lives, maintaining records of revenues, dues and remissions, and deciding civil and criminal suits at the headquarters of ten, four hundred, and eight hundred villages.

According to the Dharma Sutras, the headman is appointed by the king. According to Kautilya’s Arthasastra, the office of headman was hereditary, subject to confirmation by the king. Jatak story mentions village assemblies for managing village affairs. Under the rule of the Pandyas and the Cholas, well-organised assembles, with wide powers of self-government, functioned with an executive body or various executive committees.

Executive committees were elected by the members according to rules framed by themselves. The assemblies enjoyed a high reputation for integrity and honesty. They enjoyed the king's patronage and managed temple funds. The assemblies decided disputes, granted lands, founded and maintained hospitals, took charge of charitable endowments and controlled taxes.

At the time of the Buddha (in the sixth century B.C.), the village was an autonomous unit of corporate life ministering to its own needs of taxation, education, settlement of disputes and public works. One finds a lot of change in village life during this period.

In Pali texts the Gamabhojaka (person who received village revenues by royal charter) appears as a tyrant who fleeced people with arbitrary exactions and sometimes interfered with the autonomous and associate life of the village. People during this period amused themselves at fairs and carnivals where animal fights, acrobatic and magical feats, dances and dramatic performances were held for entertainment. Prostitution, drinking and gambling were common vices.

The accounts given by Megasthenes report the existence of seven castes, namely, Brahmanas or philosophers, cultivators of land, herdsmen and hunters, artisans and traders, soldiers, spies and councilors (officers of the king).

These were in fact vocational groups rather than castes based on heredity. Inter-caste marriages were quite common. It seems that this was the period when socio-cultural distinctions arose. However, distinctions in terms of the ruler and the ruled existed earlier in the Indian village. Inter-village ties always existed. The villages had connections with the king and townsmen. Both were governed by the king and the officers appointed by him.

Village Community in Medieval India

The village scene underwent a sea-change in the medieval period. The temple and the village council (panchayat) emerged as the most effective institutions. Medieval Hindu rulers neglected their obligations to their subjects.

The people were left with no choice except to search for their own means of improving their lot. The temple and the panchayat emerged as the means to a happy, healthy and productive life. The panchayat protected people from exploitation by the government.

The temples maintained a good number of employees, patronised scholars, and served as seminaries of higher knowledge and the fine arts. They also served as bankers and farmers, daily feeding thousands of people, besides carrying on a variety of religious, educational and cultural activities. Many mosques also served as seminaries and they had government patronage. Temples and panchayats no doubt filled up the socio-cultural vacuum created by the rulers, but they also created a static culture in India. The economy became stagnant. No new changes, innovations and devices for advancement of society were introduced.

In the early medieval period, the majority of people lived in villages with agriculture as their principal occupation. The agriculturists were required to pay land revenue to the state through different types of intermediaries.

The land-man ratio was low, food was plentiful and cheap. Life in the villages was isolated and unprogressively, and extremely simple and unchanging. The village economy was largely self-sufficient. The village artisans and servants, the priest and the moneylender satisfied all his (the villager's) requirements. The joint family system afforded him protection; the village panchayat gave his minor grievances a just redress.

The village with its caste panchayats and headman was an autonomous unit of the state which carried out its activities unmindful of what happened to the central government. Thus, medieval India had a different village scene from that of ancient India.

⇒ **National geographic society** defines A rural area is an open swath of land that has few homes or other buildings and not very many people.
⇒ Agriculture is the primary industry in most rural areas. Most people live or work on farms or ranches. Hamlets, villages, towns, and other small settlements are in or surrounded by rural areas.
⇒ **United states census(2000 census)** defines rural areas as comprising open country and settlements with fewer than 2500 residents areas designated as rural can have population densities as high as 999 per square mile as 1 person per square mile.

2.4 Scenario: Rural / Urban village of India population Growth

Rural Urban Distribution of Population

All areas which are not categorized as urban area are considered as Rural Area.
Number of Rural Units (or Villages) in India:

Villages

Census 2001	6, 38,588	
Census 2011	6, 40,867	Increase: 2,279

Indicators

⇒ Population by Rural Urban Residence by sex
⇒ Population (0 to 6 years) by Rural Urban Residence by sex
⇒ Number of literates by Rural Urban Residence by sex

Derived from above

• Sex ratio [Females per thousand males]
• Sex ratio (0-6) [Girls (0-6 years) per thousand boys]
• Literacy rate [Persons (7years and above) who can read and write with understanding]

Population by rural urban Residency – India – 2011

Persons:

Total	1,210,193,422
Rural	833,087,662
Urban	337,105,760

Rural Urban Distribution Person (in %)

Total	100%
Rural	68.84%
Urban	31.16%

Variation in Rural Population from 2001 to 2011 Censuses - INDIA

⇒ During 2001-11 the growth of Rural Population has been 12.18%

⇒ Growth in Rural Population in India is steadily declining since 1991

⇒ Meghalaya (27%) & Bihar (24%) witnessed largest growth among States in 2001-11

⇒ Four States recorded decline in Rural Population during 2001-11. These are Kerala (by 26%), Goa (19%), Nagaland (15%) & Sikkim (5%).

Growth Rates (Rural) India, EAG & Non-EAG States

⇒ General decline in Rural Growth Rate among all the three categories during the last decade 2001-11

⇒ Whereas Non-EAG States have shown decline in growth since 1971-81, the EAG States have declined only during the last decade.

⇒ The Growth in Rural Areas in Non-EAG States during 2001-11 has sharply declined to 5.71%.

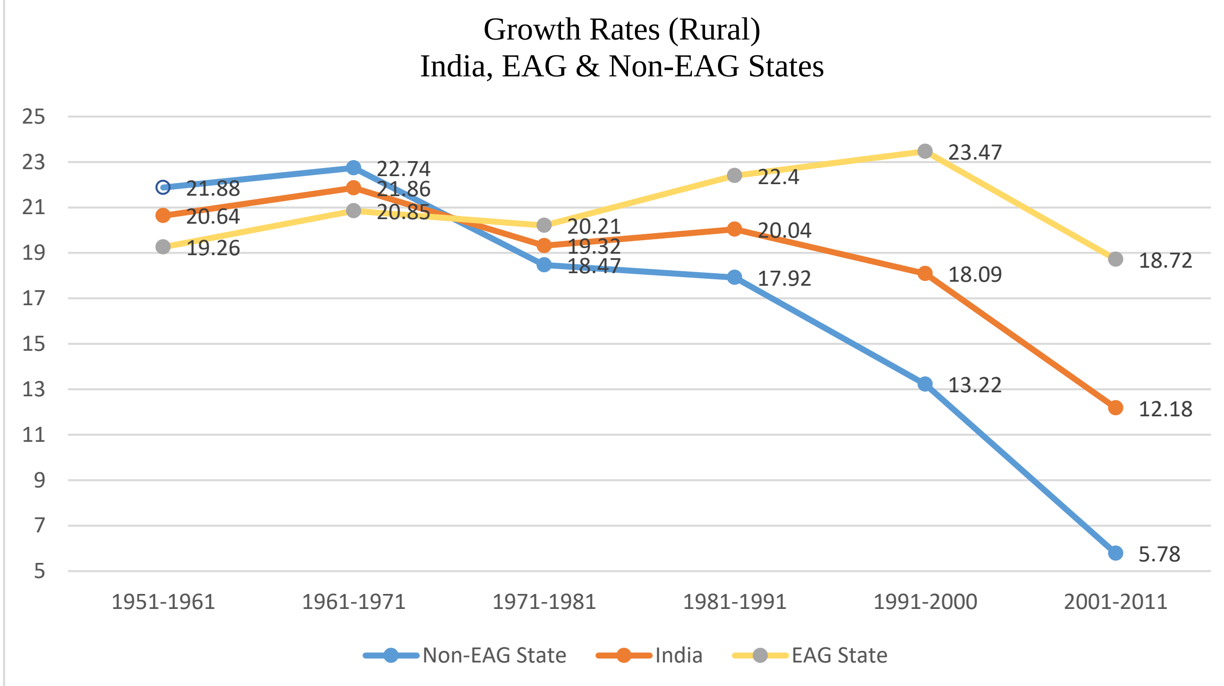


Fig-4 Growth Rates (Rural) India, EAG & Non-EAG States

Variation in Urban Population from 2001 to 2011 Censuses – India

There has been a spurt in growth of population in urban areas in the country, which could be due to

⇒ Migration

⇒ Natural increase and

⇒ Inclusion of new areas under 'Urban'

⇒ More than 30% growth in urban population in States, *viz.*, Sikkim (153%), Kerala (93%), Tripura (76%) is significant.

Child Population (0-6 years)

⇒ The Child Population in India declined by 5.0 million (or – 3.0 %) between 2001 and 2011

⇒ This is due to the sharp decline of 8.9 million (or – 7.0%) in child population in rural areas

⇒ In Urban areas, the child population increased by 3.9 million (or +10.3 %)
⇒ In 28 States/UTs there is a decline in the proportion of Child Population in Rural Areas between 2001 & 2011 Censuses
⇒ In one UT there is a similar decline in the Urban Areas.
⇒ For the first time since Independence, the absolute increase in population is more in urban areas that in rural areas.
⇒ Rural – Urban distribution: 68.84% & 31.16%.
⇒ Level of urbanization increased from 27.81% in 2001 Census to 31.16% in 2011 Census.
⇒ The proportion of rural population declined from 72.19% to 68.84%.

Data Highlights – Census 2011 Population (in Crore)

	2001	2011	Difference
India	102.9	121.0	18.1
Rural	74.3	83.3	9.0
Urban	28.6	37.7	9.1

(Table-3 Census data of urban and rural (Population in crore))

Source: Census 2011 – Provisional Population Totals - India

2.5 Scenario: Rural / Urban village of Gujarat as per Census 2011 and latest

Population of Gujarat - With a Population of 71,521,926 Gujarat is the 10th largest state in terms of Population in India. Gujarat is one of the most industrialized states of India and thus attracts people from all over India both in terms of investment and jobs. From a small figure of 50,671,017 in 2001, the population of Gujarat has gone to 60,383,628 in 2011. Population growth in Gujarat has witnessed an increase of 19.17 in this decade. Out of this figures, total male population stands at 31,482,282 and female at 28,901,346 in state of Gujarat. In terms of Population, Ahmedabad is the largest city of Gujarat with 6.2 million people living here. Surat and Vadodara are other two major cities with high number of urban population residing here. Rajkot is the fourth largest city of Gujarat with population of 1.50 million. The cities like Bhavnagar, Bhuj, Junagadh and Jamnagar constitutes a large number of urban populations in Gujarat.

Population of Gujarat in 2020

The state of Gujarat comprises of 33 districts which are further divided into talukas, regions and districts. As of 2020, Population of Gujarat is 71,521,926. The same figure was recorded to be 70,208,143 in 2019. The state adds more that 1.2 million people to its population on an annual basis. Therefore, Population of Gujarat is increasing at an descent rate and is now over 7 crores human beings. Population of Gujarat in 2018 was 68,915,579. Ahmedabad is the most populous district with a total population of 7,574,254.
Gujarat has witnessed a descent growth in its population in the last 60 years. From a small figure of 16 Lakh in 1950, it has gone passed 6.03 Crore in 2011. Rapid Industrialization and development of the Gujarat state has attracted people from all over India. Thus Population of Gujarat has increased a lot in the last 6 decades beginning from 1950.

Gujarat Urban Population 2011:

Out of total population of Gujarat, 42.60% people live in urban regions. The total figure of population living in urban areas is 25,745,083 of which 13,692,101 are males and while remaining 12,052,982 are females. The urban population in the last 10 years has increased by 42.60 percent.

Sex Ratio in urban regions of Gujarat was 880 females per 1000 males. For child (0-6) sex ratio the figure for urban region stood at 852 girls per 1000 boys. Total children (0-6 age) living in urban areas of Gujarat were 2,952,359. Of total population in urban region, 11.47 % were children (0-6).

Average Literacy rate in Gujarat for Urban regions was 86.31 percent in which males were 90.98% literate while female literacy stood at 70.26%. Total literates in urban region of Gujarat were 19,672,516.

- ⇒ **National geographic society** defines A rural area is an open swath of land that has few homes or other buildings and not very many people.
- ⇒ Agriculture is the primary industry in most rural areas. Most people live or work on farms or ranches. Hamlets, villages, towns, and other small settlements are in or surrounded by rural areas.
- ⇒ **United states census(2000 census)** defines rural areas as comprising open country and settlements with fewer than 2500 residents areas designated as rural can have population densities as high as 999 per square mile as 1 person per square mile.

2.6 Rural Development Issues - Concerns - Measures

Rural Development Issues

Zamindari System

By the introduction of the zamindari system, the Britishers collected as much revenue as they could from the farmers. This system enabled the peasants to remain in a deprived condition. The zamindars did less to augment the conditions of the farmers and rural communities. The Britishers extracted minerals from rural land to make use of in their country Britain. They compelled the farmers to grow indigo for their own benefit. One of the most critical problems was, they did not put into operation any strategies or resources to bring about improvements in rural areas, but exploited the resources. With the prevalence of this system, the conditions of the farmers led to further deterioration and there was augmentation of poverty among them (Agarwal, n.d.).

Lack of Infrastructure

In rural communities, still there is lack of infrastructure and other facilities. Individuals are experiencing shortage of electricity, poor communication, improper roads and other infrastructural facilities. Within homes, shortage of electricity and water are regarded as major problems that are imposing detrimental effects upon the lives of rural individuals. In order to facilitate ones living conditions, individuals need lighting, heating and cooling equipment in accordance to the weather conditions, restrooms, clean drinking water and so forth. Improvements in roads and communication is necessary for the individuals to transfer and form links with the wider community. Agricultural infrastructure has the potential to bring about changes in the traditional agriculture or subsistence farming into advance, innovative, and dynamic farming system within the country (Patel, n.d.). So, when there is lack of infrastructure, the individuals certainly encounter major impediments within the course of bringing about improvements in their living conditions and overall quality of life.

Use of Traditional Cooking Methods

The rural individuals, particularly belonging to remote areas, have developed their own traditional methods of cooking and food preservation, primarily to survive in extreme weather conditions. The communication that they have developed with other individuals and local authorities, has rendered a significant contribution in leading to an increase in the utilization of better techniques to prepare and store food (Krishnan, 2014). In the traditional cooking methods, they make use of mud stoves. In mud stoves, wood is used to light the fire and meals are usually prepared in earthen pots. The main reason behind the use of traditional cooking methods is, rural individuals usually do not possess the resources to make use of modern methods. One of the major disadvantages of the use of traditional cooking methods is, around 300000 deaths have taken place, due to pollution (Agarwal, n.d.). But when these individuals cannot afford gases, then they need to depend upon traditional methods.

Lack of Health Care Facilities – In rural communities, health care facilities too are not in a well-developed state. When the individuals experience any health problems and illnesses, then they are required to transfer to distance regions or cities to obtain medical facilities. Due to lack of health care facilities, the rural individuals normally remain unaware of the approaches and strategies that are necessary to take care of their health and well-being. Furthermore, they also remain unaware of what essential nutrients, they need to consume to facilitate physical and psychological growth and development in an effective manner. Hence, this is one of the major problems that leads to deprived health conditions among rural communities.

Lack of Education

In rural communities, the system of education is not in a well-developed state as compared to urban areas. There is prevalence of illiteracy among the rural communities. Though these individuals recognize the significance of education, but due to number of factors are unable to get enrolled in schools to acquire educational skills. The number of factors that lead to prevalence of illiteracy among the individuals are, distance of schools from homes, lack of transportation facilities, lack of financial resources, shortage of teachers in schools, inappropriate teaching-learning methods, lack of school infrastructure, lack of facilities within homes, discriminatory treatment, particularly against the girls and inadequate development of extra-curricular activities.

Lack of Technical Knowledge

In the present existence, technology has gained prominence. The individuals, belonging to all categories and backgrounds are making use of technology for the implementation of various tasks and activities. Among the rural individuals, there is lack of technical knowledge. Still, rural entrepreneurs as well as the individuals residing in rural communities do not possess adequate knowledge and information in terms of usage of technology. Lack of technical knowledge has proved to be a major impediment within the course of implementation of various tasks and activities. But there have been establishment of training centres that are providing knowledge to the rural individuals, regarding technology. After acquiring knowledge in terms of usage of technology, they are making use of it for augmenting their overall quality of life. Modern methods and technology is used in the agricultural sector, farming practices and so forth. Furthermore, rural folks make use of it for communication and leisure and recreational purposes as well.

Lack of Employment Opportunities

The rural individuals are in most cases employed in the agricultural sector. The agricultural sector does not generate sufficient income for the farmers, with the purpose of sustaining the living conditions of themselves and their families. Apart from agricultural sector, the other areas, which they get engaged into for the purpose of sustaining their living conditions are production of handicrafts, jewellery, garments, food items, animal husbandry, marketing and selling, and so forth. When rural individuals are involved in the production of these items, then they usually market their products, especially at the time of festivals. But one of the unfortunate aspects is, there are lack of employment opportunities among them to a major extent. This is also regarded as a major cause of poverty.

Unawareness

As it has been stated that rural individuals put into practice the traditional values and methods in the implementation of various tasks and activities. The main reason being, they are unaware of modern and innovative methods, strategies and approaches. Research has indicated that individuals in rural and tribal communities are dependent upon the natural environmental conditions to a major extent. They even obtain herbs and medicinal plants from the forests to treat their wounds and illnesses. Therefore, it can be stated that unawareness and lack of information enables them to adopt traditional methods and practices in the implementation of daily life tasks and activities. Unawareness is regarded as the major cause of their backwardness.

Malnutrition

Malnutrition is the condition, when the individuals do not obtain proper diet and nutrition. In other words, when their intake of food is less than what is required, then the individuals are experiencing malnutrition. There are two aspects of malnutrition, i.e. over-nutrition and under-nutrition. Over-nutrition is the state, when an individual consumes more diet, then what is required. Whereas, under-nutrition is the state, when individuals consume less diet, then what is required. In rural communities, individuals are mostly under-nourished. They experience problems and challenges within the course of fulfilling their adequate diet and nutritional requirements. The major causes are poverty and lack of financial resources. Due to malnutrition, these individuals, belonging to all age groups experience severe health problems and illnesses.

Discriminatory Treatment against Girls

In some rural communities, the birth of the girls is not appreciated and they are discriminated against. Strong preference is given to male children and when there are male children within the family, then more attention is paid to them. Male children are encouraged towards acquisition of education and are enrolled in schools. Whereas, girls are compelled to remain confined within their homes and trained in terms of the implementation of household responsibilities. It is usually believed by the individuals that when the male members of the family will be educated, then they would be able to enhance the status and bring about well-being of their families and communities. Furthermore, more attention is paid towards the health care needs, and diet and nutrition of males more as compared to girls. Girls in rural communities usually remain deprive of number of aspects. Hence, it is vital to formulate measures to generate awareness among them that girls should be provided equal treatment as boys.

Description of Rural Development Measures

⇒ To develop rural area as whole in terms of culture, society, economy, technology and health.
⇒ To develop living slandered of rural mass.
⇒ To develop rural youths, children and women.
⇒ To develop and empower human resource of rural area in terms of their psychology, skill, knowledge, attitude and other abilities.

⇒ To develop infrastructure facility of rural area.
⇒ To provide minimum facility to rural mass in terms of drinking water, education, transport, electricity and communication.
⇒ To develop rural institutions like Panchayat, cooperatives, post, banking and credit.
⇒ To provide financial assist to develop the artisans in the rural areas, farmers and agrarian unskilled labour, small and big rural entrepreneurs to improve their economy.
⇒ To develop rural industries through the development of handicrafts, small scaled industries, village industries, rural crafts, cottage industries and other related economic operations in the rural sector.
⇒ To develop agriculture, animal husbandry and other agricultural related areas.
⇒ To restore uncultivated land, provide irrigation facilities and motivate farmers to adopt improved seed, fertilizers, package of practices of crop cultivation and soil conservation methods.
⇒ Vocational training and information actions
⇒ Setting up of management, relief and advisory services
⇒ Adding value to agricultural and forestry products
⇒ Cooperation for development of new products, processes and tech.

Rural development measures
The Swedish rural development programme comprises various forms of support. They are intended to encourage efforts to increase competitiveness, help the environment, and improve quality of life in rural areas. In this way the measures help us to achieve the goals of the rural development programme.

You can get support for improving the environment
If you run a farm and want to sell environmental services you can get support for this. For example, you can get support for reducing nitrogen leaching. You can also get environmental support for keeping endangered livestock breeds.

You can get support for investing in the environment or for increasing the environmental benefit measures that you get environmental support for. One example is establishment and restauration of wetlands. You can also get support for extra efforts in maintaining pastures or mown meadows. The County Administrative Boards and the Sami Parliament themselves set their priorities and decide which applications to accept. Their priorities are based on established strategies.

You can be compensated for poor farming conditions
Are you running a traditional farm in an area that is unsuited for agricultural production? If so, you can get support for less favoured areas in order to compensate for the drawback. At the same time you help maintain the vitality of rural areas and the open agricultural landscape.

Enterprise support helps you develop your business
Do you want to start a new company in a rural area, or expand into new activities? Do you need to make an investment or purchase a service in order to develop your company? Do you want to acquire new skills for yourself or your employees? If so, you can apply for enterprise support.
One goal of the enterprise support is to make agriculture, horticulture, forestry and reindeer husbandry more competitive. Another goal is to bring new activities into rural companies, and to

make the countryside a more attractive place to live. Enterprise support is always linked to an existing or new company. Examples include setting-up aid and investment support.

- **Programs Initiated by the Government for Rural Development**
- ⇒ Pradhan Mantri Gram Sadhak Yojana (PMGSY)
- ⇒ Swaranjayanti Gram Swarozgar Yojana (SGSY)
- ⇒ Rural Housing (Indira Awaas Yojana)
- ⇒ DRDA Schemes
- ⇒ Training Schemes
- ⇒ Integrated Rural Development Programs (IRDP)
- ⇒ National Rural Employment Program (NREP)
- ⇒ Jawahar Rozgar Yojana (JRY)

2.7 Various infrastructure guidelines with the Norms for Villages for the provisions of different infrastructure facilities

- ⇒ DRDAs must themselves be more professional and should be able to interact effectively with various other agencies. They are expected to coordinate with the line departments, the Panchayati Raj Institutions, the banks and other financial institutions, the NGOs as well as the technical institutions, with a view to gathering the support and resources required for poverty reduction effort in the district. It shall be their endeavour and objective to secure inter-sectoral and inter-departmental coordination and cooperation for reducing poverty in the district. It is their ability to coordinate and bring about a convergence of approach among different agencies for poverty alleviation that would set them apart.
- ⇒ The DRDAs are expected to oversee the implementation of different anti-poverty programs of the Ministry of Rural Development in the district. This is not to be confused with actual implementation, which will be by the Panchayati Raj and other Institutions. The DRDAs will monitor closely the implementation through obtaining of periodic reports as well as frequent field visits. The purpose of the visit should be to facilitate the implementing agencies in improving implementation process.
- ⇒ Implementation of programs is high. This would include over-seeing whether the intended beneficiaries are receiving the benefits under the different programs.
- ⇒ The DRDAs shall keep the Zilla Parishad, the State and the Central Government duly informed of the progress of the implementation of the programs through periodic reports in the prescribed formats. Special report, as and when called for, shall be provided.
- ⇒ The DRDAs shall take necessary step to improve the awareness regarding rural development and poverty alleviation particularly among the rural poor. This would involve issues of poverty, the opportunities available to the rural poor and generally infusing a sense of confidence in their ability to overcome poverty.

Importance in rural context

- ⇒ Rural development is the process of improving the quality of life and economic well-being of people living in rural areas, often relatively isolated and sparsely populated areas.
- ⇒ Rural development actions are intended to further the social and economic development of rural communities.

⇒ Rural development programs have historically been top-down from local or regional authorities, regional development agencies, NGOs, national governments or international development organizations.

⇒ Rural development aims at finding ways to improve rural lives with participation of rural people themselves, so as to meet the required needs of rural communities.

⇒ The outsider may not understand the setting, culture, language and other things prevalent in the local area. As such, rural people themselves have to participate in their sustainable rural development.

Sustainable Village Development Concept

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it three key concepts:

⇒ The idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs."

⇒ While the modern concept of sustainable development is derived mostly from the 1987 Brundtland Report, it is also rooted in earlier ideas about sustainable forest management and twentieth century environmental concerns. As the concept developed, it has shifted to focus more on economic development, social development and environmental protection for future generations. It has been suggested that "the term 'sustainability' should be viewed as humanity's target goal of human-ecosystem equilibrium (homeostasis), while 'sustainable development' refers to the holistic approach and temporal processes that lead us to the end point of sustainability".

Goals of Sustainable development

⇒ Good Health and well-being

⇒ Clean water and sanitation

⇒ Quality Education

⇒ Gender equality

Sr. no.	Category	Population serve per unit
1.	Nursery school	2500
2.	Primary school	5000
3.	Secondary school	7500
4.	Collage	1.25 lakh
5.	Technical education centre	10 lakh
6.	Engineering collage	10 lakh
7.	Dispensary	15000
8.	Hospital	1 lakh
9.	Anganwadi	5000
10.	Community room	5000
11.	Community Hall	15000
12.	Music, dance and drama center	1 lakh
13.	Meditation and spiritual centre	1 lakh
14.	Police post	40000 to 50000
15.	Police station	90000
16.	Fire station	2 lakh

17.	Old age home	5 lakh
18.	Science centre.	10 lakh
19.	Cremation ground	5 lakh
(Table-4 URDPFI Standards (2014))		

2.8 Ancient / Existing Electrical concept study as a Literature Review for village development

Power Distribution System

A distribution substation is located near or inside city/town/village/industrial area. It receives power from a transmission network. The high voltage from the transmission line is then stepped down by a step-down transformer to the primary distribution level voltage. Primary distribution voltage is usually 11 kV, but can range between 2.4 kV to 33 kV depending upon region or consumer.

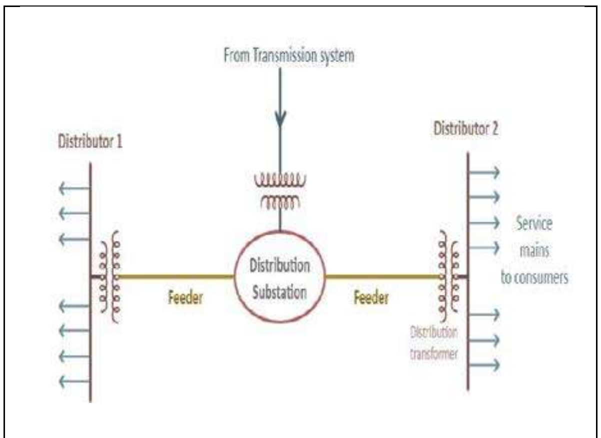
A typical power distribution system consists of -

⇒ Distribution substation
⇒ Feeders
⇒ Distribution Transformers
⇒ Distributor conductors
⇒ Service mains conductors

Along with these, a distribution system also consists of switches, protection equipment, measurement equipment etc.

Distribution feeders: The stepped-down voltage from the substation is carried to distribution transformers via feeder conductors. Generally, no tappings are taken from the feeders so that the current remains same throughout. The main consideration in designing of a feeder conductor is its current carrying capacity.

Distribution transformer: A distribution transformer, also called as service transformer, provides final transformation in the electric power distribution system. It is basically a step-down 3-phase transformer. Distribution transformer steps down the voltage to 400Y/230 volts. Here it means, voltage between any one phase and the neutral is 230 volts and phase to phase voltage is 400 volts. However, in USA and some other countries, 120/240 volts split-phase system is used; where voltage between a phase and neutral is 120 volts.



(Fig-5 Distribution Substation)

Distributors: Output from a distribution transformer is carried by distributor conductor. Tapings are taken from a distributor conductor for power supply to the end consumers. The current through a distributor is not constant as tapings are taken at various places throughout its length. So, voltage drop along the length is the main consideration while designing a distributor conductor.

Service mains: It is a small cable which connects the distributor conductor at the nearest pole to the consumer's end. The above figure shows a simple radial AC power distribution system. The figure does not show other equipment like circuit breakers, measuring instruments etc. for simplicity purpose.

Primary Distribution

It is that part of an AC distribution system which operates at somewhat higher voltages than general residential consumer utilization. Commonly used primary distribution voltages in most countries are 11 kV, 6.6 kV and 3.3 kV. Primary distribution handles large consumers such as factories and industries. It also feeds small substation from where secondary distribution is carried out. Primary distribution is carried out by 3-phase, 3-wire system.

Secondary Distribution

This part directly supplies to the residential end consumers. Domestic consumers are fed with single phase supply at 230 volts (120 volts in USA and some other countries). Three phase supply may also be provided at 400 volts for big properties, commercial buildings, small factories etc. Secondary transmission in most countries is carried out by 3-phase, 4-wire system.

Classification of Power Distribution Systems

- **According to nature of current:**
  - ⇒ DC distribution system
  - ⇒ AC distribution system
- **According to type of construction:**
  - ⇒ Overhead distribution system
  - ⇒ Underground distribution system
- **On the basis of scheme of connection**
  - ⇒ Radial distribution system
  - ⇒ Ring main distribution system
  - ⇒ Inter-connected distribution system

⇒ The existing facilities of electrical is street lights, some of them are wired and some of them are solar.

⇒ In Derdi Kumbhaji power supply is 24/7 for houses as well as for other buildings.

⇒ For agriculture purpose electricity is also available. In some farm there is also solar power is available.

2.9 Other Projects / Schemes of Gujarat / Indian Government

Sr. no.	Government Scheme	Details
1	Pradhan Mantri Gram Sadhak Yojana (PMGSY)	The main objective of this program is to provide connectivity to all the unconnected habitations in rural areas, through the construction of roads by the end of the tenth plan period.
2	Swaranjayanti Gram Swarozgar Yojana (SGSY)	It came into effect on 1st April, 1999. The main objective of this program is to cover all the aspects

		of self-employment, like the organization of rural poor into self-help groups.
3	Rural Housing (Indira Awaas Yojana)	The Government of India in 1998, announced a National Housing and Habitat Policy, which aims at providing housing for all and facilitating the construction of 20 lakh, additional housing units (13 lakhs in rural areas and seven in urban areas) with emphasis put upon providing standing benefits to the deprived.
4	DRDA Schemes	The primary objective is to effectively manage the schemes and augment their professionalism. It is based on the recommendations of the inter-ministerial committee, known as the Shankar Committee.
5	Training Schemes	The National Institute of Rural Development (NIRD) has been conducting training programs, seminars and workshops.
6	Integrated Rural Development Programs (IRDP)	Its primary focus is to enable the selected families to cross the poverty line within a given frame of time.
7	National Rural Employment Program (NREP)	NREP is a redesigned program for the FWP. It has been initiated with the objective of creating additional employment opportunities for the rural individuals, mainly with the help of surplus food grains.
8	Jawahar Rozgar Yojana (JRY	Under this scheme, it was expected to provide at least one member of each poor family (BPL family) an employment of 50 to 100 days in a year at a work near his or her residence. About 30 percent of the jobs, under this scheme were reserved for women. This scheme was implemented through the village panchayats.

(Table-5 Government schemes)

Chapter: 3
Smart Village Concept Idea and its Visit (Civil & Electrical Concept)

3.1 Introduction: Concepts, Definitions and Practices

Brief about Veraval

Veraval (CT) town is situated in district RAJKOT, GUJARAT. The Veraval town has population of 19152, male population is 10535 and female population is 8617 as per the Census 2011 data. Population of Children under the age of 0-6 is 2586, male child population under the age of six is 1395 and female child population under the age of six is 1191. Total literacy rate of Veraval city is 84.86%, male literacy rate is 89.98% and female literacy rate is 78.56%. In Veraval Female Sex Ratio is 818 per 1000 male persons. Child sex ratio is 854 per 1000 male child under the age of six. Total number of house hold in Veraval is 4620.

Total working population of Veraval is 7524 which are either main or marginal workers. Total workers in the town/city are 7524 out of which 6657 are male and 867 are female. Total main workers are 7224 out of which male main workers are 6511 and female main workers are 713. Total marginal workers of Veraval are 300.\
Veraval with Census 2011 of India Town/City code 513091 is located in District RAJKOT, GUJARAT, India. Veraval Town/City location on google Map Show on Google Map.

- **Concepts**

The basic concept of smart village is to collect community efforts and strength of people from various streams and integrate it with information technology to provide benefits to the rural community. According to Mahatma Gandhi's philosophy and thoughts smart village project provides, "Global means to the local needs."
The basic concept of smart village is to collect community efforts and strength of people from various streams and integrate it with information technology to provide benefits to the rural community. According to Mahatma Gandhi's philosophy and thoughts smart village project provides, "Global means to the local needs." The concept of smart village is defined as below,

S	Social, skilled and simple.	Zero tolerance for caste and creed and no discrimination on gender and religion. Skilled simple living and high thinking.
M	Moral, methodical and modern.	Moral values of Mahatma Gandhi and Swami Vivekananda using modern (latest) methods .
A	Aware, adaptive and adjusting.	Awareness about global, social and economic issues adaptive and adjusting the fast changing environment.
R	Responsive and ready	Ready to generate all resources for self - sufficiency and self-governance. Responsive for co-operative movements and collective wisdom.
T	Techno savvy and transparent	Tecnosavy for IT and transparent mobile usage harmonic relations.

(Table-6 Concept of smart villages)

- **Definition**

Smart Village is a concept adopted by national, state and local governments of India, as an initiative focused on holistic rural development, derived from Mahatma Gandhi's vision of Adarsh Gram and Swaraj.

- **Practices in civil**

⇒ Improved Infrastructure and Housing: improve liveability of people by providence of good infrastructure facility and better housing.
⇒ Transportation facility
⇒ Water management
⇒ Health center facility
⇒ Waste management
⇒ Rain water harvesting system
⇒ Recreation facility
⇒ Provide Good quality of life.
⇒ Clean and sustainable environment, etc.

Smart Energy

Provision of clean and sustainable, energy is central to almost all other dimensions of rural development. Energy security is the secret mantra, which enables development in agriculture, health-care, education and skilling of rural communities. With a wide variety of solar, wind, biomass and biogas technologies now available at competitive costs, we are at the cusp of witnessing energy disruption and creating an abundant energy economy. For rural energy supply and management, the element of 'smart' refers to creation and management of mini, micro and nano grids within the energy eco-system of a village or a group of villages. It is particularly relevant to rural areas with no or unreliable grid connectivity. These micro / nano grids bring in the element of selfreliance in energy for rural community and create a possibility of giving back the surplus to the grid. Developing a village with this approach can usher in a new developmental model. The vision for a smart village revolves around energy security.

Smart Connectivity

Smart connectivity has two distinct connotations for smart village concept. One is to provide reliable and high quality broadband and voice communications. And the second, probably more importantly, through a range of Information and Communication Technology (ICT) solutions, applications and services, be an integral part of smart technology solutions for all other domains like smart agriculture, smart water management, smart education, smart health-care and so on. Rural communities tend to be politically disenfranchised due to their relative remoteness. Consequently, they lack information on societal issues and have difficulty becoming actively involved in debates about how to address them. Smart villages, through ICT, can allow rural communities to become more aware of their social, economic and political rights, engage in governance processes at all levels to the collective benefit and empowerment of all.

Smart Agriculture

For any village, its agricultural eco-system is one of the most intrinsic identities that directly relates to its social, environmental and financial fabric. Efficiency and productivity in agriculture is directly related to the farming practices adopted by the communities. Fortunately, the intersection of technology and agriculture has opened up a lot of opportunities for the farmer, consumer and suppliers. This intersection is now called as Precision Agriculture (PA). The development of PA is driven by Internet of Things (IoT), BDAA and the plummeting cost of sensors in the semiconductor industry. Infusion of PA techniques and practices can drive transformation at every stage in agriculture. The immediate benefits are self-sufficiency for villages, generating business and increasing financial freedom for villagers (both farmers and suppliers).

Smart Education

Smart villages aim to increase the time available for students to study and will address prevalent factors that negatively affect the ability of students to acquire the knowledge and skills necessary to achieve economic goals and improve labor productivity. ICT-equipped schools can provide a good deal of handholding in accessing internet and consequently the world's knowledge base, ending the information isolation experienced by many rural communities. New opportunities can be generated for distance and adaptive learning, reducing the need to move to towns or cities to achieve higher levels of education. In addition, ICT and internet access also have a "pull factor", providing incentives for school attendance and for attracting and retaining good teachers, addressing issues such as school dropouts and cognitive development.

Smart Health

At the most basic level, households in smart villages will be able to consume potable water and a more nutritious diet due to the reduced cost of boiling water and cooking food, and enhanced agricultural productivity arising from associated development initiatives and reduced wastage. ICT-enabled m-health initiatives can enable mobile health diagnostic solutions, requiring relatively low levels of local medical skill and providing access to specialist health-care services based in urban communities where necessary. Epidemiological data can be gathered, providing the opportunity for more effective interventions and early warning capability to address health related challenges such as malnourishment, underweight child birth, anemic mother etc.

Smart Environment

Smart villages can be stewards of the environment aided by technologies to monitor key environmental indicators such as forest health, water quality, soil conditions and changes to the landscape. They can also reduce pressure on deforestation using efficient cook stoves to decrease the need for traditional biomass energy sources such as charcoal and wood a key driver of unsustainable forest use.

Smart villages can host community-run recycling facilities ranging from those equipped to recycle wastewater and organic waste from agro-processing, to next-generation facilities for the recycling of e-waste, including energy-storage and generation technologies such as batteries and solar panels. Depending on geographical endowments, some smart villages will be able to operate as regional ecotourism hubs, an activity that can improve the welfare and connectivity of rural and urban communities. The aforementioned Villages have all emerged as Smart Villages but only in a particular domain. It's not holistic in nature. However, the pressing need of hour is to have a Smart Village with all sorts of comprehensiveness in it.

Smart Infrastructure

In order to ease life of villagers in every possible way, a village has to be well supported with infrastructure to enhance efficiency of habitants and efficacy of inputs from the villagers. The infrastructure includes roads, institution buildings, weather station equipment, hospital equipment, telephone towers etc. Most of these infrastructures can be established with well-intended village habitants and the guiding institutions through convergence of funds, functions and functionaries. Smart element needs to be included in every stage of infrastructure development.

Census	Population	Male	Female	Total no of house hold
2001	13332	7751	5581	3029
2011	19152	10535	8617	4620

(Table-7 Census of smart village Veraval)

3.2 Vision-Goals, Standards and Performance Measurement Indicators

Vision-Goals

⇒ Identify the transportation challenges and needs of the citizen and business community and demonstrate how advanced technologies can be used to address issues in safety, mobility, and climate change, now and into the future.

⇒ Determine which technologies, strategies, applications, and institutional arrangements demonstrate the most potential to address and mitigate, if not solve, transportation challenges identified within a city.

⇒ Support and encourage cities to take the evolutionary and revolutionary steps to integrate advanced technologies – including connected and automated vehicle technologies – into the management and operations of the city, consistent with the USDOT vision elements. Demonstrate, quantify, and evaluate the impact of these advanced technologies, strategies, and applications towards improved safety, efficiency, and sustainable movement of people and goods.

⇒ Examine the technical, policy, and institutional mechanisms needed for realizing the potential of these strategies and applications – including identifying technical and policy gaps and issues – and work with partners to address them.

⇒ Assess reproducibility and qualify successful smart city systems and services for technology and knowledge transfer to other cities facing similar challenges.

➢ **Standard**

⇒ Effective governance and efficient delivery of services

⇒ International and Local targets, benchmarking and planning.

⇒ Informed decision making and policy formulation.

⇒ Leverage for funding and recognition in international entities.

⇒ Transparency and open data for investment attractiveness.

⇒ Evaluate the impact of infrastructure projects on the overall performance of a city.

➢ **Performance Measurement Indicators**

Sr. no.	Indicators	Sr. no.	Indicators
1	Energy	8	Education
2	Economy	9	Environment
3	Finance	10	Governance
4	Health	11	Recreation

5	Solid waste	12	Telecommunication and net
6	Water	13	Waste Water management
7	Transportation	14	Water and Sanitation

(Table-8 List of indicators)

➢ **Benchmarks of smart village.**

Sr. No	Parameters	Benchmarks
1.	Seaware and sanitation	⇒ 100% household have access to toilet. ⇒ School should have separate toilet for girls ⇒ 100% households should have access to toilets ⇒ 100% households should be connected to the waste water network ⇒ Efficiency in the collection and treatment of waste water
2.	Solid waste management	⇒ 100% household are covered by daily door to door collection system ⇒ 100% collection of municipal solid waste. ⇒ 100% recycle of solid waste
3.	Strom water drainage	⇒ 100% coverage of road network with storm water drainage system. ⇒ Aggregate number of incident of water logging reported.
4.	Electricity	⇒ 100% metering of electricity. ⇒ 100% household have electricity. ⇒ Reduce electric waste.
5.	Transportation	⇒ Maximum travel time 30 minutes in small and medium size Cities and 45 minutes in metropolitan area. ⇒ Access to Para-transit within 300m walking distance.
6.	Education	⇒ 95% up should be literate.

(Table-9 Smart Cities Bench Mark)

3.3 Technological Options

➢ **Enhanced Use of Smart Phones and Optical Fibre Technology for Internet**

India has become the second biggest Smartphone market in terms of unique Smartphone users, crossing 220 million users, surpassing the US market, as per the report by Counterpoint research. Over 20 mobile phone brands are now assembling their parts in India.

➢ **Online Library & E – education**

After provision of internet facility at villages using various advanced technology, our next responsibility towards making villages smarter is to provide a quality education to the villagers. Internet is one of the easy way of accessing the data and information. This technology can now be explored to more extent by providing online education in schools and colleges. Worldwide digital contents are available on internet which can be accessed by children in villages to make them compatible with rest of the world. All Schools shall be connected with broadband.

- **Smart and efficient public transport system**

Lack of transportation facility is the major reason behind isolating villages from rest of the world. Since last 70 years of freedom, roads and train network in rural part of India could not be spread to our expectations. There are thousands of villages in our country to which as such no transportation is available. The direct impact of this is on accessibility of villagers to urban areas, market and lack of any other facilities which is only available in big cities. To overcome this problem, smart transportation can be main melody for development of smart villages.

- **Smart sewage management system and sanitation**

No village or group of villages can be termed truly 'smart' without an effective sewage management system and there is a need for framing a proper sanitation plan for towns intended to become smart. Management of large quantity of household waste and garbage had become major headache for local managing bodies. Also dumping such garbage in locality is affecting common people's health. To solve the problem related with sewage management, an urgent and effective action plan is required. The knowledge enhancement and capacity building on sanitation diagnostics, town sanitation planning and decision making and analysis of cost effective and sustainable waste water treatment technologies for mainstreaming fecal sludge should be main focus for developing smart villages. Preparing our mind set for sewage management at personal level will be more fruitful. Every individual can have dust bin fixed outside their home where they can put their household garbage instead of throwing in open space. Different colored dust bins can be chosen for different categories of wastes like dry and wet, decomposable and non decomposable waste, etc. Ample number of waste collecting vehicles so called 'Ghantagadi'can be availed for each village to collect it. Waste material dumping yards shall be far away from civilization and shall have provision for categorizing and recycling of collected waste. Also similar types of actions are required to manage bio waste generated in hospitals as well as e waste generated.

- **Renewable energy sources and solar energy**

Traditional sources of energy like wood, coal, diesel, petrol, oil, natural gas, etc. are now on the verge of ending. Also excessive use of these sources is polluting earth's environment and is responsible for remarkable adverse effects, like abrupt climate change, drought and flood situation, green house effects, melting of ice caps on poles, de-thickening of ozone layer in atmosphere collectively known as global warming. Due to fast growing development of urban civilization, forests are reducing with greater rate. By the 1990s, the excess use of traditional sources in developing countries was marked as a leading environmental threat, with negative impacts linked with deforestation, desertification and widespread soil erosion. Thus to save our earth from the threat of global warming, alternative energy sources which burns less carbon are required to be invented and solar energy source can play vital role to overcome these global environmental effects.

- **Smart buildings**

Automated Intelligent Buildings, Advanced Heating Ventilation and Air conditioning systems (HVAC), Lighting Equipment.

- **Smart and efficient public transport system**

Lack of transportation facility is the major reason behind isolating villages from rest of the world. Since last 70 years of freedom, roads and train network in rural part of India could not be spread to our expectations. There are thousands of villages in our country to which as such no transportation is available. The direct impact of this is on accessibility of villagers to urban areas, market and lack of any other facilities which is only available in big cities. To overcome this problem, smart transportation can be main melody for development of smart villages.

3.4 Road Map and Safe Guards

A smart city is a city that engages its citizens and connects its infrastructure electronically. A smart city has the ability to integrate multiple technological solutions, in a secure fashion, to manage the city's assets-the city's assets include, but not limited to, local departments' information systems, schools, libraries, transportation systems, hospitals, power plants, law enforcement, and other community services.

The goal of building a smart city is to improve the quality of life by using technology to improve the efficiency of services and meet residents' needs. Business drives technology and large-scale urbanization drives innovation and new technologies. Technology is driving the way city officials interact with the community and the city's infrastructure.

Through the use of real-time control systems and sensors, data are collected from citizens and sensors and then processed in real-time. The information and knowledge gathered are keys to tackling inefficiency, which leads to optimizing systems.

A smart city offers technological solutions to tell what is happening in the city, how the city is evolving, and how to enable a better quality of life.

⇒ The visual perception of Indian villages has not changed much though certain corrective policy measures and infrastructural reforms have taken place.

⇒ A combination of factors like agriculture becoming less remunerative, poor civic services, defunct infrastructure, and unavailability of good career opportunities has accelerated the migration from rural areas to cities.

⇒ The goal of building a smart city is to improve the quality of life by using technology to improve the efficiency of services and meet resident's needs. Business drives technology and large-scale urbanization drives innovation and new technologies. Technology is driving the way city officials interact with the community and the city's infrastructure.

⇒ The policy needs to define the roles, responsibilities, strategies, and objectives of the smart cities.

⇒ Develop a Smart City Policy: Develop a policy to drive the initiative, where roles, farm duties, objective, and goals, can be defined. Create plans and policy on how the goal will be realize.

3.5 Issues & Challenges

States and ULBs will play a key supportive role in the development of Smart Cities. Smart leadership and vision at this level and ability to act decisively will be important factors determining the success of the Mission. Understanding the concepts of retrofitting, redevelopment and Greenfield development by the policy makers, implementers and other stakeholders at different levels will require capacity assistance.

Major investments in time and resources will have to be made during the planning phase prior to participation in the Challenge. This is different from the conventional DPR-driven approach. The Smart Cities Mission requires smart people who actively participate in governance and reforms.

Citizen involvement is much more than a ceremonial participation in governance. Smart people involve themselves in the definition of the Smart City, decisions on deploying Smart Solutions, implementing reforms, doing more with less and oversight during implementing and designing post-project structures in order to make the Smart City developments sustainable.

- **Financing**

Smart cities project is not smartly privileged, unfortunately, when it comes to funding. Financing is said to be one of the biggest challenges when it comes to the smart city challenge. The total investment approved under the smart city plans of 90 cities has gone up to Rs.1,91,155 cr. With the presence of state sponsored companies also the project seems to have no good start. Banks financing these projects as of now is the major reason of a considerable increase in the number of non-performing assets. The government is recently taking steps to finance these projects by making changes in the budget and we hope the problem is addressed to soon.

- **Lack of Centre-State Co-ordination**

Fruitful implementation of a project can be done only if there is a co-ordination between various government bodies. There is a need of proper regulation when it comes to planning for the development of smart cities. Both horizontal and vertical co- ordination is the requisite right now.

- **Retrofitting existing legacy city infrastructure to make it smart**

There are a number of latent issues to consider when reviewing a smart city strategy. The most important is to determine the existing city's weak areas that need utmost consideration, e.g. 100-per-cent distribution of water supply and sanitation. The integration of formerly isolated legacy systems to achieve citywide efficiencies can be a significant challenge.

- **Co-ordination among multiple stakeholders**

This clearly is a challenge that the central government will face while implementing smart cities. The state government, private sector, the central government, and other regulatory bodies are stakeholders in the project. It is very important that all the stakeholders are aligned and are aware of their roles and responsibilities. There should be no room for conflicts in segregation of duties. The involvement of multiple stakeholders in the project adds to the complexity due to the difference in ways of working.

- **Education / Job Opportunity Development**

Education is a basic determinant of the quality of life of individuals, people with limited skills and competencies are excluded from good jobs and have fewer prospects for economic prosperity. Higher levels of educational attainment are generally linked to better occupational prospects and higher income for individuals, hence having a positive effect on their quality of life. People who have completed tertiary education improve their possibilities to secure a job: the unemployment rate decreases with the educational level.

- **Reliability of utility services**

For any smart city in the world, the focus is on reliability of utility services, whether it is electricity, water, telephone or broadband services. Smart cities should have universal access to electricity 24×7; this is not possible with the existing supply and distribution system. Cities need to shift towards renewable sources and focus on green buildings and green transport to reduce the need for electricity.

3.6 Smart Infrastructure - Intelligent Traffic Management

One of the key components in smart cities of the future is the use of Advanced Traffic Management Systems (ATMS) and Advanced Traveller Information Systems (ATIS) for efficient management and control of traffic flows. The purpose of the ATMS/ATIS is to improve the overall traffic system performance, e.g. reducing emissions, noise and travel times.

In order to manage and control traffic flows, the conditions of the road traffic have to be captured. The road traffic state can be described using speed, flow and density on a specific segment of the road. The length of the segment might vary depending on the geometry of the road. When estimating the traffic state, different types of traffic models are commonly used. However, the models can not include all aspects of the real system, and in order to have a good representation of reality the models have to be combined with measured data of the traffic state, e.g. traffic counts and speed/travel time measurements.

Today, most existing ATMS/ATIS rely on fixed point measurements from loop and radar detectors. Eulerian sensors can collect observations in terms of flow, speed and occupancy1, but are unable to provide any trajectory based measurements, such as direct trip observations or travel times on routes, which can contribute even further to the understanding of the behaviour of the traffic flow. Already, cities generate large amounts of space-time location data from different systems, such as cellular networks, social networks and participatory sensing. When eulerian sensors are combined with lagrangian sensors available in connected vehicles and user devices, the possibility of observing large scale mobility patterns will dramatically change. Massive amounts of lagrangian sensors enable a new era of road traffic sensing, making it possible to directly observe trips for a much larger penetration than before. These observations enable a new dynamic understanding of experienced travel times, as well as departure time, mode and route choices, which relate to the travel demand.

⇒ **Traffic Monitoring**

It can be considered as one of the key components of a smart city. Traffic monitoring allows the local authorities to monitor the flow of traffic pertaining to a particular area, route or street. It helps in keeping track of the inflow of traffic from other neighbouring cities during specific days or a particular time of the year. Historical data of traffic monitoring can be very useful in smart city planning and city infrastructure development.

⇒ **Pollution Avoidance**

Rising pollution levels pose a threat to the environment as along with having adverse impacts on human health and wellbeing. The extent of air and noise pollution are directly proportionally to the intensity of traffic congestion in a city. Long-standing queues of vehicles result in the exorbitant emission of pollutants resulting in an increase in temperatures, a decrease in rainfall, respiratory problems, etc.

⇒ **Route Optimization**

In recent times, it has been observed that the shortest route doesn’t seem to work well in terms of total travel time, fuel consumption and average waiting time. In such scenarios, an optimum route is the best option for travel as it considers factors such as traffic congestion, distance travelled, total travel time and fuel consumption. An optimum route comprises of a trade-off between all these parameters and sits well for a traveller in context to its time and money being spent on travel.

⇒ Green Corridor

It's been a couple of years since the concept of a green corridor has seen the light of the day. It is a corridor which in reality is a route from a source to the destination comprising of various traffic signals all of which having a green signal. The green corridor is used to cater to the emergency vehicles by allowing them to reach their desired destination without any waiting time and at maximum speed.

(Fig-6 Smart Infrastructure)

⇒ Accident Detection

The overcrowded streets of present-day roads have given rise to the number of accidents. Accident detection is a crucial part of a traffic management system as it not only informs the medical services to attend to the accident hit personnel's but also has an impact on the traffic flow and congestion levels of a particular region.

⇒ Jamming

Prevention of traffic jams and reduction in average waiting time are the two most important functionalities of an efficient traffic management system.

⇒ Vehicle Tracking

It helps the local administration in keeping track of vehicles in terms of the areas they are traveling, time of travel, speed, places visited and vehicle type. All of these parameters prove to be fruitful when it comes to maintaining a state of law and order in the city.

3.7 Cyber Security

⇒ **Network Security**
Protect your networks against external and internal attack. Manage the network primer. Filter out unauthorised access and malicious contents. Monitor and test security controls.

⇒ **Malware Protection**
Produce relevant policy and establish anti-malware defences that are applicable and relevant to all business areas. Scan for malware across the Organ.

⇒ **Monitoring**
Establish a monitoring strategy and produce supporting policies. Continuously monitor all ICT system and networks. Analyse logs for unusual activity that could indicate an attack.

⇒ **Incident Management**
Establish an incident response and disaster recover capability. Produce and test incident management plans. Provide specialist training to the incident management team. Report criminal incidents to law enforcement.

⇒ **User Education and Awareness**
Produce user policies covering acceptable and secure use of the organisation's systems. Establish a staff training programme. Maintain user awareness of the cyber risks.

⇒ **Home and Mobile Working**
Develop a mobile working policy and train staff to adhere to it. Apply the secure baseline to all devices. Protect data both in transit and at rest.

⇒ **Secure Configuration**
Apply security patches and ensure that the secure configuration of all ICT systems is maintained. Create a system inventory & define a base line build for all ICT devices.

⇒ **Removable Media Controls**
Produce a policy to control all access to removable media. Limit media types and use. Scan all media for malware before imported on the corporate system.
⇒ **Managing User Privileges**
Establish account management processes and limit the number of privileged accounts. Limit user privileges and monitor user activity. Control access to activity and audit logs.

⇒ **Information Risk Management Regime**
Establish and effective governance structure and determine your risk appetite. Maintain board's engagement with cyber risk. Produce supporting information risk management policies.

3.8 Retrofitting-Redevelopment-Greenfield Development District Cooling

Retrofitting
Retrofitting means providing something with a component or feature not fitted during manufacture or adding something that it did not have when first constructed. It is often used in relation to the

installation of new building systems, such as heating systems, but it might also refer to the fabric of a building, for example, retrofitting insulation or double glazing.

The process of retrofitting involves the careful balancing of different elements and their effects on the overall performance of a building. A change in one part of a building can affect another, and sometimes this is only apparent after irreversible defects have occurred. For example

⇒ Sealing buildings to improve their air-tightness can cause condensation problems.
⇒ Insulating a roof without also ventilating it can cause decay of timber structure.
⇒ Internal wall insulation will remove the benefits of thermal mass which may have a detrimental effect on fuel usage.
⇒ External wall insulation will prevent the thermal store of heat from solar gain to be utilised within the building.
⇒ Poorly installed cavity wall insulation can create cold spots that then have damp problems that are extremely difficult to rectify.
⇒ Pre-existing problems can be covered up, and so more difficult to diagnose and rectify.

Redevelopment

Redevelopment is not just constructing buildings; it ensures that residents of a community are empowered to improve their quality of life and environment as a result of sound Planning practices. Redevelopment is typically perceived as the physical placement and regulation of land uses and structures. However, redevelopment goals should also incorporate other aspects of community development such as design, preservation of historic assets, public spaces, promotion of environmental justice, environmental remediation and even issues that enhance the level of social services provided to neighborhood residents.

This document discusses the need for improved redevelopment planning, key redevelopment planning concepts and a list of policies. APA-NJ will use this policy guide as a means to substantiate its position on redevelopment planning in New Jersey; both in its legal definition as well as the practice of sound and integrated land use planning. For the purposes of this guide, there are several forms of "redevelopment" that is centered on re-planning efforts, zoning and private investment. The more traditional understanding of redevelopment, revolves around the Local Redevelopment and Housing Law (LRHL). It contains certain tax incentives and powers; and lastly it discusses the rehabilitation and reuse of existing structures and neighborhoods.

According to the Redevelopment Handbook, A Guide to Rebuilding New Jersey's Communities; 'Redevelopment is defined as: "A process to rebuild or restore an area in a measurable state of decline, disinvestment, or abandonment. Redevelopment may be publicly or privately initiated, but it is commonly recognized as the process governed by the Local Redevelopment and Housing Law and undertaken in accordance with a redevelopment plan adopted by a municipality. If used correctly, it can transform an underutilized or distressed area into an economically viable and productive part of the community."

District cooling

District cooling systems distribute chilled water to supply air-conditioning or process cooling. Cities with major downtown or commercial districts with district cooling systems include Stockholm, Hamburg, Paris, Tokyo, Chicago, Minneapolis, St. Paul, New Orleans, and Houston. The first major district cooling system was employed in Hartford, Connecticut, in 1962. Other systems were built in the 1960s and 1970s. District cooling experienced a renaissance during the

1990s, when many countries demanded the termination of the use of CFC due to ozone depletion. District cooling systems are much smaller than district heating systems. Annual cold generation is approximately 1 or 2 PJ in the largest district cooling systems.

The distribution network is similar to that of a district heating system, with one supply pipe and one return pipe. Cold water is circulated instead of warm water. The supply temperature is normally 6 or 7°C, but an ice mixture of 0°C is sometimes used. Customers heat the chilled water in the supply pipe by cooling air supplied to a building or a industrial process. The typical temperature in the return pipe is 12–17°C. The water is again chilled when it circulates through the cold-generation plant. District cooling systems are never used citywide. The low temperature difference makes district cooling distribution expensive, so district cooling networks can only be built in areas with high cooling demand densities, such as downtowns and commercial areas.

Cold generation can be accomplished by central compression or absorption chillers. Free cooling with deep, cold lake or seawater can also be used, as is the case in Toronto and Stockholm. However, this is only possible in areas with cold winters, which annually create cold reservoirs for summer use. Since the diurnal variation of the cooling demand is large at peak load, a significant portion of the peak demand can be met by cold energy storage capacity with a cold water storage tank or an ice storage facility.

Two major associations exist between district heating and district cooling systems. The evaporator of a heat pump can be used for cold generation in a district cooling system and the condenser can simultaneously generate heat in a district heating system. One part of bought electricity will then create two parts of sellable cold and three parts of sellable heat, giving a higher return of the heat pump investment. The other association is the possible use of low-cost district heat for operation of local absorption chillers in connection with customer cooling demands. In this way, citywide deliveries of cooling can be accomplished without installing a citywide district cooling system. This variant is sometimes called warm district cooling, in contrast to cold district cooling, which refers to ordinary district cooling systems. District heating systems using this warm variant are employed in Gothenburg, Mannheim, New York, and Seoul.
These two associations can be integrated into a regeneration plant, in which power generation is integrated with the generation of both cold and heat. First, a cogeneration unit can generate electricity and heat. These products are then used for feeding a compression chiller or a absorption chiller.

There is an operation optimization benefit for district cooling. Cold generation can be optimized by using different generation technologies to meet various cooling demands. The base load demand can be met by an absorption chiller if low-cost heat is available. Next-generation units in merit order include a compression chiller with heat recovery and a similar chiller without heat recovery. Extreme peak load can be met by a cold storage.

Major advantages of district cooling systems are reduced grid power demand by supplying cooling energy through the district cooling system rather than through the local power grid, shifting power demand to off-peak periods through cold energy storage, and the use of free cooling. Advantages for customers with district cooling are the requirement for less space for cooling equipment inside the building, less operation and maintenance costs, and less electricity cost. The subscribed cooling capacity can also be adjusted to the actual measured customer cooling demand. The customer does not have to buy an expensive oversized chiller.

Green Field Development

Greenfield development will introduce most of the Smart Solutions in a previously vacant area (more than 250 acres) using innovative planning, plan financing and plan implementation tools (e.g. land pooling/ land reconstitution) with provision for affordable housing, especially for the poor. Greenfield developments are required around cities in order to address the needs of the expanding population. From a legal perspective, the challenges in obtaining timely, effective, and affordable approvals for Greenfield residential development. In particular, we focus on the constraints on Greenfield developments (not all green fields are equal); the need to integrate land use planning with the provision of infrastructure; and the opportunities provided by the Special Housing Area legislation. Greenfield areas are seen as the low hanging fruit in terms of providing land for urban expansion, however the reality is quite different. There will be no perfect sites where the conversion of land for urban use will have no effects; all areas will be constrained, and the conversion of any area will need to occur in the context of compromises HAVING been made. One of the most important issues with Greenfield developments is to ensure that the development area can be appropriately served with infrastructure. New areas (Greenfield) will be developed around cities in order to accommodate the expanding population in urban areas. Application of Smart Solutions will enable cities to use technology, information and data to improve infrastructure and services that includes physical as well as social infrastructure. One well known example is the GIFT City in Gujarat. For Bhubaneswar, the constituent proposal comprise of:

⇒ Identification and Preparation of Town Planning Schemes as an urban growth strategy through effective management of land resources.
⇒ Master planning of mixed-use integrated townships in Jagasara and Shyamapur. Unlike retrofitting and redevelopment, Greenfield developments could be located either within the limits of the ULB or within the limits of the local Urban Development Authority (UDA). Some of the important determining factors about Greenfield development are:
⇒ Areas of land that have never been used for construction, areas of natural, often grassed, land.
⇒ Nothing to demolish, and no existing issues
⇒ Cheaper to develop
⇒ Demand for rural/suburban housing
⇒ Easier to comply with environmental standards
⇒ Profitable for local farmers to sell their land on, and they have a right to do so.

3.9 Strategic Options for Fast Development

⇒ The strategic components of area-based development in the Smart Cities Mission are city improvement (retrofitting), city renewal (redevelopment) and city extension (Greenfield development) plus a Pan-city initiative in which Smart Solutions are applied covering larger parts of the city. Below are given the designs of the three models of Area-based smart city development:
⇒ Retrofitting will introduce planning in an existing built-up area to achieve smart city objectives, along with other objectives, to make the existing area more efficient and liveable. In retrofitting, an area consisting of more than 500 acres will be identified by the city in consultation with citizens. Depending on the existing level of infrastructure

⇒ Redevelopment will effect a replacement of the existing built-up environment and enable co-creation of a new layout with enhanced infrastructure using mixed land use and increased density. Redevelopment envisages an area of more than 50 acres, identified by Urban Local Bodies (ULBs) in consultation with citizens. For instance, a new layout plan of the identified area will be prepared with mixed land-use, higher FSI and high ground coverage. Two examples of the redevelopment model are the Saifee Burhani Upliftment Project in Mumbai (also called the Bhendi Bazaar Project) and the redevelopment of East Kidwai Nagar in New Delhi being undertaken by the National Building Construction Corporation.

⇒ The use of pilot projects and open sensor data can play a pivotal role in ensuring high returns for Smart City initiatives.

⇒ Greenfield development will introduce most of the Smart Solutions in a previously vacant area (more than 250 acres) using innovative planning, plan financing and plan implementation tools (e.g. land pooling/ land reconstitution) with provision for affordable housing, especially for the poor. Greenfield developments are required around cities in order to address the needs of the expanding population. One well known example is the GIFT City in Gujarat. Unlike retrofitting and redevelopment.

⇒ Pan-city development envisages application of selected Smart Solutions to the existing city-wide infrastructure. Application of Smart Solutions will involve the use of technology, information and data to make infrastructure and services better. For example, applying Smart Solutions in the transport sector (intelligent traffic management system) and reducing average commute time or cost of citizens will have positive effects on productivity and quality of life of citizens. Another example can be waste water recycling and smart metering which can make a huge contribution to better water management in the city.

3.10 India's Urban Water and Sanitation Challenges and Role of Indigenous Technologies

Water supply and Sanitation Challenges

Universal access to both water and sanitation still remains an issue in urban India. As illustrated, the mere presence of infrastructure is no indicator of service levels. While 40 per cent do not have acce0ss to public piped water supply, the remaining households may not get a sufficient quantity of water, or regular water supply. In absence of public service, households depend on multiple sources of water—procuring water from private players or some form of provisioning. In addition, nearly one-third of urban households do not have any water source within their premises, and nearly a third depend on shared facilities. Water quality is likely to be a concern. At the city level, the biggest concern remains the high distribution losses, and high non-revenue water.

Nearly 10 million urban households do not have access to any form of latrine, and defecate in the open, while another 2 million have access to unimproved sanitation. Any equally pertinent concern is the abysmal record on wastewater conveyance and treatment side. Only one-third of the waste is carried through severed networks, and only 15 per cent of wastewater is treated. There are minimal facilities for safe sullage /septage removal, transportation and treatment. The focus has predominantly been on creation of new infrastructure, without adequate attention paid to putting in place a sustainable O & M region to ensure sustainability of infrastructure.

The urban poor are disproportionately affected by the lack of access to water and sanitation. Urban poor households are more likely to need to fetch water from outside their houses, and more likely to depend on shared facilities. On the sanitation side, they are more likely not to have access to adequate sanitation facilities. As highlighted above, there are unique challenges to ensure provisioning of services to the poor, including tenure security, affordability and space constraints.

The environmental concerns posed by the urban water supply and sanitation are two-fold. There is inadequate attention being paid to the protection of water sources, and there are hardly any efforts to move towards conjoint management of water. The more severe concern is pollution of both surface and groundwater caused by a lack of treatment of wastewater. Some points are:

⇒ Only 43.5% of the households in India are using tap water as the major source of drinking water.
⇒ In urban areas, 30% of households do not have access to water within their premises and 18.6% do not have access to even the most rudimentary forms of sanitation facilities.
⇒ The urban poor end up paying more than the rich per unit of water. Non-revenue water on average across 28 cities was 39% (2008-09).
⇒ India’s urban population grew by 31.8% in the last decade to reach 0.37 Billion, compared with the national average of 17.64%.
⇒ Class I and Class II towns together generate 38,254 million liters of sewage per day; only 11,787 MLD (31%) are treated.

Indigenous Technology

- **Indigenous water purification technologies**

These technologies can improve the drinking water quality of smaller villages as well as larger cities. It uses the Pressure Driven Membrane Processes. These are suitable for all capacity units e.g. they are adaptable from household level unit or community level unit to large scale unit. Water purification technologies make use of the nuclear energy and solar energy also.

- **Environment friendly Plasma technologies:**

Solid waste dumping sites or landfill sites need more amount of land which is not available in urban areas. Incineration of solid waste pollutes the environment if the incinerators are not designed or operated properly. Thermal Plasma Technology is ideally suited for waste treatment. By plasma technology Hazardous & toxic compounds are broken down to elemental constituents at high temperatures; Inorganic materials are converted to Vitrified Mass; and Organic materials are Pyrolysis or Gasified, converted to flue gases (H2 & CO) & Lower hydrocarbon gases when operated at low temperature (500 – 600OC). Disposal of carcass is also being thought of using plasma pyrolysis.

- **Unique Multi Stage Biological Treatment Solution:**

Multi Stage Biological Treatment Solution (MSBT) can be implemented on existing STP which is not able to process Sewage to optimum efficiency. MSBT can be implemented as a modular or container on the banks of rivers on Drains/Nalas which discharge waste water to the river. It can also be implanted in small urban societies and housing complex for better water management.

Role of environmental isotope techniques in the water resources development and management

There are two type of isotopes, stable isotopes and radioactive isotopes. Isotope techniques are used to find out the type of contamination in surface water and ground water, the sources and origin of contamination, pollutant dispersion in surface water bodies, to assess the groundwater salinity, to assess the changes due to long-term exploitation of groundwater, for hydro-chemical investigation and to carry out geochemical evolution of groundwater.

The BARC UF Membrane Technology for Domestic Water Purifiers:

Water filters manufactured by Sondhka based on membrane based water Purification Technology has been developed by BARC. Benefits of BARC Polysulfone Membrane are high tech 0.02micron or 20nm, simple form factor, rugged (life of more than 1 year) and low maintenance (about Rs. 500 per year). It is very easy to use and very low-cost solution for the water contamination.

Deployment of BARC Domestic Water Purifier in Rural Area through AKRUTI Program:

Rural Human & Resource Development Facility is disseminating BARC technologies, namely Nisargruna Biogas, Soil Organic Carbon Testing Kit, Seed Bank, Domestic Water Purifier, Weather Forecasting, LLL, RIA, FSD, VTD; under the AKRUTI(Advance Knowledge of Rural technology Implementation) Program. Activities carried out under the AKRUTI program are surveys for safe drinking water, Interaction with the villagers, Entrepreneurship development for domestic water purifier production and Awareness programs for benefits of use purified water. RHRDF has also launched a scheme for safe drinking water for village under CSR.

3.11 Initiatives in village development by local self-government

In the past "government as provider" approach, the priorities were to secure budget allocations and develop projects. The Housing Policy and the NCU statement implicitly give higher priority to two other requirements: first, the reform of policies and regulations that now inhibit development initiatives by the people; and second, more efficient resource management and the building of institutional capacity. Resource Management and Institutional Development. As discussed in Section 5, India's urban institutions do not have the capacity to provide adequate services at present, let alone address the requirements of accelerated urban growth in the future. Proposals relate to three types of institutions. He primes public sector actors in the urban development process; call for clearer allocations of responsibility and authority to them; and recognize the need for new organizational relationships between local gover-ents and development authorities and State governments that would avoid overlaps and facilitate coordinated programming. Improved personnel incentives will be needed to permit the recruitment and retention of qualified staff as will skills training programs. Resource constraints, however, preclude simply expanding local government under current practices in proportion to urban growth. In many areas, the very nature of the way work is conducted will have to be redesigned to permit much higher levels of productivity. The NCU recognizes reforms of internal management as vital. This is likely to entail implementing more systematic and efficient approaches in many areas: for example, budgeting and financial management; project management and control; billing and collections; infrastructure systems maintenance; and personnel management.

Financial Systems. Constraints on government budgets and the rigidities of the present system of intergovernmental transfers prevent an adequate response of traditional arrangements to the challenge of urbanization. A new and more decentralized system of public and private financial intermediaries will be required. The establishment of the NHB represents an important step: an apex institution that will stimulate the creation of a network of mortgage financing. The NCU also calls for the creation of Urban Infrastructure Development banks to permit local governments to borrow for infrastructure.

⇒ Under the scheme, during 2019-24, MPs will be able select one village every year for integrated development aimed at improving the overall quality of rural life. The project also envisages turning villages into model villages not just through infrastructure development but gender equality, peace and harmony.
⇒ It also aims to instil the spirit of community service, mutual cooperation, self-reliance, local self-government and drive transparency and accountability in public life.
⇒ The programme also aims to inspire a sense of pride among people by giving them ownership of the development schemes and through initiatives like honouring village elders, celebrating village day and folk art festivals and by driving them to develop their own village song.
⇒ The blueprint of the project, which is likely to be unveiled by Prime Minister Narendra Modi on Saturday, will have the gram panchayat as the basic unit for development. While a population size of 3,000-5,000 per development unit has been fixed for plain areas, for hilly, tribal and difficult areas the population base for each of these selected villages will be between 1,000 and 3,000. According to the document, while Lock Sabha MPs will have to choose a gram panchayat from within their constituencies, Rajya Sabha MPs will be able to select a gram panchayat from a district of their choice in the state from which they have been elected.

3.12 Smart Initiatives by District Municipal Corporation

Rajkot has been selected in the list of 100 Smart cities under the Smart City Mission of Ministry of Urban Development (MOUD), Government of India launched in June 2015. Moving forward the city is in the process of preparing a Smart City Proposal (SCP) as a requirement to participate in the Smart City Challenge. Under the Smart City Challenge, top 20 cities will be selected from 100 shortlisted cities based on the SCP. The process of SCP preparation would be driven by intense citizen engagement at multiple levels in the city, for which Rajkot Municipal Corporation (RMC) has prepared an extensive Stakeholder Consultation Plan. RMC will carry out three rounds of stakeholder consultations over the period of next two months. RMC has completed the Round 1 consultation where Citizen’s views and suggestions were called for to arrive at City’s Vision and define goals in terms of their aspiration to see their city in next 5,10 or 20 years followed by strategies to achieve these goals. The stakeholders are expected to highlight suggestions/ideas on improvement of city services such as water supply, transportation system, sanitation, housing, health, education, energy, open spaces, air quality, safety etc. In the next stage i.e. Round 2 of stakeholder consultations, which will be carried out during the month of October, RMC will seek similar kind of feedback from citizens on area development and pan city smart solutions.

3.13 Any Projects contributed working by Government / NGO / Other Digital Country concept

Pradhan Mantri Gram Sadhak Yojana (PMGSY)

The roads are considered vital in any region. The development of roads enables the individuals to promote economic growth and alleviate poverty. Government has launched a centrally sponsored scheme, which is known as the Pradhan Mantri Gram Sadhak Yojana. The main objective of this program is to provide connectivity to all the unconnected habitations in rural areas, through the construction of roads by the end of the tenth plan period. The rural areas usually have the population of more than 500 individuals. PMGSY is a special central intervention as part of the poverty reduction strategy. Though rural roads is a state subject, the central government is making provision of financial assistance as a centrally sponsored program. The main objective of road connectivity is to ensure that essential services, such as education, employment opportunities, health care and medical, markets etc. are available to all citizens. State Government agencies and Panchayti Raj institutions will ensure that all the related programs focus upon making provision of services to habitations, connected under PMGSY (Pradhan Mantri Gram Sadhak Yojana, n.d.).

3.14 How to implement other Countries smart villages projects in Indian village context (Regarding Environment , Employment)

Ohio City

Geography

Ohio's geographic location has proven to be an asset for economic growth and expansion. Because Ohio links the Northeast to the Midwest, much cargo and business traffic passes through its borders along its well-developed highways. Ohio has the nation's 10th largest highway network and is within a one-day drive of 50% of North America's population and 70% of North America's manufacturing capacity. To the north, Lake Erie gives Ohio 312 miles (502 km) of coastline, which allows for numerous cargo ports. Ohio's southern border is defined by the Ohio River (with the border being at the 1792 low-water mark on the north side of the river), and much of the northern border is defined by Lake Erie. Ohio's neighbours are Pennsylvania to the east, Michigan to the northwest, Lake Erie to the north, Indiana to the west, Kentucky on the south, and West Virginia on the southeast. Ohio's borders were defined by metes and bounds in the Enabling Act of 1802 as follows:

Population

From just over 45,000 residents in 1800, Ohio's population grew at rates of over 10% per decade (except for the 1940 census) until the 1970 census, which recorded just over 10.65 million Ohioans. Growth then slowed for the next four decades. The United States Census Bureau estimates that the population of Ohio was 11,613,423 on July 1, 2015, a 0.67% increase since the Census. Ohio’s population growth lags that of the entire United States, and Caucasians are found in a greater density than the United States average. As of 2000, Ohio's centre of population is located in County, in the county seat of Gilead. This is approximately 6,346 feet (1,934 m) south and west of Ohio's population centre in 1990. As of 2011, 27.6% of Ohio's children under the age of 1 belonged to minority groups. 6.2% of Ohio's population is under five years of age, 23.7 percent under 18 years of age, and 14.1 percent were 65 or older. Females made up approximately 51.2 percent of the population.

Languages

About 6.7% of the population age 5 years and over reported speaking a language other than English, with 2.2% of the population speaking Spanish, 2.6% speaking other Indo-European languages, 1.1% speaking Asian and Austronesia languages, and 0.8% speaking other languages. Numerically: 10,100,586 spoke English, 239,229 Spanish, 55,970 German, 38,990 Chinese, 33,125 Arabic, and 32,019 French. In addition 59,881 spoke a Slavic language and 42,673 spoke another West Germanic language according to the 2010 Census.[89] Ohio also had the nation's largest population of Slovene speakers, second largest of Slovak speakers, second largest of Pennsylvania Dutch (German) speakers, and the third largest of Serbian speakers.

Religion

Amish children on the way to school.

According to a Pew Forum poll, as of 2008, 76% of Ohioans identified as Christian. Specifically, 26% of Ohio's population identified as Evangelical Protestant, 22% as Mainline Protestant, and 21% as Catholic.17% of the population is unaffiliated with any religious body. 1.3% (148,380) was Jewish. There are also small minorities of Jehovah's Witnesses (1%), Muslims (1%), Hindus (<0.5%), Buddhists (<0.5%), Mormons (<0.5%), and other faiths (1-1.5%). According to the Association of Religion Data Archives (ARDA), in 2010 the largest denominations by adherents were the Catholic Church with 1,992,567; the United Methodist Church with 496,232; the Evangelical Lutheran Church in America with 223,253, the Southern Baptist Convention with 171,000, the Christian Churches and Churches of Christ with 141,311, the United Church of Christ with 118,000, and the Presbyterian Church (USA) with 110,000.With about 70,000 people in 2015 Ohio had the second largest Amish population of all states of the US.

According to the same data, a majority of Ohioans, 55%, feel that religion is "very important," 30% say that it is "somewhat important," and 15% responded that religion is "not too important/not important at all. 36% of Ohioans indicate that they attend religious services at least once weekly, 35% attend occasionally, and 27% seldom or never participate in religious services.

3.15 Electrical concept

Analysis on requirement of achieving smart power in a smart city: **C**ontinuous power supply is a major element in the smart city development. For a continuous supply of power in the smart city it is very essential to have strong and smart transmission and distribution (T&D) systems but today’s T&D systems seems to be inadequate to meet the increasing power demand therefore leaving a question on T&D’s ability to supply adequate power to the upcoming smart cities. Supplying power to the smart cities will be a challenging task and how the masters of the power sector are going to address these challenges will be a thing to watch. On this note, the article will discuss about the requirements of achieving smart power in a smart city. It will also inform about ways to address the T&D challenges.

Chapter: 4
About Derdi Kumbhaji

4.1 Introduction

4.1.1 Introduction About Derdi Kumbhaji Village details

Derdi is a Village in Gondal Taluka in Rajkot District of Gujarat State, India. It is located 44 KM towards South from District headquarters Rajkot. 280 KM from State capital Gandhinagar. Derdi Pin code is 364465 and postal head office is Derdi Kumbhaji. Derdi is surrounded by Kotda Sangani Taluka towards East, Jetpur Taluka towards South, Lodhika Taluka towards North, Kunkavav-Vadia Taluka towards South. Derdi Local Language is Gujarati. Derdi Village Total population is 8450 and number of houses are 1770. Female Population is 48.7%. Village literacy rate is 75.3% and the Female Literacy rate is 33.8%.

Gram Panchayat	Derdi Kmbhaji
Block / Tehsil	Gondal
District	Rajkot
State	Gujarat
Pin code	364465
Area:	3169.6 Hect.
Population	8450
Households	1770
Nearest Town:	Gondal (36.7 km)

Cast Data as per Census 2011

Schedule Caste (SC) constitutes 9.46 % while Schedule Tribe (ST) were 0.31 % of total population in Derdi village.

Working Population as per Census 2011

In Derdi village out of total population, 3162 were engaged in work activities. 85.86 % of workers describe their work as Main Work (Employment or Earning more than 6 Months) while 14.14 % were involved in Marginal activity providing livelihood for less than 6 months. Of 3162 workers engaged in Main Work, 1043 were cultivators (owner or co-owner) while 366 were Agricultural laborers.

4.1.2 Justification/ need of the study

In India there are 640 districts, (200 backward) 6, 50,000 villages (1, 25,000 backward.)The Government takes responsibility for uplifting rural and poorer regions. There is lot of public spending to improve the infrastructure, water and sanitation in these areas. But not much improvement achieved in most of the villages. Vishwakarma Yojana helps in better and fast development of rural areas. By providing urban facilities in rural areas, decrease this rate of migration & also increase standard of living of people of rural areas.

The basic need of this study is to provide facilities in the villages for the Rurban Development. Implement the different Physical and Social infrastructural facilities in the villages and to lessen the urban migration of people of the village. So, for this purpose information of village is to be collected like Drainage Facility, Education Facilities, Health Facilities, Transportation Facilities, Banking Facilities, and Public Toilets etc. It will also provide so many job opportunities.

Development of the village will indirectly affect the GDP of India. So, it is very important to develop the villages of India.

⇒ To kwon the current situation of village.
⇒ To give various benefits to villagers though various government schemes in village.
⇒ To solve many civil and electrical problems in village
⇒ To development of socio culture facilities like community hall, public library, recreational activities and repairing of existing amenities.

4.1.3 Study Area

Derdi Kumbhaji is a village in Gondal taluka in Rajkot district of Gujarat state, India. It is located 73.3 Km towards south from district head-quarters Rajkot. 270 Km from state capital Gandhinagar. Derdi Kumbhaji pin code is 364465 and postal office is Derdi Kumbhaji. According to census 2011 information Derdi Kumbhaji village code is 513270. Derdi Kumbhaji village is located in Gondal tehsil of Rajkot district in Gujarat, India. Derdi Kumbhaji have grampanchyat. The total geographical are of village is 3169.6 Hector. Derdi Kumbhaji has total population of 8450 peoples. There are about 1770 houses in Derdi Kumbhaji village. Gonadl is the nearest town to the city and it is located 34.8 Km away.

⇒ From Techno economic survey of Derdi Kumbhaji village we observe some physical and social facilities are not so batter like underground drainage, Recreational Facilities.
⇒ Provision of social infrastructure such as drinking water, health care, education, sanitation, housing, road and electrification.
⇒ To study the existing facilities and parameters of village.

4.1.4 Objectives of the study

⇒ To study the present scenario of village, and involvement of villagers, Sarpanch, governments in development of village.
⇒ To study the existing growth, characteristics and development of villages.
⇒ To provide basic amenities in the village, like transportation, sanitation, educational, health care facilities.
⇒ To reduce migration from rural to urban.
⇒ To promote integrated development.
⇒ To provide sustainable development.
⇒ To propose the comprehensive planning suited for ideal village.
⇒ To Design and planning for village basic facilities and needs. To promote integrated development of rural areas with provision of quality housing, better connectivity, employment opportunities and supporting physical and social infrastructure.
⇒ Refurbishing of village water tanks and wells, construction of rain water harvesting structures for sustainable Development.
⇒ Electricity connections like street lighting that is energy efficient and eco-friendly

4.1.5 Scope of the Study

By the analyzing present conditions, we can improve the basic amenities and facilities like agricultural facilities, milk cooperative facility, education facilities. To improve life style of the villagers by helping them to develop their skills by assisting them in implementing income generating activities in close coordination and cooperation with national and international organizations.

⇒ By the analysing the present conditions we can improve the basic amenities and facilities like agriculture facilities, milk cooperative facility, education facility.

⇒ Most of people lived at village so first to developed the village as per the Urbanisation term.

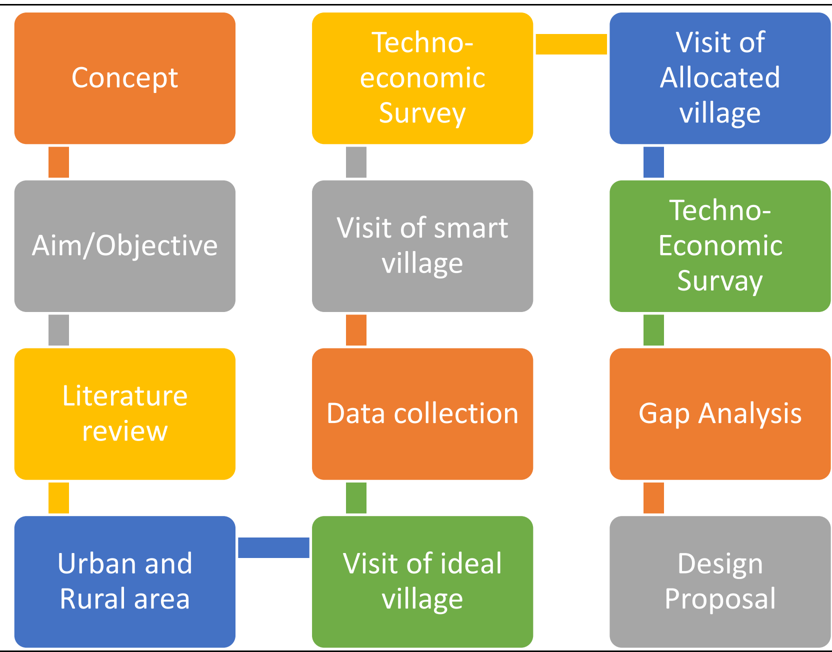
⇒ Solutions of rural problems can bring the change in the rural society.

⇒ To Improve life style of villagers by helping them to develop their skill by assisting them in implementing income generating activities in close coordination and cooperation with national and international organizations.

⇒ The information and data from visit will help us to develop the methodology for improvement in village. The primary data collected through survey will give the level of services available in village and its requirements for improvement.

⇒ Based on these studies the requirement can be known and the further plan based on this requirement can be visualize for compacted development of the village.

4.1.6 Methodology Frame Work for development of your village



(Fig-7 Frame Work for development of your village)

4.1.7 Available Methodology for development of related to Civil/Electrical

Creation of infrastructure - connectivity, civic and social infrastructure along with Provision of alternative livelihood generation are the key pillars.

Basic Physical Infrastructur*e* – Water Supply, Transportation, Sewerage, public Toilet and Solid Waste collection and Management should be the priority focus and be provided

Basic Social Infrastructure – Health and Education facilities should be provided and ensure proper delivery of facilities to village dwellers.

Promote integrated development of rural areas with provision of quality hour, better connectivity, employment opportunities and supporting physical and social infrastructure.

- ⇒ Post office
- ⇒ Primary school
- ⇒ Secondary school
- ⇒ Street lights
- ⇒ Panchayat building
- ⇒ Good road
- ⇒ Bank
- ⇒ Electricity for all Field

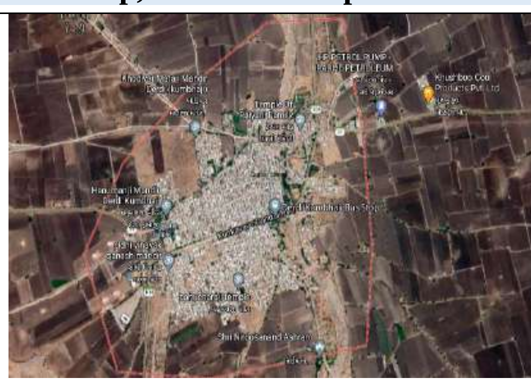
4.2 Derdi Kumbhaji Study Area Profile

4.2.1 Study Area Location with brief History land use details

According to Census 2011 information the location code or village code of Derdi Kumbhaji is 513270. Derdi Kumbhaji is located in Gondal Tehsil of Rajkot district in Gujarat, India. It is situated 73.3 Km away from district headquarter Rajkot. Derdi kumbhaji has also grampanchyat. The totak Geographical area of village is 3169.6 hector. Derdi kumbhjai has total population of 8450. There are about 1770 houses in derdi kumbhjai village. Gondal is the nearest towan to the derdi Kumbhaji approximately 36.7 km.

Locality Name:	Derdi Kumbhaji
Taluka Name:	Gondal
District:	Rajkot
State:	Gujarat
Language:	Gujarati
Pin Code:	364465
Residential Area:	200 hectare
Agricultural land area:	350 hectare
Forest area:	3.2 hectare

4.2.2 Base Location map, Land Map, Gram Tal Map



(Fig-8 Base location map)

4.2.3 Physical & Demographical Growth

The village is home to 8450 people, among them 4335 are male and 4115 are female. 9.46% are from schedule caste and 42% are schedule tribes. Child (aged under 6 years) population of Derdi Kumbhaji village is 9%, among them 60% are boys and 40% are girls. There are 1770 households in the village and an average 5 persons live in every family.

Population of the village has increased by 10% in last 10 years. In 2001 census total population here were 8082. General caste population has increased by 15%; Schedule caste population has decreased by -11%; Schedule Tribe population has increased by 25% and child population has decreased by -5% in the village since last census.

As of 2011 census there are 949 females per 1000 male in the village. There are 356 girls under 6 years and 435 male under 6 years. Total Schedule cast population in Derdi Kumbhaji is 799 out of which 384 are males and 415 are females. Total workers in Derdi Kumbhaji is 3162 out of which 2374 are males and 788 are females. Total schedule Tribes in village are 26 out of which 26 are males and 9 are females. Total Marginal Workers are 447 out of which 210 are males and 237 are females. Schedule Caste (SC) constitutes 9.46 % while Schedule Tribe (ST) were 0.31 % of total population in Derdi village.

Work Profile: - In Derdi village out of total population, 3162 were engaged in work activities. 85.86 % of workers describe their work as Main Work (Employment or Earning more than 6 Months) while 14.14 % were involved in Marginal activity providing livelihood for less than 6 months. Of 3162 workers engaged in Main Work, 1043 were cultivators (owner or co-owner) while 366 were Agricultural laborers.

⇒ The coordinate of Derdi Kumbhaji is (21.749813, 70.993566)
⇒ Distance to the nearest railway station is gondal (35.9 km)
⇒ There is 6 anganwadi, 1 primary school, 1 secondary school, 1 private collage, 1 PHC and there are other facilities too.

4.2.4 Economic generation profile / Banks

⇒ In Derdi Kumbhaji there are major occupational group is Farmers and in second there is small scale industries group.
⇒ Average income of village dwellers are 7000 to 10,000 per months.
⇒ The major crops grown in village is Cotton and Ground nut.
⇒ Village has more than 1 bank.
⇒ Village has bank and ATM also.
⇒ There is also a post office.

4.2.5 Actual Problem faced by Villagers and smart solution

No.	Problem	Smart solution
1	Some minor Physical Facilities	Maintenance with new techniques
2	Transportation	Efficient design with ease of maintenance
3	Sanitation	Design and maintenance with necessary requirement
4	Health facilities	Maintenance with effective and less costly
5	Socio-cultural facilities	New construction

(Table-10 Problem with smart solution)

4.2.6 Social scenario -Preservation of traditions, Festivals, Cuisine

➢ **Preservation of traditions**

There is no any heritage or any ancient structure in village.

➢ **Cuisine**

In Derdi Kumbhaji there are some shops which we can find lunch and dinner and there are some shops of snacks. Most of the people about 95% of total population of Derdi Kumbhaji is vegetarians.

- **Festivals**

In Derdi Kumbhaji there is all festivals are celebrate with delight. The people of Derdi are like to celebrate all festivals with tradition. People of Derdi Kumbhaji is religious so they celebrate all festival together and joyfully. They celebrate janmastami with fast not because of just festival but also with their religious fillings and asthas. They celebrate holi and dhuleti which is festival of colors. They celebrate Holi with a big and holy fire and peoples are celebrate with moving around the holy fire. In local and ancient language it's called parikrma.

Like vise they celebrate all festival with joy and cultural tradition. Not only Hindu festivals but they celebrate all religious festival with brotherhood filling.

- **Social scenario**

Particulars	Total	Male	Female
Total No. of Houses	1770	-	-
Population	8450	4335	4115
Child (0-6)	781	435	356
Schedule Cast	788	435	356
Schedule Tribe	26	17	9
Literacy	83.05%	89.82%	76.03%
Total Workers	3162	2374	788
Main Workers	2715	-	-
Marginal Workers	447	210	237

(Table-11 Social scenario)

4.2.7 Migration Reasons / Trends

The major occupation in village is farmers and other in very less percentage. The main aim to migration is for employment and for business. Lack of facilities is not major concern for migration for Derdi Kumbhaji.

4.3. Data Collection Derdi Kumbhaji village

4.3.1 Describe Methods for data collection

⇒ By interview of local people
⇒ By Gram panchayat
⇒ By official website of government
⇒ Interaction with the villagers.
⇒ Census 2011 reports and other reports published by different Ministries of the Government.

4.3.2 Primary details of survey

Derdi Kumbhaji is located 35.9 Km from Gondal. Forest area of Derdi Kumbhaji is 3.24 hector. Population of village as per census 2011 is 8450. Total Male is 4335 and total Female is 4115. Total number house hold is 1770. Village is connected through all type of Road. Village has street light and good drinking water facilities.

Derdi is a large village located in Gondal Taluka of Rajkot district, Gujarat with total 1770 families residing. The Derdi village has population of 8450 of which 4335 are males while 4115 are females as per Population Census 2011. In Derdi village population of children with age 0-6 is 791 which makes up 9.36 % of total population of village. Average Sex Ratio of Derdi village is 949 which is higher than Gujarat state average of 919. Child Sex Ratio for the Derdi as per census is 818, lower than Gujarat average of 890. Derdi village has higher literacy rate compared to Gujarat. In 2011, literacy rate of Derdi village was 83.05 % compared to 78.03 % of Gujarat. In Derdi Male literacy stands at 89.82 % while female literacy rate was 76.03 %. As per constitution of India and Panchyati Raaj Act, Derdi village is administrated by Sarpanch (Head of Village) who is elected representative of village. Our website, don't have information about schools and hospital in Derdi village.

4.3.3 Average size of the House Geo-Tagging of House

Average size of house is 2700 Square foot.
Geo-Tagging of House: - The process of tagging geographical details like village map, boundaries and physical infrastructure are decided by local or tehsil or district government bodies. Latitude longitude and altitude are available in internet platform called as google map.

4.3.4 No of Human being in One House

Average number of Human being per house is 5.

4.3.5 Material available locally in the village and Material out Sourced by the villagers

All type of construction material is available like cement, bricks, sand, wood, water, aggregate etc.

4.3.6 Geographical Detail

Sr. no.	Information	Description
1	Residential Area	200 hector
2	Forest area	3.2 hector
3	Agricultural land area	350 hectare
4	Major occupation group	Farmers
5	Pin code	364465
6	Nearest Railway station	Gondal (36.7)
7	Connected to Road	All type of Road

(Table-12 Geographic Details)

4.3.7 Demographical Detail - Cast Wise Population Details / Which ID proof using by villagers

Sr. No.	Information	Details
1	Total No. of Houses	1770
2	Population	8450(M: 4335, F: 4115)
3	Schedule cast	799
4	Literacy	83.05%
5	Total Workers	3162

(Table-13 Demographic Details)

4.3.8 Occupational Detail - Occupation wise Details / Majority business

Major Occupation group in Village are Farmers, Animal Husbandry and Minor shops respectively.

4.3.9 Agricultural Details / Organic Farming / Fishery

The major crops in village is Ground nut, cotton, wheat, cumin seeds, coriander.

4.3.10 Physical Infrastructure Facilities - Manufacturing HUB / Ware Houses

In Derdi Kumbhaji there is manufacturing hub called Khushboo Ice Cream. No other manufacturing HUB or Ware Houses. There is piped water available. Piped water from piped in to dwelling, piped to yard/plot, public tap/standpipe, tube well/bore well also available. Surface water available but only in monsoon and in some part of winter. There is also lake/pond available. There is water tank facility available, both underground and overhead tanks are available. In village 80% underground drainage facilities is remain. In Derdi Kumbhaji village approach road, main road, internal streets are available at good condition. Transportation facilities are good in Derdi village. Electricity in village is 24/7 available. Sanitation facilities are also very good in village.

4.3.11 Tourism development available in the village for attracting the tourist

In Derdi Kumbhaji village there are no any tourism activity available for attracting the tourist. Tourism Development can be implemented in Derdi as Cultural, Water Park, Sports, Business related etc.

4.4 Infrastructure Details (With Exiting Village Photograph)

4.4.1 Drinking Water / Water Management Facilities

In Derdi Kumbhaji village drinking water facilities are good condition. In village piped water is available in all houses. In village underground and elevated/overhead both are available. There are two underground tanks are available at village out of which one has capacity of 1 lakh liter and other one have capacity of 2 lakh lit. One overhead tank is also available which has capacity of 1 lakh liter. Dug well and bore wall both wells are available for water supply.

(Fig-9 Drinking water storage facilities)

4.4.2 Drainage Network / Sanitation Facilities

In Derdi Kumbhaji village drainage facilities are available. In all village open drainage are available and in some part of village underground drainage facilities are also available. Underground drainage construction are remain in some part of village. About 80% underground drainage are remaining. Cleaning of drainage is done before and after monsoon.

(Fig-10 Drainage network)

4.4.3 Transportation & Road Network

In Derdi Kumbhaji village all local transportation are available. For travelling in nearby village or taluka chhakada available. S.T buses are also available for nearby taluka or some nearby villages. For S.T. there is not proper bus stand for seating of people. Buses are stopped near the road side and because of that sometime it create traffic. Private buses and riksha area also available for transport. All internal streets of derdi village is good some of them have C.C road and some of them have paver blocks. Cleaning of streets are done by panchayat in periodic time. Roads which are connected by other village and other tehsil are good condition. Within 10 km from Derdi Kumbhaji village there is also petrol pump is available. Nearest highway to the Derdi Kumbhaji is NH-8 which is 30 km away from village.


(Fig-11 Transportation and road network)

4.4.4 Housing condition

There are many houses which are pacca. There are 40% houses are kuchha and remain are pacaa. Kachha houses which is present in villages are not so bad they are still in working condition. They are old but construction of those houses are still strong and attractive.


(Fig-12 Housing condition)

4.4.5 Social Infrastructure Facilities, Health, Education, Community Hall

(Fig-13 Social Infrastructure)

In Derdi Kumbhaji there are 6 nos of Anganwadi(ICDS) and all are working. In Derdi Kumbhaji village there is a sub-center available. There is also a PHC available in village. All facilities which are mention in above are good and workable condition. In Derdi Kumbhaji village there are 4 Private clinic.

In Derdi Kumbhaji village primary school is available. There is also a secondary school, higher secondary school and one private Arts collages is available.

4.4.6 Existing Condition of Public Buildings & Maintenance of existing Public Infrastructures

In Derdi Kumbhaji village Grampanchyat building is newly constructed. Water tanks are need some maintenance so that water is not get polluted. Open drainage facilities are need maintenance for effectively use in all weather. All other facilities or say public buildings are at good and workable condition.


(Fig-14 Social Infrastructure)

4.4.7 Technology Mobile/ WIFI / Internet Usage Details

There are not WIFI facilities in all village, WIFI facilities available only for gram panchayat. All villagers have smartphone and internet connection are good at village.

4.4.8 Sports Activity as Gram Panchayat

There are no any sports activities done by villagers or gram panchayat. The primary school has some sports equipment and tools & also children and students are using these facilities.

4.4.9 Socio-Cultural Facilities, Public Garden /Park/Playground /Pond/ Other Recreation Facilities

In Derdi Kumbhaji village there is newly constructed building. There is also a separate building for post office. There are no other socio-cultural facilities like community hall, public library, Public Garden, village pond, Recreational center.

4.4.10 Other Facilities (e.g. like foot path development-Smart toilets-Coin operated entry, self-cleansing, waterless, public building)

There are no any kind of facilities like smart toilet-coin operated entry, footpath development, self-cleansing, waterless public building, etc. in the Derdi Kumbhaji village. There are some houses in which solar system is there like solar panel and solar water heater. And according to current population the village has a smart thing which is RO water plant.

4.4.11 Any other details

No other details.

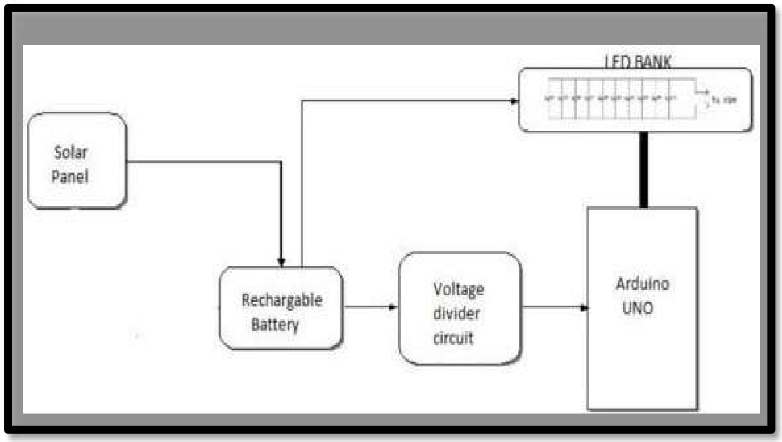
4.5 Electrical Concept

4.5.1 Renewable energy source planning particularly for villages

Auto Intensity Controlled Solar LED Street Lights/High Power LED

The solar powered LED Street light with auto intensity control which provides different intensities at different times of night using pulse width modulation technique. The system consists of light dependent resistor (LDR) which is also known as photo resistor made of cadmium sulfide is used for precise switching operation and an Atmega328P microcontroller which is programmed using Arduino programming language to act as a pulse width modulator. The program can be rewritable according to the requirements needed.

Block Diagram



(Fig-15 Block Diagram for solar led)

Explanations of Each Block

Solar Panel

A solar panel is a collection of solar cells. The solar panel converts the solar energy into electrical energy. Output of the solar panel is its power which is measured in terms of Watts or Kilo watts. Solar power uses multiple reflectors to collect more sun's thermal energy. Thermal energy collected through the day to perform different operations. Performance of the solar panel depends on a number of factors like climate, conditions of the sky, orientation of the panel, intensity and duration of sunlight and its wiring connections.

Rechargeable Battery

A rechargeable battery is a type of electrical battery which can be charged, discharged into a load, and recharged many times, while a non-rechargeable or primary battery is supplied fully charged, and discarded once discharged. Several different combinations of electrode materials and electrolytes are used, including lead– acid, nickel cadmium (Ni-Cd), nickel metal hydride (Ni-MH), lithium ion (Li-ion), and lithium ion polymer (Li-ion polymer).

Voltage Divider circuit

A voltage divider is a simple circuit which turns a large voltage into a smaller one. Using just two series resistors and an input voltage, we can create an output voltage that is a fraction of the input. Voltage dividers are one of the most fundamental circuits in electronics equation of circuit.

Arduino UNO

Micro-controller will control the intensity of light at different time slots. Micro controller circuit will generate PWM waves to provide different intensities. This system provide sets of digital and analog I/O pins that can be interfaced to the street light circuit. Operating voltage of Arduino UNO is 5v so that we will convert 12v from Battery to 5v.

LDR

The theoretical concept of the light sensor lies behind, which is used in this circuit as a darkness detector. The LDR is a resistor and its resistance varies according to the amount of light falling on its surface. When the LDR detect light its resistance will get decreased, thus if it detects darkness its resistance will increase.

WORKING

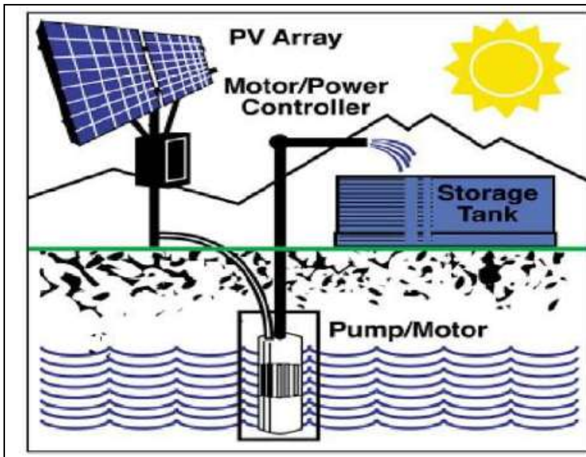
The experimental setup involves the following working principle. The solar panels convert the sun light into electrical energy. This obtained electrical energy during the day time is stored in the rechargeable battery and used during the night time. The solar street light draws the power from the battery. The LDR is used for precise switching operation of street light at the dusk and dawn. Light dependent resistor makes the street light switch on during sunset and switch off during the sunrise automatically. A programmable Microcontroller Atmega328P of Arduino is engaged to provide different intensities at the different times of night using PWM technique for saving the energy.

4.5.2 Irrigation Facilities

Solar Powered Water Pump for Agriculture

Introduction

Photovoltaic (PV) panels are often used for agricultural operations, especially in remote areas or where the use of an alternative energy source is desired. In particular, they have been demonstrated time and time again to reliably produce sufficient electricity directly from solar radiation (sunlight) to power livestock and irrigation watering systems. A benefit of using solar energy to power agricultural water pump systems is that increased water requirements for livestock and irrigation tend to coincide with the seasonal increase of incoming solar energy. When properly designed, these PV systems can also result in significant long-term cost savings and a smaller environmental footprint compared to conventional power systems. The volume of water pumped by a solar- powered system in a given interval depends on the total amount of solar energy available in that time period. Specifically, the flow rate of the water pumped is determined by both the intensity of the solar energy available and the size of the PV array used to convert that solar energy into direct current (DC) electricity. The principle components in a solar-powered water pump system (shown in Figure) include The PV array and its support structure, electrical controller and electric-powered pump. It is important that the components be designed as part of an integrated system to ensure that all the equipment is compatible and that the system operates as intended. It is therefore recommended that all components be obtained from a single supplier to ensure their compatibility.



(Fig-16 a typical solar-powered water pump system, which includes a solar array, controller, pump, and storage tank)

The following information is required to design a PV-powered pump

The volume of water required in a given period of time for livestock or irrigation purposes, as well as for storage. (A storage volume equal to a three-day water requirement is normally recommended for livestock operations as a backup for the system’s safety features and cloudy days.)

The total dynamic head (TDH) for the pump.
The quantity and quality of available water.
The system's proposed layout and hydraulic criteria.

Electrical controllers

Electrical controllers and safety devices are incorporated into PV-powered water pump systems to control the electric power input to the pump and to provide necessary electrical protection and switching. A PV system may incorporate storage batteries that can be charged when incoming solar energy exceeds the pumping power requirement. The batteries can then be used to power the pump when the pumping requirement exceeds the solar power input. The battery charge and discharge will be regulated by the control unit. The use of batteries, however, does require a more complex control system and can significantly increase the cost and maintenance of the PV-powered system. Remember, the first goal of a solar-powered water pump system is to store water, not electricity. The use of batteries should therefore be discouraged unless absolutely necessary since the added expense and complexity usually outweighs any advantages.

(Fig-17 PV solar array with storage tank and stock. (Source: "Renewable Energy Primer-Solar."))

Pumps that use PV systems are normally powered by DC motors. These motors use the DC output from the PV panels directly. Alternating current (AC) motors are sometimes used, but they require more complex control systems. They also result in less total energy availability due to the electrical losses caused when an inverter is used to convert the DC to AC electricity. Because DC motors do not require an inverter, utilize a less complex control system, and result in more total energy availability, they are most commonly paired with solar-powered pumps.
The type of pump configuration and mounting can be either submersible, surface mount, or floating, depending on the water source.
Solar-powered pumps are characterized as either positive displacement pumps (e.g., diaphragm, piston, or helical rotor) or centrifugal pumps. Positive displacement pumps are typically used when the TDH is high and the flow rate (measured in GPM) required is low. Conversely, centrifugal pumps are typically used for low TDH and high flow rates.

This is important when considering the placement of the panels and controller relative to the location of the pump. A general rule of thumb is that if the array consists of four or more panels and is located more than 50 feet away from the pump, the use of a higher voltage pump should be considered.

4.5.3 Electricity Facilities with Area

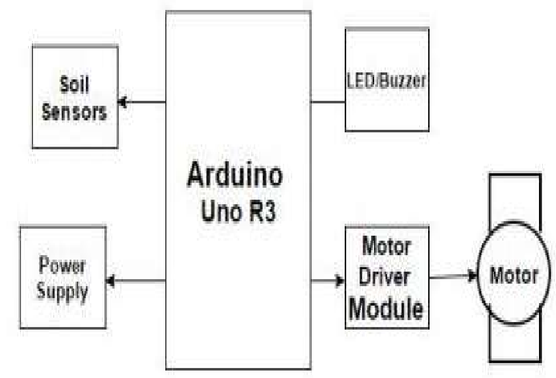
Automatic Water Plant System

Introduction

This system is used to provide water to the plants or gardening automatically using microcontroller (Arduino Uno). We can automatically watering the plants when we are going on vacation or don't we have to bother my neighbors, Sometimes the neighbors do too much of watering and the plants end up dying anyway. There are time based devices available in India which waters the soil on set interval. They do not sense the soil moisture and the ambient temperature to know if the soil actually needs watering or not.

Block diagram

There are two functional components. They are the moisture sensors module and the motor driver for motor pump. Thus the Arduino Board is programmed using the Arduino IDE software. The function of the moisture sensor is to sense the temperature content present in the soil, and also it measure moisture level in the soil. The motor driver interrupts the signal to, water pump supplies water to the plants. This project uses microcontroller Arduino Uno board to controls the motor and monitor soil moisture. Follow the schematic to connect the Arduino to the motor driver, and the driver to the water pump. The motor can be driven by a 5 volt battery, we can also supplies power from external source or from Arduino board. The Arduino Board is programmed using the Arduino IDE software.



(Fig-18 Block diagram for Automatic Water Plant System)

Working

An automatic plant watering system using Arduino microcontroller UNO R3 is programmed such that it gives the interrupt signals to the motor via the motor driver module. Soil sensor is connected to the A0 pin to the Arduino board which senses the moisture content present in the soil. Whenever the soil moisture content values goes down, the sensor senses the humidity change, giving signal to the microcontroller so that the pump (motor) can be activated. This concept can be used for automatic plant watering system. The circuit comprises an Arduino UNO board, a soil moisture sensor, a 5V motor pump, a Motor driver L293D (IC1), motor driver IC to run the water pump. You can power the Arduino board using a 5V to 9V wall wart or plugin adaptor or solar panel. You need a separate 5V to 9v battery for the pump motor. Hence, the moisture sensors measure the moisture level (water content) of the different plants. If the moisture level is goes to be below the desired and limited level, the moisture sensor sends the signal to the Arduino board which triggers the Water Pump to turn ON and supply the water to respective plant using the Rotating Platform/Sprinkler. When the desired moisture level is reached, the system halts on its own and the water Pump is turned OFF.

4.6 Existing Institution like - Village Administration – Detail Profile

4.6.1 Bachata Mandali

There is no any Bachat Mandli in Derdi Kumbhaji village.

4.6.2 Dudh Mandali

There is dudh Mandali in village at working condition.

4.6.3 Mahila forum

There is no Mahila forum in village.

4.6.4 Plantation for the Air Pollution

There is no such activity done of tree plantation for the air pollution in the Derdi Kumbhaji village. But that kind of activities are done in the primary and secondary school by the students of the Derdi Kumbhaji village.

4.6.5 Rain Water Harvesting - Waste Water Recycling

There are rain water harvesting system in major houses in village there is no waste water recycling system in villages.

4.6.6 Agricultural Development

There are no any specific activity done for agriculture. But individual activity is done by farmers in their own farm.

4.6.7 Any Other

There is no any other facilities in village.

Chapter: 5
Technical Options with Case Studies

5.1 Concept (Civil)

5.1.1 Advance Sustainable construction techniques

Introduction

The pursuit of sustainable development brings the built environment and construction industry into sharp relief. It is a well-known fact that the construction industry is a major contributor to socio-economic development in most of the countries. Statistics show that the construction industry normally constitutes more than half of the total national capital investment, and represents as much as 10% of G.N.P. in every country. Sustainable construction development has become a major subject of policy, research and innovation, globally. The sustainable development uses locally available building materials which are energy efficient and durable. It provides an opportunity to living inhabitants to live with healthy, comfortable conditions throughout the buildings full life cycle. The life cycle consists of material production, construction planning, design, construction, operation and maintenance processes.

(Fig-19 Sustainable Construction Method)

Defining Sustainability

Technology can make it possible to achieve after greater measure of sustainability, to economically reduce, re-use and recycle. The potential multipliers from spending on research and development are huge. Identifies technologies which can be used during construction to improve efficiency and reduce waste. As long as sustainability in construction projects is considered it is generally achieved by bellow things:

⇒ Defining clear goals sympathetic to sustainability issues.
⇒ Concentrated effort at design stage to achieve these goals.
⇒ Focusing on decisions like site selection, building layout, design etc.
⇒ Choosing the right materials which are recyclable after their useful lives.
⇒ Choosing the right methods of construction in terms of energy and resource efficiency.
⇒ Creating an efficient and integrated building envelope harnessing the gifts of nature.

Methodology

Careful selection of environmentally sustainable building materials is the easiest way for architects to begin incorporating sustainable design principles in buildings. Traditionally, price has been the foremost consideration when comparing similar materials or materials designated for the same function. However, the "off-the-shelf" price of a building component represents only the manufacturing and transportation costs, not social or environmental costs. The three principles of sustainability in architecture

- **Economy of Resources**: It is concerned with the reduction, reuse, and recycling of the natural resources that are input to a building.
- **Life Cycle Design:** It provides a methodology for analyzing the building process and its impact on the environment
- **Humane Design:** It focuses on the interactions between humans and the natural world. These principles can provide a broad awareness of the environmental impact, both local and global, of architectural consumption.

Sustainable Building Material

Sustainable building materials can be defined as materials with overall superior performance in terms of specified criteria. For Selection of Sustainable building materials the following criteria are commonly used:

1. Locally produced and sourced materials
2. Transport costs and environmental impact
3. Thermal efficiency
4. Occupant needs and health considerations
5. Financial viability
6. Recyclability of building materials and the demolished building
7. Waste and pollution generated in the manufacturing process
8. Energy required in the manufacturing process
9. Use of renewable resources
10. Toxic emissions generated by the product

Maintenance costs few of the materials are described below

Lime

Lime is our chief material which replaces the cement in building construction. It gives the good air quality by absorbing the carbon and emitting oxygen in the atmosphere. The cost of lime is comparatively less than that of Cement. Life span of lime building is much more as compared to cement building. Depending on the mix of aggregate and water hydrated lime can be used to manufacture a lime concrete, mortar, and plaster or stucco Color Lime Plaster. The Volatile Organic Compounds (paints) are available by using colored lime plaster as paint. It reduces the painting for whole structural life. It is maintenance free, washable and water proof. Its shine and glossiness increases as the time passes. It gives better aesthetics look than conventional painting work.

(Fig-20 Lime)

Fly Ash Bricks

Fly ash is one of the naturally occurring by products from the coal combustion process and is a material that is nearly

(Fig-21 Flay Ash bricks)

the same as volcanic ash. There are following types of fly ash bricks:
1. Fly ash Lime/Gypsum Bricks
2. Clay Fly Ash Bricks
3. Sand Fly Ash Bricks
4. Red Mud- Fly ash bricks

Eco-Friendly Tiles

An Eco-friendly tile replaces the conventional flooring and uses less energy in their production. It is cheap as compared to the conventional tile. They are available as per the client requirement in various patterns and also easy to place. This tile improves performance of indoor environment quality. Ecofriendly tiles are cheap in cost as compared to regular tiles; these tiles are manufactured on the construction site so that its transportation charges are reduced.


(Fig-22 Eco-Friendly Tiles)

Bamboo

Bamboo is the fastest growing plant on earth. It is a member of the grass family and can be found in many regions throughout the world in a diverse range of climates from cold mountains to hot tropical regions. As a natural cellulose fiber, bamboo fabric can be 100% biodegraded in soil by microorganisms and sunlight" showing that not only is bamboo an environmentally sustainable natural resource but also that disposal of the material has no damaging effect on the environment. Bamboo provides bamboo products suitable for use as roofing or cladding materials. In Asian countries, it is used as a substitute to steel reinforcement in concrete and more recently bamboo has been manufactured for use as household flooring systems whereby the bamboo is steamed, flattened and glued together into flooring panels.


(Fig-23 Bamboo)

Ferro Cement

Ferro cement has a very high tensile strength to weight ratio and superior cracking behavior in comparison to reinforced concrete. Prefabricated Ferro cement cavity walls present a series of possibilities for the solution of building construction at maximum reduction of the electrical energy. Advantages of Ferro cement as a construction material may be summarized as follow:

⇒ Very high quality control.
⇒ Pre-Fabricated products.
⇒ Easy production and installation.
⇒ Fast construction.
⇒ Manpower can be easily trained at site.


(Fig-24 Ferro Cement)

⇒ Improved structural performance.
⇒ Cost reduction, 15-50% cheaper than conventional techniques.
⇒ Less maintenance.
⇒ Reduction in dead weight, 50-75% lighter than conventional techniques.

Future Scope

1) Technological innovation in the field of automation with higher level of micro-processor based controlling systems leads to better performance of technologies like solar panels, Integrated HVAC & Electrical systems.

2) In context to the Indian scenario new experimentation for the application of agro-waste as substitute for the sustainable construction material shall be explored.

3) Non-conventional materials for a sustainable construction material with bioconstruction system reinforced with cellulose fibers can be considered. Example of such system can be met kaolin +lime + hemphurds + waste paper pulp in place of conventional concrete.

4) A digital computer based sustainable design tool for the building material applications for a particular building project involves integrated design approach. This involves Life Cycle Analysis based on CAD model. However present technological limitations do not provide a correct/optimum solution to the problem. Advancements in algorithm & more realistic data for the analysis engine can fine tune such tools. It will change the scenario of present building design technology.

Conclusion

Sustainable building materials are those which are produced or sourced locally. These materials are containing recycled & industrial waste materials and byproducts. Sustainable materials have a lower impact on environment & are thermally efficient. The production of these building materials require considerable less amount of energy in production when compared to the modern or traditional construction materials. The advantages in selection of sustainable building material lies in the fact that they are not only economically viable but also reduce toxic emissions thereby reduce overall environment impact. Sustainable building material & technology should be utilized appropriately & contextually in each neighborhood development. The use of sustainable material & technology not only reduces transport & production cost, carbon emissions but also provides avenues for employment & skill development for community members.

5.1.2 Soil Liquefaction

Definition

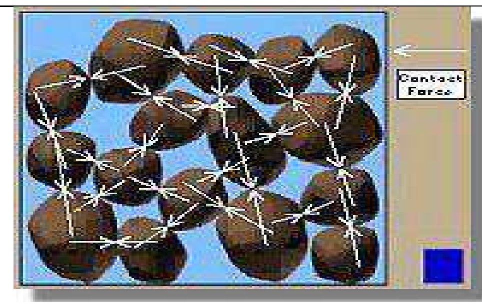
Liquefaction is the phenomena when there is loss of strength in saturated and cohesion-less soils because of increased pore water pressures and hence reduced effective stresses due to dynamic loading. It is a phenomenon in which the strength and stiffness of a soil is reduced by earthquake shaking or other rapid loading.

Liquefaction occurs in saturated soils and saturated soils are the soils in which the space between individual particles is completely filled with water. This water exerts a pressure on the soil particles that. The water pressure is however relatively low before the occurrence of earthquake. But earthquake shaking can cause the water pressure to increase to the point at which the soil particles can readily move with respect to one another.

Although earthquakes often triggers this increase in water pressure, but activities such as blasting can also cause an increase in water pressure. When liquefaction occurs, the strength of the soil decreases and the ability of a soil deposit to support the construction above it.
Soil liquefaction can also exert higher pressure on retaining walls, which can cause them to slide or tilt. This movement can cause destruction of structures on the ground surface and settlement of the retained soil.

Cause behind liquefaction
It is required to recognize the conditions that exist in a soil deposit before an earthquake in order to identify liquefaction. Soil is basically an assemblage of many soil particles which stay in contact with many neighboring soil. The contact forces produced by the weight of the overlying particles holds individual soil particle in its place and provide strength.

Soil grains in a soil deposit. The height of the blue column to the right represents the Level of pore-water pressure in the soil.



The length of the arrows represents the size of the
Contact forces between individual soil grains. The contact forces are large when the pore-water pressure is low.

(Fig-25 Cause behind liquefaction)

Occurrence of liquefaction is the result of rapid load application and break down of the loose and saturated sand and the loosely-packed individual soil particles tries to move into a denser configuration. However, there is not enough time for the pore-water of the soil to be squeezed out in case of earthquake. Instead, the water is trapped and prevents the soil particles from moving closer together. Thus, there is an increase in water pressure which reduces the contact forces between the individual soil particles causing softening and weakening of soil deposit. In extreme conditions, the soil particles may lose contact with each other due to the increased pore-water pressure. In such cases, the soil will have very little strength, and will behave more like a liquid than a solid - hence, the name "liquefaction".

Methods of reducing liquefaction hazards

1) By Avoiding Liquefaction Susceptible Soils: - Construction on liquefaction susceptible soils is to be avoided. It is required to characterize the soil at a particular building site according to the various criteria available to determine the liquefaction potential of the soil in a site.

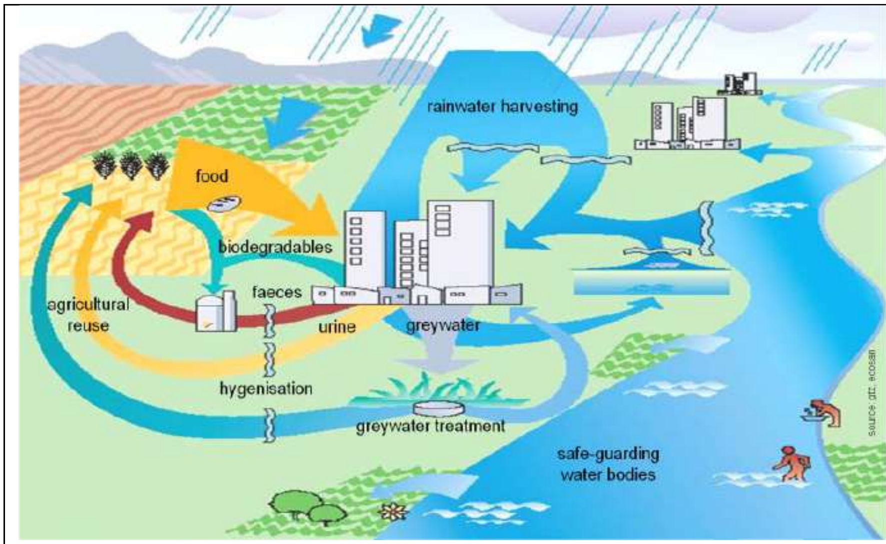
2) Build Liquefaction Resistant Structures: - The structure constructed should be liquefaction resistant i.e., designing the foundation elements to resist the effects of liquefaction if at all it is necessary to construct the structure on liquefiable soil because of favorable location, space restriction and other reasons.

3) Improve the Soil: - This involves mitigation of the liquefaction hazards by improving the strength, density and drainage characteristics of the soil. This can be done using variety of soil improvement techniques.

5.1.3 Sustainable Sanitation

Background

If everyone around the world practiced appropriate hygiene and had access to good, reliable sanitation and drinking water, 2.4 million deaths could be prevented each year. Diseases like HIV/AIDS, tuberculosis and malaria are often discussed in media, but one disease is killing more young children every year than the three mentioned diseases together. The disease is called diarrhea and to prevent this disease from spreading, hygiene, sanitation and water are the three key factors.



(Fig-26 Suistanable Sanitation)

Globally, 63 per cent of the population have access to improved sanitary facilities. That means 2.5 billion people do not have access to improved sanitation. One third of the 2.5 billion people without improved sanitation live in India. Shared sanitation facilities, public or accessible for some people, are not counted as improved sanitation, since the facilities often lack in cleanliness and accessibility. Globally, the amount of people using shared sanitation is increasing, and in urban areas it is often the only option for people to avoid open defecation. In India, the amount of people who practice open defecation is estimated to be 626 million. (UNICEF and the World Health Organization, 2012)

In Mumbai, the financial capital of India, live 12.5 millions of people (The Registrar General & Census Commissioner, 2011). This makes it one of the most populated cities in the world. Around half of the population in Mumbai live in slum areas (Bapat & Agarwal, 2003). The largest slum district is called Dharavi, which is located in the middle of the urban area. Mumbai is located in the state Maharashtra. In Maharashtra, 78 per cent of the population have access to piped water within premise and 60 per cent of the population have access to sanitation (World Bank, 2012).

Purpose and aim

The purpose of this thesis is to investigate the possibility to implement a sustainable sanitary system in the slum areas of Mumbai, India. The aim is to present design requirements from the potential users and information about their life situation. The deliverables is a cross mapping between the identified requirements and existing sustainable sanitary systems. A description is made of the different sanitary situations and how to identify each situation, together with an exemplification of a sustainable sanitation concept. The effect on employment in the slum areas is also concerned during the work.

Definition of Sustainability in Relation to Sanitation

The concept sustainable sanitation is often used in the literature, and sometimes without statement what is meant by sustainable sanitation. Therefore we define below our boundary of a sanitation system and what we think is needed for a sanitation system to be sustainable. A sanitation system encompasses, in our view, the users of the system, the collection, transport, treatment, and management of end products of human excreta, greywater, solid waste, industrial wastewater, and storm water. A sanitation system that is sustainable, in our view, protects and promotes human health, does not contribute to environmental degradation or depletion of the resource base, is technically and institutionally appropriate, economically viable and socially acceptable.

Sustainable Sanitation

1. Health and hygiene

The topic includes the risk of human exposure to pathogens from the point where the sanitary system is located to the point of reuse or disposal.

2. Environmental and natural resources

The topic includes the need for energy, water and other natural resources during the construction, operation and management of the system. Also potential emissions, recycling or re-use of natural resources and returning of organic material to the nature is included in the topic.

3. Technology and operation

This topic deals with the functionality of the whole system. Here should also issues like robustness and sensitivity of the system be considered, for example water shortages or power outs.

4. Financial and economic issues

The topic is referring to the user's ability to pay for the system, including construction, operation and maintenance and reinvestments. External costs, like environmental pollution or external benefits like employment creation and improved health, are also included.

5. Socio-cultural and institutional aspects

This topic is involving the convenience, gender issues, impacts on the human dignity and the framework of legislations.

5.1.4 Transport Infrastructure / system

Transport infrastructure is a critical ingredient in economic development at all levels of income. It supports personal well-being and economic growth. Transport infrastructure plays a role as a capital input into production and wealth generation. The economic impact can be transformative, especially at lower levels of income. Examples include transcontinental railways or canals linking oceans. At higher levels of income the direction of causality between infrastructure development and income growth becomes increasingly complicated. However, the two remain correlated even in the most developed economies.

The indirect contribution of infrastructure to economic development arises through a multitude of channels, including the enabling of productive private investment, the creation of new activities (supply chains), or the reshaping of economic geography.

Transport infrastructure is a necessary input into the production of transport services which, in turn, are necessary to allow for the market exchange of final goods and inputs (including labour) – or for broader welfare benefits (e.g., travel time savings). Given its central economic role, transport infrastructure is often referred to as the backbone of a modern economy.

(Fig-27 Transportation infrastracture)

The workshop identified a number of clear problems with current measurement of transport infrastructure spending. These include:

1. Lack of clear and commonly agreed definitions for a number of critical terms used
2. Lack of critical data
3. Absence of methods to estimate missing data
4. The lack of clear definitions and common practices to measure transport infrastructure spending hinders meaningful comparison between countries and across spending options, leading to less-informed decisions.

5.1.5 Vertical Farming

What Is Vertical Farming?

Vertical farming is the practice of producing food on vertically inclined surfaces. Instead of farming vegetables and other foods on a single level, such as in a field or a greenhouse, this method produces foods in vertically stacked layers commonly integrated into other structures like a skyscraper, shipping container or repurposed warehouse.

Using Controlled Environment Agriculture (CEA) technology, this modern idea uses indoor farming techniques. The artificial control of temperature, light, humidity, and gases makes producing foods and medicine indoor possible. In many ways, vertical farming is similar to greenhouses where metal reflectors and artificial lighting augment natural sunlight. The primary goal of vertical farming is maximizing crops output in a limited space.

How Vertical Farming Works

There are four critical areas in understanding how vertical farming works: 1. Physical layout, 2. Lighting, 3. growing medium, and 4. Sustainability features.

(Fig-28 Vertical Farming)

Firstly, the primary goal of vertical farming is producing more foods per square meter. To accomplish this goal, crops are cultivated in stacked layers in a tower life structure. Secondly, a perfect combination of natural and artificial lights is used to maintain the perfect light level in the room. Technologies such as rotating beds are used to improve lighting efficiency. Thirdly, instead of soil, geoponic, aquaponics or hydroponic growing mediums are used. Peat moss or coconut husks and similar non-soil mediums are very common in vertical farming. Finally, the vertical farming method uses various sustainability features to offset the energy cost of farming. In fact, vertical farming uses 95% less water.

5.1.6 Corrosion Mechanism, Prevention & Repair Measures of RCC Structure

Mechanism

Corrosion of reinforcing steel is a significant economic and safety problem, preventing many buildings from attaining their design life. It is now a must look into field as corrosion of reinforcing steel is seen almost in every 10 out of 100 constructions within a life of 10 years. Nowadays the increase content of pollutants in the city atmosphere has very much affected the lifespan of RCC structures. The increased content of pollutants include a very high rates of Sulphates and Chlorides which when these mixes with rain water and falls over these structures and damages the visible parts.

Some metals, such as gold, silver, and platinum, occur naturally in their pure form. Many other metals, including iron, are found in their natural state as ores, natural oxides, sulphides, and other reaction products. These metals must be derived from their ores by smelting, from which the metal absorbs and retains the energy needed to free it from the ore. This metallic state is unstable, however, because the metal tends to recombine with elements in the environment and return to its natural state, losing the extra energy in the process. The process of a metal reverting to its natural state is called oxidation, or corrosion.

Prevention & Repair Measures of RCC Structure Mechanism

⇒ **Adequate Concrete Cover:** A good amount of concrete cover should be provided over the steel reinforcement bars. This ensures proper maintenance of the alkaline nature within the concrete and the passivity of the steel bars. The steel bars should be precisely placed in position.

⇒ **Employing Good Quality Concrete:** High quality concrete must be used. It helps to maintain proper alkaline nature. For the concrete, a water/cement ratio of 0.4 or less is to be maintained as excessive water may damage the steel bars.

⇒ **Proper Compaction:** Concrete must be sufficiently compacted such that no air voids or air pockets are present in it.

⇒ **Using FBEC Bars**: Fusion Bonded Epoxy Coating (FBEC) is applied on the steel bars to prevent them from corrosion. Epoxy powder is spread electrostatically on to the steel bars. The powder melts and flows over the bars upon heating, which forms a protective coating. They are thermoset polymer coatings because application of heat will not melt the coating. Apart from rears, it also has wide application in pipeline construction.

⇒ **Use of Cement Based Polymers:** Cement based polymers can be used in the concrete to enhance its protection against corrosion capabilities. The cement based polymers act as a binder in the concrete. They also increase the durability, tensile strength and vibration damping of the concrete.

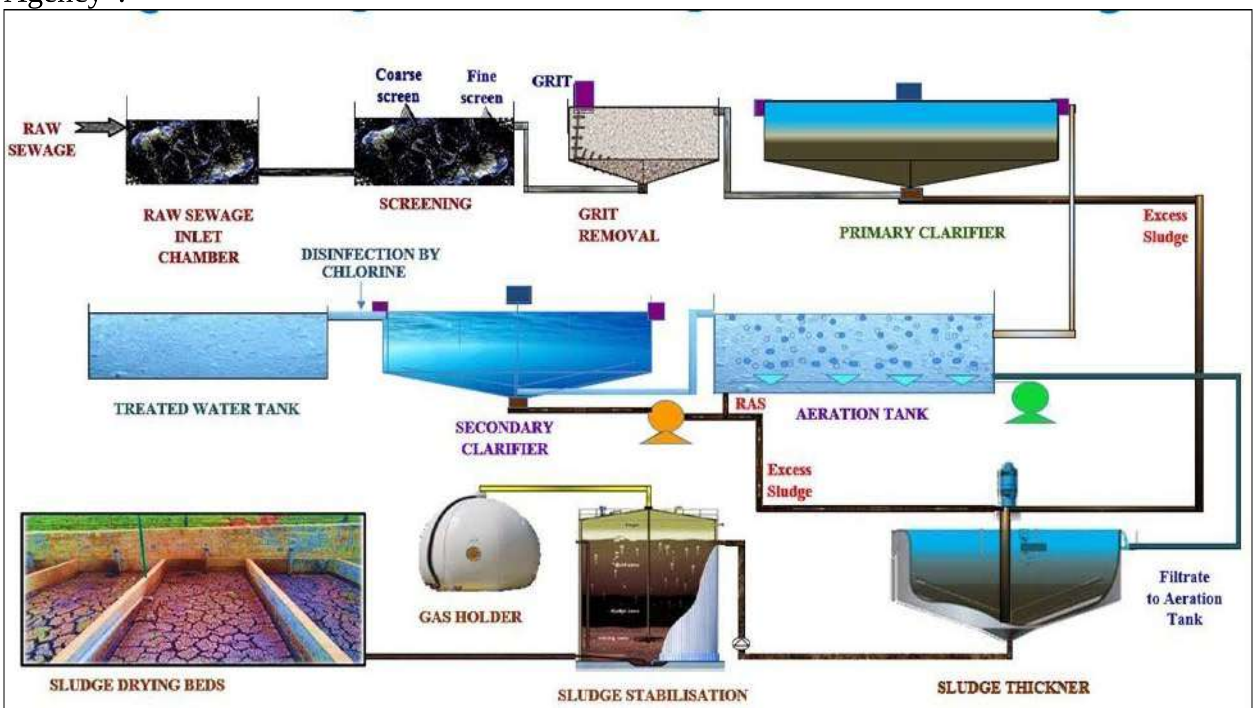
⇒ **The Rapid Chloride Permeability Test (RCPT):** This test is performed to assess the degree of corrosion. The quantity of electrical current that passes through a sample 50 mm thick and 100 mm in diameter in 6 hours is measured. Based on this, a qualitative rating is made of the permeability of the concrete.

⇒ **Use of Migratory Corrosion Inhibitors**: These are to be used in the concrete mix or applied on the hardened surface of the concrete. These inhibitors diffuse through the concrete cover and reach the steel bars to protect them against corrosion. Calcium nitrite based inhibitors are quite common.

5.1.7 Sewage treatment plant

It includes physical, biological and sometimes chemical processes to remove pollutants. Its aim is to produce an environmentally safe sewage water, called effluent, and a solid waste, called sludge or bio solids, suitable for disposal or reuse. Reuse is often for agricultural purposes, but more recently, sludge is being used as a fuel source.

Water from the mains, used by manufacturing, farming, houses (toilets, baths, showers, kitchens, sinks), hospitals, commercial and industrial sites, is reduced in quality as a result of the introduction of contaminating constituents. Organic wastes, suspended solids, bacteria, nitrates, and phosphates are pollutants that must be removed.
"To make wastewater acceptable for reuse or for returning to the environment, the concentration of contaminants must be reduced to a safe level, usually a standard set by the Environment Agency".



(Fig-29 Sewage treatment plant)

Sewage can be treated close to where it is created (in septic tanks and their associated drain fields or sewage treatment plants), or collected and transported via a network of pipes and pump stations to a municipal treatment plant. The former system is gaining popularity for many new ECO towns, as 60% of the cost of mains sewerage is in the pipework to transport it to a central location and it is not sustainable. It is called 'Decentralisation' of sewage treatment systems.

The job of designing and constructing sewage works falls to environmental engineers. They use a variety of engineered and natural systems to meet the required treatment level, using physical, chemical, biological, and sludge treatment methods. The result is cleaned sewage water and sludge, both of which should be suitable for discharge or reuse back into the environment. Sludge, however, is often inadvertently contaminated with many toxic organic and inorganic compounds and diseases and the debate is raging over the safety issues. Some pathogens, for example, 'Prion' diseases (CJD or 'Mad Cow Disease is a Prion disease) cannot be destroyed by the treatment process.

The features of wastewater treatment systems are determined by:

1. The nature of the municipal and industrial wastes that are conveyed to them by the sewers.
2. The amount of treatment required to keep the quality of the receiving streams and rivers.

Discharges from treatment plants are usually diluted in rivers, lakes, or estuaries. They also may, after sterilisation, be used for certain types of irrigation (such as golf courses), transported to lagoons where they are evaporated, or discharged through underground outfalls into the sea. However, sewage water outflows from treatment works must meet effluent standards set by the Environment Agency to avoid polluting the waters that receive them.

5.1.8 Detail Case study on Metro rail in Delhi

(Fig-30 Delhi Metro)

Background

India is currently the fourth largest GHG emitter in the world, although its per capita emissions are less than half of the world's average. Further, India's transport sector accounts for 13% of the country's energy related CO2 emissions (MoEF, 2010). It is evident that opportunities exist to make India's transport growth more sustainable by aligning development and climate change agendas. India's National Action Plan for Climate Change (NAPCC) recognizes that GHG emissions from transport can be reduced by adopting a sustainability approach through a combination of measures such as increased use of public transport, higher penetration of bio-fuels, and enhanced energy efficiency of transport vehicles. The key objectives for the LCT project are as follows:

1. Delineating an enabling environment for coordinating policies at the national level to achieve a sustainable transport system

2. Enhancing capacity of cities to improve mobility with lower CO2 emissions The LCT project has been endorsed by the Ministry of Environment and Forests (MoEF), Government of India. It is being jointly implemented by the UNEP Risø Centre, Denmark (URC); Indian Institute of Technology, Delhi (IIT-D); Indian Institute of Management, Ahmedabad (IIM-A); and CEPT University, Ahmedabad.

The case study of Metro rails is one of the four case studies being carried out under the LCT project. These studies cover transportation projects under implementation in India for passenger and freight transport. The objective of these case studies is to explain the economic, social and environmental impacts of selected transportation projects. While the current case study deals with Metro projects, the other three studies cover freight transport Bus Rapid Transit projects and Non-motorized transport projects. All of the above mentioned projects are perceived by policymakers as interventions that can contribute to sustainable development.

This study is based on the premise that metro rail projects in cities are considered inevitable for efficient urban transport by many planners and policy makers, however, these projects have major implications for achieving inclusive sustainable low-carbon development goals. The focus of the study is not whether or not to undertake the metro project, but rather explicitly discuss the costs and benefits to different stakeholders. This is an exploratory study that may help to identify the important linkages of this framework.

Purpose

The broad purpose of this study is to examine the costs and benefits of metro rail projects for achieving the twin goals of inclusive and sustainable development and low-carbon growth. The main goals of sustainable development are economic efficiency, sustainable growth (conserving resources, energy security, and energy efficiency) and inclusiveness. The major goal for low-carbon growth is to reduce GHG emissions in order to achieve global targets for minimizing threats of climate change. Energy efficiency gains associated with metro rail projects are known to policymakers in India. However, the implication of other costs and benefits based on life cycle methodology are less known. This study aims to provide a framework for short and long-term assessment of costs and benefits of transport infrastructure projects like the metro rail projects in cities.

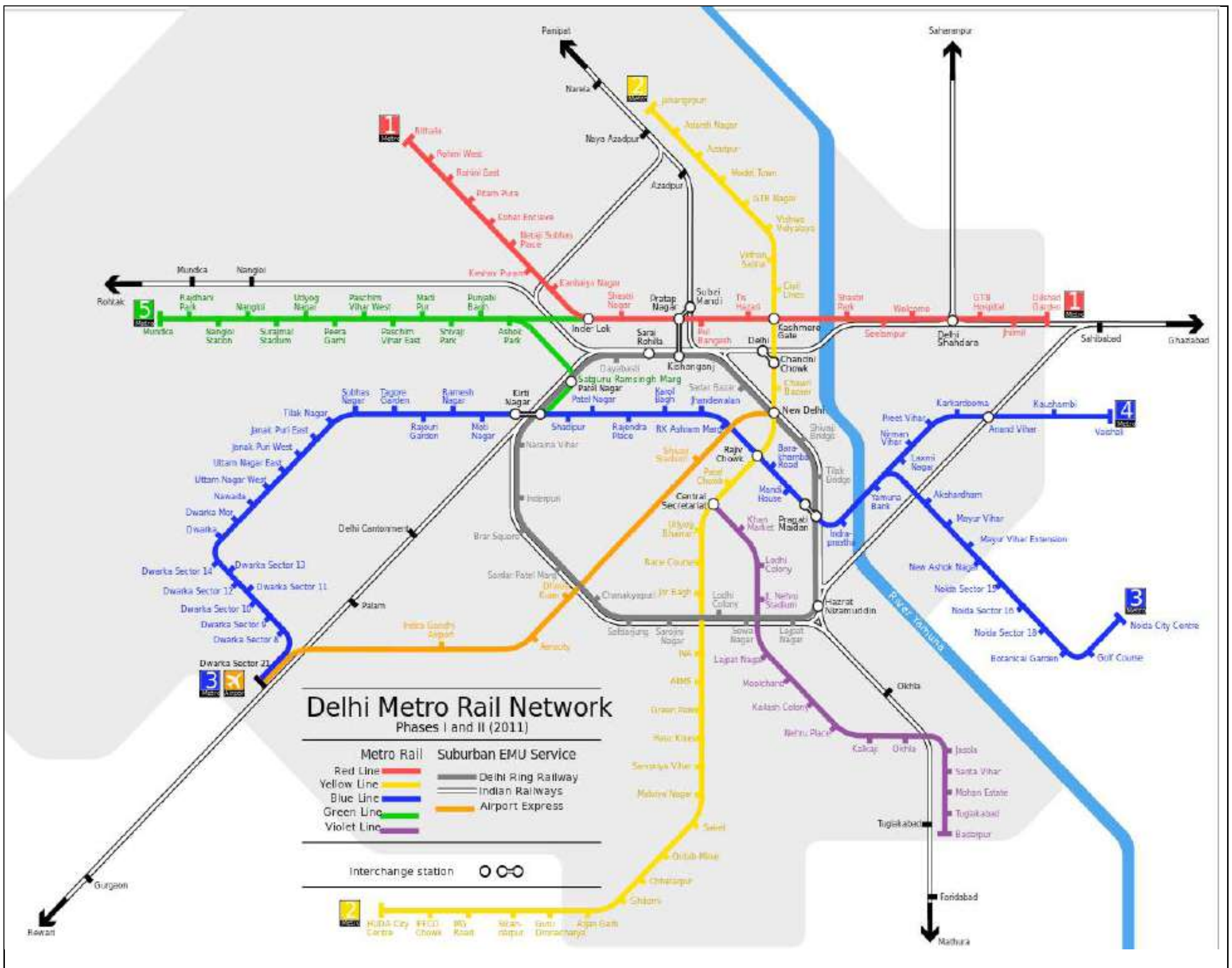
Scope

This case study is broadly conceived to assess the potential of the Delhi-metro rail. When evaluating mass transit options for Indian cities, metro systems are given preference over surface systems due to the belief that a road-based bus system cannot cater to the capacity requirement as much as metro systems. In addition to this, metro rails are perceived to have higher levels of comfort, speed, and efficiency as compared to bus systems. Capital intensive construction and high operation cost of metro systems necessitates financial support from state and central governments, foreign loans, tax exemptions and other subsidies. However, no explicit analysis of these considerations is available and more elaborate studies would be required to understand each of these dimensions. This study covers the following aspects of the Delhi metro rail project:

1. Overview of project demand estimation and financing plans
2. Impact on safety and CO2 emissions

It is important to recognize that CO2 emissions would occur in both the construction and operations phase of the project. The current study focuses on short-term assessment and briefly mentions the CO2 impact based on life cycle methodology.

Delhi Metro and Airport Link



(Fig-31 Delhi Metro Rail Network – Phases I and II in 2011)

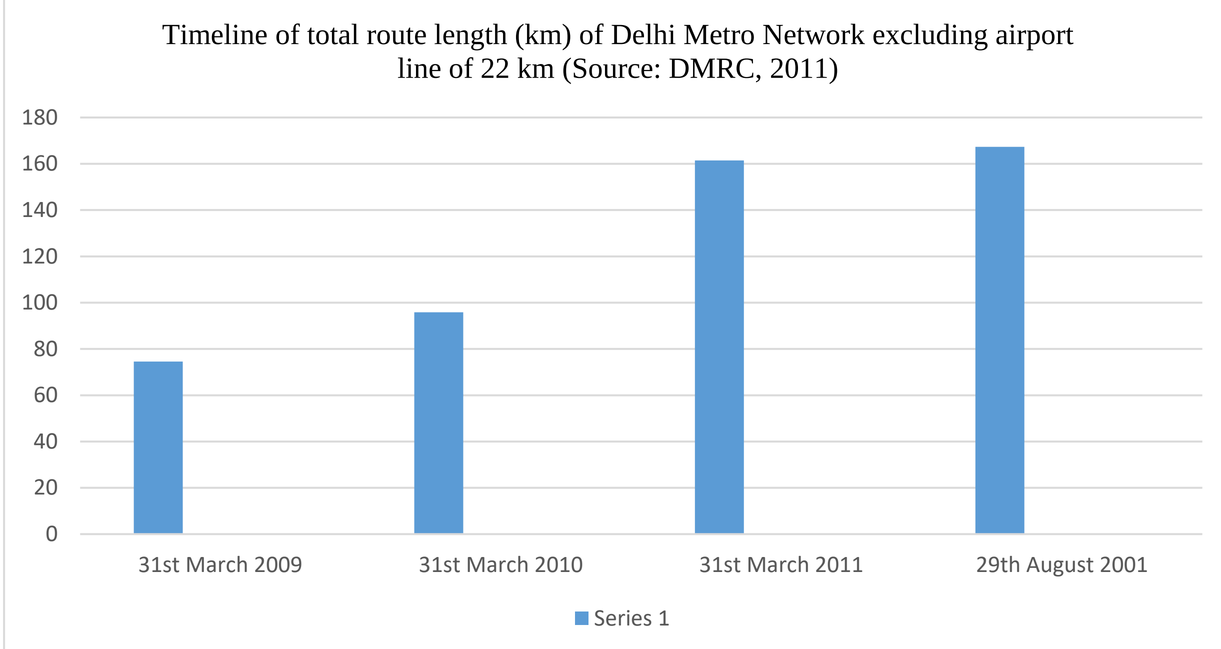
The first significant mention of a mass rapid transit system for Delhi emerged from a 1969 traffic and travel characteristics study. Since then, many official reports by a wide variety of government departments have been commissioned to explore the issues related to technology (underground rail, surface rail, light rail, busbased, etc.), route alignment, and whether urban mass transit is ultimately the jurisdiction of the National Government or the Delhi Union Territory Government. In 1984, the Delhi Development Authority and the Urban Arts Commission came up with a proposal for developing a multi-modal transport system, which would consist of constructing three underground mass rapid transit corridors, as well as augmenting the city's existing suburban and road transport networks (Sreedharan, 2002 cited in Siemiatycki, 2006). Following that, the Government of National Capital Territory of Delhi (GNCTD) commissioned Rail India Technical and Economic Service (RITES) Limited, in 1988–89, to study the feasibility of introducing an Integrated Multi-Modal Mass Rapid Transit System for Delhi. The study was completed by RITES in 1991, and recommended a 198.5 km predominantly rail-based network (http://delhigovt.nic.in/dmrc.asp#4). In July 1994, the Central Cabinet gave the go-ahead, in principle, for the MRTS for Delhi and directed the GNCTD to take up the preparation of a Detailed Project Report (DPR). RITES finalised (May 1995) the DPR for a 55.30 km MRTS comprising rail and metro corridors, for completion by March 2005. The Union Cabinet sanctioned the Delhi MRTS Phase I (Project) of 55.30 km in September 1996, at a total cost of USD 971 million – at April 1996 prices (CAG, 2008).

For implementation and operation of the project, the Delhi Metro Rail Corporation Limited was registered in May 1995 as a joint venture between the Ministry of Urban Affairs and the GNCTD. It started its operation in December 2002 with an 8 km line (CAG, 2008). The construction of the Delhi Metro has been carried out in phases. With the completion of Phase I and II of the Delhi Metro Rail project, the Delhi Metro currently has an operational network of 190 km3 consisting of elevated, at-grade and underground lines.

The 22.7 km long – 16 km underground and 7 km elevated – airport line, or the Orange line, under the Delhi Metro network is officially called the Delhi Airport Express Line. It has been implemented using a public private partnership (PPP) model, through a special purpose vehicle (SPV) – the Delhi Airport Metro Express Private Limited (DAMEPL). The civil works were carried out by the Delhi Metro Rail Corporation (DMRC), while the system installations, as well as the rolling stock, was supplied, installed and operated by DAMEPL, which also developed, operated and maintained this Express Link. The shareholders of DAMEPL are Reliance Infrastructure Limited (RInfra) and a Spanish company. DAMEPL will be operating the line for 30 years, under a revenue sharing model4. It must pay DMRC a fixed concession fee of USD 10.2 million and a share of gross revenue – 1% for the first 5 years, 2% for the fifth to tenth year, 3% for the eleventh to fifteenth year and 5% thereafter (IIR, 2011).

Coverage

By the end of July 2011, the Delhi Metro completed its two phases – I and II – that comprised a total operational network length of 190 km (Table 1), consisting of elevated, at-grade and underground lines. Phase I consisted of three lines with a network of 65.1 km, with 73% of the length as elevated. The construction of this phase started in October 1998 and was completed in 2006. Phase II consisted of 13 sections covering 124.6 km, with almost 77% elevated, and was fully completed in July 2011 (IIR, 2011). The DMRC has about 200 train sets, of which 42 are standard gauge and the rest are broad gauge. These make more than 2,500 trips per day on their seven operations corridors, including the Airport Express Link (DMRC Phase II handbook).



(Fig-32 Timeline of total route length (km) of Delhi Metro Network excluding airport line of 22 km (Source: DMRC, 2011))

Phase I			
Line	**Length (Km)**	**No. of Stations**	**Date of Completion**
Shahdara – Tri Nagar – Rithala	22.0	18	March 2004
Vishwa Vidyalaya – Central Secretariat	10.8	10	July 2005
Indraprastha – Barakhamba Road – Dwarka Sub City	32.1	31	November 2006
Total Phase I	65.0	59	-
Phase II			
Shahdara – Dilshad Garden	3.1	3	June 2008
Indraprastha – Noida Sector 32 City Centre	15.1	11	-
Yamuna Bank – Anand Vihar ISBT	6.2	5	January 2010
Vishwavidyalaya – Jahangirpuri	6.4	5	February 2009
Inderlok – Kirti Nagar – Mundka	18.2	15	April 2010
Central Secretariat – HUDA City Centre	27.5	19	September 2010
Dwarka Sector 9 to Dwarka Sector 21	2.8	2	Octomber 2010
Airport Express Line	22.7	6	February 2011
Anand Vihar – KB Vaishali	2.6	2	-
Central Secretariat – Badarpur	20.0	15	January 2011
Total Phase II	124.6	83	-
Total Network	189.6	142	-

(Table-14 Network details of Delhi Metro Rail – Phases I and II)

The corridors of the Delhi Metro network are divided into six lines, each identified by a specific colour, as shown in Table below.

Line Name	Terminal	
Red Line	Dilshad Garden	Rithala
Yellow Line	Jahangirpuri	HUDA City Centre
Blue Line	Noida City Centre	Dwarka Sector 21
	Yamuna Bank	Vaishali
Green Line	Inderlok	Mundka
	Kirti Nagar	Ashok Park Main
Violet Line	Central Secretariat	Badarpur
Airport Express (Orange Line)	New Delhi	Dwarka Sector 21
(Table-15 Lines of Delhi Metro Network)		

The Delhi Metro project proposes to cover the entire city of Delhi and the adjoining sub-cities (Gurgaon, Noida, Ghaziabad, etc.) with a network of 405 km, in four phases, by 2021. The Group of Ministers approved Phase III of the Delhi MRTS project in August 2011. The approved network has four corridors covering a route length of 103 km and 67 stations. The approved cost of the project is USD 7 billion. In addition, the extension of the Delhi Metro to Faridabad, covering a route length of 13.9 km and 9 stations, has been approved and will be funded by the Government of Haryana and the Government of India (GOI) (DMRC, 2011). Phase IV of the project has been proposed by the Delhi Metro, but has yet to be approved. This phase will consist of 108.5 km of network length. After the completion of Phase IV of the DMRC, only 35% of the Delhi population will be within walking distance of metro rail.

Finance

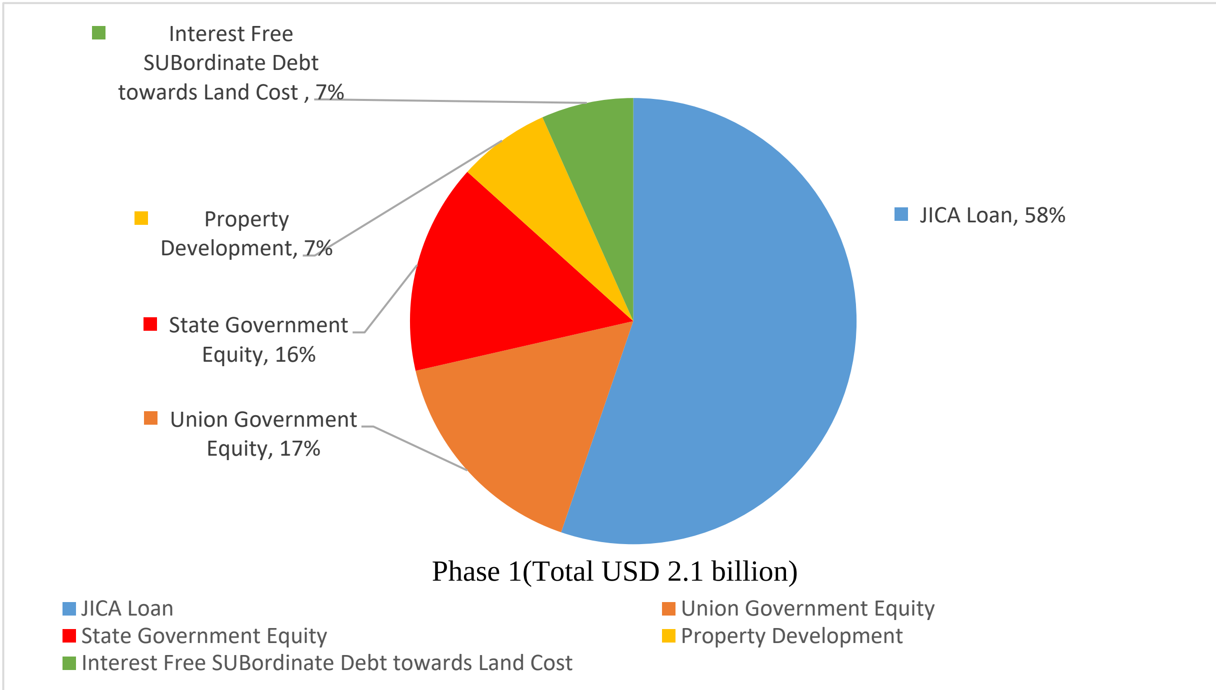
The following section on finance covers the funding pattern of different phases of the Delhi Metro, tax liabilities and exemption to DMRC, operating revenue and cost streams, as well as their different components. While mentioning the tax regime of the Delhi Metro, the tax liability of the bus counterpart of the Delhi Metro, the Delhi Transportation Corporation (DTC), has been discussed in order to provide a reference for comparison.

Funding Pattern

Phase I of the project was developed with a total investment of USD 2.1 billion, at an average cost of USD 32 million per km. Of this, the Japan International Cooperation Agency (JICA), formerly known as Japan Bank of International Cooperation (JBIC), funded about 60% in six tranches, with the first one in 1997. The loan was sanctioned at an annual interest rate of 1.2%, and a repayment period of 30 years with a moratorium period of 10 years.

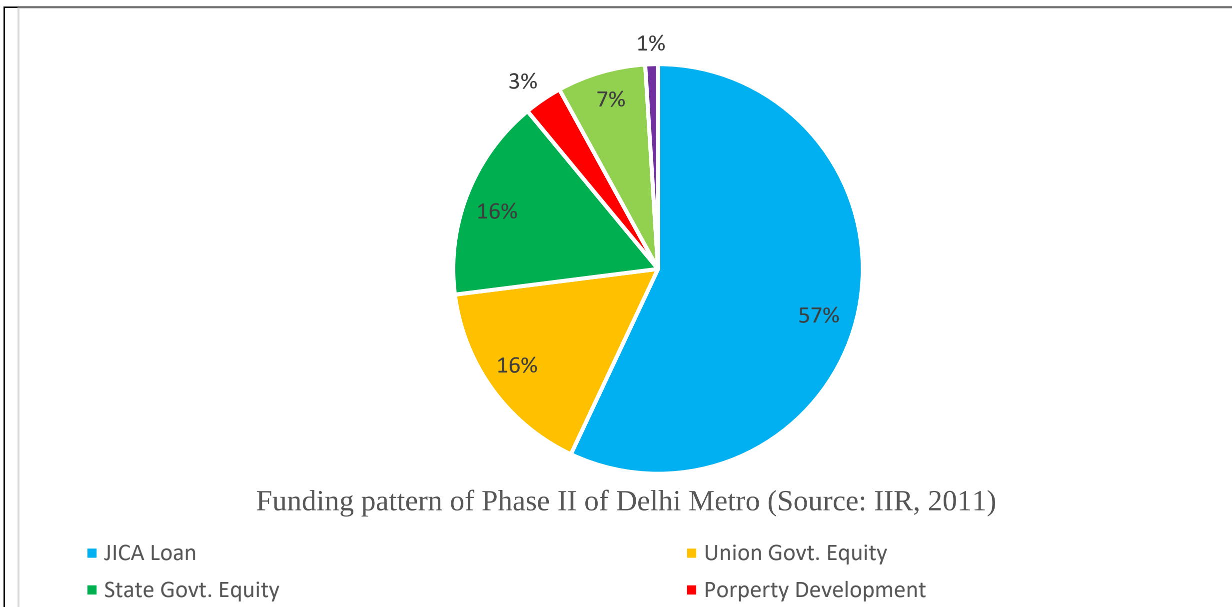
The Union Government and the GNCTD jointly financed 28% of the project cost through equity contributions, in addition to providing a subordinate loan to cover the cost of land acquisition, which was approximately 5% of the project cost. The remaining 7% of the funds were internally generated through property development.

Phase II of the project was developed at a cost of USD 3.8 billion, at an average rate of USD 31 million per km. Of this, 39.6% was financed through equity participation (shared equally by the Union Government and the GNCTD), and 49% was financed through the JICA loan. The remainder was funded through property development, grants and subordinate debt.



(Fig-33 Funding pattern of Phase I of Delhi Metro (Source: IIR, 2011))

In order to calculate the percentage contribution of Delhi Metro's fare box revenue to the total income (see Table 2 for total income), the rental portion was removed from traffic operations. This reduces the proportion of traffic operations in the total income to 47% (2010–11), 56% (2009–10), 42% (2008–09) and 49% (2007–08) from 58%, 71%, 54% and 63%, respectively (see Figure 9). This highlights the fact that the income from the fare box contributes to less than half of the total revenue of Delhi Metro operations.



(Fig-34 Funding pattern of Phase II of Delhi Metro (Source: IIR, 2011))

Revenue and Cost Streams

The following section describes the revenue and cost streams of the DMRC, focusing only on the operational revenue and operational cost/expenditure. In this section, different components of revenue and expenditure have been elaborated, using the information obtained from the annual reports published by the Delhi Metro.

Revenue Stream

The Delhi Metro Rail Corporation (DMRC) has the following sources of revenue, as mentioned in the financial reports (DMRC, 2008; DMRC, 2009; DMRC, 2010; DMRC, 2011):

1. Traffic Operations: Income from train operation, feeder bus earnings, rental income of space for kiosks, parking, shops, restaurants, advertisements, sale of tender forms and sale of carbon credits.

2. Consultancy: Income from consultancy services to other metro systems in India, and abroad, and sale of tender forms.

3. Real Estate: Income from sales of land, and leases.

4. External Project Works: Income from works carried out in other metro projects.

5. Others: Deferred government grant, income from sale of carbon credits, sale of tender documents, etc.

Income Source	2006–07		2007–08		2008–09		2009–10		2010–11	
	USD (million)	% Total	USD (million)	% Total	USD (million)	% Total	USD (million)	% Total	USD (million)	% Total
Traffic Operations	44.5	41%	63.4	63%	78.6	54%	105.4	71%	187.7	58%
Consultancy	1.3	1%	2.7	3%	5.6	4%	6.4	4%	4.3	1%
Real Estate	50.4	46%	24.0	24%	49.0	34%	5.9	4%	19.7	6%
External Project Works	-	-	-	-	-	-	16.7	11%	76.9	24%
Others	12.3	11%	10.8	11%	11.6	8%	13.1	9%	33.0	10%
Total	108.6	100 %	100.9	100 %	144.8	100 %	147.6	100 %	321.6	100 %

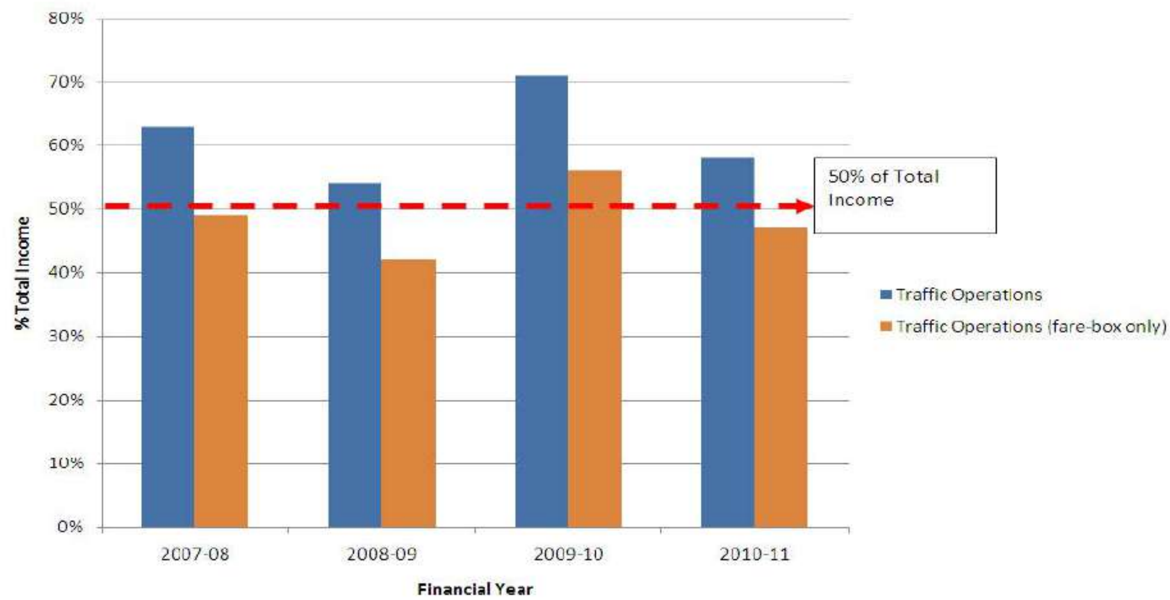
(Table-16 Sources of revenue of DMRC)

In the above table, the real estate income in the years 2006 to 2009 is comparatively higher because of the upfront income that is received when vacant land is given for commercial exploitation (Business Standard, 2008). During this time, the percentage income from traffic operations varied From as low as less than half (41%) to two-third (63%) of the total income. From 2009 onwards, the revenue income from real estate comes every year and, therefore, is comparatively lower.

In 2010–11, again, the percentage income from traffic operations is reduced due to the higher contribution of revenue from external project works taken by the Delhi Metro.

Cost Stream of DMRC

This section outlines the major cost components in the operations of the Delhi Metro. The total operational cost of the Delhi Metro has more than doubled (2.4 times) from 2007 to 2010. Interestingly, the network length of the Delhi Metro has also increased by the same proportion (2.4 times), from 65 km to 156 km during the same period (2007–2010). Even though the total cost has increased, the percentage contribution of different cost components to the total operating cost remains almost the same throughout the years.



(Fig-35 Contribution of traffic operations to the total income with and without rental income)

The Delhi Metro has electricity consumption from traction – running of trains – and non-traction purposes, such as lifts and escalators, air-conditioning of underground stations, lighting of stations, etc. The former is under traction expenses and the latter is under electricity and water expenses in the operating cost components.

Expenditure Head	2007–08		2008–09		2009–10		2010–11	
	USD (million)	% Total	USD (million)	% Total	USD (million)	% Total	USD (million)	% Total
Employee Cost	17.8	44%	17.3	38%	23.5	41%	43.1	44%
Operations And Administration Expenses								
Stores Consumed	1.9	5%	2.3	5%	4.1	7%	5.4	6%
Traction Expenses	4.8	12%	6.4	14%	8.1	14%	15.2	16%
Plant and Machinery	2.6	7%	3.2	7%	3.5	6%	3.6	4%
Housekeeping	2.4	6%	2.5	5%	3.4	6%	7.0	7%
Electricity and Water	5.1	13%	7.1	16%	7.6	13%	11.7	12%
Total	40.1	100%	45.7	100%	57.8	100%	97.8	100%

(Table-17 Major components and their share in the total operating cost of DMRC5)

As seen in Table the two components (traction and electricity) contribute 25–30% of the total operational cost. It should be noted that this cost is incurred when the DMRC is supplied with a subsidized rate of electricity.

In addition to the costs mentioned above, the Delhi Metro has an additional liability of loan repayment, the interest incurred on it, as well as the depreciation cost, which is increasing rapidly with the expanding network. By 2012, the DMRC had a total debt of USD 3 billion (The Economic Times, 2012). During the financial year 2010–11, the interest and financial charges reached more than USD 36 million. Similarly, the depreciation value increased more than seven times, from USD 15.2 million in 2005 to USD 116 million in 2011.

Tax Regime of DMRC

The following section reviews the tax regime of the Delhi Metro. As the Delhi Metro project was not considered commercially viable6, the Government of India provided concessions to the DMRC (CAG, 2008), including many tax exemptions, as well as

1. Interest free subordinate loans from the GOI, GNCTD, HUDA, and NOIDA for supporting the cost of the land required for the project.

2. The long-term debt required for the project was raised by the GOI, through a loan agreement executed with JICA at concessional rates of interest and transferred to the company.

3. Immunity from exchange rate fluctuation – fluctuation risk for the period of repayment of foreign loans was to be shared between the GOI and the GNCTD, equally.

4. Exemption from property tax and electricity tax.

5. Exemption from import duty, excise duty, sales tax and works contract tax.

6. No dividend to be paid on government equity until the JBIC loan is fully repaid.

For example, for Phase I of the Delhi Metro project, the Government of India gave a customs and excise duty exemption amounting to more than USD 280 million to the DMRC in 2002 (Financial Express, 2006).

In addition, the Delhi Government gave a tax relief of USD 92 million in the form of sales tax and works contract tax waivers, as well as a waiver of 1% cess, etc. (ET, 2003). In addition to the above-mentioned concessions, the Delhi Metro is also provided electricity at a subsidized rate on a cost-to-serve basis (DERC, 2009; Business Standard, 2009) and at a lesser rate – at least 40% less, USD 0.06 versus USD 0.1 in 2011 – than other non-domestic consumers (Day & Night News, 2011).

Metro Ridership Trend

Delhi Metro’s average daily ridership increased from 82,179 in December 2002 to almost 1.4 million passengers in March 2011 (DMRC, 2011). Within the metro network, there is a large variation in the usage of different lines. For instance, by June 2011, 50% of the network under Line-2 (Jahangirpuri – HUDA City Centre), Line-3 (Dwarka Sector 9 to NOIDA City Centre) and Line-4 (Yamuna Bank to Anand Vihar) accounted for 75% of the total ridership (DMRC website, 2011). The ridership of the Delhi Metro has been much lower than its estimated numbers. Table 7 shows the actual and projected ridership of the Delhi Metro for four years of operation. It can be seen that the actual ridership remained, at most, one-fourth of the projected figures.

Year	Passengers Per Day		Actual as % of projected
	Actual	Projected	
2006	492,750	2,497,300	20%
2007	621,830	2,759,517	23%
2008	767,662	3,049,266	25%
2009	889,094	3,369,439	26%

(Table-18 Projected and actual ridership of Delhi Metro in Phase I corridors (UNFCCC, 2011)

Given the trend of much lower ridership of the Delhi Metro, the DMRC has revised its projected ridership many times since the completion of Phase I. The original feasibility study for developing a metro system for Delhi projected a daily ridership of 3.1 million passengers by 2005, which was later reduced to a projected demand of 2.18 million passengers per day on the first three corridors (65.8 km), upon completion in December 2005. This figure was further reduced to 1.5 million in 2005 (Mohan, 2008). The latest revision came in 2011 (DMRC, 2011), according to which the DMRC's target was to achieve an average ridership of 2 million passengers per day by the end of 2011, for a 190 km long network. It should be noted that this revised ridership is less than the projected ridership for the 65 km of network in 2006. The inaccuracy in the estimation of projected ridership figures has been accepted by the DMRC, which is clearly indicated by the following statement from the audit report of Phase I of the Delhi Metro by the Comptroller and Auditor General of India (CAG) office: "The fact that transport modeling for ridership was not carried out accurately by RITES, was accepted by the company (DMRC) as well as the Ministry of Urban Development (MoUD) before the Empowered Group of Secretaries in 2005" (CAG, 2008).
In order to estimate the usage of the Delhi Metro per unit length of the network, Table 8 shows the number of passengers per km of metro network, based on the actual ridership. It gives an average of 11,450 passengers per km. Moreover, the ridership stabilizes at about 11,000 passengers per km, and then drops with an increment of network length. Also, the revised projection of the ridership of 2,000,000 passengers per day for 190 km of network, gives 10,500 passengers per km.

Year	Network Length (km)	Passengers per km per day
2006	33	14,900
2007	65	9,550
2008	68	11,300
2009	76	11,600
2010	16	9,900
Average		11,450

(Table-19 Average passenger per km in Delhi metro)

It is imperative to learn lessons from the large variance of projected and actual ridership of the Delhi Metro. With more than USD 40 billion to be spent on metro rails in the next 10 years, in more than a dozen cities in India (HPEC, 2012), there is an urgent need to revise the existing travel demand models in order to project metro ridership closer to the realistic value.
The unrealistic projection of ridership for rail projects in not new, and has occurred numerous times in the past. There are many international (and one Indian) examples of metro projects for which the actual ridership remained only a fraction of what had been projected. The following examples have been cited from Flyvbjerg et al., 2002:

⇒ By 1999–2000, the Kolkata Metro had a ridership of less than 10% of the projected ridership.

⇒ A study of 10 rail projects in the US, done by USDOT, found that on average actual ridership was 65% lower than forecasted.

⇒ A UK study, by TRR Laboratory, of 9 metro systems in both developing and industrialized nations found that the ridership forecast was over 100% above the actual ridership.

⇒ A Denmark study, by Aalborg University, of 27 rail projects found that for two-thirds of projects, forecasts are overestimated by more than two-thirds.

Metro User Travel Characteristics

This section describes the travel characteristics of metro users, based on information obtained from a primary survey. In order to understand the benefits that can be achieved from a public transportation system, and get insight into its long-term effectiveness as a sustainable system, it is imperative to comprehend the characteristics of the users.

Metro User Survey

An on-board survey of Delhi Metro passengers was conducted during the month of November, in 2011 (see Annexure 1 for the questionnaire). The survey was carried out on all lines of the Delhi Metro network, except the airport line. It was conducted by six volunteers, with one volunteer in each coach of a six-coach train – the Delhi Metro runs four and six-coach trains. The volunteers consisted of five males and one female. This was done to cater to the five general coaches, where both male and female passengers are allowed, and one ladies coach, where only female passengers are permitted to enter. The survey was conducted during morning and evening peak hours of travel – starting at 8AM and 6PM, respectively. It consisted of the volunteers selecting respondents for the survey in a random manner and interviewing them. During the survey, care was taken to ensure that there was no bias in the selection of standing and sitting passengers. In total, 1,112 respondents took part in the survey7. The survey consisted of nine questions regarding, access and egress modes, origin and destination metro stations, auto ownership, alternative modes, and a question to investigate induced trips. The following sections describe the results from the different survey questions.

Access and Egress Modes

Respondents of the on-board survey were asked to mention the modes used to access their starting metro station, and the egress modes used after de-boarding the metro station. More than 50% of respondents (52% – access, and 57% – egress) mentioned using non-motorised modes (walk, cycle and rickshaw) for their access-egress trips – with almost 44% of respondents walking. Almost one fifth and one-tenth of the respondents used autos and buses, respectively. The usage of motorcycles and cars differed in access and egress trips. For access trips, motorcycles were used by 4.3%, while cars were used by 12.3%. For egress trips, motorcycle usage reduced to 3% and car usage reduced to 7%.

Mode	Percentage of Respondents	Number of Respondents
Walk	43.9	473
Cycle	1.6	17
Rickshaw	6.5	70
Motorcycle	4.3	46
Auto	20.7	223
Bus	11.2	121
Car	12.3	132

(Table-20 Access Mode)

A majority of the respondents using non-motorised modes for the last-mile connectivity of their metro trip underscores the importance of infrastructure, which could provide safe movement of non-motorised modes and augment the current metro ridership. Moreover, the smaller share of bus use for access/ egress trips (~11%) may be an indicator of inconvenience, due to the changing of modes, additional wait times and out-of-pocket expenses.

Average Trip Length

In the survey, respondents were asked to mention their starting and destination metro stations. Using this information, travel distance on the metro route has been calculated. This was done by first determining the latitude and longitude of all the metro stations. The distance between each consecutive metro stations was determined by calculating the straight line between the two stations. This is a safe approximation because the alignment of metro stations is mostly made as a straight line between two consecutive stations. A distance matrix was formed using the distance of the consecutive metro stations, as calculated above. Using MATLAB software, a program was made to measure the travel length for the origin-destination pair, corresponding to each survey respondent. The table below shows the percentage of survey respondents for the different distance categories.

On average, survey respondents travelled a mean distance of 20.2 (± 0.57) km at a 95% confidence interval. Using origin-destination metro stations and the fare chart, the fare paid by respondents for their current trip has been determined. The average fare paid by survey respondents is INR 20.7 ± 0.3 (USD 0.41). Moreover, a similar value of average fare (INR 19.3/USD 0.39) is obtained using total revenue, USD 772,000, and corresponding ridership, 2,006,949, for January 9, 2012 – reported by the Delhi Metro. This corroborates the results of the survey and indicates that the survey sample is representative of the population.

Access Audit of Metro Stations

Accessing metro stations contributes to a significant proportion of disutility (or inconvenience) for a trip by metro. There are several reasons for this. First, the access and egress parts of a public transportation trip involve the most physical effort for walking, transferring, etc. Second, unlike bus networks which have a much higher coverage and smaller catchment areas for each bus stop, metro stations have much larger catchment areas. Consequently, there is a large portion of the city's population for which access and egress distances are longer than a comfortable walking distance of 500–700 metres. Third, as the access and egress trips become longer, individuals have to interact with more elements of road infrastructure, such as footpaths and pedestrian crossings. Pedestrian infrastructure has an important implication for the safety of public transport users and, thus, determines, to some extent, the willingness of individuals to use public transportation. Therefore, the disutility of a metro trip increases even further if the pedestrian infrastructure is inconvenient or absent from the roads. In order to measure the accessibility of Delhi metro stations, accessibility audits were carried out at three major stations – Hauz Khas, Kashmere Gate and New Delhi Railway. All three stations are on the Yellow Line, which runs North-South, and are located in three different parts of the city. Hauz Khas is located in the southern part, Kashmere Gate is in the northern part, and New Delhi Railway is in the central part of Delhi.

Security of Delhi Metro

As the Delhi Metro was considered a soft target for terrorists, starting in April 2007, Central Industrial Security Force (CISF) personnel were deployed at different stations in its network (TOI, 2007). In 2011, there were 4,500 CISF personnel deployed at various stations of the Delhi Metro (Zeenews.com, 2011). With the expanding network in satellite towns, the DMRC needs a total of more than 7,000 CISF personnel (Indian Express, 2009). It should be noted that the CISF is a

Federal Government funded agency, and the cost of security by the CISF is not absorbed by the Delhi Metro.

Fatalities and Injuries during Construction

From the information obtained using the Right to Information (RTI) Act, 2005, in December 2007, there were 60 fatal accidents during the construction of the Delhi Metro – from 2000 through 2007. Moreover, there were 26 major non-fatal accidents during the same period. Figure 15 shows the yearly trend of fatalities, obtained from the RTI data. Another source (Civil Society, 2009) which obtained information on accidents during metro construction, using RTI from police records, puts the total deaths at 261 and total injuries at 481, by 2009.

Displacement of Households

A significant proportion of people living in poverty continue to live in informal settlements without water and sanitation services, in many Indian cities. It is estimated that nearly 3 million people live in Jhuggi Jhopri (JJ) clusters in Delhi – unplanned squatter or slum settlements – which was projected to increase to 4.5 million by 2011 and 6 million by 2020 (Anand, 2007; Tiwari 2003). Figure 16 shows the geographical spread of the JJ clusters in Delhi, and the citywide occurrence of these low-income settlements.

As the city carries out its development process, it leads to the eviction of people living in low income households. This, in turn, leads to their loss of access to regular employment and livelihood opportunities, in addition to education, health care, and other social necessities. Between 2000 and 2004, more than 100,000 Jhuggies in Delhi have been displaced 10–25 km away from their original location (Tiwari, 2003). Similar eviction and relocation of Jhuggies took place with the development of the Delhi Metro, which acquired large tracts of land along its lines. According to the Environmental Impact Assessment report of Phase I of the Delhi Metro, the project required 348.45 hectares of land and needed to relocate 2,502 Jhuggies (Hazards Centre, 2006).

1. Several households from different slum settlements were relocated to a designated resettlement colony called Holambikalan, located at the North-West periphery of Delhi. A survey of 201 households in the resettlement colony was carried out in 2004 (Anand, 2007). The survey found impacts on the accessibility and the socio-economic profiles of the relocated households. The following are different impacts that were found to be statistically significant:The bus route availability and frequency reduced after relocation – from a 5-minute headway to 63 minutes (13 times).
2. For 19% of the households the income remained the same after relocation, while for 66% it decreased, and for 15% it increased. On average, household income reduced from INR 3,145 (USD 78.6) to INR 2,514 (USD 62.85) after relocation.
3. Nearly 99% of the households did not have availability/need of using RTVs for access before relocation, but all households use RTVs to travel after relocation.
4. The daily travel distance after relocation increased from an average of 4.4 km to 15.4 km, resulting in an increase in travel time as well as cost.

Emissions from Electricity Used in Metro

The Delhi Metro is a system that runs mainly on electricity. It has electricity consumption from traction – running of trains – and non-traction purposes, such as lifts and escalators, air-conditioning of underground stations, lighting of stations, etc. As seen in the section on Cost and Revenue Streams, electricity contributes 25 to 30% of the total operating cost of the Delhi Metro.

To evaluate such a system, it becomes essential to estimate the emissions attributed to its operation. According to a 2007 estimate, electricity generation in India contributes 37.8% of CO2 eq. emissions – CO2, SO2, NO2 (MOEF, 2010). This is because India's production of electricity is mainly by coal-based thermal power plants. In 2009, 69% of electricity in the country came from coal (IEA, 2011). Since the coal in India has a higher fly ash content (30–40%), electricity generation leads to the formation of particulate matter (PM10 /PM2.5) – a source of air pollution in the form of fly ash (Senapati, 2011). Therefore, the Delhi Metro has no direct emissions from its operation, but contributes to carbon emissions at power plants during the generation of electricity used for its operation.

Considering the per unit cost of electricity for the Delhi Metro as Rs 39 (USD 0.06), and the cost of electricity for the financial year (FY) 2010–11 as USD 27 million (Traction and Electricity/Water Expenses in Table 5), the result is approximately 450 million units of electricity consumption per annum for the Delhi Metro. For the same year, the average annual ridership of the Delhi Metro was 1.42 million (ridership in March 2011 from DMRC, 2011), and the average trip length was 20 km, as estimated from the on-board survey of 1,112 metro users.

Using the electricity emission factor for India from the United Nations Greenhouse Gas Calculator10 as 0.943 kg per KWh and a transmission and distribution loss of 32%, as provided by the Central Electricity Authority (IEA, 2011a), gives 61 g of CO2 equivalents per passenger km of travel on the Delhi Metro. Sperling et al. (2004)11 have estimated CO2 equivalent emissions per passenger km from rail transit in developing countries to be in the range of 20–50 g. It should be noted that these emissions values include only the operational aspect of the Delhi Metro, and not the life cycle emissions during vehicle manufacturing, station construction, steel manufacturing for tracks, etc.

5.2 Concept (Electrical)

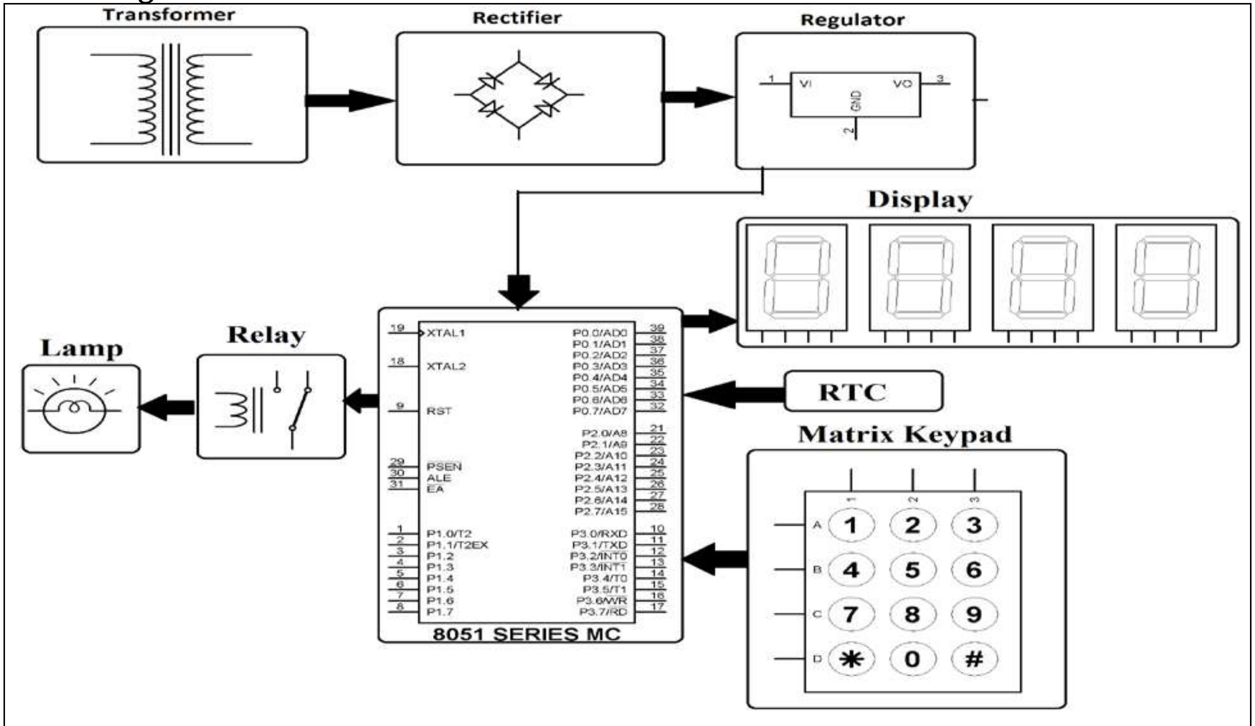
5.2.1 Programmable Load Shedding

In today's world, there is a continuous need for automatic appliances with the increase in standard of living, there is a sense of urgency for developing circuits that would ease the complexity of life. The project is designed to operate an electrical load multiple number of times as per the program. It overcomes the difficulties of switching the load ON/OFF manually.

This proposed has an inbuilt real time clock (RTC) to keep tracking the time and thus to switch ON/OFF the load accordingly. Load shedding is what electric utilities do when there is a huge demand for electricity that exceeds the supply. Thus in a distribution system it needs to be precisely controlled for specific period of time. Programmable load shedding time management system is a reliable circuit that takes over the manual task of switch ON/OFF the electrical devices with respect to time. It uses real time clock (RTC) interfaced to a microcontroller of 8051 family.

While the set time equals to the real time, then microcontroller gives command to the corresponding relay to turn ON the load and then another command to switch OFF as per the program. Multiple ON/OFF time entry is the biggest advantage with this project. A matrix keypad helps enter.

Block Diagram



(Fig-36 Block Diagram of Programmable Load Shedding)

BLOCK DIAGRAM EXPLANATION

The various blocks in the circuit are

1. Transformer
2. Regulator
3. LCD display
4. Microcontroller
5. RTC
6. Keypad
7. Output relay

Microcontroller

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using. Atmel's high-density nonvolatile memory technology and is compatible with the industry standard 80C51 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications. The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

Transformer

A transformer is a static electric that transfers energy by inactive coupling between its winding circuits. A varying current in the primary winding creates a varying magnetic flux in the transformer's core and thus a varying magnetic flux through the secondary winding. This varying magnetic flux induces a varying electromotive force (EMF).

Regulator

A regulator is a system used to maintain a steady voltage. The resistance of the regulator varies in accordance with the load resulting in a constant output voltage. The regulating device is made to act like a variable resistor, continuously adjusting a voltage divider network to maintain a constant output voltage, and continually dissipating the difference between the input and regulated voltages as waste heat. By contrast, as witching regulator uses an active device that switches on and off to maintain an average value of output. Because the regulated voltage of a linear regulator must always be lower than input voltage, efficiency is limited and the input voltage must be high enough to always allow the active device to drop some voltage.

RTC

The DS12885, DS12887, and DS12C887 real-time clocks (RTCs) are designed to be direct replacements for the DS1285 and DS1287. The devices provide a real-time clock/calendar, one time-of-day alarm, three mask able interrupts with a common interrupt output, a programmable square wave, and 114 bytes of battery- backed static RAM (113 bytes in the DS12C887 and DS12C887A). The DS12887 integrates a quartz crystal and lithium energy source into a 24-pin encapsulated DIP package. The DS12C887 adds a century byte at address 32h. For all devices, the date at the end of the month is automatically adjusted for months with fewer than 31 days, including correction for leap years. The devices also operate in either 24-hour or 12-hour format with an AM/PM indicator. A precision temperature-compensated circuit monitors the status of VCC. If a primary power failure is detected, the device automatically switches to a backup supply. A lithium coin-cell battery can be connected to the VBAT input pin on the DS12885 to maintain time and date operation when primary power is absent. The device is accessed through a multiplexed byte-wide interface, which sup- ports both Intel and Motorola modes.

LCD

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD

KEY PAD

Matrix keyboards are common as an input device in microcontroller-based projects. A conventional way of connecting a matrix keyboard to a microcontroller is to use multiple I/O pins of the MCU. The MCU then uses a scanning algorithm to identify which keys are pressed. A drawback of this method is that it requires a large number of the MCU's I/O pins to connect the keyboard. For example, to connect a 4×3 keyboard requires seven digital I/O pins. It scans row and column to know what is the input.

Output relay

Relay is used to obtain the output. From the output of the relay, the control goes to the main power supply. The whole system acts as an automatic switch.

Circuit Operation

The programmable load shedding time management for utility department circuit consists of an 8592 microcontroller ic,16*2 LCD module,7805 voltage regulator ic,4*3 keypad ,DS12887 RTC IC, relay, a Crystal oscillator.

The 7805 voltage regulator converts the input voltage to 5V and is given to the VCC (pin: 40) of the 8952 microcontroller. This voltage is necessary to enable the microcontroller .A DS12887 RTC interfaces with port0 of the microcontroller i.e., from pins 32 to 39.The RTC shows the real time at every instant. Once the RTC is programmed, it will work continuously even though the power goes off in between. The keypad is interfaced with port2 of the microcontroller i.e. from pins21 to28.The keypad is used to set the real time, the time for load shedding time and the time duration. The 16*2 LCD is interfaced to port1of the microcontroller i.e. from pins 1 to 8.The crystal oscillator helps to provide the working frequency 11.059MHz for the microcontroller.

The microcontroller programmed in such a way that we can set the actual time and load shedding time. Using the program we can monitor both real time and load shedding time. Program always check the equality and whenever it get matched output relay turn off. Then it began to check equality with target time and real time, whenever it get matched relay turns on.

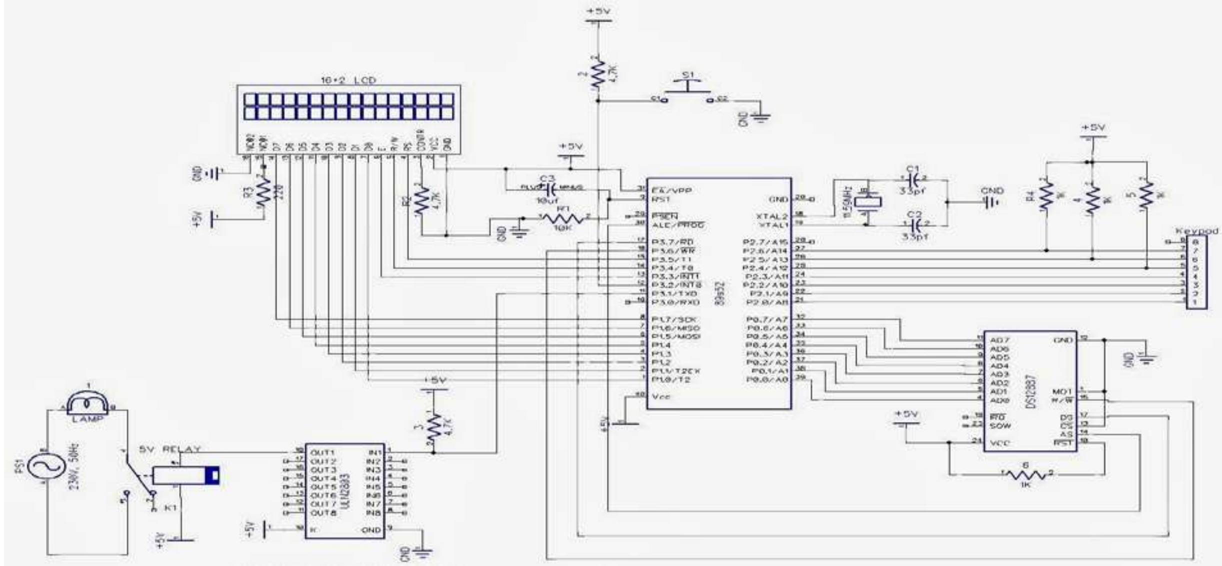
There are many advantages for this circuit. Some of them are.

⇒ Power can be saved.
⇒ Low cost.
⇒ Easy to use.
⇒ Accuracy in time.
⇒ Effective distribution of power.
⇒ We can set the time in advance

PROPOSED SYSTEM FEATURES

⇒ Automatic Load shedding is possible.
⇒ Differs from current system we can program the Load shedding process.
⇒ RTC provides the real time.
⇒ LCD provides the real time and Load shedding timings.
⇒ KEYPAD to set the time.
⇒ Easy to set up.
⇒ Economical and reliable

Circuit Diagram

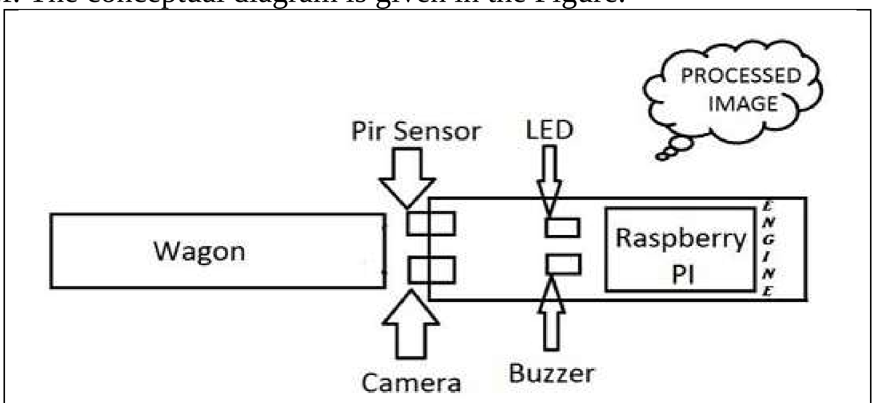


(Fig-37 Circuit Diagram of Programmable Load Shedding)

5.2.2 Railway Security System using IoT

Introduction

There are many cases reported for coal mines thief near the rural areas when the train halts for some time. This has affected a lot in the Indian railways economy. So this paper devices a new technique for Indian railways to remotely monitor the system. The proposed model has a motion detection sensor which detects the motion of the object which performs skin detection and then sends the image to the railway server using IoT. So that immediately an action can be taken to avoid coal thief. The conceptual diagram is given in the Figure.



(Fig-38 Conceptual diagram)

Related works

Design and development of an integrated and heterogeneous network was proposed by Sandro Chiocchio et al [1] and which concentrates on board communication through an 868 MHz Wireless Sensor Network component, data communications across a mobile network through M2M (Machineto- Machine) communication, data collection on the Cloud for processing and detection of anomalies.

To reduce the energy consumption to values sustainable by energy harvesters without penalizing the quality of service, a bi-periodic communication scheme for the local wireless transmission was proposed by Alessandro et al with a dynamic management and consumption model of receiver and GPRS transceiver, which optimize the sleep modes. The proposed solutions are compared and the theoretical predictions are validated by measurements using different operating conditions.
Several key aspects when applying sensor networks such as radio wave propagation, energy scavenging and performance of the WSN aboard the wagon were investigated by Mathias et al. The aboard network communicates at 2.45 GHz, and the external communication is an 868 MHz radio frequency radio link. Though WSN node energy is limited, appropriate energy scavenging schemes are proposed and evaluated using prototypes. Effort has been proposed to improve the identified gaps. The work suggests that piezoelectric harvesting technique is adoptable in which experiments scavenged 2.32 mW.
Bidhan et al proposed train over speed protection system. Application of RFID was studied in detail over complex railway system automation. Application of RFID technology can improve the operating efficiency, safety of men and machines, and improve economy.
A feasibility study was presented by Eugen et al and considered a real-world deployment on one of Europe’s busiest railroad sections. Raw data obtained was from there which was annotated with the help of video footage and contains vibration patterns of 186 trains of six various types with accuracy of 97%. Length of the train wagons was measured using mean-squared error method. Visual inspection of the data shows further opportunities to improve the measurement of speed and detection of worn-out wheels.
Traffic monitoring is the search for moving trains in SAR images where trains are located, their velocity is determined, and type & number of wagons are identified. Commuter trains in the area of Munich, Germany are considered for their case study by Gottfried et al and they concentrated on feature extraction of TerraSAR-X images.
In the proposed work, Camera captures snapshots of the intruder only when motion is detected. This will not lead to unnecessary wastage of storage of space. Also, the system has capability of detecting animal, leaves etc. against human intervention. The image of the intruder will be sent to the driver node.

Hardware and software

Hardware

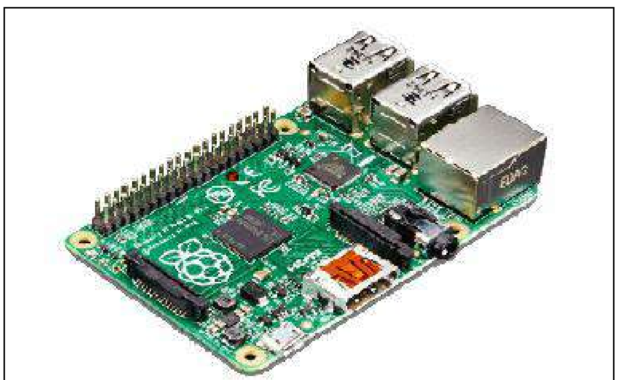
The Components used are microcontroller Raspberry pi 3b, PIR sensor, Camera module2, led, buzzer and power supply for Raspberry pi.

Raspberry pi 3b

It is a device where all the processing of information takes place. It is used to process the PIR sensor data, perform the skin detection algorithm and is a communication device that sends images to the railway server in anomalies. The microcontroller Raspberry pi used in the project is shown in Figure with the specification as follows

SoC: Broadcom BCM2837

CPU: 4× ARM Cortex-A53, 1.2GHz

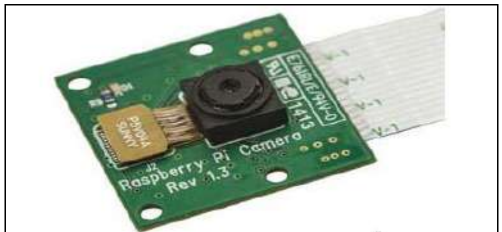


(Fig-39 Raspberry pi 3b)

GPU: Broadcom Video Core IV
RAM: 1GB LPDDR2 (900 MHz)
Networking: 10/100 Ethernet, 2.4GHz 802.11n wireless
Bluetooth: Bluetooth 4.1 Classic, Bluetooth Low Energy
Storage: micro SD
GPIO: 40-pin header, populated

PIR Sensor (SB0061)
It is a module used to detect the motion of the object. The Sensor specifications is given below
Compact size: 28 x 38 mm
Supply current: DC 5v-20v
Current drain: <50uA
Voltage Output: High/Low signal: 3.3V

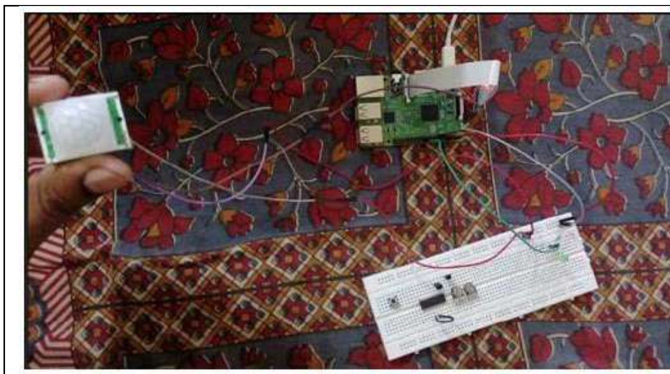
Pi Camera module
This module is used to captures the live video with a resolution of 5MP as shown in Figure.



(Fig-40 Pi Camera module)

<u>Software</u>
IOP Conf. Series: Materials Science and Engineering **263** (2017) 052024 doi:10.1088/1757-899X/263/5/052024
The PIR sensor and skin detection algorithm is performed in python idle 2.7.Node red graphical tool of IBM blue mix is used for sending the images to the railway node and images are also uploaded to drop box.
Algorithm
Step 1: The PIR sensor is mounted on the railway wagon along with the pi camera.
Step 2: The PIR sensor detects the motion of the object. It can be anything like leaves, trees, animals etc.
Step 3: As the motion is detected by the PIR camera starts the live streaming.
Step 4: After this the camera's live video is given as input to the skin detection algorithm. The human skin is detected.
Step 5: Then the image of the thief is sent to the railway node using IOT (Node Red) and images are also uploaded in drop box.

System integration
After testing the modules mentioned above individually, they have been integrated together with the Raspberry PI. Now, as soon as the motion is detected by the PIR Raspberry PI invokes the camera to take an image of that instance. Once the image is taken the Rasp Image Processing i.e. Skin Detection Algorithm to make out whether the image captured is a human. If it was a human then that picture will be uploaded to the drop box and also images


(Fig-41 System Integration)

are sent to railway node using IOT. Any official can have a look at that picture provided if he has internet connection. So using this system it will become easy for the officials to carry out further investigation. The system integration is shown in Figure.

Implementation and results

Drop box software is used to store files in cloud storage. It offers cloud storage, file synchronization and client software. For auto uploading the pictures, we have installed Drop box up loader onto the Raspberry PI. And then we have created an account in the Drop box Developers. After logging in to Drop box account we have created an app to store the pictures in the cloud storage. Whenever the motion is detected, the picture of that instance is taken by the camera will get uploaded to the Drop box. Figure 5 shows the detected images that were auto uploaded to the Drop box app. Images are auto uploaded to the Drop box App provided the Skin Detection Algorithm. The Algorithm confirms that the skin has been detected and it is human as shown in Figure 6. This project helps Railway officials to carry further investigation. It also prevents theft of goods from the open top freight trains. Any Railway Officials can access that images that would be uploaded to the app provided if he has an internet connection. Memory is sufficiently available as cloud storage platform has been used videos can also get auto uploaded to the Drop box App.

5.2.3 Management through Energy Harvesting Concept

Energy harvesting is the process by which ambient energy is captured and converted into electricity for small autonomous devices, such as satellites, laptops and nodes in sensor networks without the need for battery power. Energy harvesting applications reach from vehicles to the smart grid.

With electronic circuits now capable of operating at microwatt levels, it is feasible to power them from non-traditional sources. This has led to energy harvesting, which provides the power to charge, supplement or replace batteries in systems where battery use is inconvenient, impractical, expensive or dangerous. It can also eliminate the need for wires to carry power or to transmit data. Energy harvesting can power smart wireless sensor networks to monitor and optimize complex industrial processes, remote field installations and building HVAC. In addition, otherwise wasted energy from industrial processes, solar panels, or internal combustion engines, can be harvested for useful purposes. A key component in energy harvesting is a power converter that can operate with ultralow voltage inputs.

Now that we have described why it is feasible and what it can do, how does energy harvesting actually work? Put simply, it is a process that:

- ⇒ Captures minute amounts of energy
- ⇒ Accumulates that energy
- ⇒ Stores the energy
- ⇒ Maintains the stored energy as a power source

Typical energy harvesting inputs include:

- ⇒ Solar power
- ⇒ Thermal energy
- ⇒ Wind energy
- ⇒ Salinity gradients
- ⇒ Kinetic energy

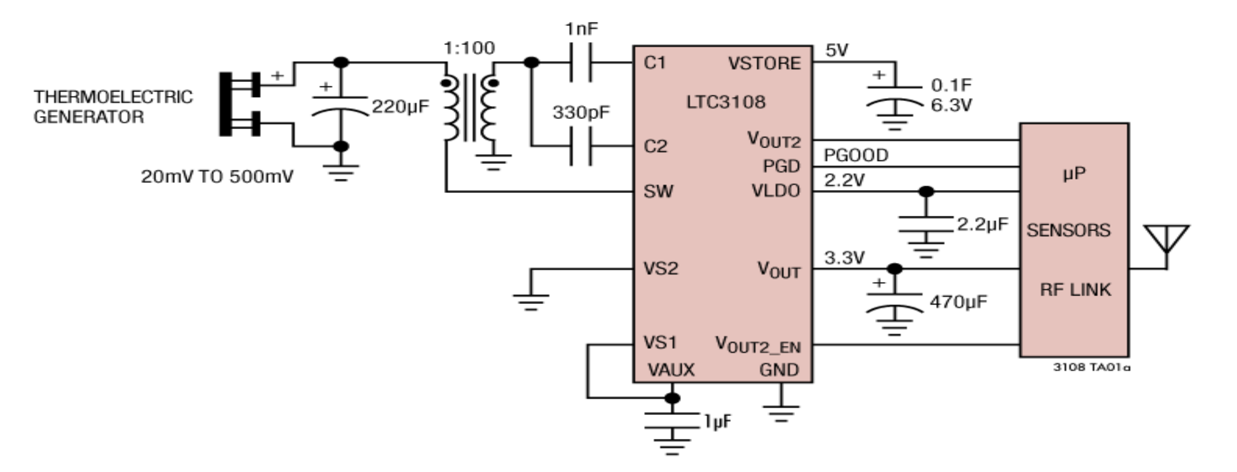
Today, energy harvesters do not usually produce enough energy to perform mechanical work, however they provide small amounts of power to support low-energy electronics. In most cases, the "fuel" for energy harvesters is naturally present and may be considered free. Using natural sources in remote areas for energy harvesting is an attractive alternative to inconvenient utility and battery power. These natural energy sources may be available maintenance-free for a lifetime. Energy harvesting can also be an alternative energy source that supplements the primary power source and enhances its reliability.

Energy harvesters are intended for applications requiring very low average power, but require periodic pulses of higher load current. For example, in many wireless sensor applications the circuitry is only powered to make measurements and transmit data periodically at a low duty cycle. Energy harvesting is becoming more feasible today because of the increased efficiency of devices capable of capturing, storing, and producing electrical energy. This can be accomplished with the help of very efficient, very low-voltage input step-up converters. Also, improved low-voltage, high-efficiency microprocessors may allow them to become participants in energy harvesting systems.

Energy Harvesting IC

Linear Technology's LTC3108, a highly integrated dc-dc converter is intended for energy harvesting. It can harvest and manage surplus energy from extremely low-input voltage sources such as TEG (thermoelectric generators), thermopiles, and small solar cells.

The circuit in Fig. uses a small step-up transformer to boost the input voltage to an LTC3108 that provides a complete power-management solution for wireless sensing and data acquisition. It can harvest small temperature differences and generate system power instead of using traditional battery power. The LTC3108 is available in a small, thermally enhanced12-lead (4mm × 3mm) DFN and a 16-lead SSOP packages.



(Fig-42 LTC3108 provides power management for wireless sensing and data acquisition)

The LTC3108 utilizes a MOSFET switch to form a resonant step-up oscillator using an external step-up transformer and a small coupling capacitor. This allows it to boost input voltages as low as 20mV, high enough to provide multiple regulated output voltages for powering other circuits. The frequency of oscillation is determined by the inductance of the transformer secondary winding and is typically in the range of 20kHz to 200kHz. For input voltages as low as 20mV, a primary-secondary turns ratio of about 1:100 is recommended. For higher input voltages, this ratio can be lower.

The ac voltage produced on the secondary winding of the transformer is boosted and rectified using an external-charge pump capacitor (from the secondary winding to pin C1) and the rectifiers internal to the LTC3108. The rectifier circuit feeds current into the VAUX pin, providing charge to the external VAUX capacitor and the other outputs.

LDO Output

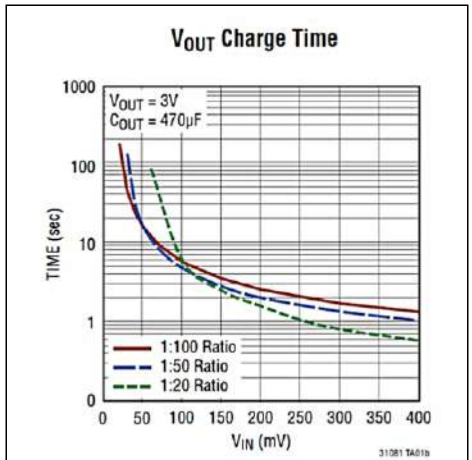
A 2.2V LDO can support a low-power processor or other low-power ICs. The LDO is powered by the higher value of either VAUX or V_{OUT}. This enables it to become active as soon as VAUX has charged to 2.3V, while the VOUT storage capacitor is still charging. In the event of a step load on the LDO output, current can come from the main VOUT capacitor if VAUX drops below V_{OUT}. The LDO requires a 1µF ceramic capacitor for stability. Larger capacitor values can be used without limitation, but will increase the time it takes for all the outputs to charge up. The LDO output is current limited to 4mA typical.

VS2	VS1	V_{OUT}
GND	GND	2.35
GND	VAUX	3.3
VAUX	GND	4.1
VAUX	VAUX	5

(Table-21 Setting for output voltage)

For pulsed-load applications, size the VOUT capacitor to provide the necessary current for a pulse on load. The capacitor's value will be dictated by the load current, duration of the load pulse, and the voltage droop the circuit can tolerate. The capacitor must be rated for whatever voltage has been selected for VOUT by VS1 and VS2 (Table 13-1).

There must be enough energy available from the input voltage source for VOUT to recharge the capacitor during the interval between load pulses. Reducing the duty cycle of the load pulse allows operation with less input energy. The VSTORE capacitor may be a very large value (thousands of microfarads or even Farads) to provide holdup at times when the input power may be lost. Note that this capacitor can charge all the way to 5.25V (regardless of the settings for V_{OUT}), so ensure that the holdup capacitor has a working voltage rating of at least 5.5V at the temperature for which it will be used. Fig. 13-2 plots the time for voltage to build up to its final value for a given input voltage and the input transformer turns ratio. The LTC3108's extremely low quiescent current (<6µA) and high-efficiency design ensure the fastest possible charge times for the output reservoir capacitor.



(Fig-43 Plot of time for voltage to build up to its final value using the LTC3108.)

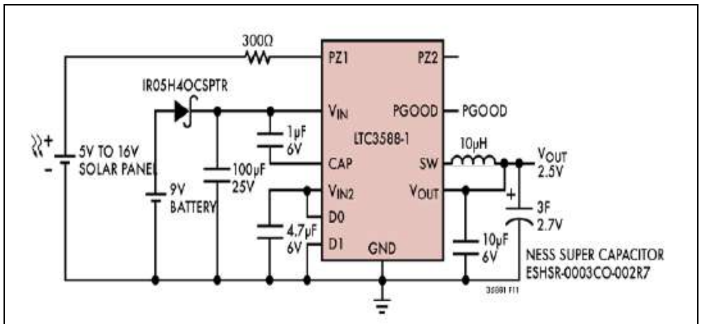
As listed in Table 13-1 above, the main output is pin-selectable via VS1 and VS2 for one of four fixed voltages (2.35V, 3.3V, 4.1V, or 5V) to power a wireless transmitter or sensors. A second switched output can be enabled by the host to power devices that do not have a micropower shutdown capability. The addition of a storage capacitor provides continuous power even when the input energy source is unavailable.

A power-good comparator monitors VOUT. The PGD pin is an open-drain output with a weak pull-up (1MΩ) to the LDO voltage. Once V_{OUT} charges to within 7% of its regulated voltage, the PGOOD output goes high. If V_{OUT} drops more than 9% from its regulated voltage, PGD goes low. The PGD output is designed to drive a microprocessor or other chip I/O and is not intended to drive a higher current load such as an LED. Pulling PGOOD up externally to a voltage greater than VLDO will cause a small current to be sourced into VLDO. PGOOD can be pulled low in a wire-OR configuration with other circuitry.

V_{OUT2} is an output that can be turned on and off by the host, using the V_{OUT2}_EN pin. When enabled, V_{OUT2} is connected to V_{OUT} through a 1.3Ω P-channel MOSFET switch. This output, controlled by a host processor, can be used to power external circuits such as sensors and amplifiers that do not have a low power sleep or shutdown capability. VOUT2 can be used to power these circuits only when they are needed.

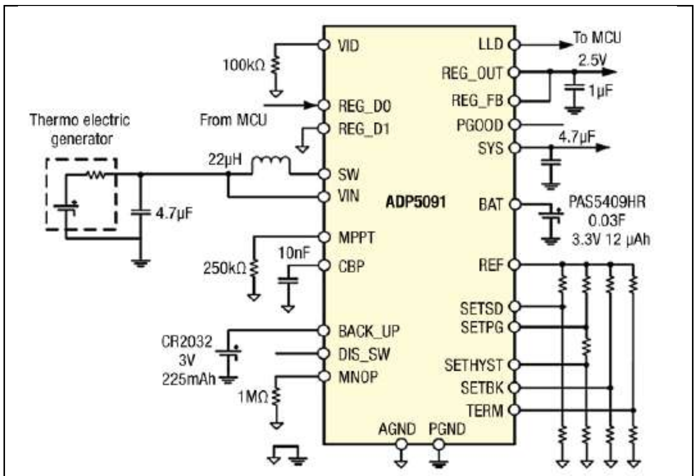
Piezoelectric Energy Harvesting

Linear Technology's LTC3588-1 is an ultralow quiescent current power supply for energy harvesting and/or low current step-down applications (Fig. 13-3). The IC interfaces directly to a piezoelectric or alternative ac power source, to rectify a voltage waveform and store harvested energy on an external capacitor, bleed off any excess power via an internal shunt regulator, and maintain a regulated output voltage by means of a manpower high-efficiency synchronous buck regulator.



(Fig-44 The LTC3588-1 employs a high efficiency buck converter to harvest solar energy and then convert it to a well-regulated output.)

The LTC3588-1 has an internal full-wave bridge rectifier accessible via the differential PZ1 and PZ2 inputs that rectifies ac inputs such as those from a piezoelectric element. The rectified output is stored on a capacitor at the VIN pin and can be used as an energy reservoir for the buck converter. The low-loss bridge rectifier has a total drop of about 400mV with typical piezo generated currents (~10µA). The bridge is capable of carrying up to 50mA. One side of the bridge can be operated as a single-ended DC input. PZ1 and PZ2 should never be shorted together when the bridge is in use.



(Fig-45 The ADP5091/92 provides efficient conversion of the harvested limited power.)

When the voltage on VIN rises above the UVLO rising threshold the buck converter is enabled and charge is transferred from the input capacitor to the output capacitor. A wide (~1V) UVLO hysteresis window is employed with a lower threshold approximately 300mV above the selected regulated output voltage to prevent short cycling during buck power-up. When the input capacitor voltage is depleted below the UVLO falling threshold, the buck converter is disabled. Extremely low quiescent current (450nA typical) in UVLO allows energy to accumulate on the input capacitor in situations where energy must be harvested from low power sources.

You can configure the LTC3588-1 for use with dc sources such as a solar panel as shown in Fig. 13-3 by connecting them to one of the PZ1/PZ2 inputs. Connecting the source in this way prevents reverse current from flowing in each element. Current limiting resistors should be used to protect the PZ1 or PZ2 pins. This can be combined with a battery backup connected to VIN with a blocking diode.

Analog Devices' ADP5091/92 is an intelligent integrated energy harvesting Nano-powered management solution that converts dc power from PV cells or thermoelectric generators (Fig. 13-4).The IC charges storage elements such as rechargeable Li-Ion batteries, thin film batteries, super capacitors, or conventional capacitors, and powers up small electronic devices and battery-free systems.

The ADP5091/92 provides efficient conversion of the harvested limited power from a 16 μW to 600 mW range with sub-μW operation losses. With the internal cold-start circuit, the regulator can start operating at an input voltage as low as 380 mV. After a cold start up, the regulator is functional at an input voltage range of 80 mV to 3.3 V. You can program an additional 150mA regulated output with an external resistor divider or VID pin.

By sensing the input voltage, the control loop keeps the input voltage ripple in a fixed range to maintain stable dc-to-dc boost conversion. The OCV dynamic sensing mode and none-sensing mode both programming regulation points of the input voltage allow extraction of the highest possible energy from the harvester. A programmable minimum operation threshold (MINOP) enables boost shutdown during a low light condition. As a low light indicator for microprocessor, the LLD is the MIONP comparator output. In addition, the DIS_SW pin can temporarily shut down the boost regulator and is RF transmission friendly.

The charging control function of ADP5091/92 protects rechargeable energy storage, which is achieved by monitoring the battery voltage with programmable charging termination voltage and shutdown discharging voltage. In addition, a programmable PGOOD flag with programmable hysteresis monitors the SYS voltage.

An optional primary cell battery can be connected and managed by an integrated power path management control block that is programmable to switch the power source from the energy harvester, rechargeable battery, and primary cell battery.

The ADP5091/92 is available in a 24-lead LFCSP and is rated for a −40°C to +125°C junction temperature range.

5.2.4 Moisture Monitoring System

Sensing Soil Moisture Content by Auto Irrigation System

Introduction

Continuous increasing demand of food requires the control in highly specialized greenhouse vegetable rapid improvement in food production technology. In a production and it is a simple, precise method for country like India, where the economy is mainly based on irrigation. It also helps in time saving, removal of human agriculture and the climatic conditions are isotropic, still error in adjusting available soil moisture levels and to we are not able to make full use of agricultural resources. Maximize their net profits. The main reason is the lack of rains & scarcity of land

Irrigation is the artificial application of water to the soil reservoir water. The continuous extraction of water from usually for assisting in growing crops. In crop production earth is reducing the water level due to which lot of land is it is mainly used in dry areas and in periods of rainfall coming slowly in the zones of un-irrigated land.

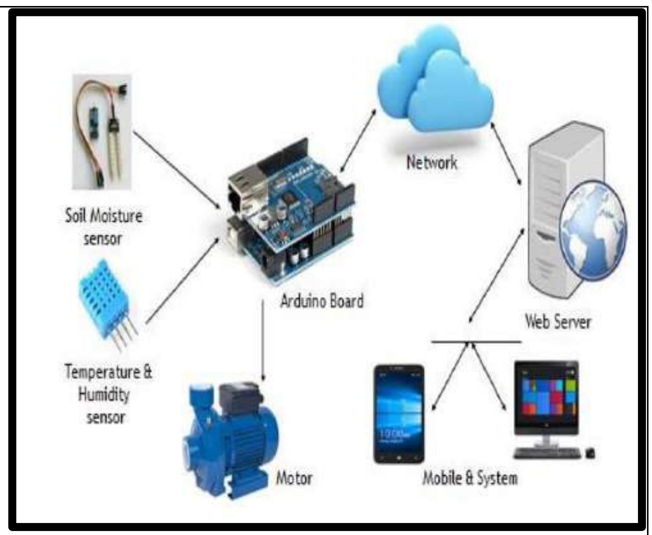
Another shortfalls but also to protect plants against frost. Very important reason of this is due to unplanned use of Types of Irrigation water due to which a significant amount of water goes to surface irrigation waste. Localized irrigation in modern drip irrigation systems, the most significant Drip Irrigation advantage is that water is supplied near the root zone of sprinkler irrigation. The plants drip by drip due to which a large quantity of water is saved.

The main aim of provide water to the plants or gardening automatically using microcontroller (Arduino Uno). We can automatically water the plants when we are going on vacation or don't, we have to bother my neighbors, Sometimes the neighbors do too much of watering and the plants end up dying anyway. There are timer-based devices available in India which waters the soil on set interval. They do not sense the soil moisture and the ambient temperature to know if the soil actually needs watering or not.

Assimilation is that the artificial application of water to the land or soil It is used to assist in the growing of agricultural maintenance of landscapes, and re vegetation of disturbed soils in dry areas and during periods of inadequate rainfall.

When a zone comes on, the water flows through the lateral lines and ultimately finally ends up at the irrigation electrode (drip) or mechanical device heads. Several sprinklers have pipe thread inlets on the lowest of them that permits a fitting and also the pipe to be connected to them. The sprinklers are usually used in the top of the head flush with the ground surface. As the method of dripping will reduce huge water losses it became a popular method by reducing the labor cost and increasing the yields.

When the components are activated, all the components will read and gives the output signal to the controller, and the information will be displayed to the user (farmer). The sensor readings are analog in nature so the ADC pin in the controller will convert the analog signals into digital format.



(Fig-46 Block diagram of the system Soil water content)

Then the controller will access information and when the motors are turned On/Off it will be displayed on the LCD Panel, and serial monitor windows.

There are many systems are available to water savings in various crops, from basic ones to more technologically advanced ones. For instance, in one system plant watering status was monitored and irrigation scheduled based on temperature presents in soil content of the plant

Irrigation

Little water is lost to deep percolation if the proper amount is applied. Drip irrigation is popular because it can Irrigation system uses valves to turn irrigation ON and increase yields and decrease both water requirements and OFF. These valves may be easily automated by using labor. Controllers and solenoids. Automating farm or nursery Drip irrigation requires about half of the water needed by irrigation allows farmers to apply the right amount of sprinkler or surface irrigation. Lower operating pressures water at the right time, regardless of the availability of and flow rates result in reduced energy costs.

A higher labor to turn valves on and off. In addition, farmers using degree of water control is attainable. Automation equipment are able to reduce runoff from over Plants can be supplied with more precise amounts of watering saturated soils, avoid irrigating at the wrong time water. Disease and insect damage is reduced because plant of day, which will improve crop performance by ensuring foliage stays dry. Operating cost is usually reduced. Adequate water and nutrients when needed. Automatic Federations may continue during the irrigation process Drip Irrigation is a valuable tool for accurate soil moisture because rows between plants remain dry.

The capacity of soil to retain water is a function of soil texture and structure. When removing a soil sample, the soil being evaluated is disturbed, so its water-holding capacity is altered. Indirect methods of measuring soil water are helpful as they allow information to be collected at the same location for many observations without disturbing the soil water system.

The new soil moisture sensor uses Immersion Gold which protects he nickel from oxidation. Electrodes nickel immersion Fig. Overview of Automated Irrigation System gold (ENIG) has several advantages over more conventional (and cheaper) surface plating such as The above fig 1 explains about important parameters to be HASL (solder), including excellent surface planarity measured for automation of irrigation system are soil (particularly helpful for PCB's with large BGA packages), moisture.

Soil Moisture

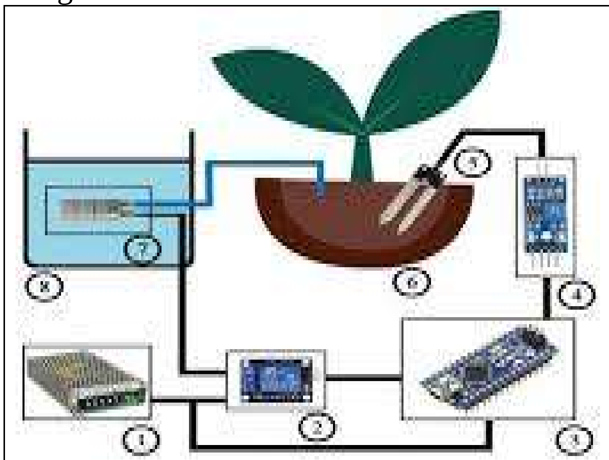
Soil moisture is an important component in the Atmospheric water cycle, both on a small agricultural scale and in large scale modelling of land/atmosphere interaction. Vegetation and crops always depend more on the moisture available at root level than on precipitation occurrence. Water budgeting for irrigation planning, as well as the actual scheduling of irrigation action, requires local soil moisture information. Knowledge of the degree of soil wetness helps to forecast the risk of flash floods, or the occurrence of fog. The relation which monitors and controls all the activities of drip between content and potential is not universal and depends irrigation system efficiently. The present proposal is a on the characteristics of the local soil, such as soil density model to modernize the agriculture industries on a small and soil texture. Scale with optimum expenditure. Using this system, one the basic technique for measuring soil water content is the can save manpower, water to improve production and gravimetric method. Because this method is based on ultimately profit. Direct measurements, it is the standard with which all other methods are compared.

Working

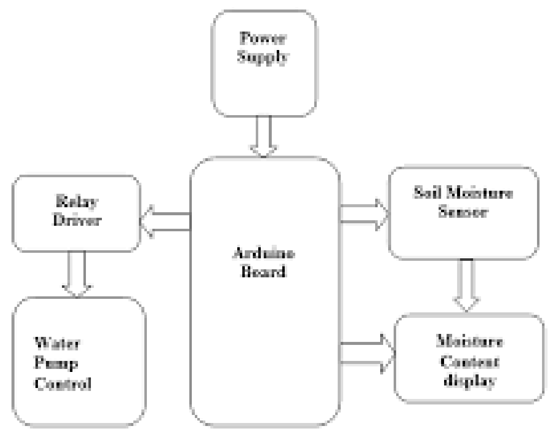
An automatic plant watering system using Arduino microcontroller UNO R3 is programmed such that it gives the interrupt signals to the motor via the motor driver module. Soil sensor is connected to the A0 pin to the Arduino board which senses the moisture content present in the soil. Whenever the soil moisture content values go down, the sensor senses the humidity change, giving signal to the microcontroller so that the pump (motor) can be activated. This concept can be used for automatic plant watering system. The circuit comprises an Arduino UNO board, a soil moisture sensor, a 5V motor pump, a Motor driver L293D (IC1), motor driver IC to run the water pump. You can power the Arduino board using a 5V to 9V wall wart or plugin adaptor or solar panel. You need a separate 5V to 9v battery for the pump motor.

Block Diagram

There are two functional components in this project. They are the moisture sensors module and the motor driver for motor pump. Thus, the Arduino Board is programmed using the Arduino IDE software. The function of the moisture sensor is to sense the temperature content present in the soil, and also it measures moisture level in the soil. The motor driver interrupts the signal to, water pump supplies water to the plants. This project uses microcontroller Arduino Uno board to controls the motor and monitor soil moisture. Follow the schematic to connect the Arduino to the motor driver, and the driver to the water pump. The motor can be driven by a 5-volt battery, we can also supply power from external source or from Arduino board. The Arduino Board is programmed using the Arduino IDE software



(Fig-47 Soil Moisture Block Diagram)



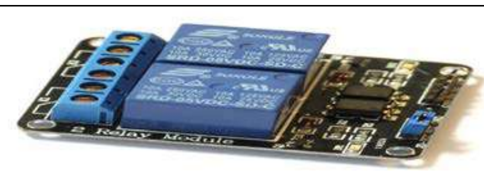
(Fig-48 Sensing Soil Moisture Component)

Component & Requirement

1. Power Supply
2. Relay module
3. Arduino Uno
4. Soil moisture Sensor
5. Amplifier circuit
6. Plant
7. Water pump
8. Water Tank

Relay

In figure, shows are a relay is an electrically operated switch. Several relays use a magnet to automatically operate a switch, however alternative in operation principles are used, like solid state relays. Relays are used wherever it's necessary to regulate a circuit by a separate low-power signal, or wherever many circuits

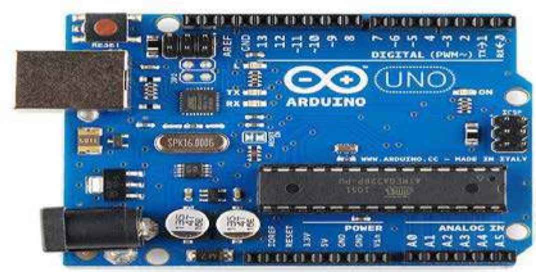


(Fig-49 Relay)

should be controlled by one signal. The essential relays were handling in long distance communicate circuits as amplifiers, they unbroken the signal coming back in from one circuit and re-transmitted it on another circuit.

Arduino

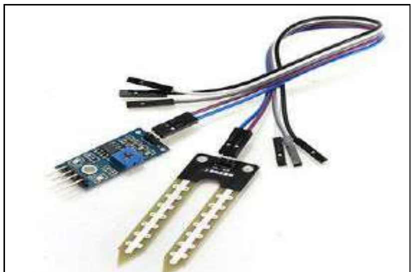
In figure it is showing an Arduino board is an open source platform used for building electronics projects. Arduino is a programmable circuit's board which we can write a program based on your projects. Arduino program will be uploading with IDE (Integrated Development Environment) software that runs on your computer, it is used to write and upload computer code to the Arduino physical board. Arduino language is merely a set of C/C++ functions that can be called from your code.



(Fig-50 Arduino)

Soil Sensor

In figure, Soil moisture sensors measure the humidity of water content in soil. Since the direct hydrometric measuring of free-soil wetness needs removing, drying, and coefficient of a sample, soil wetness sensors live the meter water content indirectly by victimization another property of the soil, like electrical phenomenon, non-conductor constant, or interaction with neutrons, as a proxy for the wetness content.


(Fig-51 Soil Sensor)

Motor Driver L293D

In figure, L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that we can control more than two DC motor with a single L293D IC at same time.


(Fig-52 Motor Driver L293D)

Motor 5V

An AC motor is an electrical motor driven by Associate in alternating current (AC). In figure: 5, The AC motor normally consists of two basic components, an outdoor stationary stator coil having coils furnished with AC to supply a rotating flux, and an indoor rotor connected to the output shaft manufacturing a second rotating flux. The rotor flux could also be made by permanent magnets, reluctance striking, or DC or AC electrical windings.


(Fig-53 Motor 5V)

Transistor

The 2N2222 may be a common NPN bipolar semiconductor device; bipolar junction transistors (BJT) used for general purpose low-power amplifying or switch applications. It is designed for low to medium current, low amplifying current, low power, medium voltage, and might operate at moderately high speeds. It had been originally created within the TO-18 metal.

(Fig-54 Transistor)

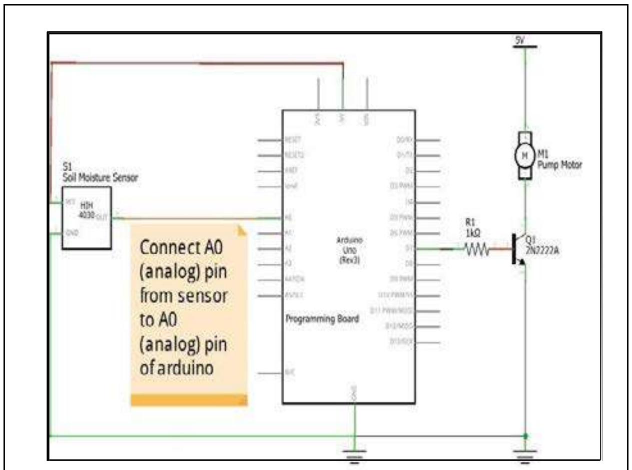
Resistor

It is an electrical device may be a passive two-terminal electrical part that implements resistance as a circuit component. In electronic circuits, resistors unit of measurement accustomed reduce current flow, alter signal levels, to divide voltages, bias active components, and terminate transmission lines, among completely different uses.

(Fig-55 Resistor)

Circuit Diagram

Here In this figure: soil moisture sensors are connected to Arduino A0 pin for analog input, so we can get temperature content present in soil. Vcc pin is connected through 5V Arduino pin; GND pin is representing ground to connect all components. D7 is known as a digital pin, so it connected with transistors to amplifying low power. Motor driver module VCC pin connected through D13 pin of Arduino board, based on temperature monitor it pass the current to the motor pump, D7 pin is used for Ground. We can write values as output. D7 connected through resistors 1k and same connection goes through transistors for low amplifying current.



(Fig-56 Circuit Diagram)

In transistor has three pin which we called as Emitter, base and collector.

5.2.5 Home Automation using IoT / Any other methodology

IoT home automation: Getting started

Home automation has three major parts:

⇒ Hardware

⇒ Software/Apps

⇒ Communication protocols

Each of these parts is equally important in building a truly smart home experience for your customers. Having the right hardware enables the ability to develop your IoT prototype iteratively and respond to technology pivots with ease.

A protocol selected with the right testing and careful consideration helps your avoiding performance bottlenecks that otherwise would restrict the technology and device integration capabilities with sensors and IoT gateways.

Another important consideration is the firmware that resides in your hardware managing your data, managing data transfer, firmware OTA updates and performing other critical operations to make things talk.

Applications of home automation

Rebuilding consumer expectations, home automation has been projected to target wide array applications for the new digital consumer. Some of the areas where consumers can expect to see home automation led IoT-enabled connectivity are:

⇒ Lighting control
⇒ HVAC
⇒ Lawn/Gardening management
⇒ Smart Home Appliances
⇒ Improved Home safety and security
⇒ Home air quality and water quality monitoring
⇒ Natural Language-based voice assistants
⇒ Better Infotainment delivery
⇒ AI-driven digital experiences
⇒ Smart Switches
⇒ Smart Locks
⇒ Smart Energy Meters

The list is still not exhaustive and will evolve over the time to accommodate new IoT use cases. Now that you are familiar with home automation applications, let's have a detailed look at what components are involved in building a typical home automation prototype.

Home automation components

We have talked about them before, but, let's clearly separate them into components that would finally help you build a realistic model of what major components are involved in building a smart home. The major components can be broken into:

⇒ IoT Sensors
⇒ IoT Gateways
⇒ IoT Protocols
⇒ IoT Firmware
⇒ IoT Cloud and Databases
⇒ IoT Middleware (if required)

IoT sensors involved in home automation are in thousands, and there are hundreds of home automation gateways as well. Most of the firmware is either written in C, Python, Node.Js, or any other programming language.

The biggest players in IoT cloud can be divided into a platform as a service (PaaS) and infrastructure as a service (LaaS).

Major IoT platform as a service provider:

⇒ AWS IoT
⇒ Azure IoT
⇒ Thingworx
⇒ Ubidots

⇒ Thingspeak
⇒ Carriots
⇒ Konekt
⇒ TempoIQ
⇒ Xively
⇒ IBM Bluemix

Characteristics of IoT platforms

Again these platforms are extremely divided over the IoT application and security-related features that they provide. A few of these platforms are open source.

Let's have a look at what you should expect from a typical IoT platform:

⇒ Device security and authentication
⇒ Message brokers and message queuing
⇒ Device administration
⇒ Support towards protocols like CoAP, MQTT, HTTP
⇒ Data collection, visualization, and simple analysis capabilities
⇒ Integrability with other web services
⇒ Horizontal and vertical scalability
⇒ WebSocket APIs for real time for real-time information flow

Apart from what we mentioned above, more and more platform builders are open sourcing their libraries to developers. Take for example the Dallas temperature library for DS18B20 for Arduino was quickly ported because of open source development to a new version that helped developers to integrate DS18B20 with Link it one. Understanding these things become crucial as IoT tends to evolve continuously and having an equally responsive platform makes it business safe to proceed. Let's now deeply evaluate each of these components, starting with IoT sensors

Home Automation Sensors

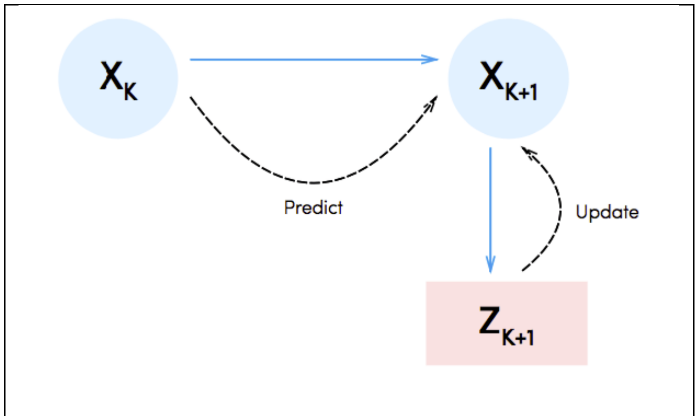
There are probably thousands of such sensors out there that can be a part of this list. Since this is an introduction towards smart home technology, we will keep it brief. We will break down IoT sensors for home automation by their sensing capabilities:

⇒ Temperature sensors
⇒ Lux sensors
⇒ Water level sensors
⇒ Air composition sensors
⇒ Video cameras for surveillance
⇒ Voice/Sound sensors
⇒ Pressure sensors
⇒ Humidity sensors
⇒ Accelerometers
⇒ Infrared sensors
⇒ Vibrations sensors
⇒ Ultrasonic sensors

Depending upon what you need you may use one or many of these to build a truly smart home IoT product. Let's have a look at some of the most commonly used home automation sensors.

Temperature sensors

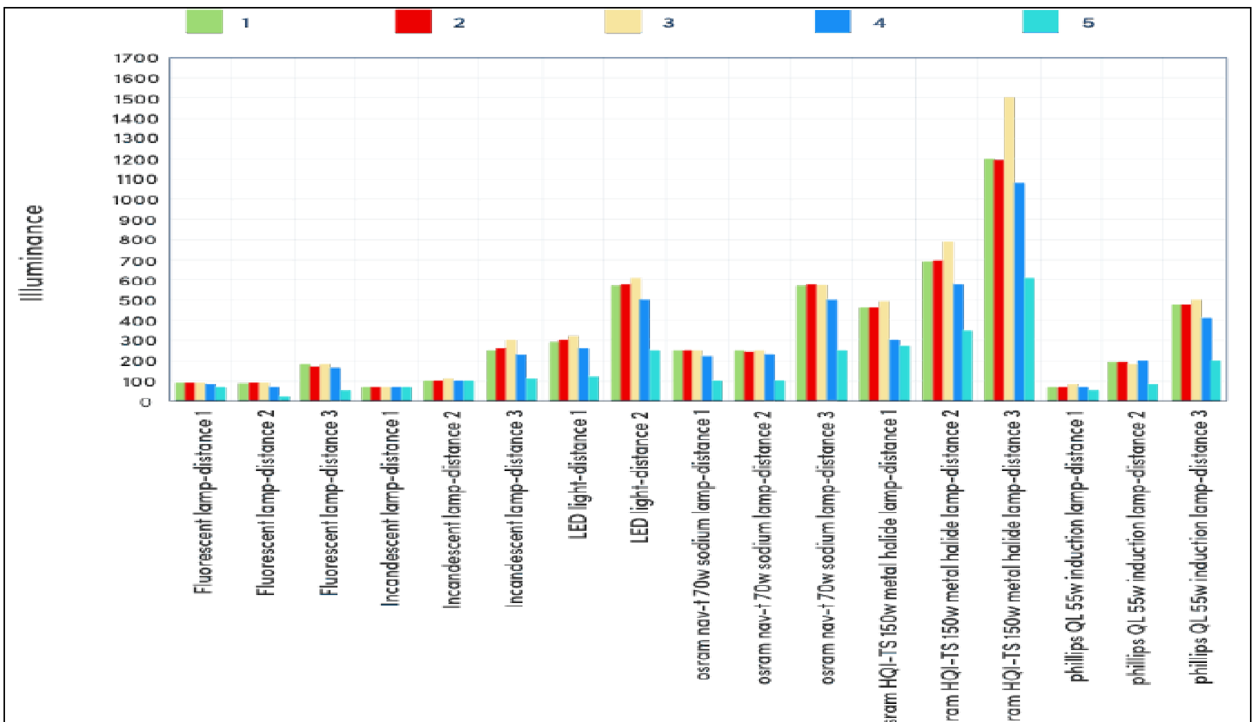
The market is full of them, but the famous temperature sensors are DHT11/22, DS18B20, LM35 and MSP430 series from TI. MSP430 series is more accurate than the rest but at the same time is one of the most expensive for prototyping or initial product testing purposes. MSP430 tops all temperature sensors as the precision and battery consumption is minimum with them. MSP430 tops all temperature sensors as the precision and battery consumption is minimum with them.



(Fig-57 Temperature sensors)

DHT11 has a very restricted temperature range and suffers from accuracy issues. DHT22, on the other hand, is a little bit more accurate but still, doesn't make it as the preference.
DS18B20's, on the other hand, are more accurate, as opposed to digital temperature sensors like DHT22 and 11, Dallas temperature sensors are analogue and can be extremely accurate down to 0.5 degrees.
Take note that often the temperatures that you directly sense from these sensors may not be very accurate and you would occasionally see 1000 F or greater values no matter what you are doing.
There's an entire logic that goes around building temperature sensors that we will address in another blog post.

Lux Sensors



(Fig-58 Lux Sensors)

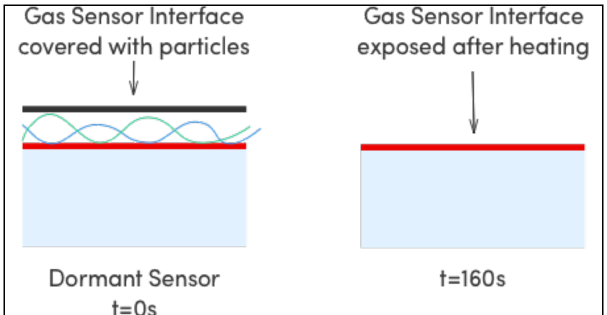
Lux sensors measure the luminosity and can be used to trigger various functions range from cross-validating movements to turn the lights on if it becomes too dark. Some of the most popular light sensors are TSL2591 and BH1750.

Recent tests to include TSL2591 and BH1750 into low-powered IoT devices have found them to be working fairly good for most of the use cases.
Here's a study was done by Robert and Tomas that shows how these two compare against a spectrometer and a photodiode.
To get a good idea of whether these two sensors would suffice your needs we would suggest illuminance tests followed by normalization of the data to observe deviations under various situations.

Water level sensors for Home Automation
While building your prototype you may consider a solid state eTape liquid level sensor, or like others who just use an HC-SR04 ultrasonic sensor to measure the water level sensor.
On the other hand, in other cases where those two don't suffice, one has to utilize something that can deliver a much higher performance.
Float level sensors and other ICs like LM1830 offers a more precise measurement capability to IoT developers. Although, they are substantially much more expensive than others.

Air composition sensors
There are a couple of specific sensors that are used by developers to measure specific components in the air:

- ⇒ CO monitoring by MiCS-5525
- ⇒ MQ-8 to measure Hydrogen gas levels
- ⇒ MiCS-2714 to measure nitrogen oxide
- ⇒ MQ135 to sense hazardous gas levels (NH3, NOx, Alcohol, Benzene, smoke, CO2



(Fig-59 Air composition sensors)

Most of these are sensors have a heating time, which also means that they require a certain time before they actually start delivering accurate values. These sensors mainly rely on their surface to detect gas components. When they initially start sensing, there's always something that's there on their surface, some sort of deposition that requires some heating to go away.
Hence, after the surface gets heated enough true values start to show up.

Video cameras for surveillance and analytics
A range of webcams and cameras specific to Hardware development kits are usually used in such scenarios. Hardware with USB ports offers to integrate and camera module to build functionalities. But, utilizing USB ports in not very efficient, especially in the case of real-time video transfer or any kind of video processing.
Take RaspberryPi for example, it comes with a camera module (Pi cam) that connects using a flex connector directly to the board without using the USB port. This makes the Pi cam extremely efficient.

Sound detection for Home Automation

Sound detection plays a vital role from monitoring babies to turning on and off lights automatically to automatically detecting your dog's sound at the door and opening it up for them.

Some commonly used sensors for sound detection includes SEN-12462 and EasyVR Shield for rapid prototyping.

These sensors aren't as good as industrial grade sensors like those from 3DSignals which can detect even ultra-low levels of noise and fine tune between various noise levels to build even machine break up patterns.

Humidity sensors for Home Automation

These sensors bring the capability of sensing humidity/RH levels in air for smart homes. The accuracy and sensing precision depends a lot on multiple factors including the overall sensor design and placement.

But certain sensors like DHT22 and 11 built for rapid prototyping would always perform poorly when compared to high-quality sensors like HIH6100 and Dig RH.

While building a product to sense humidity levels, ensure that there's no localized layer of humidity that is obscuring the actual results. Also, keep into consideration that in certain small spaces, the humidity might be too high at one end as compared to the others.

When you look at free and open spaces where the air components can move much freely, the distribution around the sensor can be expected to be uniform and subsequently would require very less amount of corrective actions for the right calibration.

Home Automation Protocols

One of the most important parts of building a home automation product is to think about protocols, protocols that your device would use to communicate to gateways, servers, and sensors. A few years ago, the only way to do so was by either using Bluetooth, wifi or GSM. But due to added expenses on cellular sim cards, and low performance of Wifi, most such solutions didn't work.

A few years ago, the only way to do so was by either using Bluetooth, wifi or GSM. But due to added expenses on cellular sim cards, and low performance of Wifi, most such solutions didn't work.

Bluetooth survived and later evolved as Bluetooth Smart or Bluetooth low energy. This helped bring a lot of connectivity in the "mobile server powered economy", in this essentially your phone would act as a middleware to fetch data from BLE powered sensors and sent it over to the internet.

When looking at the major home automation protocols, the following tops the list:

⇒ Bluetooth low energy or Bluetooth Smart: Wireless protocol with mesh capabilities, security, data encryption algorithms and much more. Ideal for IoT-based products for smart homes.

⇒ ZigBee: Low cost, mesh networked and low power radio frequency based protocol for IoT. Different ZigBee versions don't talk to each other.

⇒ X10: A legacy protocol that utilizes power line wiring for signaling and control

⇒ Insteon: Communicates with devices both wirelessly and with wires

⇒ Z-wave: Specializes in home automation with an emphasis on security

⇒ Wi-Fi: Needs no explanation

⇒ UPB: Uses existing power lines installed in a home, reduces costs

⇒ Thread: A royalty-free protocol for smart home automation, uses a 6lowpan

⇒ ANT: An ultra-low power protocol helping developers build low-powered sensors with a mesh distribution capabilities.

Home Automation: Which protocol is the best?

While there are some protocols that clearly offer much more than others, but it is always important to start from your smart home development needs and then move towards narrowing down the solutions.

The commonly preferred protocols are Bluetooth low energy, Z-wave, ZigBee, and Thread. The protocol selection can now be narrowed down by the following factors:

⇒ Ability to perform identity verification
⇒ Quality of sensor networks
⇒ Data transfer rate
⇒ Security level
⇒ Network topology required
⇒ Density of objects around
⇒ Effective Distance to be covered

Home Automation Architecture

This architecture supports the following considerations for home automation solutions:

⇒ End to end security mechanisms involving multilevel authentication
⇒ End to end data encryption, including the link layer
⇒ Flexible and configurable access and authorization control
⇒ Powerful cloud infrastructure
⇒ Network agnostic with built-in feedback loops
⇒ Configurable cloud-based rules engine
⇒ API endpoints
⇒ Data scalability
⇒ NoSQL databases

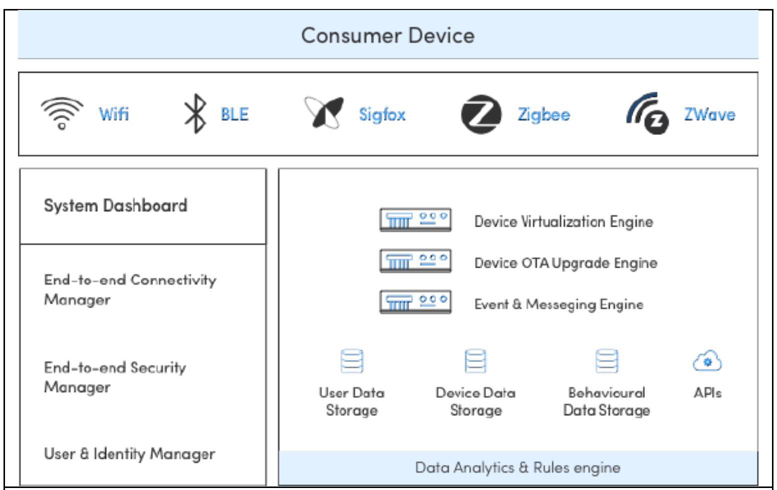
Home Automation Gateways

For developing a home automation product, often stand-alone product sending data to a server is not enough. Often due to battery and protocol limitations, the data from a sensor or sensors present in a home has been routed through an IoT gateway.

To select the perfect gateway for your IoT home automation, consider some of the factors including:

⇒ Communication protocols supported
⇒ Real-time capabilities
⇒ MQTT, CoAP, HTTPS support
⇒ Security and configuration
⇒ Modularity

When it comes to building IoT gateways, modularity and hybrid IoT protocol support top that list when a product is in the early stages of market introduction.



(Fig-60 Home Automation Architecture)

To incorporate a gateway in your home automation stack you can consider the following options:

Either create a Gateway from the ground up using existing hardware stacks for prototyping (using Raspberry Pi, Intel Edison, etc.). Then when a PoC is validated you can create your own custom hardware.

Or, you can use existing gateway modules like Engines BLE gateway. These gateways are extremely easy to customize and connect with your cloud services and devices. However, they may or may not offer the same level of support that you need to build certain features.

For example, a gateway with a bad networking queue may result in traffic congestion, or it may not support the required protocols that you wish to use.

Further, pivoting with these gateways to some other technology stack may become very difficult. It should have been emphasized that they are extremely good for robust prototyping needs.

Home automation programming language for smart home developers

The following programming languages dominated the home automation space: Python, Embedded C, C, Shell, Go, JavaScript (node.js). This has mainly happened due to the sheer optimization of the languages for similar use cases.

Home Automation frameworks

If you think you can build everything from home automation (protocols, hardware, software, etc.) on your own, it is a bit unrealistic. Everyone starting from high growth start-ups to billion dollar consumer focused enterprises are now taking the help of home automation frameworks to build connected products to delight consumers.

Everyone starting from high growth start-ups to billion dollar consumer focused enterprises are now taking the help of home automation frameworks to build connected products to delight consumers.

There are more than 15 different smart home frameworks available for IoT developers to use and build their next generation of connected home products. Some of these frameworks are open source and some are closed-source. Let's have a look at some of them in the sections that follows.

Some of these frameworks are open source and some are closed-source. Let's have a look at some of them in the sections that follows.

Open source IoT platforms and frameworks for Home Automation

Looking forward to doing a quick and dirty prototype? There's no need to write down everything from scratch. Thanks to a bunch of awesome contributions by people like we have open source platforms that can get your home automation products up and running in no time.

Our favourites are:

⇒ Home Assistant
⇒ Calaos
⇒ Domoticz
⇒ OpenHAB: Supports Raspberry Pi, written in Java and has design tools to build your own mobile apps by tweaking UI.
⇒ OpenMotics[Asked their developer, waiting for them to respond(dev confirmed)]
⇒ LinuxMCE
⇒ PiDome
⇒ MisterHouse
⇒ Smarthomatic

Let's take a look at the major home automation IoT platforms.

Home Assistant for smart home development:

Supports RaspberryPi, uses Python with OS as Hassbian. It has simplified automation rules that developers can use to build their home automation product saving them thousands of lines of code.

Home Assistant supports the following:

How home assistant works involve the following:

⇒ Home control responsible for collecting information and storing devices

⇒ Home automation triggers commands based on user configurations

⇒ Smart home triggers based on past user behavior

As developers, it is very important for us to understand the architecture of Home Assistant for us

(Fig-61 Home Assistant for smart home development)

to build high-performing products on top of it.

Let's have a look at Home control's architecture that makes control and information flow possible. Home control consists of five components:

⇒ Components

⇒ State machine

⇒ Event bus

⇒ Service registry

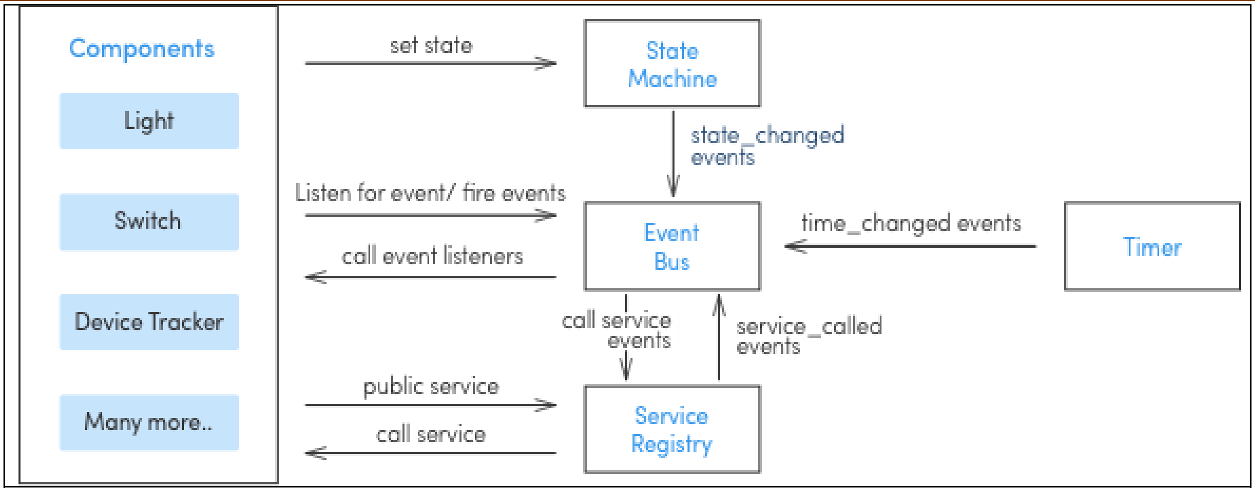
⇒ Timer

The core architecture of Home Assistant

All of these components working together create a seamless asynchronous system for smart home IoT. In the earlier version of Home Assistant core, the core often had to stop while looking for new device information.

But, with the new versions of home assistant, a backward compatible API, and ansyn core have been introduced making things a lot faster for IoT applications.

The best part about home assistant's core architecture is how carefully it has been designed and developed to support IoT at home.



(Fig-62 The core architecture of Home Assistant)

OpenHAB for Smart home automation

OpenHAB is a home automation and IoT gateway framework for smart homes. Similar to Home Assistant, OpenHAB works nicely with Raspberry Pi and comes with their own design tools to create a UI for your home automation product.

An understanding architecture of OpenHAB:

⇒ Modularity: It is realized with the bundle concept

⇒ Runtime dynamics: so that software components can be managed at the runtime

⇒ Service orientation: there are services for various components to speak with each other and exchange information

⇒ Further relying on the OGSi framework, it leverages the following layers stacked together:

⇒ Modular layer: Manages dependencies between bundles

⇒ Life cycle layer: controls the life cycle of the bundles

⇒ Service layers: defines a dynamic model of communication between various modules

⇒ Actual services: this is the application layer, using all other layers

⇒ Security layer: optional, leverages Java 2 security architecture and manages permissions from different modules

⇒ OpenHAB features:

⇒ Plugin framework

⇒ Rules engine

⇒ Logging mechanism

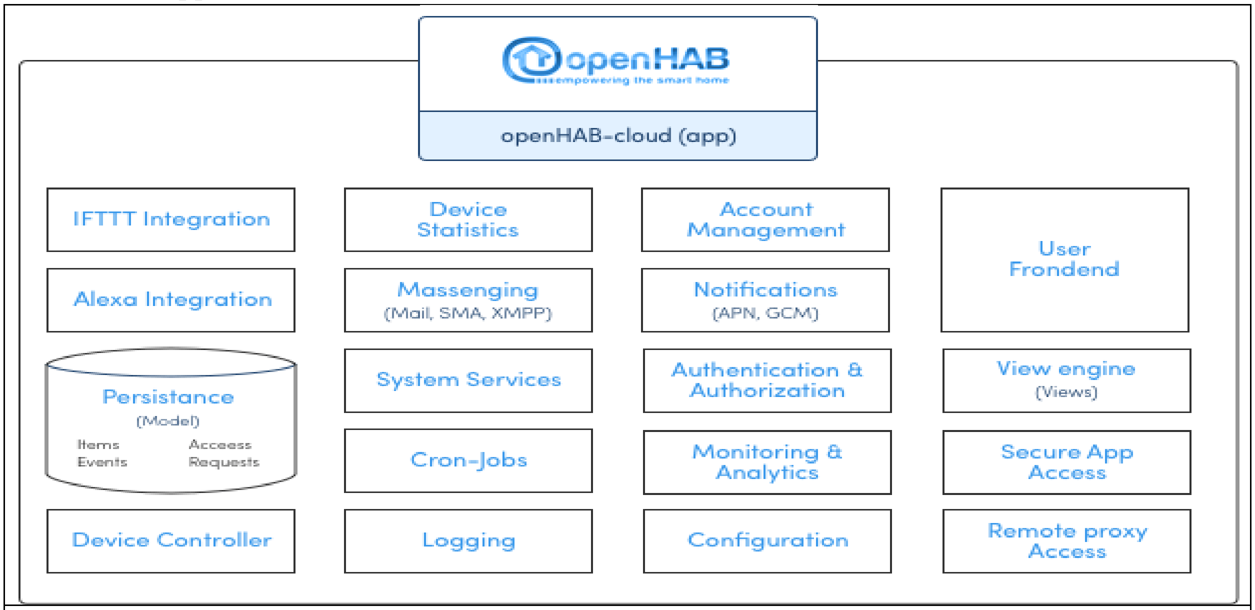
⇒ UI abstraction: A tree structure for UI Widgets, Item UI providers, and dynamic UI configuration

⇒ UI implementations are available for the web, Android, and iOS

⇒ Designer tools availability

OpenHAB has been primarily only been observed as a project for the hobbyist programmer, even many parts of openhab.org convey the same. But, we have observed a different effort in the recent times from OpenHAB into building the developer economy for building IoT smart homes. Takes this slowly growing Github repo talking about OpenHAB cloud for example.According to the repository, OpenHAB cloud architecture will look something like this: Impressive enough that some open platform out there is thinking about system services, Cron jobs, logging, etc.

Further, looking at the frameworks and technologies that openHAB will support: Node.Js, Express.Js, Nginx, MongoDB, Redis, Socket.IO
Unlike Home Assistant's vast integrability, openHAB is currently limited to:
⇒ IFTTT
⇒ Amazon Alexa
⇒ AWS EC2 [AWS Multi-AZ isn't compatible for multiple time zone availability]
⇒ AWS IoT with openHAB
⇒ MQTT support



(Fig-63 OpenHAB cloud architecture)

OpenHAB is extremely powerful, but at the same time very limited in terms of integration. The team behind openHAB is extremely promising and have already conveyed their plans to open up openHAB to other integration capabilities very shortly.

Calaos for Home Automation

Calaos was developed initially by a company that was closed back in 2013, but the home automation since then has lived and is being maintained and upgraded by developers. While now being open source, it facilitates premade source code to:
⇒ Create sweet home environment
⇒ Control music
⇒ Automation rules that focus on time, mood or ambiance
⇒ Easy configuration
⇒ Calaos supports the following hardware:
⇒ Premoboard
⇒ Cubieboard
⇒ RaspberryPi
⇒ Intel-based machines

Their lack of support towards developing private IoT applications restricts their usage by developers to build high-quality solutions for consumers.

Domoticz for Home Automation

Domoticz allows you to monitor and configure your devices and sensors with the simplest possible design. Impressive enough that the entire project is extremely lightweight, it further is backed by high integrability with third parties and features like auto learning switches.

This platform has been designed to work with operating systems like Linux and Windows.

Protocol capabilities of Domoticz include: Z-wave, Bluetooth, Apple Homekit, X10 and MQTT

Hardware integration capabilities of Domoticz:

⇒ RFXCOM Transceiver
⇒ ESP2866 Wifi module
⇒ P1 smart meter
⇒ Youless meter
⇒ Pulse counters
⇒ 1-Wire
⇒ Philips Hue
⇒ Essent E thermostat

Domiticz can be used to create any sort of services that you can think of, ranging from a smart weather device to a Telegram bot.

Domoticz architecture

Currently, very few people know about the architecture of Domoticz, making it extremely difficult to build applications on it without taking unnecessary risks in building the product itself.

For example, the entire design of general architecture feels a little weird when you look at the concept of a sensor to control to an actuator. It seems to be missing.

Building advanced application with Domoticz can be done using C++, lula, PHP, shell, etc.

Blockchain in IoT for connected home

Consumers, especially those who grew up in the digital era understand the importance of privacy and security more than millennials. With the evolution of IoT, security has taken center stage for realistic deployment scenarios.

Deployment of Blockchain into home networks can easily be done with a $35 raspberry pi. A blockchain secured layer between devices and gateways can be implemented without massive revamp of the existing code base.

Simply put, blockchain as a technology that would be an implementation that most users won't even know about, but will play a huge role in future to reassure them with revolutionary and new business models like dynamic renting for Airbnb.

So far, interoperability issues and broken protocols seemed to have hampered the growth of IoT-based smart homes.

But, as technology is progressing and more and more computing power can be generated with very low powered devices, home automation will gradually become a technology that will easy for us to build and develop for on a daily basis.

5.2.6 PC Based Electrical Load Control

Automation system is mostly depending upon the power systems in industrial, residential or commercial, which needs remote controlling and monitoring. By employing wireless technologies, it is more competent to execute a suitable technology depending upon the requirements of the proposed system like speed, cost, and distance.

For distant controlling and monitoring of different loads and by means of efficient power usage through real time power spending with the help of a PC based graphical user interface application. The progress of technology equipments is becoming simpler and easier for us. Automated systems have more benefits over manual system. PC based electrical load controlled systems are highly reliable, precise and time conserving systems. They give number of features like rapid data storage, transfer data and data securities.

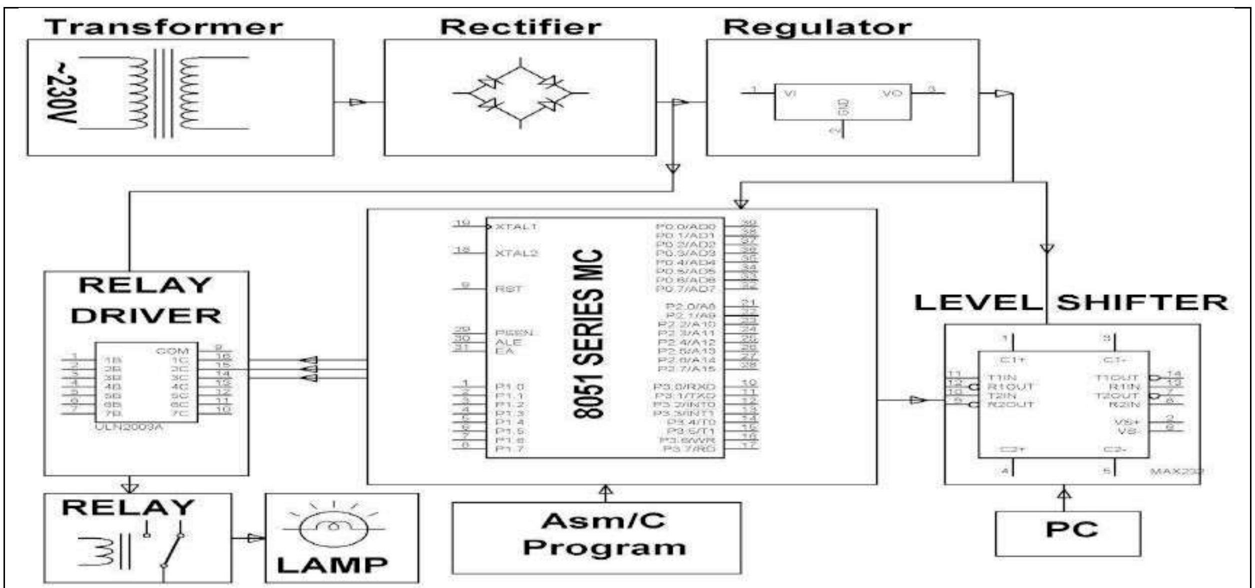
(Fig-64 PC Based Electrical Load Control Syatem Project Kit)

PC Based Electrical Load Control System

The PC based electrical load control system can be built with 8051 series Microcontroller, Level Shifter IC, DB Connector, Relays, Relay Driver, Transformer, Diodes, Capacitors, Resistors, LED, Crystal, Lamps, Keil compiler and Language: Embedded C or Assembly.

Keil an ARM Company makes C compilers, macro assemblers, real-time kernels, debuggers, simulators, integrated environments, evaluation boards, and emulators for ARM7/ARM9/Cortex-M3, XC16x/C16x/ST10, 251, and 8051 MCU families.

Compilers are programs used to convert a High Level Language to object code. Desktop compilers produce an output object code for the underlying microprocessor, but not for other microprocessors.



(Fig-65 PC Based Electrical Load Control System Block Diagram)

I.e. the programs written in one of the HLL like ‘C’ will compile the code to run on the system for a particular processor like x86 (underlying microprocessor in the computer).

For example compilers for Dos platform is different from the Compilers for Unix platform So if one wants to define a compiler then compiler is a program that translates source code into objectcode.

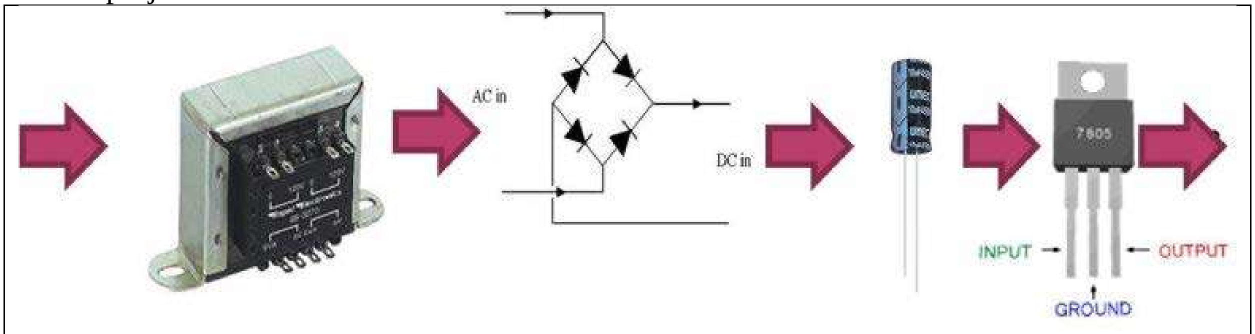
Power Supply

- The 230V AC supply is first stepped down to 12V AC using a step down transformer.

⇒ This is then converted to DC using bridge rectifier.

⇒ The AC ripples is filtered out by using a capacitor and given to the input pin of voltage regulator 7805.

⇒ At output pin of this regulator we get a constant 5V DC which is used for MC and other ICs in this project.



(Fig-66 Power Suply)

Microcontroller

It is a smaller computer; it has on-chip RAM, ROM, I/O ports. The features of this microcontroller include the following.

⇒ 8K Bytes of In-System Programmable (ISP) Flash Memory

⇒ 4.0V to 5.5V Operating Range

⇒ Fully Static Operation: 0 Hz to 33 MHz

⇒ 256 x 8-bit Internal RAM

⇒ 32 Programmable I/O Lines

⇒ Three 16-bit Timer/Counters

⇒ Eight Interrupt Sources

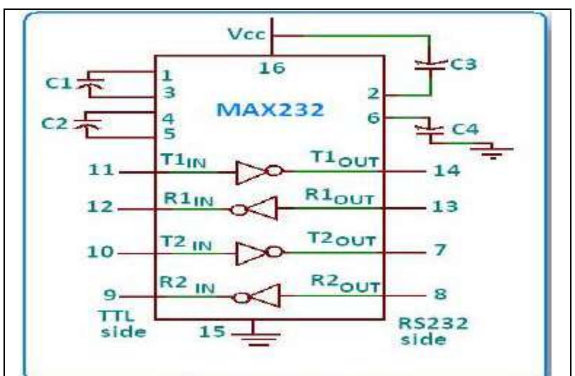
⇒ Full Duplex UART Serial Channel

MAX232

⇒ The MAX232 is an integrated circuit that converts signals from an RS-232serial port to signals suitable for use in TTL compatible digital logic circuits.

⇒ He MAX232 is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals.

⇒ When a MAX232 IC receives a TTL level to convert, it changes a TTL Logic 0 to between +3 and +15V, and changes TTL Logic 1 to between -3 to -15V, and vice versa for converting from RS232 to TTL



(Fig-67 MAX232)

Db9 Connector

The DB9 (originally DE-9) connector is an analog 9-pin plug of the D-Sub miniature connector family.

Relay

⇒ A relay is an electrically operated switch.
⇒ Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts.
⇒ The coil current can be on or off so relays have two switch positions and have double throw (changeover) switch contacts as shown in the diagram.
⇒ Relays allow one circuit to switch a second circuit which can be completely separate from the first.
⇒ For example a low voltage battery circuit can use a relay to switch a 230V AC mains circuit.
⇒ There is no electrical connection inside the relay between the two circuits, the link is magnetic and mechanical.
⇒ To drive relay through MC ULN2003 relay driver IC is used.
⇒ Relay Driver ULN2003

ULN is Relay Driver Application

⇒ The ULN2003 is a monolithic high voltage and high current Darlington transistor arrays.
⇒ It consists of seven NPN Darlington pairs that feature high-voltage outputs with common-cathode clamp diode for switching inductive loads.
⇒ The collector-current rating of a single Darlington pair is 500mA.
⇒ The Darlington pairs may be paralleled for higher current capability.
⇒ The ULN functions as an inverter.
⇒ If the logic at input 1B is high then the output at its corresponding pin 1C will be low

Project Working

The main goal of this project is to control the electrical load through a PC (personal computer). For example, lighting in the theatre can be controlled form the PC for superior stage management. At present, they are physically controlled which makes it complex to organize the lighting with the particular scene. By employing this system, one can manage the electrical load ON/OFF by just being seated at one place using a PC.
This system is incorporated with the electrical loads and also associated to the PC where centralized control takes place. It uses an MAX 232 protocol from the microcontroller to communicate with the PC.
To switch the appliances, we employ Hyper Terminal on personal computer. Once the connection is established with the PC, then the system begins working. The 8051 family microcontroller is used in this project.
Further, this project can be improved by implementing a GUI based control board on the PC with suitable embedded system software. The power control can also be integrated using power electronics devices.

5.2.7 Electrical Parameters Measurements

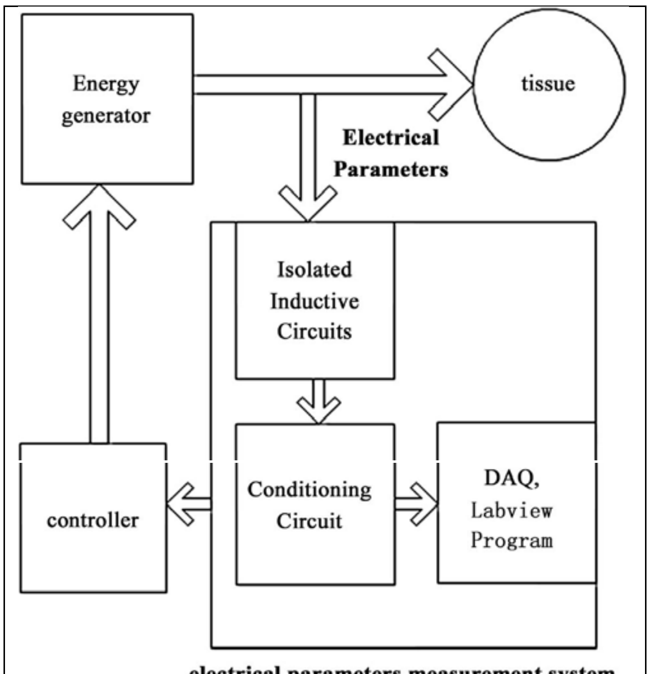
THE SYSTEM PLATFORM

The whole system is depicted in Figure, incorporating a high-frequency energy generator and an electrical parameters measurement system. The former is to generate on biological tissues a high-frequency energy of 450 kHz with the biggest power as high as 150 w. And the system converts the high-frequency voltage and current into measured values within the range of 0 - 2 V respectively corresponding to the real voltage and current effective values. Also it provides the controller with feedback, and the controller does a fitting and adjusting of the feedback information for the real values and on this basis realizes the control of constant power and real-time judgment of biological impedance. To determine a super fitting strategy for the controller, the detected values are acquired by DAQ data cards and delivered to LabVIEW program for processing and display. A series of detected values are acquired in the cases of varying load and recorded as *i* and *iVII*. Meanwhile, oscilloscope is applied for the measurement of the effective values of the output voltage and current from the energy generator, recorded as *rms* and *rmsV*. Between the detected values and real values, there exists a correspondence. Fitting these detected values by different methods can help decide an optimized scheme that can well adjust the measured values into real effective values. Finally, the controller assisted by such an optimized scheme can obtain a set of feedback data reflecting the effective values of the real-time voltage and current and then complete the controlling of constant power and an in-time judgment of impedance.

Isolated Inductive Circuits and the Conditioning Circuit

A transformer must be applied for isolated induction of the voltage and current from the high frequency energy generator, as displayed in Figure. Given that the energy to be measured is a high frequency signal of 450 kHz, ferrite functioning in high frequency environment can be chosen as the magnetic material for the trans- former. To prevent it from saturation, for the voltage isolation circuit, resistors must be connected in series to divide the voltage. Then, the reduced voltage is delivered to the primary side of the voltage transformer, which is made of winding ferrite and holds a transformation ratio of 60:10. As for the current inductive transformer, there are two schemes. The first is to use self-made ferrite annular core, with a transformation ratio of 1:100, while the second is to apply the PA1005.100NL current sensor designed by Pulse Company. A narration of the differences between the two is available in the part of Experiment Design and Results.

Here is the operating principle of the conditioning circuit: to lessen the load effect, signals detected from the voltage and current sensors first go through a voltage follower and then a low pass filter to filter out the higher harmonics. After that, the two different signals are converted into single-end signals by AD8251. Finally, the conversion chip AD637 is applied to transform them into effective values, which are 0 - 2 V direct current signals. For conditioning circuit, to get a precise effective value from the conversion, there are two key points [5]: one is to enhance the total gain of the isolated inductive and conditioning circuits so as to maintain the input signal of AD637 within the range of 1 - 2 V, because when the AD637 input signal is below 100 mV, its bandwidth will be less than 200 kHz, and in this case the

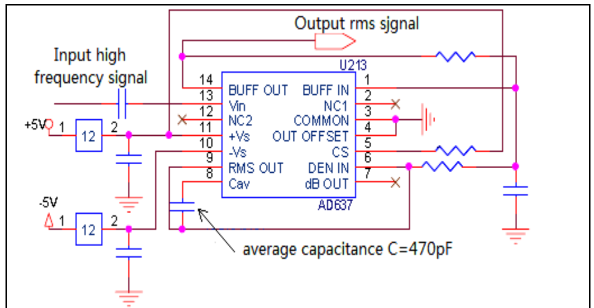


(Fig-68 Structure of the electrical parameters measurement system.)

high frequency output signals from the energy generator will be distorted. The second is the rational allocation of the AD637 peripheral circuit, particularly the peripheral average capacitance C. According to a lot of experimental verification, when C = 470 pF, a good result of precise effective value conversion can be achieved. Figure is a display of the conversion circuit.

EXPERIMENT DESIGN AND RESULTS

A self-regulating power generator is used in the experiment and the output energy from it operated on the load targets after transiting through the electrical parameters- measurement system. After converted by Data Acquisition (DAQ) Cards, detection values were transmitted to the PC and processed in LabVIEW. The detailed hardware structure is shown in Figure.



(Fig-69 Effective values conversion circuit.)

Electrical Units of Measure

Electrical Units of Measurement are used to express standard electrical units along with their prefixes when the units are too small or too large to express as a base unit.

The standard units of electrical measurement used for the expression of voltage, current and resistance are the Volt [V], Ampere [A] and Ohm [Ω] respectively.

These electrical units of measurement are based on the International (metric) System, also known as the SI System with other commonly used electrical units being derived from SI base units. Sometimes in electrical or electronic circuits and systems it is necessary to use multiples or sub multiples (fractions) of these standard electrical measuring units when the quantities being measured are very large or very small.

The following table gives a list of some of the standard electrical units of measure used in electrical formulas and component values.

Electrical Parameter	Measuring Unit	Symbol	Description
Voltage	Volt	V or E	Unit of Electrical Potential V = I × R
Current	Ampere	I or i	Unit of Electrical Current I = V ÷ R
Resistance	Ohm	R or Ω	Unit of DC Resistance R = V ÷ I
Conductance	Siemen	G or ℧	Reciprocal of Resistance G = 1 ÷ R
Capacitance	Farad	C	Unit of Capacitance C = Q ÷ V
Charge	Coulomb	Q	Unit of Electrical Charge Q = C × V
Inductance	Henry	L or H	Unit of Inductance VL = -L(di/dt
Power	Watts	W	Unit of Power P = V × I or I2 × R

Impedance	Ohm	Z	Unit of AC Resistance Z2 = R2 + X2
Frequency	Hertz	Hz	Unit of Frequency ƒ = 1 ÷ T

(Table-22 Standard Electrical Units of Measure)

Multiples and Sub-multiples

There is a huge range of values encountered in electrical and electronic engineering between a maximum value and a minimum value of a standard electrical unit. For example, resistance can be lower than 0.01Ω or higher than 1,000,000Ω. By using multiples and submultiple's of the standard unit we can avoid having to write too many zero's to define the position of the decimal point. The table below gives their names and abbreviations.

Prefix	Symbol	Multiplayer	Power of Ten
Terra	T	1,000,000,000,000	1012
Giga	G	1,000,000,000	109
Mega	M	1,000,000	106
kilo	k	1,000	103
none	none	1	100
cent	c	1/100	10-2
mille	m	1/1,000	10-3
micro	µ	1/1,000,000	10-6
Nano	n	1/1,000,000,000	10-9
Pico	p	1/1,000,000,000,000	10-12

(Table-23 Multiples and Sub-multiple)

So to display the units or multiples of units for either Resistance, Current or Voltage we would use as an example:

- ⇒ 1kV = 1 kilo-volt – which is equal to 1,000 Volts.
- ⇒ 1mA = 1 milli-amp – which is equal to one thousandths (1/1000) of an Ampere.
- ⇒ 47kΩ = 47 kilo-ohms – which is equal to 47 thousand Ohms.
- ⇒ 100uF = 100 micro-farads – which is equal to 100 millionths (100/1,000,000) of a Farad.
- ⇒ 1kW = 1 kilo-watt – which is equal to 1,000 Watts.
- ⇒ 1MHz = 1 mega-hertz – which is equal to one million Hertz.

To convert from one prefix to another it is necessary to either multiply or divide by the difference between the two values. For example, convert 1MHz into kHz.

Well we know from above that 1MHz is equal to one million (1,000,000) hertz and that 1kHz is equal to one thousand (1,000) hertz, so one 1MHz is one thousand times bigger than 1kHz. Then to convert Mega-hertz into Kilo-hertz we need to multiply mega-hertz by one thousand, as 1MHz is equal to 1000 kHz.

Likewise, if we needed to convert kilo-hertz into mega-hertz we would need to divide by one thousand. A much simpler and quicker method would be to move the decimal point either left or right depending upon whether you need to multiply or divide. As well as the "Standard" electrical units of measure shown above, other units are also used in electrical engineering to denote other values and quantities such as:

- **Wh – The Watt-Hour**, The amount of electrical energy consumed by a circuit over a period of time. Eg, a light bulb consumes one hundred watts of electrical power for one hour. It is commonly used in the form of: **Wh** (watt-hours), **kWh** (Kilowatt-hour) which is 1,000 watt-hours or **MWh** (Megawatt-hour) which is 1,000,000 watt-hours.

- **dB – The Decibel**, The decibel is a one tenth unit of the Bel (symbol B) and is used to represent gain either in voltage, current or power. It is a logarithmic unit expressed in **dB** and is commonly used to represent the ratio of input to output in amplifier, audio circuits or loudspeaker systems. For example, the dB ratio of an input voltage (V_{IN}) to an output voltage (V_{OUT}) is expressed as $20\log_{10}$ (Vout/Vin). The value in dB can be either positive (20dB) representing gain or negative (-20dB) representing loss with unity, ie input = output expressed as 0dB.

- **θ – Phase Angle**, The Phase Angle is the difference in degrees between the voltage waveform and the current waveform having the same periodic time. It is a time difference or time shift and depending upon the circuit element can have a “leading” or “lagging” value. The phase angle of a waveform is measured in degrees or radians.

- **ω – Angular Frequency**, Another unit which is mainly used in a.c. circuits to represent the Phasor Relationship between two or more waveforms is called Angular Frequency, symbol **ω**. This is a rotational unit of angular frequency $\boldsymbol{2\pi f}$ with units in *radians per second*, **rads/s**. The complete revolution of one cycle is 360 degrees or 2π, therefore, half a revolution is given as 180 degrees or π rad.

- **τ – Time Constant**, The Time Constant of an impedance circuit or linear first-order system is the time it takes for the output to reach 63.7% of its maximum or minimum output value when subjected to a Step Response input. It is a measure of reaction time.

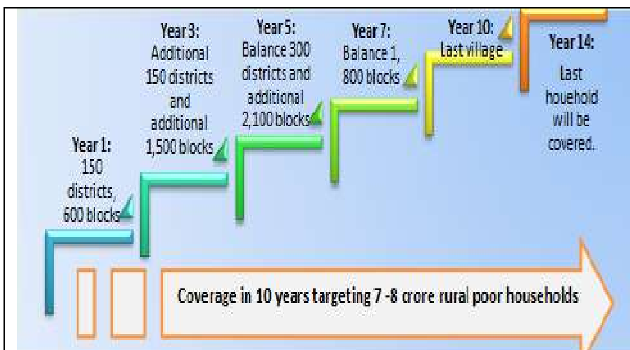
Chapter: 6
Swatchh Bharat Abhiyan (Clean India)

6.1Swatchhta needed in allocated village -Existing Situation with photograph


(Fig-70 Swatchhta in allocated village)

Streets and rods are cleaning by panchayat so there is no needed of swatchhta in Derdi Kumbhaji One problem is cleaning is not regularly in village. Some society are clean by society management or by people itself. We discus with serpanch and talati mantri for put dustbins at various place in village. By that one type of self-cleaning procedure can take place. Majority of villagers clean their own site that means they clean infront of their own main doors by that whole streets is clean which is very good concept. Sarpanch also told is cleaning of village is done in periodically which is after every 1 to 1.5 months. We also give some suggestion regarding disposal of different kind of garbage in different color dustbin. Like The Green-colored dustbins are meant for wet and biodegradable wastes. For e.g.: kitchen wastes including vegetables and fruits skins. Blue dustbins are meant for disposal of plastic wrappers and non-biodegradable wastes. Yellow dustbins are meant for papers and glass bottles.

6.2 Guidelines - Implementation in allocated village with Photograph



(Fig-71 Guild lines for the process implementation)

⇒ Need of this type of dustbins provide by gram Panchayat to village.
⇒ Also forth need of waste collection system or vehicle some people are aware about
⇒ Swatch Baharat but some people mind-set is not good.
⇒ In our village need of cameras monitor cleanliness of village and may help to Take action against villagers and also need awareness about swatch Baharat program.
⇒ In our village have individual toilets but, need of cluster and community toilets.

6.3 Activities Done by Students for allocated village with Photograph

Our village also uses manpower for clean roads and households road side area. Major space is clean in our village and good cc roads. We are also talk with villagers for clean village and use dustbin. We click goods photographs of village. We are also discussing with Sarpanch and Talati about cleanliness.

Chapter: 7

Village condition due to Covid-19

7.1 Taken steps in allocated village related to existing situation with photograph

When we visit the village at that time covid -19s cases are higher in our district. During visit we use mask and sanitizer and we also maintain social distance of 6 feet. In village all villagers are stay in their home they don't came out in its not so necessary. All villagers wear mask and use sanitizer frequently. If they have to go to grocery shop for shopping they maintain social distance. In all shops shopkeeper use sanitizer and thermal gun for check that nobody have any symptoms of covid-19. In all shop shopkeeper also make circles out of his shop for maintain social distance. Shopkeeper follow all guideline given by Sarpanch and Government. Sarpanch check all shops and village also for no one is can go out unnecessary.

(Fig-72 Sanitizer at Grampanchyat Derdi Kumbhaji)

7.2 Activities Done by Students for allocated village with Photograph

We talk with sarpanch and villagers about covid-19 and we should take prevention about it. We explain guidelines given by government for unlock. We explain some home remedies for improve their immunity. We explain importance of mask, sanitizer and social distancing. We give guideline to villagers who are at grocery shop or outside their home we also explain importance of social distancing, mask and sanitizer. We also show them to how to wear mask properly. We also give idea to those people who have not mask. We give suggestion for use gamcha or handkerchief as a mask for temporary basis. We also discuss with them to improve immunity by natural remedies. We suggest them to drink hot water, use fruits and vegetables after wash only. Some are also doing their job at city so we suggest them to take shower first as soon as their came home and also wash and add minor sanitizer in it.

7.3 Any other steps taken by the students / villagers

We gave all necessary guideline and importance of social distancing, mask and senitizer. Gave some suggestion regarding improve they immunity. Rather then that there is no any activity is done .

Chapter: 8

Sustainable Design Planning Proposal (Prototype Design)- Part- I

(Scenario/Existing Situation/Proposed Design in Auto cad/Recapitulation Sheet/Measurement Sheet/Abstract Sheet /Sustainability of Proposal/Any other software)

8.1 Design Proposals

Sustainable Design – Public Garden

In sustainable design we design Public Garden for recreational purposes. In Derdi Kumbhaji village there is no any type of recreational facilities. By providing public garden senior citizens have good place to sit and for walk, and children are also play there.

Physical Design – Police Station

In Derdi Kumbhaji there is no any police station. Derdi Kumbhaji population is 8450 as per census 2011 which is slightly greater than average population of any other village. That is one of the reason and other reason is that there is no police station nearby villages only one at gondal. By providing police station at Derdi Kumbhaji village nearby all villages will be safe.

Social Design – Community Hall

In Derdi Kumbhaji village there is no any place or hall for any function or any other type of programs. People have to go to gondal or nearby town for functions. By providing Community Hall villagers don't have to go any other place. Community hall is a public location where members of a community gather for group activities, events, festivals and social purpose. They may sometimes be open for whole community or for a specialized group example Mahila mandal hall. A community hall of village generally consists of a hall, storage or kitchen area and washroom.

Socio-Culture Design – Public library

In Derdi Kumbhaji village there is no Library for learners. By providing Public Library students of Derdi Kumbhaji can read or do the study related work quietly and efficiently. Senior citizens are also use library for reading newspapers or any other books.

Smart village – Public Health Care center (PHC)

By providing PHC in village, villagers have not required to go to city for small and medium disease. Emergency medical facilities are also available in PHC. Medicines are also available at affordable rate.

Heritage Village – Batch Mandali

In heritage village design we provide Batch Mandali. Provides an overview of basic budgeting, entrepreneurship and a guide for writing a business plan. It gives credit by deposit some item. It also cover minor type of insurance.

All the drawings, of proposed designs like plan, elevation and section, have been added at the end of report of part 1

8.1.1 Sustainable Design (Civil)
PUBLIC GARDEN

Scenario:

Gardens have been an important aspect of many cultures in history. In the past, community gardens were commonly used to provide food for families year-round. During WWII, victory gardens were an important source of food for families. Recently, there has been a resurgence of community gardens to help mitigate the impacts of food deserts and as a use for the increased number of vacant lands present in urban areas. Community gardens can provide fresh, healthy produce for residents and allow them to reduce their food bills. Social ties are important to the wellbeing of people in a community since they can bring positive health effects and community involvement. Community gardens allow for the creation of social ties and build a greater feeling of community. These connections help reduce crime, empower residents and allow residents to feel safe in their neighborhoods. Gardens in urban areas are positively correlated with decreased crime rates. Vacant lands can lead to crime which can detrimentally impact the health of residents. Residents in areas with high crime rates may experience cardiovascular disease and mental health disorders The consequences of vacant lands are decreased property values, drug use, and the illegal dumping of litter, tires and chemicals. Gardens can improve economic opportunities by training volunteers and selling food at farmers' markets urban agriculture can teach residents useful skills in planning, food production and business improving vacant lots increased property values in New Kensington, Philadelphia by 30%.

Existing Situation in Derdi Kumbhaji

In Derdi Kumbhaji village we give design of Public Garden. The population of Derdi Kumbhaji village is 8450 as per census 2011 so it is required to have one public garden in village. There is no any type of recreational facilities in village so we decide the design of public garden.

Sustainability of the design
Public Garden as an important place
Design utilized by,
Villagers, gusts in village, and all public.

Needs
For recreational, for entertainment, for health, for pic of mind.

Design brief
Public garden is design for recreational purpose, for entertainment, a place to relief stress and anxiety, help to improve mental health.

Public Garden Design
L: 14m, B: 13m, H: 1.2m

Common repair and maintenance of the structure
There is no any major maintenance for public garden. Mainor maintenance are repairing of pipes. Other are to give water regularly or periodically. Cut their branches and leafs for their even growth, give fertilizer which plat need for it.

PUBLIC GARDEN QUANTITY SHEET

Estimate of : Public garden						
Sr. no	**Description**	**No.**	**L (m)**	**B (m)**	**D/H (m)**	**Qty.m^3**
1	**Excavation for wall**	4	13	0.6	1.2	37.44
2	**PCC**	4	13	0.6	0.15	4.68
3	**0.60m thick unsours rubble masonry**					
4	**0.60m thick masonry in plinth**	4	13	0.6	0.6	18.72
5	**Compound wall RCC copping**	4	13	0.6	0.1	3.12
6	**Compound wall masonry**	4	13	0.3	1.20	18.72
	Deduction of door	2	1	0.3	1.20	0.42
	Total masonry work = 18					
7	**Plaster in compound wall**	4	13	-	1.2	62.4
	Deduction of door					0.72
				Total = 61.68		
8	**Paving block in walk way**	4	8	5	0.85	136

(Table-24 Public garden quantity sheet)

PUBLIC GARDEN RATE ANALYSIS SHEET
(Rate as per SOR 2015-16 R&B)

Rate analysis Sheet					
Sr. no	**Description**	**Qt.**	**Rate(Rs.)**	**Per**	**Amount(Rs.)**
1	**Excavation for wall**	37.49	280	m^3	10497.2
2	**PCC**	4.68	2507	m^3	11718.72
3	**0.60m thick unsours rubble masonry**	18.72	2443	m^3	45732.96
4	**0.60m thick masonry in plinth**	3.12	2443	m^3	7622.16
5	**Compound wall RCC copping**	18.72	3236	m^3	60577.92

6	**Compound wall masonry**	18	2443	m^3	43974
7	**Plaster in compound wall**	61.68	97	M^2	5982.96
8	**Paving block in walk way**	136	430	M^2	58480
			Total = 244585.92		
	Add 3% contingency charge = 7337.57				
	Add 2% worked charge = 4891.71				
	Total = 2,56,815.20				

(Table-25 Public garden rate analysis sheet)

8.1.2 Physical design (Civil)
POLICE STATION

Scenario

The overall police strength of India is around 25 lakh. Of these about five lakh are armed policemen and the rest are civil policemen. The former are usually kept in reserve and deployed in cases of large-scale breakdown in public order. The number of civil policemen per lakh of population for India as a whole is 155. A huge addition to the force has happened in last few years for the country to reach this number. Even the sanctioned police strength of most states is well below the world average in terms number of civil police personnel per lakh population. While Tamil Nadu, Nagaland and Kerala employ some policemen in excess of sanctioned strength, in general, there is a shortfall. It is difficult to lay hands on authentic data on police personnel and system pertaining to rural India or the data on rural crimes. The National Crime Report Bureau statistics gives the breakup of crime data by states and has separate tables for crimes by cities, giving the cities a rank on each type of crime. But it does not segregate data on crime by rural or urban location of its occurrence. Presumably, if with the blessing of the local police administration one were to devote intense efforts, over weeks if not months, data at least for a particular district could be dug up. What follows in this essay is thus based on incomplete data.

Existing Situation in Derdi Kumbhaji

In Derdi Kumbhaji there is no police station. The nearby police station is located in gondal which is 34.8 km away. In Derdi there and nearby villages have micro to minor market which required to work efficiently and regularly without any kind of threats. By providing police station people of Derdi Kumbhaji and nearby villages are fill safe and secure.

Sustainability of the design

Police station as an important facilities

Design utilized by

Al the people of village and nearby villages also.

Needs

To reduce crime, provide safety from threats.

Design Brief

We provide Police station with PSI cabin, 2 jails and big hall for constables.

Police station Design
L: 16.3m, B: 17.5m, H: 3.85m
Carpet area: 263.06sqm.

Common repair and maintenance
There is not any major maintenance for police station in few years. After that plastering, paint, water proofing and termite treatment like maintenance required.

POLICE STATION QUANTITY SHEET

Sr. no.	Description	No	L (M)	B (M)	D/H (M)	Qty. m^3
1	**Excavation**	1	99.6	1.2	1.3	155.37
2	**PCC in foundation**	1	100.5	0.9	0.1	9.04
3	**Brickwork in foundation**					
	Step 1	1	101.4	0.6	0.3	18.252
	Step 2	1	101.7	0.5	0.4	20.34
	Step 3	1	102	0.4	1.1	44.88
					Total = 83.472	
4	**Sand filling**					
	PSI room	1	8	5	0.6	24
	Jail 1	1	8	6	0.6	28.8
	Jail 2	1	8	6	0.6	28.8
	Hall	1	8	17.6	0.6	84.48
	Toilet	1	3	2.5	0.6	4.5
	Open space	1	4.7	1	0.6	2.82
					Total = 173.4	
5	**PCC in Plinth**	1	102	0.4	-	40.8
6	**Brick masonry in superstructure**	1	102.3	0.3	3.85	118.15
	Deduction of door, windows					
	D1	1	1.90	0.3	2.5	1.435
	D2	1	1.20	0.3	2.2	0.729
	D3	2	0.9	0.3	2	1.08
	W	8	1.2	0.3	1.5	4.32
	V	5	0.6	0.3	0.7	0.63
					Total = 8.247	
	Lintel Quantity and deduction					
	D1	1	2.2	0.3	0.15	0.099
	D2	1	1.5	0.3	0.15	0.0675
	D3	2	1.2	0.3	0.15	0.108

	W	8	1.5	0.3	0.15	0.54
					Total = 0.8145	
	Total Brickwork in superstructure = 109.08					
7	**RCC Slab**	1	18.09	16.09	0.15	45.85
8	**Brickwork in Parapet wall**					
	H. wall	1	16.9	0.3	1	5.07
	V. wall	1	17.49	0.3	1	5.24
					Total = 10.31	
9	**Plastering work inside**					
	Jail 1					
	H. Wall	2	8	-	3.85	61.6
	V. Wall	1	6	-	3.85	23.1
	Jail 2					
	H. Wall	2	8	-	3.85	61.6
	V. Wall	1	6	-	3.85	23.1
	PSI Room					
	H. Wall	2	8	-	3.85	61.6
	V. Wall	3	5	-	3.85	57.75
	Toilet 1					
	H. Wall	2	3	-	3.85	23.1
	V. Wall	2	1.5	-	3.85	11.55
	Hall					
	H. Wall	2	8	-	3.85	61.6
	V. Wall	1	17.6	-	3.85	67.76
	Toilet 2					
	H. Wall	2	3	-	3.85	23.1
	V. Wall	3	2.5	-	3.85	28.89
					Total = 504.73	
	Deduction of doors and windows					
	D1	½	1.90	-	2.5	2.37
	D2	½	1.20	-	2.2	1.32
	D3	4/2	0.9	-	2	3.6
	W	8/2	1.2	-	1.5	7.2
	V	5/2	0.6	-	0.7	1.05
					Total = 15.54	
		Total plastering = 489.12				

(Table-26 Police station Quantity sheet)

POLICE STATION RATE ANALYSIS
(Rate as per SOR 2015-16 R&B)

Sr. no	Description	Qt.	Rate(Rs.)	Per	Amount(Rs.)
1	**Excavation**	155.37	280	m^3	43503

2	**PCC Foundation**	9.04	700	m^3	6328
3	**Brickwork foundation**	83.47	2443	m^3	293917
4	**Sand filling**	173.4	200	m^3	34680
5	**PCC Plinth**	40.8	120	M^2	4896
6	**Brickwork in Superstructure**	109.08	2443	m^3	266482
7	**RCC slab**	45.85	3206	m^3	146995
8	**Parapet**	10.31	2443	m^3	25187
9	**Plaster**	504.73	120	M^2	60567
				Total = 792564	
Add 3% of contingency = 23776					
Add 2% work charge = 15851					
Total = 8,32,191					

(Table-27 Police station rate analysis sheet)

8.1.3 Social design (Civil)
COMMUNITY HALL

Scenario

The Government recognizes that village halls, community centers and other charities that provide space and facilities for community services and activities can make an enormous difference to the wellbeing of their communities.1 These charities are an extremely important resource with a crucial role to play, not only in the economic and social regeneration of their local communities, but also in their contribution toward the Government's Civil Renewal agenda. Village halls and community centers exist with the purpose of meeting the needs of users and beneficiaries within their community; needs which are rapidly changing. Social and economic factors are altering the demographics of many villages, towns and cities. People's interests and tastes also change. The challenge for trustees of these charities is to adapt to reflect such changes in the way they operate.

Existing Situation in Derdi Kumbhaji

In derdi Kumbhaji there is not any kind of community hall is present. People of derdi Kumbhaji and nearby villages have to go city for major programs or they can use farm as hall place but farms has some limitation so that’s why we have to provide community hall in village which is used in all weather.

Sustainability of the design
Community hall as an important tool
Design Utilized by
All the people living in the village of even outsiders from nearby villages and relatives of the villagers can use or utilize a community hall for their different uses with the permission of Sarpanch, Talati and some authorized people of the village.

Needs
For group activities, events, festivals and social purpose etc.

Design brief
Village and community halls are the smallest buildings that can accommodate a sports program alongside the customary social and arts pursuits. There are a wide variety of types and sizes, all with the following in common. A main activity and assembly space together with ancillary accommodation that might include additional small halls.

Community Hall Design
L: 11.2m, B: 15.3m, H: 3.5m
Carpet area: 176.11sqm.

Common repair and maintenance of the structure
Some common repairs and maintenances are Exterior painting and plastering, Paving repairs, Plumbing, Repairing cracking or leaning walls etc**.** For most effective maintenance, it should be organized through a program of cyclical maintenance. At the most basic level this includes daily routines, and works upwards to periodic programs of weekly, monthly, semi-annual, annual.

COMMUNITY HALL QUANTITY SHEET

Sr. no	Description	No.	L (M)	B (M)	D/H(M)	Qty. m^3
1	**Excavation for Foundation**	1	38.15	1.1	1.3	54.55
2	**PCC in foundation**	1	38.15	0.9	0.1	3.43
3	**Brick Work in Foundation**					
	1^{st} Step	1	41.4	0.6	0.3	7.45
	2^{nd} Step	1	42.05	0.5	0.5	8.41
	3^{rd} Step	1	42.7	0.4	0.6	8.54
				Total = 24.4		
4	**P.C.C. at plinth**	1	42.7	0.4	0.075	1.28
5	**Sand filling**					
	Kitchen	1	3.5	3.5	0.075	0.918
	Store	1	1.8	1.5	0.075	0.202
	Wash	1	1.5	1.5	0.075	0.168

	Man's toilet	1	3.5	2.15	0.075	0.564
	Women toilet	1	3.5	2.15	0.075	0.564
	Change room	1	3.5	1.5	0.075	0.393
	Office	1	3.5	3.5	0.075	0.918
	Main hall	1	11.7	10.8	0.075	9.47
					Total = 13.19	
6	**Floor finish**	1	42.7	0.4	0.05	0.854
7	**Brick masonry in super structure**	1	43.35	0.3	3.5	45.51
	Deduction					
	M.D.	1	1.52	0.3	2.2	1.18
	D1	5	1.8	0.3	2.1	2.83
	M/D	2	0.6	0.2	2	0.46
	W1	2	1.8	0.3	1.30	1.40
	W2	4	1.52	0.3	1.20	2.18
	V1	3	0.6	0.3	0.6	0.32
		Total Brickwork = 37.12				
8	**Lintel**	1	43.35	0.3	0.15	1.95
9	**Slab (RCC)**	1	16.1	16.4	0.15	39.60
10	**Plaster inside**					
	Kitchen H	2	3.5	-	3.5	24.5
	V	2	3.5	-	3.5	24.5
	Store H	2	1.8	-	1.5	12.6
	V	2	1.5	-	3.5	10.5
	Wash area H	2	1.5	-	3.5	10.5
	V	2	1.5	-	3.5	10.5
	Men's toilet H	2	3.5	-	3.5	24.5
	V	2	2.15	-	3.5	15.5
	Women toilet H	2	3.5	-	3.5	24.5
	V	2	2.15	-	3.5	15.05
	Change room H	2	3.5	-	3.5	24.5
	V	2	1.5	-	3.5	10.5
	Office H	2	3.5	-	3.5	81.9
	V	2	3.5	-	3.5	75.6
					Total = 413.7	
	Deduction of doors and windows					
	M.D.	½	1.8	-	2.2	1.98
	D1	5/2	0.9	-	2.1	4.72
	M/D	2/2	0.6	-	2	1.2

	W1	2/2	1.8	-	1.3	2.34
	W2	4/2	1.52	-	1.2	3.64
	V1	3/2	0.6	-	0.6	0.54
						Plaster = 399.28
11	**Brick masonry in parapet** H	1	16.1	0.3	1	4.83
	V1	1	11.1	0.3	1	3.33
	V2	1	2.2	0.3	1	0.66
						Total = 8.82

(Table-28 Community hall quantity sheet)

COMMUNITY HALL RATE ANALYSIS SHEET
(Rate as per SOR 2015-16 R&B)

Sr. No.	Description	Qt.	Rate(Rs.)	Per	Amount(Rs.)
1	**Excavation for Foundation**	54.55	280	m^3	15274
2	**PCC in foundation (1:4:8)**	3.43	2507	m^3	8373.38
3	**Brick Work in Foundation**	24.4	2443	m^3	59609.2
4	**P.C.C. at plinth**	1.28	120	m^3	3208.96
5	**Floor finish**	13.19	2507	m^3	604.175
6	**Brick masonry in super structure**	45.51	715	m^3	7621.16
7	**Lintel**	1.95	2507	m^3	4888.65
8	**Slab (RCC)**	39.60	3206	m^3	128145.6
9	**Plaster inside**	413.7	120	M^2	47913.6
10	**Brick masonry in parapet**	8.82	2443	m^3	21547.58
					Total = 298769.585
					Add 3% contingency charge = 8963
					Add 2% work charge = 5975.39
					Total = 3,13,707.97

(Table-29 Community hall Rate analysis)

8.1.4 Socio-Cultural design (Civil)

PUBLIC LIBRARY

Scenario

Generally a library is a place where individuals access information and ideas. Access to information is very crucial; it accelerates the level of individual advancement as well as corporate educational development. Information is treated as an economic resource or as a catalyst to development and for making good decision. Information society is a society in which the quality of life as well as prospects for social change and economic development depends upon access to information to meet their needs and requirements. Public libraries are an important entity in local communities, particularly in rural and disadvantaged communities. They are more than shelves of books. Public libraries offer an ever changing range of cultural resources for the community, and they have become a type of social and cultural institution. This article discusses the broadly accepted conceptualization of information for development of social and cultural activities in people of rural areas by providing the information at all the levels necessary for that.

Existing Situation in Derdi Kumbhaji

In Derdi Kumbhaji there is no library. So we gave design for Public library as socio-cultural design. It help to improve learner’s concentration.

Sustainability of the design

Public Library as an important structure

Design Utilized by

Villagers, senior citizen and all public.

Needs

For study and reading purpose.

Design brief

We gave library with good lighting and ventilation. In our design we also mention for computer, book shells, enough capacity for local public and also provide office for librarian with toilet, and also toilet for public.

Public library

L: 12.42m, B: 8.51m, H: 3015m

Carper area: 94.74sqm.

Common repair and maintenance of the structure

Common repair and maintenance are repair of book shall furniture, repair of computer, plastering, painting, etc.

Public Library Quantity sheet

Estimate of : Library						
Sr. No	**Description**	**No**	**L (m)**	**B (m)**	**D/H(m)**	**Qty. m^3**

1	**Excavation for Foundation**	1	58.1	1.1	1.3	83
2	**P.C.C**	1	58.1	0.9	0.1	5.2
3	**Brick Work in Foundation**	1	59.6	0.6	0.3	10.7
	1st Step					
	2nd Step	1	59.9	0.5	0.4	11.98
	3rd Step up to plinth	1	60.2	0.4	0.5	12.04
4	**Sand filling in plinth**					
	Deposit	1	3.80	3.30	0.075	0.94
	Book Shall	1	4.50	3.30	0.075	1.11
	Office	1	3.80	2.40	0.075	0.68
	W.C	1	1.50	2.40	0.075	0.27
	Storeroom	1	1.20	2.40	0.075	0.21
	W.C	1	1.50	2.40	0.075	0.27
	Open area	1	7.3	6.30	0.075	3.44
					Total = 6.92	
5	**P.C.C of 0.075**	1	60.2	0.4	0.075	1.80
6	**50 mm floor finish**	1	60.2	0.4	0.05	1.20
7	**Brick Masonry in super structure**	1	60.5	2	3.15	38.11
8	**Deduction of doors and windows**					
	D1	3	0.90	0.2	2.60	1.40
	D2	1	1.8	0.2	2.60	0.93
	W1	3	2.4	0.2	1.20	1.72
	W2	1	3.2	0.2	1.20	0.768
	W3	1	5.61	0.2	1.20	1.34
	V1	2	0.8	0.2	0.6	0.192
					Total = 6.34	
Brickwork in super structure = 31.77						
9	**Slab**	1	12.6	8.7	0.15	16.44
10	**Brickwork in Parapet**					
	Horizontal wall	1	12.6	0.2	1	2.52
	Vertical wall	1	8.3	0.2	1	1.66
					Total = 4.18	
11	**Plastering work**					
	Inside plaster					
	Deposit					
	H. wall	2	3.30	-	3.15	20.74

	V. wall	2	3.80	-	3.15	23.94
	Book shall					
	H. wall	2	3.30	-	3.15	20.79
	V. wall	1	4.50	-	3.15	14.17
	Office					
	H. wall	2	2.40	-	3.15	15.12
	V. wall	2	3.80	-	3.15	23.94
	WC 1					
	H. wall	2	2.40	-	3.15	15.12
	V. wall	2	2.50	-	3.15	9.45
	Store room					
	H. wall	2	2.4	-	3.15	15.12
	V. wall	2	1.2	-	3.15	15.56
	WC2					
	H. wall	2	2.4	-	3.15	15.12
	V. wall	2	1.5	-	3.15	9.45
	Open area					
	H. wall	2	6.30	-	3.15	59.69
	V. wall	2	7.3	-	3.15	45.99
					Total = 276.25	
12	**Deduction Doors and windows**					
	D1	8/2	0.9	-	2.60	3.36
	D2	½	1.8	-	2.60	1.92
	W1	3/2	2.4	-	1.20	4.32
	W2	½	3.2	-	1.20	1.92
	W3	½	5.61	-	1.20	3.36
	V1	2/2	0.8	-	0.6	-
					Total = 21.3	
Final plaster work = 254.95			**Less than 0.5 area are not deducted**			

(Table-30 Library Quantity sheet)

Public Library RATE ANALYSIS
(Rate as per SOR 2015-16 R&B)

Rate analysis Sheet					
Sr. no.	**Description**	**Qt.**	**Rate(Rs.)**	**Per**	**Amount(Rs.)**
1	**Excavation of foundation**	83	280	m^3	23240
2	**PCC of foundation**	5.2	2507	m^3	13036.4
3	**Brick masonry up to plinth**	34.72	2443	m^3	84820.96
4	**Sand filling work**	6.92	120	m^3	830.4

5	**PCC of 75 mm**	1.80	2507	m^3	4512.6
6	**Brick masonry in superstructure**	31.77	2443	m^3	77614.11
7	**Slab**	16.44	3236	m^3	53199.84
8	**Brick work in parapet**	4.18	2443	m^3	11750.83
9	**Plastering work**	254.95	120	M^2	30594
		Total = 299600			
Add 3% contingencies = 8988.00					
Add 2% work charged establishment = 5992					
Total = 3,14,580					

(Table-31 Library Rate analysis sheet)

8.1.5 Smart Village Design (Civil)
PHC

Scenario

PHC is the first contact point between village community and the medical officer. The PHCs were envisaged to provide an integrated curative and preventive health care to the rural population with emphasis on preventive and promotive aspects of health care. The PHCs are established and maintained by the State governments under the Minimum Needs Programme (MNP)/ Basic Minimum Services (BMS) Programme. As per minimum requirement, a PHC is to be manned by a medical officer supported by 14 paramedical and other staff. Under NRHM, there is a provision for two additional staff nurses at PHCs on contract basis. It acts as a referral unit for 6 Sub Centres and has 4-6 beds for patients. The activities of PHC involve curative, preventive, promotive and family welfare services.

Existing Situation in Derdi Kumbhaji

There is a PHC available in Derdi Kumbhaji.

Sustainability of the design

PHC as an important structure

Design Utilized by

People living in the village of even outsiders from nearby villages and relatives of the villagers can use or utilize a PHC for their different uses.

Needs

For primary treatment for all villagers and for public use.

Design brief

Primary health care is a whole-of-society approach to health and well-being centered on the needs and preferences of individuals, families and communities. It addresses the broader determinants of health and focuses on the comprehensive and interrelated aspects of physical, mental and social health and wellbeing. It provides whole-person care for health needs throughout the lifespan, not just for a set of specific diseases. Primary health care ensures people receive comprehensive care ranging from promotion and prevention to treatment, rehabilitation and palliative care - as close as feasible to people's everyday environment.

PHC Design
L: 37.76m, B: 14m, H: 3.4m
Carpet area: 374.9218 sqm.

Common repair and maintenance of the structure

Some common repairs and maintenances are as below; Exterior painting and plastering; Landscaping and gardening; Paving repairs; Carpeting and flooring; Plumbing; Repairing cracking or leaning walls etc**.** For most effective maintenance, it should be organized through a program of cyclical maintenance. At the most basic level this includes daily routines, and works upwards to periodic program of weekly, monthly, semi-annual, annual, quinquennial and so on routines.

PHC Quantity sheet

PRIMARY HEALTH CLINIC						
QUANTITY SHEET						
Sr. No.	**Item Description**	**No.**	**L (m)**	**B (m)**	**H/D (m)**	**Qty. (m3)**
1	**Earthwork in Excavation in Foundation:**					
	Footing 1mx1m	26	2.030	2.030	1.200	128.57
	Depth From GL = 0.6 +0.83+0.6					
	0.6 =Extra For working space					
		Total Qty of Excavation = 128.57				
2	**Footing PCC with 1:3:6 Ratio**					
		26	0.830	0.830	0.100	1.79
		Total Qty of Footing PCC = 1.79				
3	**Footing RCC with 1:1.5:3 Ratio**					
	STEP-1	26	0.730	0.730	0.200	2.77
	STEP-2	26	0.630	0.630	0.300	3.10
	STEP-3	26	0.430	0.430	0.300	1.44
		Total Qty of Footing RCC = 7.31				
4	**Column up to Plinth Level RCC**					
	Column 1:1.5:3 Mix Ratio	26	0.230	0.230	0.300	0.41

		Total Qty of Footing Column = 0.41				
5	**Plinth Beam RCC with 1:1.5:3 Ratio**					
		1	223.74	0.230	0.400	20.58
		Total Qty of Plinth Beam = 20.58				
6	**Back-filling**					
6.a	**Back-filling In Footing**					
	Excavation Area	26	2.030	2.030	1.200	128.57
	Deduction					
	Footing P.C.C	26	0.830	0.830	0.100	1.79
	Footing RCC	26	0.730	0.730	0.200	2.77
		26	0.630	0.630	0.300	3.10
		26	0.430	0.430	0.300	1.44
	Footing Column	26	0.230	0.460	0.330	0.91
		6.a Total Qty = 118.56				
6.b	**Back Filling from Ground Level to L.C. Bed below Level**					
	Plinth area in to in	1	397.730	1.000	0.400	159.09
		6.b Total Qty = 159.09				
	Total Qty of Back Filling of 6a+6b = 277.66					
7	**L.C. Bed RCC with 1:1.5:3 Ratio**					
		1	397.730	1.000	0.200	79.55
		Total Qty of L.C. Bed = 79.55				
8	**Brick Masonry with 1:4 Ratio**					
		1	220.460	0.230	3.170	160.74
	Deduction					
	window w1	7	1.500	0.230	1.200	2.90
	window w3	1	1.400	0.230	1.200	0.39
	window w4	1	1.500	0.230	1.200	0.41
	window w5	1	1.500	0.230	1.200	0.41
	window w6	4	1.200	0.230	1.200	1.32
	window w7	2	1.380	0.230	1.200	0.76
	Vent V1	8	0.750	0.230	0.600	0.83
	Vent V2	2	0.450	0.230	0.600	0.12
	Door D4	8	0.750	0.230	2.600	3.59
	Door D3	2	1.950	0.230	2.600	2.33
	Door D2	10	1.000	0.230	2.600	5.98
	Door D1	1	2.000	0.230	2.600	1.20

		Total Qty of Walls = 140.49				
9	**Slab with 1:1:2 RCC Ratio**					
	0.15m Thick Slab	4	2.710	0.460	0.150	0.75
		2	6.490	4.000	0.150	7.79
		3	1.660	0.460	0.150	0.34
		1	7.960	5.730	0.150	6.84
		2	1.610	0.230	0.150	0.11
		1	10.460	2.500	0.150	3.92
		1	6.230	6.000	0.150	5.61
		1	4.230	4.260	0.150	2.70
		1	9.800	9.230	0.150	13.57
		1	11.100	13.380	0.150	22.28
		1	2.370	0.750	0.150	0.27
		1	1.360	0.750	0.150	0.15
		1	4.030	4.260	0.150	2.58
		1	6.260	6.260	0.150	5.88
		1	10.290	2.500	0.150	3.86
		1	8.010	5.760	0.150	6.92
		2	1.960	0.460	0.150	0.27
		Total Qty of Slab = 83.83				
10	**Parapet Wall**					
		1	103.510	0.230	1.200	28.57
		Total Qty of Parapet Wall = 28.57				
11	**Internal Plaster with 1:4 Ratio**					
	15mm thick					
		1	5.270	0.015	7.500	0.59
		4	3.770	0.015	2.900	0.66
		1	5.770	0.015	5.540	0.48
		1	4.000	0.015	3.800	0.23
		1	10.230	0.015	2.500	0.38
		1	10.640	0.015	4.000	0.64
		1	9.800	0.015	9.000	1.32
		1	3.800	0.015	3.800	0.22
		1	1.610	0.015	2.500	0.06
		1	5.800	0.015	5.800	0.50
		1	7.550	0.015	2.500	0.28
		1	7.550	0.015	5.300	0.60
		2	5.270	0.015	3.170	0.50
		8	3.770	0.015	3.170	1.43
		2	5.770	0.015	3.170	0.55

		2	4.000	0.015	3.170	0.38
		2	10.230	0.015	3.170	0.97
		2	10.640	0.015	3.170	1.01
		2	9.800	0.015	3.170	0.93
		2	3.800	0.015	3.170	0.36
		2	1.610	0.015	3.170	0.15
		2	5.800	0.015	3.170	0.55
		2	7.550	0.015	3.170	0.72
		2	7.550	0.015	3.170	0.72
		2	7.500	0.015	3.170	0.71
		8	2.900	0.015	3.170	1.10
		2	5.540	0.015	3.170	0.53
		2	3.800	0.015	3.170	0.36
		2	2.500	0.015	3.170	0.24
		2	4.000	0.015	3.170	0.38
		2	9.000	0.015	3.170	0.86
		2	3.800	0.015	3.170	0.36
		2	2.500	0.015	3.170	0.24
		2	5.800	0.015	3.170	0.55
		2	2.500	0.015	3.170	0.24
		2	5.300	0.015	3.170	0.50
		Total = 20.32				
	Deductions					
	window w1	7	1.500	0.015	1.200	0.19
	window w3	1	1.400	0.015	1.200	0.03
	window w4	1	1.500	0.015	1.200	0.03
	window w5	1	1.500	0.015	1.200	0.03
	window w6	4	1.200	0.015	1.200	0.09
	Vent V1	8	0.750	0.015	0.600	0.05
	Vent V2	3	0.450	0.015	0.600	0.01
	Door D1	1	2.000	0.015	2.600	0.08
	Door D2	22	1.000	0.015	2.600	0.86
	Door D3	4	1.950	0.015	2.600	0.30
		Total Deductions = 1.66				
		Total Qty of Internal Plaster = 18.66				
12	**External Plaster with 1:4 Ratio**					
	25MM Thick					
		1	103.510	0.025	5.250	13.59
	Deduction					
	window w1	7	1.500	0.025	1.200	0.32
	window w3	1	1.400	0.025	1.200	0.04

	window w4	1	1.500	0.025	1.200	0.05
	window w5	1	1.500	0.025	1.200	0.05
	window w6	4	1.200	0.025	1.200	0.14
	Vent V1	8	0.750	0.025	0.600	0.09
	Vent V2	3	0.450	0.025	0.600	0.02
	Door D1	1	2.000	0.025	2.600	0.13
		Total Qty of External Plaster = 12.75				

(Table-32 PHC Quantity sheet)

PHC Rate analysis sheet
(Rate as per SOR 2015-16 R&B)

Sr.no	Item	Qt.	Rate(Rs.)	Per	Amount(Rs.)
1	**Earthwork in Excavation in Foundation:**	128.57	280	m^3	35999.6
2	**Footing PCC with**	1.79	2045.70	m^3	3661.80
3	**Footing RCC with**	7.31	1644.00	m^3	12017.64
4	**Column up to Plinth Level RCC**	0.41	1689.20	m^3	692.572
5	**Plinth Beam RCC**	20.58	1644.00	m^3	33833.52
6	**Back-filling**	277.66	45.70	m^3	12689.06
7	**L.C. Bed RCC**	79.55	1644.00	m^3	130780.2
8	**Brick Masonry with**	140.49	2033.15	m^3	285637.24
9	**Slab with**	83.83	2004.35	m^3	168024.66
10	**Parapet Wall**	28.57	2443	m^3	69796.51
11	**Internal Plaster**	18.66	120	M^2	2239.2
12	**External Plaster**	12.75	130	M^2	1657.5
			Total = 7,57,029.52		
	Add 3% Contingency charge = 22,710.87				
	Add 2% Work Charge = 15,140.58				
	Total = 7,94,880				

(Table-33 PHC Rate analysis sheet)

8.1.6 Heritage Village Design (Civil)
BACHAT MANDLI

Scenario

Even though agriculture is the primary source of income and employment in rural areas, the parody of the situation is that a majority of the people living in rural districts are poor and hungry. Co-operative society plays a vital role in improving the deprived conditions of rural areas the co-operative society helps in enhancing the quality of fertilizers and facilitates better facilities for product marketing, including storage, processing, transport, and availing modern cultivation techniques. The co-operative societies impart several services to poverty-stricken sections, such as access to advanced technologies, proper training in natural resource management, and boost agricultural productivity by increasing the supply of goods. The purpose of co-operative society does not restrain to provide social benefits but also to give financial security to the people performing agrarians' activities. So, co-operatives avail finance through agricultural funds and credits to strengthen the economic position of farmers.

Existing Situation in Derdi Kumbhaji

In today scenario there is no any batch Mandali (credit co-operative society)

Sustainability of the design

Bachat Mandali as an important structure

Design Utilized by

All villagers and nearby villagers only.

Needs

For financial stabilization and for self as well as state development

Design brief

In heritage village design we provide Batch Mandali. Provides an overview of basic budgeting, entrepreneurship and a guide for writing a business plan. It gives credit by deposit some item. It also cover minor type of insurance.

Bachat mandali Design

L: 11.3m, B: 12.3m, H: 3m.

Carpet area: 114 sqm.

Common repair and maintenance of the structure

Some common repairs and maintenances are as below; Exterior painting and plastering; Landscaping and gardening; Paving repairs; Carpeting and flooring; Plumbing; Repairing cracking or leaning walls etc.

BACHAT MANDLI QUANTITY SHEET

Sr. no	Description	No.	L (m)	B (m)	D/H(m)	Qt. m^3
1	**Excavation in foundation**	1	73.2	1.2	1.3	114.19
2	**PCC**	1	74.25	0.9	0.1	6.68

3	**Brickwork in foundation**					
	Step 1	1	75.3	0.6	0.3	13.55
	Step 2	1	75.65	0.5	0.4	15.13
	Step 3	1	76	0.4	1.1	32.4
4	**Sand Filling**					
	Room 1 = 6 x 6	1	6	6	0.6	21.6
	Room 2 = 6 x 6	1	6	6	0.6	21.6
	Room 3 = 3 x 2	1	3	2	0.6	3.6
	Room 4 = 5 x 6	1	5	6	0.6	18
	Room 5 = 3 x 2	1	3	2	0.6	3.6
	Space 1 = 1.7 x 2	1	1.7	2	0.6	5.1
	Space 2 = 1.7 x 2	1	1.7	2	0.6	5.1
					Total = 75.6	
5	**DPC at plinth**	1	76	0.4	-	30.4
6	**Brick Work in Super Structure**	1	76.35	0.3	3	68.71
	Deduction of D/W					
	W = 1.52 x 1.22	13	1.52	0.3	1.22	7.23
	D1 = 1 x 2.30	4	1	0.3	2.30	2.76
	D2 = 1.7 x 2.30	1	1.7	0.3	2.30	1.17
					Total = 11.25	
Total Brick work in Superstructure = 57.46						
7	**R.C.C. Slab**	1	12.9	11.9	0.1	15.35
8	**Brickwork in Parapet Wall**					
	Horizontal wall	1	11.9	0.3	0.7	2.49
	Vertical wall	1	12.3	0.3	0.7	2.58
					Total = 5.073	
9	**Plastering Work (Inside)**					
	Room (1)					
	H. Wall	2	6	-	3	36
	V. Wall	2	6	-	3	36
	Room (2)					
	H. Wall	2	6	-	3	36
	V. Wall	2	6	-	3	36
	Room (3)					
	H. Wall	2	3	-	3	18
	V. Wall	2	2	-	3	12
	Room (4)					
	H. Wall	2	3	-	3	18

	V. Wall	2	2	-	3	12
	Room (5)					
	H. Wall	2	5	-	3	30
	V. Wall	2	6	-	3	36
	Open Space					
	H. Wall	1	1.7	-	3	5.1
	V. Wall	2	2	-	3	12
					Total = 287.1	
	Deduction in Plaster					
	W (1.52 x 1.22)	13/2	1.52	-	1.22	12.05
	D1 (1 x 2.30)	7/2	1	-	2.30	8.05
	D2 (1.7 x 2.5)	½	1.7	-	2.30	1.95
					Total = 22.055	
			Total Plaster Work = 265.04			
10	**Marble Flooring 2cm Thick**					
	Room 1	1	6	6	-	36
	Room 2	1	6	6	-	36
	Room 3	1	3	2	-	6
	Room 4	1	3	2	-	6
	Room 5	1	5	6	-	30
	Open Spaces 1	1	1.7	2	-	3.4
	Open Spaces 2	1	1.7	2	-	3.4
					Total = 120.08	

(Fig-34 Bachat mandli quantity sheet)

BACHAT MQANDLI RATE ANALYSIS SHEET
(Rate as per SOR 2015-16 R&B)

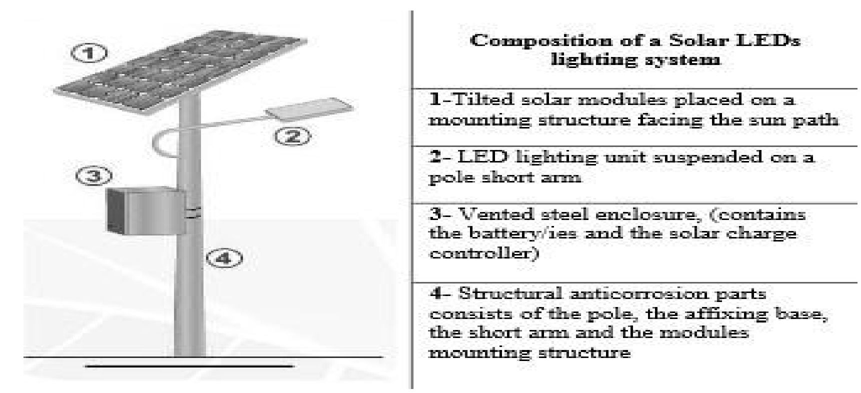
Sr. no.	Particular	Qt.	Rate(Rs.)	Per	Amount(Rs.)
1	**Excavation**	114.19	280	m3	31973.2
2	**PCC in Foundation**	6.68	700	m3	4676
3	**Brick work in foundation**	62.12	2443	m3	151759.16
4	**Sand filling**	75.6	200	m3	15120
5	**D.P.C. in plinth**	30.4	120	M2	3648
6	**Brick masonry in superstructure**	57.46	2443	m3	140374.78
7	**R.C.C. Slab**	15.35	3206	m3	49212.1

8	**Brickwork in Parapet**	5.073	2443	m3	12393.33
9	**Plastering Work**	287.1	120	M2	34452
			Total = 465221.83		
Add 3% contingency charge = 13956.65					
Add 2% worked charge = 9304.43					
Total = 4,88,482.91					

(Fig-35 Bachat mandli Rate analysis sheet)

8.1.7 Electrical Design 1
Solar Street light Installation Design

The solar street light does not need to set up the transmission line or route the cable, and no any special management and control are required. It can be installed in the entire public place such as the square, the parking lot, the campus, the street or the highway etc. We are going to design a Solar Street Light Installation for The main Street of our Allocated Village.



(Fig-73 Solar Street Light)

Components required for a single Solar Street Light Pole

⇒ Light pole
⇒ LED lamp
⇒ Solar cell
⇒ Control box (Charger, component)

Calculation for Solar Street Light Installation

As we seen above our basic components required are Solar Cell, LED Lamp, Light Pole and Control Box (It consists of Charger, Controller, and Battery). Now these components are available in Different Ratings as per our requirement. And hence cost of that component also varies with the change in rating.

Selection of Component Rating

So here are some calculation formulae which will help us know the rating of component to be used to calculate the power of Photovoltaic Cell required

P (pv) = $(1/n1n2) \times (Pled \times hled/\text{h } (pv)) \times k$

Where:

1 -------------- Charging efficiency of the battery
2 -------------- Efficiency of the LED driver circuit
PLED ------------- Power consumption of the LED (W)
HLED --------------- Daily lighted time of Lamps (h)
h (pv) --------------- Average of daily peak sunshine hours

k ---------------- Loss coefficient of solar panel
To calculate the capacity of Battery required
The capacity of the battery can be calculated by the following formula
C = $(D + 1)\ k1(1 - k2)$
In the formula
C --------- Standard capacity of the battery.
Q --------- Power consumption per day of the lamps.
D --------- Maximum number of continuous rainy days.
k1 --------- Depth of discharge (DOD), generally the DOD of VRLA is 0.75. k2 --------- Loss electricity of the battery's self-discharge. (10%)
Selection of LED depends on the site area and the light pole generally used are of 9-12 m height.

Cost Calculation
Rating & costing of street light

Type	Led ratting (Watt)	Battery size (AH)	Controller size (A)	Pole height (m)
1	Lexom mini 8 watt	25-30	5	7
Cost(Rs)	3500-4000	4000-6000	1000-2000	2000-3000

(Table-36 Rating and Costing of Street Light)

Mathematical parameters are as follows
Capacity of solar panel = Rating of LED X no of running hours No of charging hours
Specific design parameters for 7meter pole height

Parameters	Parameters specifications
Pole height	Pole height 7 meter
Thickness of pole	Top 2.5 meter: 3mm Bottom 4.5 meter: 4mm
Diameters of pole sections	Top 2.5 meter: at least 3 inch Bottom 4.5 meter: at least 4 inch
Weight of pole only	At least 75 kg

(Table-37 Specific design parameter for electrical pole)

Cost Estimation of single solar street light

Parameters	Cost in INR
LED Light	4000
Solar panel	3000
Charge controller	5000
Pole	10000
Wire	2000
Installation cost	5000
Battery	5000
Total approx. cost	**34000**

(Table-38 Cost Estimate of Single Street Light Pole)

Final Estimate cost for single pole: Approx. **RS34000**

8.1.8 Electrical Design 2

Solar pump system

Solar panel

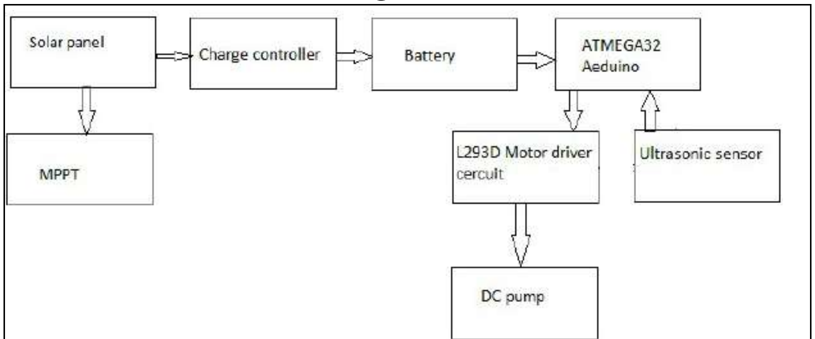
Here we are going to use solar power as input of dc hand pump. The solar panel works on principle of photovoltaic cell. When sun light falling on solar panel the solar cells converts this solar energy into electrical energy.

MPPT

Maximum power point tracking is a device which is used for change the direction of solar panel automatically. When sun changes his direction sun light falling on panel gets decreases and panel generates small amount of power to avoid this kind of situation mppt is used it will sense the direction of sun and rotates solar panel in the direction of sun light.

Charge controller

Charge controller is a device which is used to protect battery from over charge. We will charge our battery through charge controller so when battery gets charged the charge controller won't allow battery to charge more and it will protect and increase life of battery.



(Fig-74 Block Diagram of solar pump system)

Ultrasonic sensor

Ultrasonic sensor is a device which is measures distance using ultrasonic waves. The sensor head emits UN ultrasonic wave and receives the wave reflected back from the target. Ultrasonic sensors measures the distance to the target by measuring the time between the emission and reception.

L293D motor driver circuit

L293D is a typical Motor driver or motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that we can control two DC motor with a single L293D IC.

ATMEGA32 Arduino

Here we are making automatic hand pump so we can called Arduino as heart of our controlling system. As ultrasonic sensor and L293D motor driver IC both are connected with Arduino and it will control both IC. Ultrasonic sensor will sense the distance of garget and gives signals to Arduino than Arduino will give signal to motor driver IC and motor will run and we will get water from pump.

Pump

Pump is a device which is used to lift fluid from bottom to top. Pumps lift water from underground and discharge it directly into a distribution system. Most water distribution pumps are of the centrifugal type, in which a rapidly rotating impeller adds energy to the water and raises the pressure inside the pump casing.

Voltage multiplied by amperage is the power produced. It is measured in units of watts (Pw), as shown in Equation 1: Watts = Volts x Amps

Power losses in an electrical circuit are proportional to the square of the current, as shown in Equation 2: Power Loss = Current^2 R

Electricity in a Wire	Water in a Pipe
Amp (flow of electrons)	Q (flow rate of water)
Volts (energy potential)	Pressure (energy potential)
Watts (power) = Amps x Volts	Hydraulic/Water Power = Q x Pressure
Resistance	Friction + Minor Losses
High Voltage, Small Wire = High Amps, High Resistive losses, Heat and Fires	High Pressure, Small Pipe = High Velocity, High Friction Losses, Blown Pipe

Cost Estimation

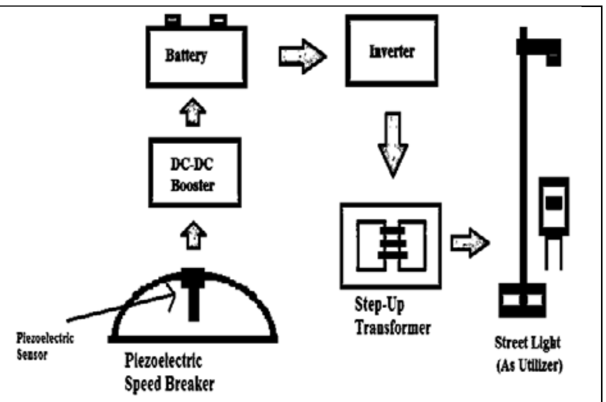
Component	No. Of comp.	Cost
DC Pump Set (2 HP)	1	10000
Solar Panel (300 watt)	4 (9000)	36000
Charge Controller	1	600
Battery System (100 Ah)	2 (5000)	10000
Arduino	1	1500
Ultrasonic Sensor	1	100
L193D motor driver IC	1	100
Other Miscellaneous Charge	1	2000
Total Cost		**61000**

(Table-39 Cost Estimate of Solar Pump System)

8.1.9 Electrical Design 3

Piezoelectric Speed Breaker Power Generator Design

Piezoelectricity is the appearance of an electrical potential across the sides of a crystal when subjected to mechanical stress. Many vehicles move over the roads frequently and each vehicle has enough kinetic energy that is lost when it impacts speed breakers. We can capture this kinetic energy which is then converted to potential energy. We can tap the energy generated and produce power by using the speed breaker as power generating unit. The kinetic energy of the moving vehicle can be converted into electrical energy by embedding a piezoelectric generator in the speed breakers.



(Fig-75 Block Diagram of piezoelectric speed breaker)

In our Village we can Construct Piezoelectric Speed Breakers at the main entrance of Village where the migration of vehicles and people is maximum and by applying the Kinetic Energy on Piezoelectric Sensor. A speed breaker is designed with spring module cantilever with piezoelectric module and electrical energy converter circuit. It includes the modifications of the speed breaker to comply with government regulation the spring characteristics the cantilever knocking mechanism and the mechanical coupling system.

Calculation for Piezoelectric Speed Breaker Installation

For Constructing a Piezoelectric Speed Breaker, We Need some Small Piezoelectric Sensors which are connected in Series or Parallel as per required current-Voltage Rating. We also need a DC-DC Booster Battery, Inverter, and Step-up Transformer.

We can construct an RCC, PVC and Rubber Speed Breaker or also We Can install a Private Safety Speed Breaker Inserting the Piezoelectric sensor on it. Output of the Speed Breaker Can Be Given to Equipment to be utilized.

Cost Calculation

Sr. No.	Installations	Quantity	Cost/Qty	Total Cost (₹)
1	Piezoelectric Sensors	60	5	**300**
2	Speed Breaker	10 m.	2000	**20000**
3	DC-DC Booster	1no.	2000	**2000**
4	Inverter	1no.	6000	**6000**
5	Battery	1 no.	15000	**15000**
6	Step Up Transformer	1 no	5000	**5000**
7	Miscellaneous	-	-	**5300**
			Total Cost	**51600**

(Table-40 Cost Estimation of Piezoelectric Speed Breaker)

8.2 Reason for Students Recommending this Design

IN CIVIL

Public Garden – There is no any recreational facilities in village and it also help to reduce mental stresses and increase mental health.

Police station – There is not any police station. For protection and regulation of law.

Community hall – In Derdi Kumbhaji there is not any community hall available. People have to go to city for any big program.

Public Library – Derdi Kumbhaji has no public library. It help student to concentration in their study.

Primary health care center (PHC) – For provide better health facilities for villagers and public.

Bachat Mandali – For Problems or for financial help for villagers and nearby villages.

IN ELECTRICAL

Solar Street light – For night visibility and safety.

Solar Pump – For use of power at any time in farm for watering.

Piezoelectric Speed Breaker Power Generator – Generating electricity using speed barker

8.3 About designs Suggestions / Benefit of the villagers

IN CIVIL

Public Garden

Derdi Kumbhaji village population is 8450 as per census 2011. So it is required that it should have at least one recreational facilities. Village does not have any recreational facilities. People are meets other people by that they interact with each other culture and feel same respect for each other. It also give mental piece and give new ideas.

Police station

We all know safety of women are very important to our culture. By providing police station it provide safety for women and villagers. Crime are reduce and safety during night increase. It help to maintain law and order in village and nearby villages.

Community Hall

In Derdi there is no any community hall. By providing community hall villagers should not go city for function. We provide community hall with all facilities like kitchen, changing room, stage and store room also. It is used in all weather.

Public Library

By providing public library students of Derdi Kumbhaji does not go to city for only reading purpose. Senior citizen also use library for reading newspapers and other books. Library has also facilities for book borrow, it means library give you book by some limited time period.

Primary Health Care Centre

Derdi Kumbhaji is big village other than average villages. So it required very good health facilities. In Derdi PHC almost all facilities are it also work in give vaccination of polio disease. In monsoon it give guideline for safety for dengue and malaria.

Bachat mandali

It gives load on property. It help in business and startup. Even though agriculture is the primary source of income and employment in rural areas, the parody of the situation is that a majority of the people living in rural districts are poor and hungry. Co-operative society plays a vital role in improving the deprived conditions of rural areas the co-operative society helps in enhancing the quality of fertilizers and facilitates better facilities for product marketing, including storage, processing, transport, and availing modern cultivation techniques. The co-operative societies impart several services to poverty-stricken sections, such as access to advanced technologies, proper training in natural resource management, and boost agricultural productivity by increasing the supply of goods. The purpose of co-operative society does not restrain to provide social benefits but also to give financial security to the people performing agrarians' activities. So, co-operatives avail finance through agricultural funds and credits to strengthen the economic position of farmers**.**

IN ELECTRICAL

Solar Street light

By providing solar street light it reduce energy for electricity generation and distribution. Solar is green energy it does not require major maintenance.

Solar Pump

In farms farmers have to wait for power and in most of the cases power supply is in night or early morning. By providing solar pump farmers can easily pump water at their conveyance.

Piezoelectric Speed Breaker Power Generator

By providing this type of speed breaker we can produce electricity. This type of speed breaker we can install in village and in village main road.

⇒ The design that we gave is give many benefits to villagers like now they don't have to go for city for any functions now they can do in that own villages.

⇒ Students now can easily any study related work with that own village.

⇒ Farmers have no paid for electricity because of the solar power design.

⇒ Health facilities that we provide now villagers are not go for city for health purposes.

Chapter: 9
Proposing designs for Future Development of the Village for the PART-II Design

In Civil

Sustainable Design: Rain Water Harvesting

An additional source of water will be available which could be used at the time of emergency or water shortage by implementing the Rain Water Harvesting system in the village households.

Physical design: Gym

Fitness is the important thing in our life. By providing gym youngsters can maintain their fitness. Promoting gym in village help to those who are planning to join defense force.

Social design: Skill development center

In village many girls and boys are willing to learn small and skill courses like computer, spoken English, tailor work, art, etc. By providing villagers can easy learn new skills which help them in their job.

Socio-Cultural design: Soil Testing laboratory

Soil testing laboratory help farmers of Derdi Kumbhaji as well as other people to know the minerals and fertility of their soil. According fertility of soil farmer are know what exact fertilizer or pesticide are used to help increase yield of crop.

Smart village design: Cybercafé

A cybercafé is a type of business where computers are provided for accessing the internet, playing games, chatting with friends or doing other computer-related tasks. In most cases, access to the computer and internet is charged based on time. Students of Derdi Kumbhaji can do their work like online filling form, online money transfer, chat, emails, etc.

Heritage village design: Agriculture Store

Majority of farmers can take benefits of agriculture store. All commodity related to agriculture are available like pesticides, fertilizers, pumps, cables, nets, pipes, motors, etc. villagers and nearby villagers can easily access to store.

In Electrical

CCTV

Derdi population is 8450 by that means there are required to CCTV. It help to monitor activity in night and by that crime rate also decrease.

Solar Roof top Installation Design

Villagers can save good amount by providing solar roof top and also it is green energy which has no pollution

Purification water plant

It is a different electrical concept which help in treatment of water which is provided in villagers.

Chapter: 10

Conclusion of the Entire Village Activities of the Project

We have visited the ideal village Shapar and that visit helped us to know about the type of infrastructure needed by the village. With help of techno-economic survey and gap analysis and also studying / surveying our ideal village Shapar, we were able to broadly define requirements of development for people of Derdi Kumbhaji village. Then we have visited the smart village Veraval and by that visit we better understood the smart technologies and concepts as smart development of our allocated village Derdi Kumbhaji.

By providing all the facilities like PHC, Public garden, police station, Public Library, Bachat mandali, Community hall. We will try further to give all necessary facilities or smart facilities. We gave all design in a required manner like Sustainable Design, Physical Design, Social Design, Socio-Cultural Design, Smart village Design, Heritage village Design. By providing all these type of design it cover all aspect of progress/development.

We observe that in our smart and ideal villages have some minor lacks. But we also give some recommendation for that lacks. In general all village need some minor to small maintenance required for some government building. In our allocated village some maintenance related smart suggestion and also we introduce some new material which is available in market.

Under Vishwakarma project phase-VIII we will develop physically as well as socially, which improves the overall lifestyle of people along with nation with preserving nature bit by bit. This will help in developing Smart villages in sustainable manner, reduce migration from villages and prevent the cities from the urban pressure. This should lead to some rethinking about the meaning of efficiency beyond the usual conceptions of economic or technical efficiency. Indeed, employment expansion is at least as important as growth in productivity. In a sense, both represent the utilization of labor as a resource. Why, then, does thinking about efficiency focus on one and neglect the other It is important to reflect on this question. The answer, which calls for change in both economics and politics, could make a real difference.

From all above observation and research we conclude that the village is also as important as urban areas. It is also an important part of our country and society. Hence it must also get all those facilities and importance which urban peoples are getting. It is also a right for the peoples living in village to get all the advantages of all the amenities. And also to eliminate migration from rural to urban area.

In second phase we will give the design of rain water harvesting, cybercafé, skill development centre, gym soil testing laboratory, agriculture store in civil. In electrical we gave the design and installation of CCTV, solar roof top installation design and purification water plant.

Chapter: 11
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⇒ **https://www.academia.edu/38054706/SUSTAINABLE_CONSTRUCTION_AN_INDIAN_PERSPECTIVE**

Chapter: 12
Annexure attachment

12.1 Survey form of Ideal Village Scanned copy attachment in the report for Part-I Survey form of Ideal Village Original copy attachment in the report for Part-II

Gujarat Technological University, Ahmedabad, Gujarat

Vishwakarma Yojana: Phase VIII Techno Economic Survey

Techno Economic Survey

For

Vishwakarma Yojana: Phase VIII

IDEAL VILLAGE SURVEY

An approach towards Rurbanisation for Village Development

Name of Village:	Shapar
Name of Taluka:	Kotda Sangani
Name of District:	Rajkot.
Name of Institute:	shri Labhubhai Trivedi institute of engg and Technology.
Nodal Officer Name & Contact Detail:	Prof. Mehul M Chanda 9427665085
Respondent Name: (Sarpanch/ Panchayat Member/ Teacher/ Gram Sevak/ Aaganwadi worker/Village dweller)	Sarpanch ÷ Geetaben Dharmendrabhai tilara Talati mantri ÷ P.L. Vasoya
Date of Survey:	28- 10 -2020.

1. **Demographical Detail:**

Sr. No.	Census	Population	Male	Female	Total House Holds
i)	2001	7143	4559	2584	1894
ii)	2011	9263	5430	3891	2602

2. **Geographical Detail:**

Sr. No.	Description	Information/Detail
i)	Area of Village (Approx.) (In Hector) Coordinates for Location:	1551-969 22.-156688, 70.799145
	Forest Area (In hect.)	0
	Agricultural Land Area (In hect.)	210.ha
	Residential Area (In hect.)	—
	Other Area (In hect.)	137.2
	Water bodies	—
	Nearest Town with Distance:	Rikda (7)km

3. **Occupational Details:**

Name of Three Major Occupation groups in Village	1.	Indostries
	2.	Farming.
	3.	

4. **Physical Infrastructure Facilities:**

Sr. No.	Descriptions	Detail	Adequate	Inadequate	Remarks
A.	Main Source of Drinking water				
	• Tap Water (Treated/ Untreated)	Fhom nanmd River	yes		
	• RO Water			No	
	• Well (Covered/ Uncovered)		yes		
	• Hand pumps		yes		
	• Tube well/ Borehole		yes		
	• River/ Canal/ Spring/ Lake/ Pond	Lake.	yes		
Suggestions if any:					
B.	Water Tank Facility				
	Overhead Tank	Capacity:	1 Nos	NO	No in ose
	Underground Sump	Capacity:	3 Nos		
Suggestions if any:					
C.	Drainage Facility				
	Available (Yes/.No)	under ground Dhainage	yes.		
Suggestions if any:					
D.	Type of Drainage				
	Closed/ Open	Closed	yes		
	If Open than Pucca / Kutchcha	Pacca	yes		
	Whether drain water is discharged directly in to Water bodies/ Sewer plants	Secuane plant	yes		
Suggestions if any:					

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E.	**Road Network :All Weather/ Kutchha (Gravel)/ Black Topped pucca/ WBM**				
	Village approach road	Pucca	yes		
	Main road	Pucca	yes		
	Internal streets	Pucca	yes		
	Nearest NH/SH/MDR/ODR Dist. in kms.	NH-8 2.5 km.	yes.		
Suggestions if any:					
F.	**Transport Facility**				
	Railway Station (Y/N) (If No than Nearest Rly Station---Kms)			No	Ribda 6.4 km
	Bus station (Y/N) Condition: (If No than Nearest Bus Station---Kms)			No	15 km. Agasra.
	Local Transportation (Auto/ Jeep/Chhakda/ Private Vehicles/ Other)	All type of transport available.	yes		
Suggestions if any:					
G.	**Electricity Distribution**				
	(Y/N) Govt./ Private (Less than 6 hrs./ More Than 6 hrs)	Govt. P.G.V.C.L	yes		
	Power supply for Domestic Use		yes		
	Power supply for Agricultural Use		yes		
	Power supply for Commercial Use		yes		
	Road/ Street Lights		yes		

	Electrification in Government Buildings/ Schools/ Hospitals		yes		
	Renewable Energy Source Facilities (Y/ N)			No	
	LED Facilities		yes.		
Suggestions if any:					
H.	**Sanitation Facility**				
	Public Latrine Blocks If available than Nos.	2 Nos	yes		
	Location Condition	Very good.			
	Community Toilet (With bath/ without bath facilities)		yes		
	Solid & liquid waste Disposal system available		yes		
	Any facility for Waste collection from road		yes		
Suggestions if any:					
I.	**Irrigation Facility:**				
	Main Source of Irrigation (Stream/River/ Canal/ Well/ Tube well/ Other)	only tube well and well	yes.		
Suggestions if any:					
J.	**Housing Condition:**				
	Kutchha/Pucca (Approx. ratio)	All Houses are Pucca	yes.		

5. **Social Infrastructural Facilities:**

Sr. No.	Descriptions	Information/ Detail	Adequate	Inadequate	Remarks

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K.	Health Facilities:				
	Sub center/ PHC/ CHC /Government Hospital/ Child welfare & Maternity Homes (If Yes than specify No. of Beds) Condition:	CHC avalible	yes		
	Private Clinic/Private Hospital/ Nursing Home	All avalible	yes		
	If any of the above Facility is not available in village than approx. distance from village: 15 km kms.				
Suggestions if any:					

L.	Education Facilities:				
	Aaganwadi/ Play group	9 Nos	yes		
	Primary School	2 Nos Govt	yes		
	Secondary school			No	3 km Vehaval
	Higher sec. School			No	15 km Rajkot
	ITI college/ vocational Training Center			No	15 km Rajkot
	Art, Commerce& Science /Polytechnic/ Engineering/ Medical/ Management/ other college facilities			No	15 km Rajkot
	If any of the above Facility is not available in village than approx. distance from village: 15.....kms.				
Suggestions if any:					

M.	Socio- Culture Facilities				
	Community Hall (With or without TV) Location:		yes	No	

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	Condition:	Very good			
	Public Library (With daily newspaper supply: Y/N) Location: Condition:			No	
	Public Garden Location: Condition:			No	
	Village Pond Location: Condition:		yes		
	Recreation Center Location: Condition:			No.	
	Cinema/ Video Hall Location: Condition:			No	
	Assembly Polling Station Location: Condition:		yes.		
	Birth & Death Registration Office Location: Condition:		yes.		
If any of the above Facility is not available in village than approx. distance from village: .15....kms.					
Suggestions if any:					
N.	Other Facilities				
	Post-office		yes		
	Telecommunication Network/ STD booth			No.	

	General Market		yes		
	Shops (Public Distribution System)		yes		
	Panchayat Building		yes		
	Pharmacy/Medical Shop		yes		
	Bank & ATM Facility		yes		
	Agriculture Co-operative Society		yes		
	Milk Co-operative Soc.		yes		
	Small Scale Industries		yes		
	Internet Cafes/ Common Service Center/Wi Fi		yes		
	Other Facility	CCTV camera	yes.		
Suggestions if any:		Announcing system.			

6. **Sustainable /Green Infrastructure Facilities:**

Sr. No.	Descriptions	Information/ Details	Adequate	Inadequate	Remarks
O.	Adoption of Non-Conventional Energy Sources/ Renewable Energy Sources			No	private is available.
P.	Bio-Gas Plant Solar Street Lights Rain Water Harvesting System		 yes yes	No.	
Q.	Any Other			No	

7. **Data Collection From Village**

Village Base Map	yes
Available: Hard Copy/Soft Copy	Hard and soft copy

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Techno Economic Survey

Recent Projects going on for Development of Village	Water Connection Project
Any NGO working for village development	No

8. **Additional Information/ Requirement:**

Sr. No.	Descriptions	Information/ Detail	Remarks
1.	Repair & Maintenance of Existing Public Infrastructure facilities(School Building, Health Center, Panchayat Building, Public Toilets & any other)		
2.	Additional Information/ Requirement		

9. **Smart Village Proposal Design**

Sr. No.	Descriptions	Information/ Detail	Remarks
1.			

Note: Photographs/ Video/ Drawings of all existing Infrastructure facilities & conditions should be taken by students of respective villages for their record and information.

For Any Administration queries/ Difficulties:
GTU VY Section:
Contact No – 079-23267588
Email ID: rurban@gtu.edu.in

સરપંચ,
શાપર (વે.) ગ્રામ પંચાયત

તલાટી-કમ-મંત્રી
શાપર (વે.) ગ્રામ પંચાયત

Nodal officer

12.2 Survey form of Smart Village Scanned copy attachment in the report for Part-I Survey form of Smart Village Original copy attachment in the report for Part-II

Veraval

Gujarat Technological University, Ahmedabad, Gujarat

Vishwakarma Yojana: Phase VIII
Techno Economic Survey

Techno Economic Survey

Vishwakarma Yojana: Phase VIII

SMART VILLAGE SURVEY

An approach towards **"Rurbanisation for Village Development"**

Name of District:	Rajkot
Name of Taluka:	Kotda Sanghani
Name of Village:	Veraval.
Name of Institute:	Shri Labhubhai Trivedi Institute of engg. and techno.
Nodal Officer Name & Contact Detail:	Prof. Mehul M Chavda 9427665085
Respondent Name: (Sarpanch/ Panchayat Member/ Teacher/ Gram Sevak/ Aaganwadi worker/Village dweller)	Takai Mansbhi S 6 9859174
Date of Survey:	27-10-2020

I. DEMOGRAPHICAL DETAIL:

Sr. No.	Census	Population	Male	Female	Total Number of House Holds
1.	2001	13332	7751	5581	3029
2.	2011	19152	10535	8617	4020

II. GEOGRAPHICAL DETAIL:

Sr. No.	Description	Information/Detail
1.	Area of Village (Approx.) (In Hector)Coordinates for Location:	1031.5 hec. 22.149739, 70.605357
2.	Forest Area (In hect.)	0
3.	Agricultural Land Area (In hect.)	758 (hect).
4.	Residential Area (In hect.)	—
5.	Other Area (In hect.)	218.5 (hect).
6.	Distance to the nearest railway station (in kilometers):	Ribda (6.4 Km)

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7.	Name of Nearest Town with Distance:	Rajkot (12 Km)
8.	Distance to the nearest bus station (in kilometers):	Rajkot (17 Km)
9.	Whether village is connected to all road for the any facility or town or City?	Yes.

III. OCCUPATIONAL DETAILS:

Name of Three Major Occupation groups in Village	1. Bearing Industries
	2. Casting Industries
	3. Farming.

Major crops grown in the village:	1. Cotton
	2. ghound nuts.
	3. Grains

IV. PHYSICAL INFRASTRUCTURE FACILITIES:

Sr. No.	Descriptions	Detail	Adequate	Inadequate	Remarks
A.	**Main Source of Drinking water**				
1.	PIPED WATER				
	Piped Into Dwelling		yes		
	Piped To Yard/Plot		yes		
	Public Tap/Standpipe		yes		
	Tube Well Or Bore Well	well-2 Tube-1	yes		
2.	**DUG WELL**				
	Protected Well	2Nos			
	Un Protected Well		yes		
3.	**WATER FROM SPRING**				
	Protected Spring			NO	
	Unprotected Spring			NO	
	Rainwater		yes		
	Tanker Truck		yes		
	Cart With Small Tank		yes		
4.	**SURFACE WATER (RIVER/DAM/ LAKE/POND/STREAM/CANAL/**				
	Irrigation Channel			No	
	Bottled Water		yes		
	Hand Pump			NO	
	Other(Specify)**Lake/ Pond**			NO	

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Suggestions if any:

B.	**Water Tank Facility**				
	Overhead Tank	Capacity: 5 lakh lit.	yes		2 Nos
	Underground Sump	Capacity 27 lakh lit	yes		5 Nos
Suggestions if any:					
C.	**The Type of Drainage Facility**				
	A. UNDERGROUND DRAINAGE 1 2 B. OPEN WITH OUTLET C. OPEN WITHOUT OUTLET		yes yes	No	100% ondergroond drainage.
Suggestions if any:					
D.	**Road Network :All Weather/ Kutchha (Gravel)/ Black Topped pucca/ WBM**				
	Village approach road	Pacca	yes		
	Main road	Pacca	yes		
	Internal streets	Pacca	yes		
	Nearest NH/SH/MDR/ODR Dist. in kms.	NH-8 (0 km)	yes		
Suggestions if any:					
E.	**Transport Facility**				
	Railway Station (Y/N) (If No than Nearest Rly Station---Kms)			No	Ribda 6.4 km
	Bus station (Y/N) Condition: (If No than Nearest Bus Station---Kms)	Aaskot 17 km		No	Local bos avalible only
	Local Transportation (Auto/ Jeep/Chhakda/ Private Vehicles/ Other)	All type	yes		
Suggestions if any:					
F.	**Electricity Distribution**				
	(Y/N) Govt./ Private (Less than 6 hrs./ More Than 6 hrs)	More then 6 hars	yes		

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	Power supply for Domestic Use		yes		
	Power supply for Agricultural Use		yes		
	Power supply for Commercial Use		yes		
	Road/ Street Lights		yes		
	Electrification in Government Buildings/ Schools/ Hospitals		yes		
	Renewable Energy Source Facilities (Y/ N)			No	
	LED Facilities		yes		
Suggestions if any:					
G.	**Sanitation Facility**				
	Public Latrine Blocks If available than Nos.	1 Nos	yes		
	Location Condition	Good	yes		
	Community Toilet (With bath/ without bath facilities)	with bath	yes		
	Solid & liquid waste Disposal system available	both.	yes		
	Any facility for Waste collection from road		yes		
Suggestions if any:					
H.	**Main Source of Irrigation Facility:**				
	TANK/POND	2 Nos Tank	yes		
	STREAM/RIVER			No	
	CANAL			No	
	WELL	2 Nos	yes		
	TUBE WELL	1 Nos.	yes		
	OTHER (SPECIFY)	—	—	—	—
Suggestions if any:					
I.	**Housing Condition:**				
	Kutchha/Pucca (Approx. ratio)	2 Nos Kachha 4021 Pucca	yes		

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V. SOCIAL INFRASTRUCTURAL FACILITIES:

Sr. No.	Descriptions	Information/ Detail	Adequate	Inadequate	Remarks
J.	**Health Facilities:**				
	ICDS (Anganwadi)	10 Nos	yes		
	Sub-Centre	4 Nos	yes		15 KM Rakot
	PHC			No	15 km Rajkot
	BLOCK PHC			No	
	CHC/RH			No	
	District/ Govt. Hospital			No	
	Govt. Dispensary		yes		
	Private Clinic	10 Nos	yes		
	Private Hospital/ Nursing Home	1 Nos	yes		
	AYUSH Health Facility	1 Nos	yes		Provide
	sonography /ultrasound facility			No No	15 Km Rajkot
	If any of the above Facility is not available in village than approx. distance from village: ..15....kms.				
Suggestions if any:					
K.	**Education Facilities:**				
	Aaganwadi/ Play group	10 Nos	yes		
	Primary School	11 Nos 6 Govt. 5 Private	yes		
	Secondary school	2 Nos Both Private	yes		
	Higher sec. School	Private school	yes		
	ITI college/ vocational Training Center			No	15 km Rajkot
	Art, Commerce& Science /Polytechnic/ Engineering/ Medical/ Management/ other college facilities			No	All Colage located at Rajkot.
	If any of the above Facility is not available in village than approx. distance from village: ..15...kms.				

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Suggestions if any:

L.	Socio- Culture Facilities	Condition	Location	Available (YES)	Available (NO)
	Community Hall (With or without TV)	Good		yes	
	Public Library (With daily newspaper supply: Y/N)		15Km Rajkot.		No
	Public Garden			yes	
	Village Pond			yes	
	Recreation Center				No
	Cinema/ Video Hall				No
	Assembly Polling Station			yes	
	Birth & Death Registration			yes	

If any of the above Facility is not available in village than approx. distance from village: 15.....kms.

Suggestions if any:

M.	Other Facilities	Condition	Location	Available (YES)	Available (NO)
	Post-office	Good.	Gram Panchayat	yes	
	Telecommunication Network/ STD booth				No
	General Market		Main Road	yes	
	Shops (Public Distribution System)		SJDC Road	yes	
	Panchayat Building	Very good.		yes	
	Pharmacy/Medical Shop			yes	
	Bank & ATM Facility			yes	
	Agriculture Co-operative Society			yes	
	Milk Co-operative Soc.			yes	
	Small Scale Industries			yes	
	Internet Cafes/ Common Service Center/Wi Fi				No
	Youth Club			yes	
	Mahila Mandal			yes	

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	Credit Cooperative Society Agricultural Cooperative Society Milk Cooperative Society Fishermen's Cooperative Society Computer Kiosk/ e-chaupal / Mills / Small Scale Industries			No	
	Other Facility				

Suggestions if any:

N.	Other Facilities	Condition		Available (YES)	Available (NO)
	1. Have these programme implemented the village? 2. Are there any beneficiaries in the village from the following programme? 3. Janani Suraksha Yojana 4. Kishori Shakti Yojana 5. Balika Samriddhi Yojana 6. Mid-day Meal Programme 7. Intergrated Child Development Scheme (ICDS) 8. Mahila Mandal Protsahan Yojana (MMPY) 9. National Food for work Programme (NFFWP) 10. National Social Assistance Programme 11. Sanitation Programme (SP) 12. Rajiv Gandhi National Drinking Water Mission 13. Swarnjayanti Gram Swarozgar Yojana 14. Minimum Needs Programme (MNP) 15. National Rural Employment Programme 16. Employee Guarantee Scheme (EGS) 17. Prime Minister Rojgar Yojana (PMRY) 18. Jawahar Rozgar Yojana (JRY) 19. Indira Awas Yaojna (IAY) 20. Samagra Awas Yojana (SAY) 21. Sanjay Gandhi Niradhar Yojana (SGNY) 22. Jawahar Gram Samridhi Yojana (JGSY) 23. Other (SPECIFY)		–	yes yes yes yes yes yes	No No No No No No No No No No No No

VI. SUSTAINABLE /GREEN INFRASTRUCTURE FACILITIES:

Sr. No.	Descriptions	Information/ Details	Adequate	Inadequate	Remarks
1.	Adoption of Non-Conventional Energy Sources/ Renewable Energy Sources			No	
2.	Bio-Gas Plant Solar Street Lights Rain Water Harvesting System	solar street light; water harvesting.	yes yes		
3.	Any Other			No	

VII. DATA COLLECTION FROM VILLAGE

Sr. No.	Descriptions	Information/ Details	Adequate	Inadequate	Remarks
1.	Village Base Map Available: Hard Copy/Soft Copy		yes		
2.	Recent Projects going on for Development of Village			No	
3.	Any NGO working for village development			No	
4.	Any natural calamity in the village during the last one year: EARTHQUAKES FLOODS CYCLONE DROUGHT LANDSLIDES AVALANCHE OTHER (SPECIFY)			No No No No No No No	

VIII. ADDITIONAL INFORMATION/ REQUIREMENT:

Sr. No.	Descriptions	Information/ Detail	Remarks

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1.	Repair & Maintenance of Existing Public Infrastructure facilities, School Building Health Center Panchayat Building Public Toilets & any other		No
2.	Additional Information/ Requirement		No
3.	During the last six months how many times CLEANING …………………………… FOGGING…………………………… Drive was undertaken in the village?	4 times	yes No

IX. Smart Village / Heritage Details

Sr. No.	Descriptions	Information/ Detail	Remarks
1.	IS THEIR ANY THING FOR THE VILLAGE ENHANCEMENT POSSIBLE ?		Not Needed.

Note: Photographs/ Video/ Drawings of all existing Infrastructure facilities & conditions should be taken by students of respective villages for their record and information.

For Any Administration queries/ Difficulties:
GTU VY Section
Contact No – 079-23267588
Email ID: rurban@gtu.edu.in

Prof. Mehul Chhanda
Nodal officer.

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12.3 Survey form of Allocated Village Scanned copy attachment in the report for Part-I Survey form of Allocated Village Original copy attachment in the report for Part-II

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Vishwakarma Yojana: Phase VIII

ALLOCATED VILLAGE SURVEY

An approach towards **"Rurbanisation for Village Development"**

Name of District:	RajRot
Name of Taluka:	Gondal
Name of Village:	Derdi Kumbhaji
Name of Institute:	Shri Labhubhai Trivedi Insti. of engg & Techo.
Nodal Officer Name & Contact Detail:	Prof. Mehul Makwana 9427665085
Respondent Name: (Sarpanch/ Panchayat Member/ Teacher/ Gram Sevak/ Aaganwadi worker/Village dweller)	Shailesh bhai Khatna (Sarpanch)
Date of Survey:	24-10-2020

I. DEMOGRAPHICAL DETAIL:

Sr. No.	Census	Population	Male	Female	Total Number of House Holds
1.	2001	8082	4140	3942	1518
2.	2011	8450	4335	4115	1770

II. GEOGRAPHICAL DETAIL:

Sr. No.	Description	Information/Detail
1.	Area of Village (Approx.) (In Hector)Coordinates for Location:	3169.6 hect.
2.	Forest Area (In hect.)	3.23 hect.
3.	Agricultural Land Area (In hect.)	350 hect.
4.	Residential Area (In hect.)	
5.	Other Area (In hect.)	—.
6.	Distance to the nearest railway station (in kilometers):	Gondal (36.7 km)

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7.	Name of Nearest Town with Distance:	Gondal 30 K.M.
8.	Distance to the nearest bus station (in kilometers):	Gondal 30 K.M. (ST Bus Stop) at Derdi but there is not a bus stand
9.	Whether village is connected to all road for the any facility or town or City?	yes.

III. OCCUPATIONAL DETAILS:

Name of Three Major Occupation groups in Village	1.	Farmer
	2.	Small business.
	3.	Animal Husbandary

Major crops grown in the village:	1.	Ground nut
	2.	Cotton.
	3.	Wheat.

IV. PHYSICAL INFRASTRUCTURE FACILITIES:

Sr. No.	Descriptions	Detail	Adequate	Inadequate	Remarks
A.	**Main Source of Drinking water**				
1.	**PIPED WATER** Piped Into Dwelling Piped To Yard/Plot Public Tap/Standpipe Tube Well Or Bore Well	yes	✓		
2.	**DUG WELL** Protected Well Un Protected Well	—	✓	—	Not usable.
3.	**WATER FROM SPRING** Protected Spring Unprotected Spring Rainwater Tanker Truck Cart With Small Tank	— — — × — —		×	
4.	**SURFACE WATER (RIVER/DAM/ LAKE/POND/STREAM/CANAL/** Irrigation Channel Bottled Water Hand Pump	yes	✓		Not usable in rainy season

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	Other(Specify)Lake/ Pond			✓	—
Suggestions if any:					
B.	**Water Tank Facility**				
	Overhead Tank	Capacity:	1 Tank	1 lakh lit.	
	Underground Sump	Capacity:	2 tanks	1 - lakh liter	1 - 2 lakh lit. liter
Suggestions if any:					
C.	**The Type of Drainage Facility**				
	A. UNDERGROUND DRAINAGE 1		✓		80% Remain.
Suggestions if any:					
D.	**Road Network :All Weather/ Kutchha (Gravel)/ Black Topped pucca/ WBM**				
	Village approach road		✓		50% Remain
	Main road		✓		
	Internal streets		✓		50% Remain.
	Nearest NH/SH/MDR/ODR Dist. in kms.		✓		NH-8 Gondal Rajkot 30 km. Away from village
Suggestions if any:					
E.	**Transport Facility**				
	Railway Station (Y/N) (If No than Nearest Rly Station---Kms)			✓	Gondal 36.7 km from village to railway
	Bus station (Y/N) Condition: (If No than Nearest Bus Station---Kms)			✓	30 km Gondal from village Gondal bus stand
	Local Transportation (Auto/ Jeep/Chhakda/ Private Vehicles/ Other)			✓	Jeeps, Chhakda other private.
Suggestions if any:					
F.	**Electricity Distribution**				
	(Y/N) Govt./ Private (Less than 6 hrs./ More Than 6 hrs)		✓		

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	Power supply for Domestic Use		✓		
	Power supply for Agricultural Use		✓		
	Power supply for Commercial Use		✓		
	Road/ Street Lights		✓		
	Electrification in Government Buildings/ Schools/ Hospitals		✓		
	Renewable Energy Source Facilities (Y/ N)			✗	
	LED Facilities		✓		50 % Led lights
Suggestions if any:					
G.	**Sanitation Facility**				
	Public Latrine Blocks If available than Nos.	1 Nos	✓		
	Location Condition				Usable
	Community Toilet (With bath/ without bath facilities)			✓	
	Solid & liquid waste Disposal system available		✓		only solid waste Disposal
	Any facility for Waste collection from road			✓	
Suggestions if any:					
H.	**Main Source of Irrigation Facility:**				
	TANK/POND STREAM/RIVER CANAL WELL TUBE WELL OTHER (SPECIFY)	Tube well	✓		
Suggestions if any:					
I.	**Housing Condition:**				
	Kutchha/Pucca (Approx. ratio)	40 % Kachha	✓		

V. SOCIAL INFRASTRUCTURAL FACILITIES:

Sr. No.	Descriptions	Information/ Detail	Adequate	Inadequate	Remarks
J.	**Health Facilities:**				
	ICDS (Anganwadi)	6 Nos	✓		
	Sub-Centre	1 Nos	✓		
	PHC	1 Nos	✓		
	BLOCK PHC			✓	
	CHC/RH			✓	
	District/ Govt. Hospital			✓	
	Govt. Dispensary			✓	
	Private Clinic	4 Nos	✓		
	Private Hospital/		✓	✓	
	Nursing Home			✓	
	AYUSH Health Facility		✓		
	sonography /ultrasound facility			✓	
	If any of the above Facility is not available in village than approx. distance from village: ....kms.				
Suggestions if any:					
K.	**Education Facilities:**				
	Aaganwadi/ Play group				
	Primary School		✓		
	Secondary school		✓		
	Higher sec. School		✓		
	ITI college/ vocational Training Center			✓	
	Art, Commerce& Science /Polytechnic/ Engineering/ Medical/ Management/ other college facilities	Arts Phivate Collage.	✓		

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If any of the above Facility is not available in village than approx. distance from village: ..30.....kms.

Suggestions if any:

L.	Socio- Culture Facilities	Condition	Location	Available (YES)	Available (NO)
	Community Hall (With or without TV)				✓
	Public Library (With daily newspaper supply: Y/N)				✓
	Public Garden				✓
	Village Pond				✓
	Recreation Center				✓
	Cinema/ Video Hall				✓
	Assembly Polling Station				✓
	Birth & Death Registration Office		Gram Panchayat	✓	

If any of the above Facility is not available in village than approx. distance from village: ....kms.

Suggestions if any:

M.	Other Facilities	Condition	Location	Available (YES)	Available (NO)
	Post-office			✓	
	Telecommunication Network/ STD booth				✓
	General Market			✓	
	Shops (Public Distribution System)			✓	
	Panchayat Building			✓	✓
	Pharmacy/Medical Shop	Good		✓	
	Bank & ATM Facility	Good		✓	
	Agriculture Co-operative Society	Good		✓	
	Milk Co-operative Soc.	Good		✓	
	Small Scale Industries			✓	
	Internet Cafes/ Common Service Center/Wi Fi				✓
	Youth Club				✓
	Mahila Mandal			✓	

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	Credit Cooperative Society Agricultural Cooperative Society Milk Cooperative Society Fishermen's Cooperative Society Computer Kiosk/ e-chaupal / Mills / Small Scale Industries				✓
	Other Facility				✓

Suggestions if any:

N.	Other Facilities	Condition		Available (YES)	Available (NO)
	1. Have these programme implemented the village?			✓	
	2. Are there any beneficiaries in the village from the following programme?			✓	
	3. Janani Suraksha Yojana			✓	✓
	4. Kishori Shakti Yojana			✓	
	5. Balika Samriddhi Yojana			✓	
	6. Mid-day Meal Programme			✓	
	7. Intergrated Child Development Scheme (ICDS)				✓
	8. Mahila Mandal Protsahan Yojana (MMPY)			✓	
	9. National Food for work Programme (NFFWP)				✓
	10. National Social Assistance Programme				✓
	11. Sanitation Programme (SP)				✓
	12. Rajiv Gandhi National Drinking Water Mission				✓
	13. Swarnjayanti Gram Swarozgar Yojana				✓
	14. Minimum Needs Programme (MNP)				✓
	15. National Rural Employment Programme				✓
	16. Employee Guarantee Scheme (EGS)				✓
	17. Prime Minister Rojgar Yojana (PMRY)				✓
	18. Jawahar Rozgar Yojana (JRY)				✓
	19. Indira Awas Yaojna (IAY)				✓
	20. Samagra Awas Yojana (SAY)				✓
	21. Sanjay Gandhi Niradhar Yojana (SGNY)				✓
	22. Jawahar Gram Samridhi Yojana (JGSY)				✓
	23. Other (SPECIFY)				✓

VI. SUSTAINABLE /GREEN INFRASTRUCTURE FACILITIES:

Sr. No.	Descriptions	Information/ Details	Adequate	Inadequate	Remarks
1.	Adoption of Non-Conventional Energy Sources/ Renewable Energy Sources			✓	
2.	Bio-Gas Plant Solar Street Lights Rain Water Harvesting System			✓	
3.	Any Other			✓	

VII. DATA COLLECTION FROM VILLAGE

Sr. No.	Descriptions	Information/ Details	Adequate	Inadequate	Remarks
1.	Village Base Map Available: Hard Copy/Soft Copy			✓	
2.	Recent Projects going on for Development of Village			✓	
3.	Any NGO working for village development			✓	
4.	Any natural calamity in the village during the last one year: EARTHQUAKES FLOODS CYCLONE DROUGHT LANDSLIDES AVALANCHE OTHER (SPECIFY)			✓	

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VIII. ADDITIONAL INFORMATION/ REQUIREMENT:

Sr. No.	Descriptions	Information/ Detail	Remarks
1.	Repair & Maintenance of Existing Public Infrastructure facilities, School Building, Health Center, Panchayat Building, Public Toilets & any other	✓	In Progress
2.	Additional Information/ Requirement		
3.	During the last six months how many times CLEANING ………………………. FOGGING………………………… Drive was undertaken in the village?	No	

IX. Smart Village / Heritage Details

Sr. No.	Descriptions	Information/ Detail	Remarks
1.	IS THEIR ANY THING FOR THE VILLAGE ENHANCEMENT POSSIBLE ?		

Note: Photographs/ Video/ Drawings of all existing Infrastructure facilities & conditions should be taken by students of respective villages for their record and information.

For Any Administration queries/ Difficulties:
GTU VY Section
Contact No – 079-23267588
Email ID: rurban@gtu.edu.in

સરપંચ
દેરડી(કું.) ગ્રામ પંચાયત

દેરડી(કુંભાજી) ગ્રામ પંચાયત તા.ગોંડલ,જી.રાજકોટ

તલાટી કમ મંત્રી
ગ્રામ પંચાયત દેરડી (કું.)-૨

nodal officer

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12.4 Gap Analysis of the Allocated Village

VILLAGE GAP Analysis					
Village Facilities	**Planning Commission/UDPFI Norms**	**Village Name:**	**DERDI KUMBHAJI**		
		Population: 9400			
		Existing	**Required as per Norms**	**Smart Village /Cities /Heritage Future Projection Design**	**Gap**
Social Infrastructure Facilities					
Education				-	
Primary School	Each Per 2500 population	1	1	-	0
Anganwadi	Each or Per 2500 population	6	1	-	5
Secondary School	Per 7,500 population	1	1	-	0
Higher Secondary School	Per 15,000 Population	1	1	-	0
College	Per 125,000 Population	1(Pvt. Arts)	0	-	1
Tech. Training Institute	Per 100000 Population	0	0	-	0
Agriculture Research Centre	Per 100000 Population	0	0	-	0
Skill Development Centre	Per 100000 Population	0	0	-	0
Health Facility				-	
Got/Panchayat Dispensary or Sub PHC or Health Centre	Each Village	1	1	-	0
Primary Health & Child Health Centre	Per 20,000 population	0	1	-	1
Child Welfare and Maternity Home	Per 10,000 population	0	0	-	0
Multispecialty Hospital	Per 100000 Population	0	0	-	0
Public Latrines	1 for 50 families (if toilet is not there in home, especially for slum pockets & kutcha house)	1	1	-	0
Physical Infrastructure Facilities					
Transportation		**Adequate**		-	
Pucca Village Approach Road	Each village	**Adequate**		-	

Bus/Auto Stand provision	All Villages connected by PT (ST Bus or Auto)	**Adequate**	No pick up stand available (connected by ST bus, auto)		
Drinking Water (Minimum 70 lpcd)		**Adequate**		-	
Over Head Tank	1/3 of Total Demand	**Adequate**	1 No. (capacity:- 1 lakh lit)		
U/G Sump	2/3 of Total Demand	**Adequate**	2 No. (capacity:- 1 lakh lit, 2 lakh lit)		
Drainage Network - Open		**Adequate**	80% Remain		
Drainage Network - Cover		**Adequate**	20% only		
Waste Management System		**Adequate**		-	
Socio- Cultural Infrastructure Facilities					
Community Hall	Per 10000 Population	0	1	-	1
community hall and Public Library	Per 15000 Population	0	1	-	1
Cremation Ground	Per 20,000 population	1	1	-	0
Post Office	Per 10,000 population	1	0	-	0
Gram Panchayat Building	Each individual/group panchayat	1	1	-	0
APMC	Per 100000 Population	0	0	-	0
Fire Station	Per 100000 Population	0	0	-	0
Public Garden	Per village	0	1	-	0
Police post	Per 40,000Population	0	1	-	0
Shopping Mall	Individual shops available				
Electrical Design					
Electricity Network		**Adequate**		-	
Any Smart Village Facility					
Technology				-	
				-	
				-	
		ESR cap	5 lakh	-	
		Sump cap	0	-	
		Lat	0	-	

(Table-41 Gap analysis)

12.5 Summary Details of All the Villages Designs in Table form as Part-I and Part-II

Sr. no.	Village Name	Discipline	Phase - I	Phase – II
1	**Khorana**	**Civil**	Public Toilet	ATM
			Bus Stand	Post office
			Community Hall	STP
			PHC Centre	Bank
			Public Garden	Rain water harvesting
			Public Library	Hall paver block
		Electrical	Solar roof top	Solar panel
			Street light	Power generator by river water
			Solar pump	Wind farm
2	**Movaiya**	**Civil**	Public garden	Bio gas plant
			Community hall	General market
			Public library	Anganwadi
			Bus stand	Post office
			Panchayat building	Godowan for agriculture product
			Public toilet	Atm
				Police station
		Electrical	House wiring	Solar library
			Street lighting	Commercial wiring
			Solar roof top	Solar street light
3	**Jaliya**	**Civil**	Chanakya Library	Soil testing laboratory
			Panchayat building	Garden
			Pay and use	Recreational center
			General market	Biogas plant
			Bus stand	Aganwadi
			Community hall	Solid waste collection
		Electrical	Solar street light	Smart garden
			Solar roof top	Solar laboratory
			Solar cleaning system	Irrigation by solar
4	**Isra**	**Civil**	Biogas plant	Community hall
			Garden	Solid waste collection
			Public toilet	Library
			Post office	Internal road
			Water harvesting	Recreational center

			Waste water treatment plant	Police station
		Electrical	Solar panel fitting	Small hydropower generation
			Solar street light	Temperature control fan
			Solar cleaning system	Water level indicates
5	**Meta khambliya**	**Civil**	Public library	Godown
			Community hall	Rain water harvesting
			Garden	Bank
			Water tank	Play ground
			Solid waste collection	Biogas plant
			Public toilet	Chabutro
6	**Visaman**	**Civil**	Compos pit	Biogas plant
			Public garden	PHC
			Solid waste management	Rain water harvesting
			Chabutro	Public library
			Shopping mall	ATM
			Community hall	Road
		Electrical	Pizo electrical generation	Solar street light
			Smart energy meter	Central control unit for irrigation water pump construction
			Solar tree	Electrical wiringand cost estimate of post office
7	**Nagar pipaliya**	**Civil**	Community hall + library	Internal road
			Post office	Public garden
			Panchayat building	Biogas plant
			Public toilet block	General market
			Skill development center	Canteen for old people
			Animal center	Fire station
		Electrical	Automatic on-off switch for water tank	Community hall wiring
			Photovolic water pump	Solar cleaning system
			Solar water purifier	Street light
8	**Derdi kumbhaji**	**Civil**	PHC	Rain water harsvesting
			Public library	Cyber café
			Community hall	Sill development center
			Public garden	Gym
			Police station	Soli testing laboratory

			Bachat mandali	Agriculture store
		Electrical	Solar street light installation design	CCTV
			Solar pump system	Solar roof installation design
			Pizo-electrical speed braker power generation design	Purification water plant

(Table-42 Summary details of all villages design Part-I and Part-II)

12.6 Drawings (If required A1, A2, A3 design is not visible then Only)

Note: All drawings are at the end of document.

12.7 Summary of Good Photographs in Table Format (village visits, Ideal, Smart Village or any other)

12.8 Village Interaction with sarpanch Report with the photograph

12.9 Sarpanch Letter giving information about the village development

MAHATMA GANDHI CHARITABLE TRUST MANAGED

SHRI LABHUBHAI TRIVEDI INSTITUTE OF ENGINEERING & TECHNOLOGY

SLTIET आत्मदिपोभवः

Approved by AICTE, New Delhi & Affiliated to GTU, Ahmedabad (Degree & Diploma)

Date:7/10/2020

To,
DDO,
Rajkot

Subject: Permission for Village Survey and data collection for study (project) purpose.

As per Vishwakarma Yojana Phase VIII guidelines, students of Shri Labhubhai Trivedi institute of engineering and technology selected different villages of Rajkot district as a part of project of GTU. Vishwakarma Yojana Phase VIII project is offered by GTU to the final year engineering students in which smart, developed and allocated village actual data are collected by students by taking visit of villages and students will gives the designs with a detail Design Plan, Estimation and Coasting of various units in the village.

The following villages are allocated to students for their projects.

1. KHORANA
2. MOVIYA
3. JALIYA
4. META KHAMBHALIYA
5. VISAMAN
6. NAGAR PIPALIYA
7. DERDI KUMBHAJI
8. ISRA

I request you to provide us permission letter so that Talati Mantri/Sarpanch can allow and help students by giving actual information and data about villages.

I request you to kindly support our project students. Be assuring that this project is allocated by **Government of Gujarat** to **Gujarat Technological University**. So, we are proposing the design for study purpose only.

For the development of village under "Vishwakarma Yojana Phase-8" project, we are expecting positive approach by you.

For
7/10/20
Prof. Mehul M Chavda
VY-Nodal officer,
SLTIET, Rajkot
Mo.9427665085

S.L.T.I.E.T. RAJKOT

7/10/2020
Dr. B M Ramani
Principal,
SLTIET, Rajkot
Mo.9825779590

Principal
Shri Labhubhai Trivedi Institute
of Engineering and Technology
Kalawad Road-Rajkot.

Mavdi, Nr. Government Engineering College, Kalawad Road, Rajkot - 360005,
Tel: (0281) 6564011-16, Fax: (0281) 2466150, Mob. : 99045 44407,
Web: www.ltiet.com, Mail: info@ltiet.com

12.10 Comprehensive report preparation as per format

We study ideal village and smart village concept through different source. We study some case study for ideal village and smart village development, identify new techniques and learn about sustainable development techniques.

We visit ideal village and smart village and study the existing situation of village. We see all facilities in village and see their condition. Major facilities are in good and workable condition. Over all village condition is good. We interact with both village serpanch and talatikam mantri. We discuss village condition with them and ask for necessary data for our survey.

After visiting ideal village and smart village we visit our allocated village derdi Kumbhaji. We visit village interact with sarpanch and talatikam mantri and a few of villagers. We see all the existing facilities of village take some good photograph of them we seem some lack of facilities in village and talk about that with serpanch.

After study the village and facilities at village we do gap analysis and then we identify some facilities that are not at village. We short list 6 design that are most important and we gave their plane elevation and section. We also give 3 electrical design.

We study and identify problems related with electrical and try to solve them with knowledge and new technique.

VY-PHASE-VIII-PART-II

Chapter: 13

From the Chapter- 9 future designs of the aspects (Feasibility, Construction, Operation and maintenance of various design options in Rural Areas along with cost with AutoCAD designs / planning with any software

13.1 Design Proposals

Sustainable Design – Rainwater harvesting
In Derdi Kumbhaji we give Rainwater harvesting as a Sustainable design. In Derdi Kumbhaji there are many houses which has not rainwater harvesting system. By providing this design they have not to face water related deficiency.

Physical Design – Gym
In Derdi Kumbhaji we gave Gym as a Physical design. It help to build their body and help to join defense or police force. It keep them healthy and fit.

Social Design – Cyber café
By providing cyber café people of Derdi can do all online work. They can do online shopping, online form fill up and many online activity. It promote digital Gujarat concept and it is also easy and convenient.

Socio-Culture Design – Skill development center
Skill development center help people of Derdi in means of different skills and woman empowerment also. In skill development center there is English class, embroidery class, seminar hall, computer lab and industrial training and equipment classes.

Smart village – Soil testing Laboratory
In Derdi Kumbhaji majority of villagers are farmer and by that means it is necessary that at least one soil testing laboratory is necessary. By soil testing laboratory farmers know their land nutrients and mineral.

Heritage Village – Agriculture Store
Majority population are cover with agriculture occupation. Agriculture store providing necessary equipment, pesticides and other small and some major equipment. It help farmer to make productive.

All the drawings, of proposed designs like plan, elevation and section, have been added at the end of report of part 2

13.1.1 Civil Design 1
Sustainable Design – Rainwater harvesting

Scenario:
Rooftop rainwater harvesting is the most common technique of rainwater harvesting for domestic consumption. In rural areas, this is most often done at small-scale. It is a simple, low-cost technique that requires minimum specific expertise or knowledge and offers many benefits. Rainwater is collected on the roof and transported with gutters to a storage reservoir, where it provides water at the point of consumption or can be used for recharging a well or the aquifer. Rainwater harvesting can supplement water sources when they become scarce or are of low quality like brackish groundwater or polluted surface water in the rainy season. However, rainwater quality may be affected by air pollution, animal or bird droppings, insects, dirt and organic matter. Therefore regular maintenance (cleaning, repairs, etc.) as well as a treatment before water consumption (e.g. filtration or/and disinfection) are very important.

Existing Situation in Derdi Kumbhaji
In Derdi Kumbhaji some of houses have rainwater harvesting system still majority houses are not have rainwater harvesting system. By providing rainwater harvesting they don't have to face water related difficulties. Rainwater harvesting also use for ground recharge.

Sustainability of the design
Rainwater Harvesting as an important structure
Design utilized by,
All villagers, sarpanch and talati and all local public.

Needs
For best utilization of rain water and drinking and other purposes.

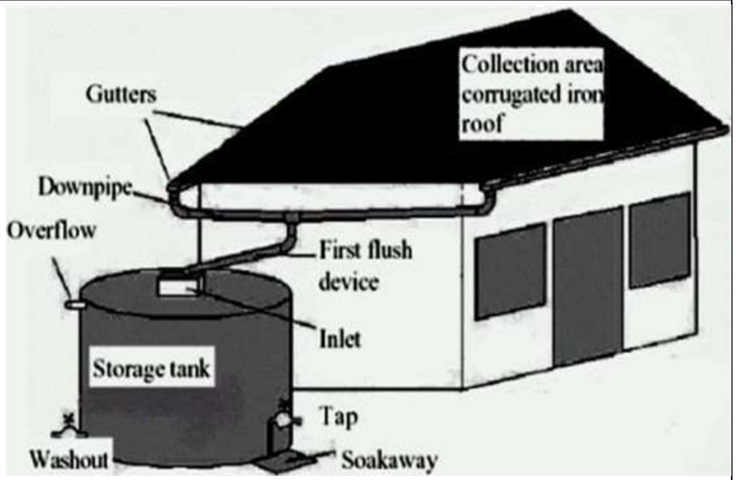
Design brief
Rainwater harvesting for storage of water and increase ground water level. It can be used for drinking, washing and curing and other purpose also.

Common repair and maintenance of the structure
Some common repairs and maintenances are as below; Exterior painting and plastering; Landscaping and gardening; Paving repairs; Carpeting and flooring; Plumbing; Repairing cracking or leaning walls etc**.**

Based on the requirement of the villager and by the survey, we have finalized some problems and requirement of the village. And then we have decided to provide rain water harvesting design, because the people of the village facing the scarcity of water. Need of the system
- ⇒ Increasing water needs/demands
- ⇒ Variations in water availability
- ⇒ Responsibilities towards protecting Nature
- ⇒ Advantage of collection and storage near the place of use
- ⇒ Quality of water supplies
- ⇒ Overall cost of the Rain water harvesting system is 2, 50,000.

Method of Collection rain water:
1. Surface runoff harvesting
2. Roof top rainwater harvesting

Rainwater harvesting is the collection and storage of rainwater for reuse on-site, Rather than allowing it to run off. These stored waters are used for various purposes such as Gardening, irrigation etc. Various methods of rainwater harvesting are described in this section.



(Fig – 76 Rainwater Harvesting)

1. Surface runoff harvesting

In urban area rainwater flows away as surface runoff. This runoff could be caught and used for recharging aquifers by adopting appropriate methods.

2. Roof Top rainwater harvesting

It is a system of catching rainwater where it falls. In rooftop harvesting, the roof becomes the catchments, and the rainwater is collected from the roof of the house/building. It can either be stored in a tank or diverted to artificial recharge system. This method is less expensive and very effective and if implemented properly helps in augmenting the ground Water level of the area.

Component of rainwater harvesting:
⇒ Catchments
⇒ Transportation
⇒ First flush
⇒ Filter

Catchments

The surface that receives rainfall directly is the catchment of rainwater harvesting System. It may be terrace, courtyard, or paved or unpaved open ground. The terrace may be flat RCC/stone roof or sloping roof. Therefore the catchment is the area, which actually Contributes rainwater to the harvesting system.

First Flush

First flush is a device used to flush off the water received in first shower. The first shower of rains needs to be flushed-off to avoid contaminating storable/rechargeable water by the probable contaminants of the atmosphere and the catchment roof. It will also help in cleaning of silt and other material deposited on roof during dry seasons Provisions of first rain separator should be made at outlet of each drainpipe.

Filter

There is always some skepticism regarding Roof Top Rainwater harvesting since doubts are raised that rainwater may contaminate groundwater. There is remote possibility of this fear coming true if proper filter mechanism is not adopted.

Secondly all care must be taken to see that underground sewer drains are not punctured and no leakage is taking place in close vicinity. Filters are used from treatment of water to effectively remove turbidity, color and microorganisms. After first flushing of rainfall, water should pass through filters. Gravel, Sand and 'netlon' mesh filter is designed and placed on top of the storage tank.

This filter is Very important in keeping the rainwater in the storage tank clean. It removes silt, dust, Leaves and other organic matter from entering the storage tank. The filter media should be cleaned daily after every rainfall event. Clogged filters prevent rainwater from easily entering the storage tank and the filter may overflow. The sand or gravel media should be taken out and washed before it is replaced in the filter.

Recharging ground water aquifers Ground water aquifers can be recharged by various kinds of structures to ensure Percolation of rainwater in the ground instead of draining away from the surface. Commonly used recharging methods are:-

- ⇒ Recharging of bore wells
- ⇒ Recharging of dug wells.
- ⇒ Recharge pits
- ⇒ Recharge Trenches
- ⇒ Soak ways or Recharge Shafts
- ⇒ Percolation Tanks

Process of Rainwater Harvesting

Rainwater harvesting is a technology used to collect, convey and store rain for later usage. It involves direct collection and storage of the run-off rainwater for direct use in future. The different usage of harvested rainwater can be for domestic purposes like cooking, washing and bathing and agriculture purposes like watering land, feeding cattle etc. It also can be artificially recharged into the ground which is the natural aquifer Rainwater Harvesting is the way to support Eco-system and Human well-being. One typical roof-top rainwater harvesting system consists of three basic components:

1. Catchments or roof surface to collect rainwater
2. Delivery system to transport the water from the roof to the storage reservoir (Gutters and drainpipes)
3. Storage reservoir or tank to store the water until it is used. The storage reservoir has an extraction device that- depending on the location of the tank- may be a Tape, rope and bucket, or a pump.

The construction of a Rain-Water- Harvesting system is determined by several Critical technical Factors:

- ⇒ Use of impermeable roofing material such as iron sheets, tiles, asbestos-cement
- ⇒ Availability of an area of at least 1 m2 near each house for constructing a storage tank
- ⇒ Water consumption rate (number of users and types of uses) and storage capacity Required
- ⇒ Availability of other water sources, either ground water or surface water that can be used
- ⇒ When stored rainwater runs out Availability of laborers with technical building skills in or nearby the community

Availability of required, suitable local construction material:

To determine what you might collect:

1. First, determine the size of the collection area in square feet by multiplying the length by the width. For example, if the roof of my house is 20’ by 80’, then the size of the area is 1600 square feet. 20’ x 80’ = 1600 sq. feet

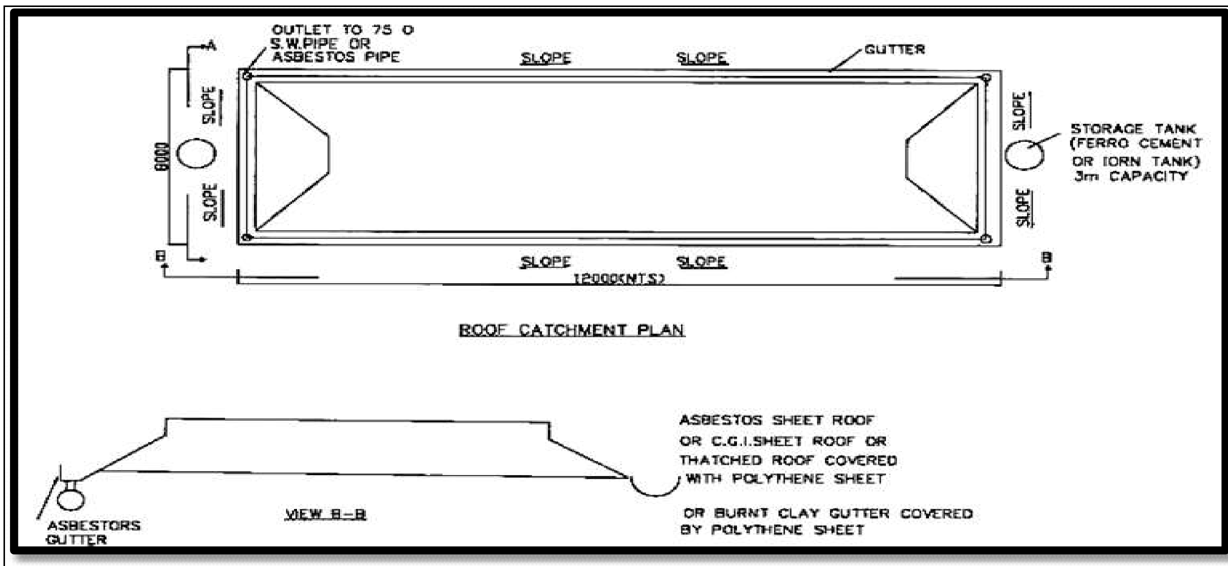
2. Since, for every inch of rainfall, we can expect to collect 600 gallons on 1000 square feet of collection area that means that every square foot of roof will collect 0.6 gallons of rainwater for every inch of rain that falls (1000 / 6oo = 0.6).

3. To calculate how much rainfall will collect on each square foot of my roof over the entire rainy season, multiply the amount collected per inch of rainfall, 0.6 gallons, by the total number of inches of rainfall during the rainy season (the 30-year average in Santa Rosa is 29”). 29” x 0.6 gallons = 17.4 gallons per square foot

4. Then, to calculate the number of gallons I will collect on entire my roof, I Multiplying the total roof area of 1600 square feet by 17.4 gallons.
1600 x 17.4 =27,840 gallons

How much will it cost to catch rain?
When community come together to harvest rain, the per-capita investment goes down.

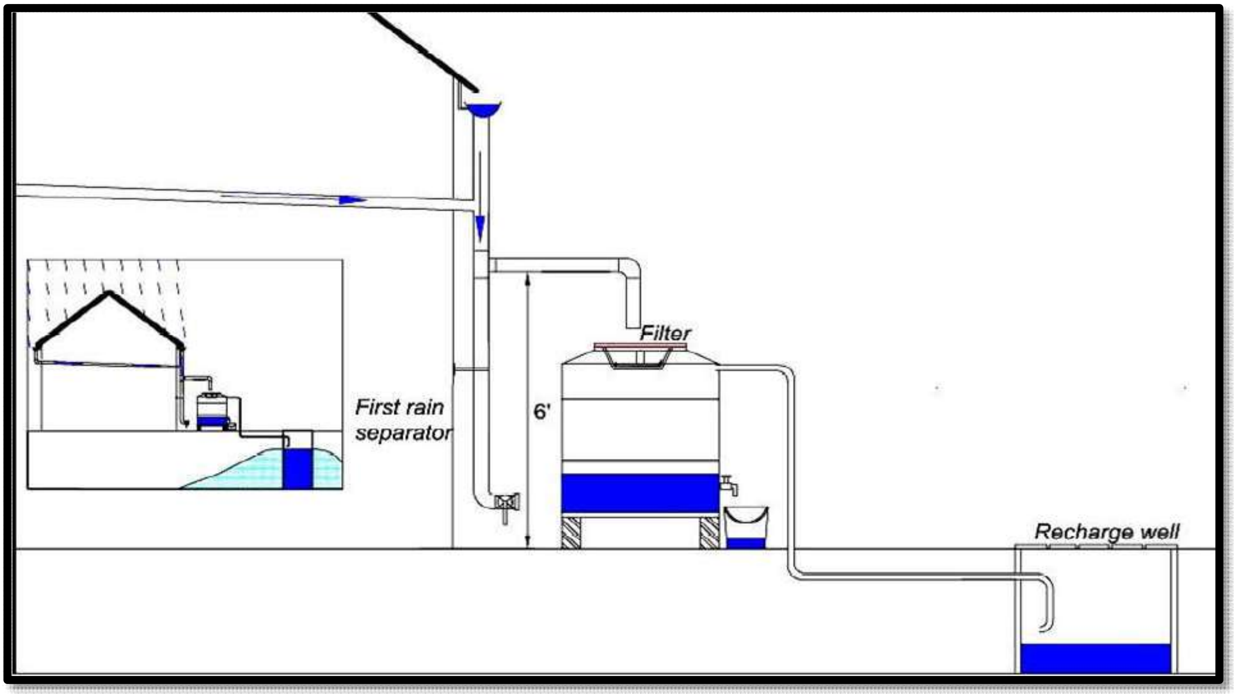
Water availability
In the village, there is one overhead water tanks available. One has capacity is 1,00,000 litter.



(Fig – 77 Roof catchment plan)

PART	LENGH(m)	WIDTH (m)	AREA (sq.m)
1	10.3	8.5	87.55

PLAN OF RAIN HARWESTING SYSTEM



(Fig – 78 Plan of rainwater harvesting system)

HARVESTING SYSTEM

Average rainfall 590 mm.

Density of water 1000 lit/m3

Collection of water volume = area × rainfall

= 87.55 × .590

= 51.65 m3

Collection of water = volume of water × density of water

= 51.65 × 1000

= 51,650 litre

	Width	Length	Height
Filter tank	1	1	1
Underground tank	1.2	3	3
Overhead tank	1	1	1

(Table-43 Dimensions of tank)

QUANTITY:

Description	Length (m)	Width (m)	Height (m)	Volume (m^3)
FILTER TANK	-	-	-	0
WATER TANK	3	1.2	3	10.8
OVER FLOW TANK	1	1	1	1
			Total = 11.8	

(Table-44 Quantity sheet)

	Description	No	L (m)	B (m)	H/D (m)	Qty.(m^3)
ILLTER TANK	Bottom Slab	1	1	1	0.15	0.15
	Side wall	4	1	1	0.15	0.6
	Top slab	1	1	1	0.1	0.1
VATER TANK	Bottom Slab	1	3	1.2	0.2	0.72
	Side wall	2	3	3	0.2	3.6
	Side wall	2	3	1.2	0.2	1.44
	Top slab	1	3	1.2	0.1	0.36
Deduction	Opening cover	1	0.5	0.5	0.1	-0.025
ER FLOW TANK	Bottom slab	1	1	1	0.15	0.15
	Side wall	4	1	1	0.15	0.6
	Sop slab	1	1	1	0.1	0.1
					Total = 7.795	

(Table-44 Quantity sheet)

ESTIMATE OF RAIN WATER HARVWSTING SYSTEM
RATE ANALYSIS OF MATERIALS

Item	Unit	Rate
Excavation in soil	Cu. m.	120.00
ith cement mortar (1:6)	Cu. m.	1400.00
Plain cement concrete (1:3:6)	Cu. m.	1500.00
Reinforced cement concrete(1:2:4) Including steel bars, shuttering etc.	Cu. m.	5000.00
PVC piping for rainwater pipes 110 mm Diameter	Meter	180.00
200 mm diameter	meter	300.00
ng borehole in metre 165.00Soft soil (with 150 mm diameter)	Meter	180.00

(Table-45 Rate analysis sheet)

ABSTRACT SHEET

Description	Unit	Rate	Quantity	Cost
Excavation in soils	cum.	120	11.8	1416
Reinforced Cement concrete (1:2:4) cu. m. 5000.00 Including steel bars, shuttering etc.	cum.	5000	7.795	38975
- 110 mm diameter	M	180	3	540
- 200 mm diameter	M	300	8	2400
PVC roof cover	Sq.m	7200	0.025	180
			Cost	43511
			Lump sum	45000
			10%	4500
			Total cost = 49500	

(Table-46 Abstract sheet)

13.1.2 Civil Design 2
Physical Design – Gym

Scenario:
Regular physical activity can improve your muscle strength and boost your endurance. Exercise delivers oxygen and nutrients to your tissues and helps your cardiovascular system work more efficiently. And when your heart and lung health improve, you have more energy to tackle daily chores.

Existing Situation in Derdi Kumbhaji
There is no Gym in Derdi Kumbhaji.

Sustainability of the design
Gym as an important structure
Design utilized by,
People living in the village of even outsiders from nearby villages and relatives of the villagers can use or utilize a cybercafé for their different uses.

Needs
For health purpose.

Design brief
Gym design for Derdi Kumbhaji as a Physical Design.

Common repair and maintenance of the structure
Some common repairs and maintenances are as below; Exterior painting and plastering; Landscaping and gardening; Paving repairs; Carpeting and flooring; Plumbing; Repairing cracking or leaning walls etc**.**

Quantity Sheet of Gym

Sr.	Item Description	No.	L (m)	B (m)	H (m)	Qty. (m^3)
1	**Excavation in foundation**	1	110.7	0.9	1.2	119.56
2	**PCC in foundation**	1	110.7	0.9	0.2	19.92
3	**Brick Work in Foundation**					
	1st step	1	111.9	0.6	0.3	20.14
	2nd step	1	112.3	0.5	0.3	16.84
	3rd step	1	112.7	0.4	0.3	13.52
	Up to plinth	1	113.1	0.3	0.1	3.39
					Total = 53.89 cum.	
4	**Sand filling**					
	Office	1	6	5	0.6	18
	Waiting area	1	6	2	0.6	7.2

	Man toilet + steam bath	1	6	5	0.6	18
	Women toilet + steam bath	1	6	4.4	0.6	15.84
	Main hall	1	14.7	17.3	0.6	152.58
					Total = 211.62 cum.	
5	**Brick Work in Super Structure**	1	113.1	0.3	3.66	124.18
	Deduction of doors and Windows					
	MD	1	1.5	0.3	2	0.9
	D1	3	1	0.3	2	1.8
	W1	6	3.5	0.3	1.5	9.45
	W2	3	2	0.3	1.5	2.7
	V	4	0.5	0.3	0.5	0.3
					Total = 15.15 cm.	
	Total Brick Work = 109.03 cm.					
6	**R.C.C. Slab**	1	17.3	21.6	0.15	56.05
7	**Brick Work in Parapet**					
	H. Wall	2	21.6	0.3	1	12.96
	V. Wall	2	17.3	0.3	1	10.38
					Total = 23.34 cm.	
8	**Plaster Work (inside)**					
	Office					
	H. wall	2	6	-	3.66	43.92
	V. wall	2	5	-	3.66	36.6
	Waiting area					
	H. wall	2	6	-	3.66	43.92
	V. wall	1	2	-	3.66	7.32
	Men Toilet + steam bath					
	H. wall	2	6	-	3.66	43.92
	V. wall	2	5	-	3.66	36.6
	Women Toilet + steam bath					
	H. wall	2	6	-	3.66	43.92
	V. wall	2	4.4	-	3.66	32.21
	Main hall					
	H. wall	2	14.7	-	3.66	107.60
	V. wall	2	17.3	-	3.66	126.63
					Total = 522.64 sqm.	
	Deduction of Doors and Windows					
	MD	½	1.5	-	2	1.5

	D1	3	1	-	2	6
	W1	6/2	3.5	-	1.5	15.75
	W2	3/2	2	-	1.5	4.5
	V	4/2	0.5	-	0.5	0.5
					Total = 28.25 sqm.	
			Total Plastering Work = 434.39 sqm.			

(Table-47 Quantity Gym)

Rate Analysis of Gym
(Rate as per SOR 2015-16 R&B)

Sr.	Item	Qty. (m3)	Rate	Per	Amount (Rs.)
1	**Excavation**	119.56	280	Cum.	33,476.8
2	**P.C.C**	19.92	700	Cum.	13,944
3	**Brickwork Foundation**	53.89	2443	Cum.	1,31,653.27
4	**Sand Filling**	211.62	200	Cum.	42,324
5	**Brick Work Superstructure**	109.03	2443	Cum.	2,66,360.29
6	**R.C.C. Slab**	96.05	3206	Cum.	1,79,696.3
7	**Brick work Perapet**	23.34	2443	Cum.	57,019.62
8	**Plaster Work**	494.39	120	Sqm.	59,326.8
Total = 7,83,801.08					
Add 3% contingency charge = 23,514.03					
Add 2% work charge = 15,676.02					
Total = 8,23,000					

(Table-48 Rate Analysis of Gym)

13.1.3 Civil Design 3
Social Design – Cyber café

Scenario:

The Internet is dramatically changing the way people live, work, communicate, recreate and participate in public life all over the world. But the growth and the penetration of the Internet is far from being distributed equally around the globe. Whereas in developed countries the Internet today reaches substantial proportions of the population, e.g. in Germany (56.2%) or in the United States (68.8%), the situation is different in developing countries. In India for example, only 2.9 percent of households had Internet access in early 2005.

This is almost twice the average for African countries (1.5% Internet penetration), but still much lower than the world average (13.9% penetration) and India is still far behind Europe with 35.5%.

The low rates of Internet access in developing countries like India are often traced back to low rates of personal computer ownership and the high cost of hardware. Another barrier is the low income level, which makes the Internet an expensive tool in developing countries. Beside these economic factors, there are a variety of cognitive barriers like low literacy rates, lack of English language skills or lack of e-literacy skills to effectively use these new technologies.

Existing Situation in Derdi Kumbhaji
There is no cyber café in Derdi Kumbhaji. People use mobile phone to use internet access.

Sustainability of the design
Cybercafé as an important structure
Design utilized by,
People living in the village of even outsiders from nearby villages and relatives of the villagers can use or utilize a cybercafé for their different uses.

Needs
Ease of use; Availability internet and for the people who can know about the internet; etc.

Design brief
A cybercafé alternatively referred to as an Internet cafe, PC bangs, or Net cafe. Cybercafé is a place to use computers to access the Internet, play games, create documents, and chat with friends using voice and video, and other computer-related tasks. At most Internet cafes the computer and Internet access is provided for an hourly or daily fee.

Common repair and maintenance of the structure
Some common repairs and maintenances are as below; Exterior painting and plastering; Landscaping and gardening; Paving repairs; Carpeting and flooring; Plumbing; Repairing cracking or leaning walls etc.

Quantity of Cyber Café

Sr.	Item Description	No.	L (m)	B (m)	H (m)	Qty. (m^3)
1	**Excavation in foundation**	1	67.53	0.9	1.2	72.93
2	**PCC in foundation**	1	67.53	0.9	0.2	12.15
3	**Brick Work in Foundation**					
	1st step	1	68.13	0.6	0.3	12.26
	2nd step	1	68.33	0.5	0.3	10.24
	3rd step	1	68.53	0.4	0.3	8.22
	4th step	1	68.73	0.3	0.1	2.06
					Total = 32.78 cm.	
4	**Sand filling**					
	Electronic store room	1	2.36	3.42	0.6	4.84

	Computers	1	12.64	3.4	0.6	25.78
	Computers Hall	1	18.58	7.9	0.6	88.06
	Man Toilet	1	1.61	1.85	0.6	1.78
	Women Toilet	1	1.65	1.85	0.6	1.83
					Total = 122.29 cm.	
5	**Brick Work in Super Structure (L = 68.73)**	1	68.73	0.3	3.35	69.07
	Deduction of doors and Windows					
	MD	1	2	0.3	2	1.2
	D1	1	1	0.3	2	0.6
	D2	2	0.8	0.3	2	0.96
	W1	6	1.12	0.3	1.2	2.41
	W2	1	0.95	0.3	1.2	0.34
	W3	1	1.63	0.3	1.2	0.58
	V	2	6.5	0.3	0.5	0.15
					Total = 6.24 cm.	
	Total Brick Work = 62.83 cm.					
6	**R.C.C. Slab**	1	11.38	18.88	0.15	32.22
7	**Brick Work in Parapet**					
	H. Wall	1	18.88	0.3	1	5.66
	V. Wall	1	13.38	0.3	1	4.01
					Total = 9.67 cm.	
8	**Plaster Work (inside)**					
	Electronic store room					
	H. wall	2	2.36	-	3.35	15.81
	V. wall	1	3.42	-	3.35	22.91
	Computers					
	H. wall	1	12.64	-	3.35	42.34
	V. wall	1	3.4	-	3.35	11.39
	Men Toilet					
	H. wall	2	1.61	-	3.35	10.78
	V. wall	2	1.85	-	3.35	12.39
	Women Toilet					
	H. wall	2	1.65	-	3.35	11.05
	V. wall	2	1.85	-	3.35	12.39
	Wide Passage					
	H. wall	1	3.52	-	3.35	11.79
	V. wall	1	1.42	-	3.35	4.75

	Computer Hall					
	H. wall	1	18.58	-	3.35	62.24
	V. wall	2	7.9	-	3.35	52.93
					Total = 270.77 sqm.	
	Deduction of Doors and Windows					
	MD	½	2	-	2	2
	D1	½	1	-	2	1
	D2	2/2	0.8	-	2	1.6
	W1	6/2	1.12	-	1.2	4.03
	W2	½	0.95	-	1.2	0.57
	W3	½	1.63	-	1.2	0.97
	V	2/2	0.5	-	0.5	0.25
					Total = 10.42 sqm.	
			Total Plastering Work = 260.35 sqm.			

(Table-49 Quantity Sheet of Cyber café)

Rate Analysis of Cyber café
(Rate as per SOR 2015-16 R&B)

Sr.	Item	Qty. (m3)	Rate	Per	Amount (Rs.)
1	**Excavation**	72.93	280	Cum.	20,420.4
2	**P.C.C**	12.15	700	Cum.	8505
3	**Brickwork Foundation**	32.78	2443	Cum.	80,081.54
4	**Sand Filling**	122.29	200	Cum.	24,458
5	**Brick Work Superstructure**	62.83	2443	Cum.	1,53,493.69
6	**R.C.C. Slab**	32.22	3206	Cum.	1,03,297.32
7	**Brick work Perapet**	9.67	2443	Cum.	22,623.81
8	**Plaster Work**	260.35	120	Sqm.	34,242
					Total = 4,45,121.76
					Add 3% contingency charge = 13,353.65
					Add 2% work charge = 8,902.43
					Total = 4,67,400

(Table-50 Rate Analysis of Cyber Café)

13.1.4 Civil Design 4
Socio-Culture Design – Skill development center

Scenario:
Education, entrepreneurship, and physical and social infrastructure all play an important role in developing rural regions. Skills are central to improving employability and livelihood opportunities, reducing poverty, enhancing productivity and promoting environmentally sustainable development.

Existing Situation in Derdi Kumbhaji
There is no any skill development center in Derdi Kumbhaji. People need to go to city for training and for learn new skills.

Sustainability of the design
Skill development center as an important structure
Design utilized by,
People living in the village of even outsiders from nearby villages and relatives of the villagers can use or utilize a skill development center for their different uses.

Needs
For learn new skills which are required in industrial, for students and also for women empowerment. For seminars and training purpose.

Design brief
Skill development center as a socio-culture design. For learning new skills, learning computer, learning English, learning embroidery work for women.

Common repair and maintenance of the structure
Some common repairs and maintenances are as below; Exterior painting and plastering; Landscaping and gardening; Paving repairs; Carpeting and flooring; Plumbing; Repairing cracking or leaning walls etc**.**

Quantity Sheet of Skill Development Centre

Sr.	Item Description	No.	L (m)	B (m)	H (m)	Qty. (m3)
1	**Excavation**	1	104.3	0.9	1.2	112.64
2	**P.C.C. in foundation**	1	104.3	0.9	0.2	18.77
3	**Brickwork in Foundation**					
	1st step	1	106.65	0.6	0.3	19.17
	2nd step	1	107.3	0.5	0.3	16.09
	3rd step	1	108.05	0.4	0.3	12.96
	4th step	1	108.8	0.3	0.1	3.26
					Total = 51.48 cum.	
4	**Sand Filling**					
	Seminar Hall	1	7	3.7	0.6	15.54

	English Classis	1	3	5	0.6	9
	Training Room	1	3	3.5	0.6	6.3
	Reception	1	7	2.2	0.6	9.24
	Waiting area	1	4.3	1.7	0.6	4.32
	Small Equipment	1	4	3.95	0.6	9.48
	Computer lab	1	4	3.95	0.6	9.48
	Passage	1	4	1.8	0.6	4.32
	Men Toilet	1	1.85	2.7	0.6	2.99
	Female Toilet	1	1.85	2.7	0.6	2.99
					Total = 73.72 cum.	
5	**Brick Work in Superstructure**	1	108.8	0.3	3.2	104.4
	Deduction of Doors and Windows					
	M.D.	1	1.5	0.3	2	0.9
	D1	1	1.2	0.3	2	0.72
	D2	4	1	0.3	2	2.4
	D3	1	0.8	0.3	2	0.96
	W	11	1.2	0.3	1.2	4.75
	V	2	0.5	0.3	0.5	0.15
					Total = 9.88 cum.	
				Total Brickwork = 94.56 cum.		
6	**R.C.C. Slab**	1	15.9	11.3	0.15	26.95
7	**Brickwork Parapet**					
	H. wall	2	11.9	0.3	0.95	6.44
	V. wall	2	15.9	0.3	0.95	9.063
					Total = 15.50 cum.	
8	**Plaster Work**					
	Seminar Hall	2	3.37	-	3.2	21.56
	H. wall	2	7	-	3.2	44.8
	V. wall					
	English classis					
	H. wall	2	3	-	3.2	19.2
	V. wall	2	5	-	3.2	32
	Training room					
	H. wall	2	3	-	3.2	19.2
	V. wall	2	3.5	-	3.2	22.4
	Reception Area					
	H. wall	2	3	-	3.2	19.2
	V. wall	2	2.2	-	3.2	7.04

	Waiting area					
	H. wall	2	4	-	3.2	25.6
	V. wall	2	1.7	-	3.2	5.44
	Small Equipment					
	H. wall	2	4	-	3.2	25.6
	V. wall	2	3.95	-	3.2	25.28
	Computer Lab					
	H. wall	2	4	-	3.2	25.6
	V. wall	2	3.95	-	3.2	25.28
	Passage 1					
	H. wall	2	4	-	3.2	25.6
	V. wall	2	1.8	-	3.2	11.52
	Men Toilet					
	H. wall	2	1.85	-	3.2	11.84
	V. wall	2	2.7	-	3.2	17.28
	Women Toilet					
	H. wall	2	1.85	-	3.2	11.84
	V. wall	2	2.7	-	3.2	17.28
	Passage 2					
	H. wall	2	3.7	-	3.2	23.68
	V. wall	2	9.1	-	3.2	58.24
					Total = 495.48 sqm.	
	Deduction of Doors and Windows					
	M.D.	½	1.5	-	2	1.5
	D1	½	1.2	-	2	1.2
	D2	4/2	1	-	2	4
	D3	2/2	0.8	-	2	1.6
	W	11/2	1.2	-	1.2	7.92
	V	2/2	0.5	-	0.5	0.25
					Total = 16.47 sqm.	
				Total Plaster = 497.01 sqm.		

(Table-51 Quantity sheet of Skill Development Centre)

Rate Analysis of Skill Development Centre (Rate as per SOR 2015-16 R&B)

Sr.	Item	Qty. (m3)	Rate	Per	Amount (Rs.)
1	**Excavation**	112.64	280	Cum.	31,539.2
2	**P.C.C.**	18.77	700	Cum.	13,139
3	**Brickwork in Foundation**	51.48	2443	Cum.	1,25,765.6

4	**Sand Filling**	73.72	200	Cum.	14,744
5	**Brickwork in Superstructure**	94.56	2443	Cum.	2,31,010
6	**R.C.C. Slab**	26.95	3206	Cum.	86,401.7
7	**Brickwork in Parapet**	15.50	2443	Cum.	37,866.5
8	**Plaster Work**	479.01	120	Sqm.	57,481.2
Total = 5,97,945.7					
Add 3% contingency charge = 17,938.3					
Add 2% work charge = 12,958.9					
Total = 6,27,900					

(Table-52 Rate Analysis of Skill Development Centre)

13.1.5 Civil Design 5
Smart village – Soil testing Laboratory

Scenario:

Soil analysis is a valuable tool for your farm as it determines the inputs required for efficient and economic production. A proper soil test will help ensure the application of enough fertilizer to meet the requirements of the crop while taking advantage of the nutrients already present in the soil. It will also allow you to determine lime requirements and can be used to diagnose problem areas. It is very important that your sampling technique is correct as the results are only as good as the sample you take. Soil testing is also a requirement for farms that must complete a nutrient management plan.

Existing Situation in Derdi Kumbhaji

There is no Soil testing laboratory in Derdi Kumbhaji. People need to go to city for testing of soil and water.

Sustainability of the design

Soil testing laboratory as an important structure

Design utilized by,

People living in the village of even outsiders from nearby villages and relatives of the villagers can use or utilize a skill development center for their different uses.

Needs

To know the nutrients, minerals and other components in soil. To know the deficiency in minerals in soil and to know the use of specified type of fertilizers and pesticide.

Design brief

Soil testing laboratory as a smart village design. Farmers of Derdi and nearby villages have not to go for city for testing of soil.

Common repair and maintenance of the structure

Some common repairs and maintenances are as below; Exterior painting and plastering; Landscaping and gardening; Paving repairs; Carpeting and flooring; Plumbing; Repairing cracking or leaning walls etc**.**

Quantity Sheet of Soil Testing Laboratory

Sr.	Item Description	No.	L (m)	B (m)	H (m)	Qty. (m^3)
1	**Excavation in foundation**	1	80.65	0.9	1.2	87.10
2	**PCC in foundation**	1	80.65	0.9	0.2	14.52
3	**Brick Work in Foundation**					
	1st step	1	81.7	0.6	0.3	14.1
	2nd step	1	82.05	0.5	0.3	12.31
	3rd step	1	82.4	0.4	0.3	9.89
	Up to plinth	1	82.75	0.3	0.3	2.48
						Total = 39.40 cm.
4	**Sand filling**					
	Laboratory 1	1	6	6	0.6	21.6
	Office	1	4	6	0.6	14.4
	Laboratory 2	1	5	6	0.6	18
	Women toilet	1	2	2.85	0.6	3.42
	Men toilet	1	2	2.85	0.6	3.42
	Passage	1	6.3	1.2	0.6	4.54
	Cubical	1	2	2	0.6	12
	Waiting area	1	6	9.2	0.6	33.12
						Total = 110.5 cm.
5	**Brick Work in Super Structure**	1	82.75	0.3	3.3	81.92
	Deduction of doors and Windows					
	MD	1	1.2	0.3	2	0.72
	D1	2	1.2	0.3	2	1.44
	D2	1	1	0.3	2	0.6
	D3	7	0.7	0.3	2	2.94
	W	7	2	0.3	1.5	6.3
	V	2	0.5	0.3	0.5	0.15
						Total = 12.15 cm.
						Total Brick Work = 69.77 cm.
6	**R.C.C. Slab**	1	12.3	16.2	0.15	29.89

7	**Brick Work in Parapet**					
	H. Wall	2	12.3	0.3	1	7.38
	V. Wall	2	16.2	0.3	1	9.72
					Total = 17.1 cm.	
8	**Plaster Work (inside)**					
	Laboratory 1					
	H. wall	2	6	-	3.3	39.6
	V. wall	2	6	-	3.3	39.6
	Office					
	H. wall	2	4	-	3.3	26.4
	V. wall	2	6	-	3.3	39.6
	Laboratory 2					
	H. wall	2	5	-	3.3	33
	V. wall	2	6	-	3.3	39.6
	Women toilet					
	H. wall	2	2	-	3.3	13.2
	V. wall	1	2.85	-	3.3	9.41
	Men toilet					
	H. wall	2	2	-	3.3	13.2
	V. wall	1	2.85	-	3.3	9.41
	Waiting area					
	H. wall	2	9.2	-	3.3	60.72
	V. wall	1	6	-	3.3	19.8
	Passage					
	H. wall	2	6.3	-	3.3	41.58
	V. wall	-	-	-	-	-
					Total = 385.12 sm.	
	Deduction of Doors and Windows					
	MD	½	1.2	-	2	1.2
	D1	2	1.2	-	2	4.8
	D2	1	1	-	2	2
	D3	0	0.7	-	2	-
	W	7/2	2	-	1.5	10.5
	V	2/2	0.5	-	0.5	0.25
					Total = 18.75 sm.	
			Total Plastering Work = 366.67 sm.			

(Table-53 Quantity sheet of Soil Testing Laboratory)

Rate Analysis of Soil Testing Laboratory
(Rate as per SOR 2015-16 R&B)

Sr.	Item	Qty. (m3)	Rate	Per	Amount (Rs.)
1	**Excavation**	87.10	280	Cum.	24,388
2	**P.C.C.**	14.52	700	Cum.	10,164
3	**Brickwork in Foundation**	39.40	2443	Cum.	96,254.2
4	**Sand Filling**	110.5	200	Cum.	22,100
5	**Brickwork in Superstructure**	81.92	2443	Cum.	2,00,130.57
6	**R.C.C. Slab**	28.89	3206	Cum.	95,827.34
7	**Brickwork in Parapet**	17.1	2443	Cum.	41,775.3
8	**Plaster Work**	366.37	120	Sqm.	43,964.4
Total = 5,34,603.81					
Add 3% contingency charge = 16,038.11					
Add 2% work charge = 10,692.07					
Total = 5,61,340					

(Table-54 Rate Analysis of Soil Testing Laboratory)

13.1.6 Civil Design 6
Heritage Village – Agriculture Store

Scenario:

Agriculture also plays an important part in rural development, especially due to land use, in countries where the sector is of less economic significance. 3. The main potential contributions of farming to rural development are in terms of supporting employment, ancillary businesses, and environmental services.

Existing Situation in Derdi Kumbhaji

There is no any agriculture store in Derdi Kumbhaji. Pesticides are available but agriculture tools are not available in Derdi.

Sustainability of the design

Agriculture store as an important structure

Design utilized by,

People living in the village of even outsiders from nearby villages and relatives of the villagers can use or utilize a skill development center for their different uses.

Needs
For agricultural related products and tools for farming, like, pesticides, fertilizers, pumps and other small and large equipment.

Design brief
Agriculture store as a heritage design. By give access of all equipment and all products related agricultural.

Common repair and maintenance of the structure
Some common repairs and maintenances are as below; Exterior painting and plastering; Landscaping and gardening; Paving repairs; Carpeting and flooring; Plumbing; Repairing cracking or leaning walls etc.

Quantity Sheet of Agriculture Store

Sr.	Item Description	No.	L (m)	B (m)	H (m)	Qty. (m3)
1	**Excavation**	1	45.3	0.9	1.2	44.84
2	**P.C.C. in foundation**	1	45.3	0.9	0.2	8.154
3	**Brickwork in Foundation**					
	1st step	1	45.6	0.6	0.3	8.208
	2nd step	1	45.7	0.5	0.3	6.855
	3rd step	1	45.8	0.4	0.3	5.496
					Total = 20.559 cum.	
4	**Sand Filling**					
	Office	1	3	4	0.6	7.2
	Hardware	1	9	5.7	0.6	30.78
	Passage	1	2	4.3	0.6	5.16
	Commodities	1	3	4.3	0.6	7.74
					Total = 50.88 cum.	
5	**L.C. Filling**	2	45.8	0.4	-	18.32sqm.
6	**Brick Work in Superstructure**	1	45.9	0.3	3.6	49.572
	Deduction of Doors and Windows					
	M.D.	1	2	0.3	2	1.2
	D	1	1	0.3	2	0.6
	W	8	1.5	0.3	1.5	5.4
		Total = 7.2 cum.				
		Total Brickwork = 42.372 cum.				

7	**R.C.C. Slab**	1	9.7	9.6	0.15	13.968
8	**Brickwork Parapet**					
	H. wall	1	9.6	0.3	1	2.88
	V. wall	1	9.7	0.3	1	2.91
					Total = 5.79 cum.	
9	**Plaster Work**					
	Office					
	H. wall	2	3	-	3.6	21.6
	V. wall	2	4	-	3.6	28.8
	Hardware					
	H. wall	2	9	-	3.6	64.8
	V. wall	2	5.7	-	3.6	41.04
	Passage					
	H. wall	2	2	-	3.6	14.4
	V. wall	2	4.3	-	3.6	30.96
	Commodities					
	H. wall	1	3	-	3.6	10.8
	V. wall	1	4.3	-	3.6	15.48
					Total = 227.88 sqm.	
	Deduction of Doors and Windows					
	M.D.	½	2	-	2	2
	D1	½	1	-	2	1
	W	8/2	1.5	-	1.5	9
					Total = 11 sqm.	
				Total Plaster = 216.88 sqm.		

(Table-55 Quantity sheet of Agriculture Store)

Rate Analysis of Agricultural Store
(Rate as per SOR 2015-16 R&B)

Sr.	Item	Qty. (m3)	Rate	Per	Amount (Rs.)
1	**Excavation**	44.84	280	Cum.	12,555
2	**P.C.C.**	8.154	700	Cum.	5707
3	**Brickwork in Foundation**	20.559	2443	Cum.	50,225
4	**Sand Filling**	50.88	200	Cum.	10,176
5	**L.C. Filling**	18.32	120	Sqm.	2198

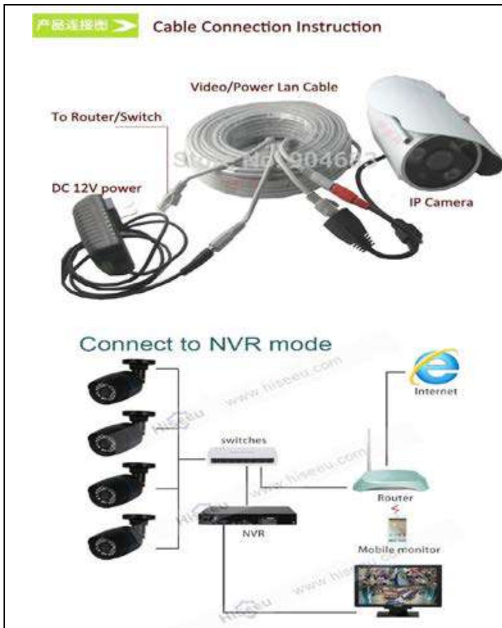
6	**Brickwork in Superstructure**	42.372	2443	Cum.	1,03,514
7	**R.C.C. Slab**	13.968	3206	Cum.	44,781
8	**Brickwork in Parapet**	5.79	2443	Cum.	14,144
9	**Plaster Work**	216.88	120	Sqm.	26,025
Total = 2,69,326					
Add 3% contingency charge = 8,079					
Add 2% work charge = 5,386					
Total = 2,82,791					

(Table-56 Rate Analysis of Agriculture Store)

13.1.7 Electrical Design 1
CCTV Installation Design

(Fig – 79 Surveillance security camera)

- Closed-circuit television (**CCTV**), also known as video **surveillance**, is the use of video **cameras** to transmit a signal to a specific place, on a limited set of monitors. **CCTV systems** may operate continuously or only as required to monitor a particular event.
- When it comes to securing your business, there are many different types of CCTV to choose from. Surveillance plays a huge part in today's society, and with cameras all around us, our day-to-day lives are experiencing higher levels of security each day.



(Fig – 80 Connecting Diagram)

What are the different types of CCTV cameras?

1. Dome Camera
2. Bullet Camera
3. C-mount Camera
4. Day/Night Camera
5. PTZ Camera

- What to Look for When Buying a CCTV System:

⇒ Should my CCTV cameras be discreet or a visual deterrent?
⇒ How do I know what to use indoors and outdoors?
⇒ What are the light conditions like?
⇒ Is image clarity important?
⇒ Is audio required?

⇒ Total 4 network camera are required to cover entire village where most of the pubic are doing IN/OUT. Also, site covers market of vegetables etc.

➢ Estimating & Costing

Sr. No	Item	Quantity	Price
1	Hikvision 2MP IP Plastic Bullet Camera	4	18000
2	CCTV Wire Cable 3+1 Copper+ Bradding Alloy+ mic Wire Alloy (20 meter/22 Yard)	100 meter Apr. (to nearby office)	1750
3	Securely 12V 10A Metal Body Security Camera CCTV Power Supply for 8 Channel SMPS	1	750
4	Mini NVR full HD 8channel CCTV security NVR 1080p on if network video recorder for Ip camera	1	4100
5	Zebronics 15.6 inch (39.6 cm) LED Backlit Computer Monitor - HD with VGA, HDMI Ports – ZEB A16HD LED	1	3700
			Total = 28300

(Table-57 Estimate & Costing of CCTV installation)

13.1.8 Electrical Design 2
Solar Rooftop Installation Design

Solar Roof Top designing can be classified based on Grid Connection:

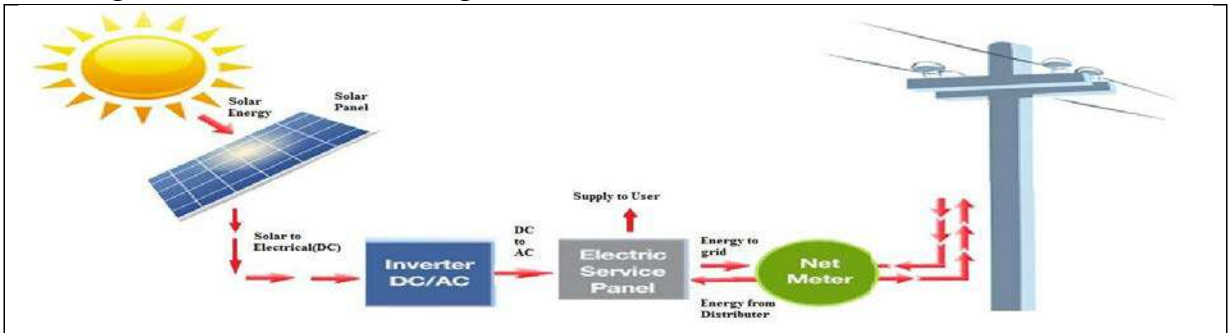
⇒ On-Grid Solar Roof Top

⇒ On-Grid Solar Roof Top

Solar Roof Top designing can be classified based on type of buildings:

⇒ Design for Residential Building

⇒ Design for Commercial Building



(Fig – 81 Block Diagram for Solar Roof Top)

Load Calculation of one house in the village

Owner Name: Sanjayhbhai Padmani

➢ House Owner has 200 Sq. Feet space which they were not utilizing. So that they can install 2kW Solar Plant. So that, 2kw solar plant cost = **74755Rs.**
40% subsidy = **29902Rs.**
Total price = 93110-37240 =**44853Rs.**
Plant useful life = **20year**

➢ Cost Estimation

Sr. No.	Installations	Quantity	Cost/Qty	Total Cost(₹)
1	Solar Panel	4 nos.	9000	**36000**
2	Inverter	1 no.	17000	**17000**
3	Installation	1111 watts	5	**5555**
4	ACDB, DCDB	1 no.	5000	**5000**
6	Surge Protecting Device	1no.	7000	**700**
7	Lightening Arrester	1no.	1500	**1500**
8	Chemical Earthing	1 set	9000	**9000**
			Total Cost Estimation for Installation	**74755**
			Government Subsidy	**-29902**
			Final Cost	**44853**

(Table-58 Cost estimation of solar roof top installation)

Plant maintenance cost is = 2138Rs/kw/year (Taken from standard Data)
Then 2kw plant maintenance cost = 2138×2**=4272Rs.**

No.	Name of Equipment	No. of Equipment	Load (Watt)	Total Load (Watt)
1	Lamp	3	40	120
2	Fan	2	80	160
3	Tube light	3	40	120
4	5 Amp Socket	3	100	300
5	16 Amp Socket	1	1500	1500
			Total	**2200 Watt**

(Table-59 Load calculation of House)

➢ Plant salvage value

15 Rs. per kilogram 1kw = 10square meter Then 2kw =20 square meter
1square meter = 20kg 20sqare meter
Weight of plant = 20×20=400kg
1 kg =15Rs.
400kg = 400×15 **= 6000Rs.**

➢ Annual income

Per day 8 unit generation Then 360 day = 360×8 **= 2880unit/year**
1unit price = 5.50Rs.
2880unit =2880 × 5.50 **= 15840Rs.**
Net annual income =Annual income - maintenance cost
= 15840-4276
= **11564 Rs. /year**
Payback period = (primary investment - salvage value) ÷ net annual income
= (55866 - 6000) ÷11564
= **4.31year**
Return of investment = (1÷ payback period) ×100
= (1÷4.31)× 100
= 23.20%

13.1.9 Electrical Design 3
AUTOMATIC IRRIGATION SYSTEM USING ARDUINO

An automated irrigation system is proposed as, so the manual interaction of farmer and operation of the system with no or just minimum effort is possible. Almost every system (surface, drip and sprinkler) can became automatic with help of Controller, Sensors and Solenoid valves. It makes the irrigation process more efficient and so that the workers can ideally concentrate on other necessary farming tasks. Automation can be utilized in many ways**:**

- To start and stop the irrigation process through supply channel outcomes.
- To start and stop the pumps.
- To stop the flow of water from one irrigation area – either a channel or a section of channel and directing the water to another area. manual effort, but the irrigator may need to spend time preparing the system at the start of the irrigation and maintaining the components so it works properly These changes occur automatically without any direct.

In the proposed system, the GSM module is used for remote automation and to know the status of electricity at farm. Global system for mobile communication is easy to access and use. Microcontroller does the control of system. A GSM based irrigation system has two major technologies; primary is the GSM and secondary is the microcontroller. GSM is a standard set used to describe protocols for digital cellular networks. The controlling of irrigation and sending the information to a mobile, which indirectly controls the field irrigation via SMS to the farmer, these two tasks are performed by the GSM facility.

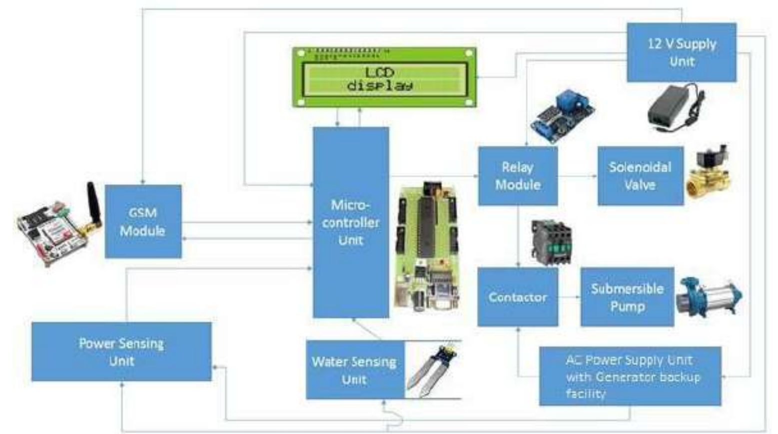
Source of Water	Bore well, Well, Canal only used by nearby landowner.
Crop Production	Majority Rice, sugarcane, pulses
Mode of water supply to farmland	Manual pipe placement in farm when required, only one person has availed drip irrigation facility.
Availability of Electricity	8 hours per day. Provided in daytime or night-time per week. Phase changes every week.
Quality of Electricity	Unbalanced 3 phase power supply. Uneven power cut-outs for regular use.
Motor used for pumping	Only 3-4 owners use 3-phase supply. Majority have transitioned over single-phase motor for reliability.
Available mobile networks	Airtel (2g and 3g), Vodafone (2g and 3g), idea (2g and 3g), BSNL (2g and 3g), 3g having moderate signal level.

(Table-60 Essentials requirements for automatic irrigation)

The microcontroller acts as a central unit and it is functioned is to automate the process. After it has been initiated by the GSM based device, finally the microcontroller presents the output to the device. While interrogation with villagers, we came to know that majority of land owners use single phase motor for pumping. We explained them about the benefits and efficiency of using 3-phase supply powered motor. When asked about not using 3-phase supply power, they said majority of time one of the phases goes down and due to that motor does not run properly. Therefore, they switched over to single-phase motor for better reliability in supplying the water to crops. They also said they have complained the distribution company about unbalance supply, but the problem arises again frequently. In addition, the time of power is fixed but due to some circumstances, this schedule gets disturbed.

Components of block diagram:

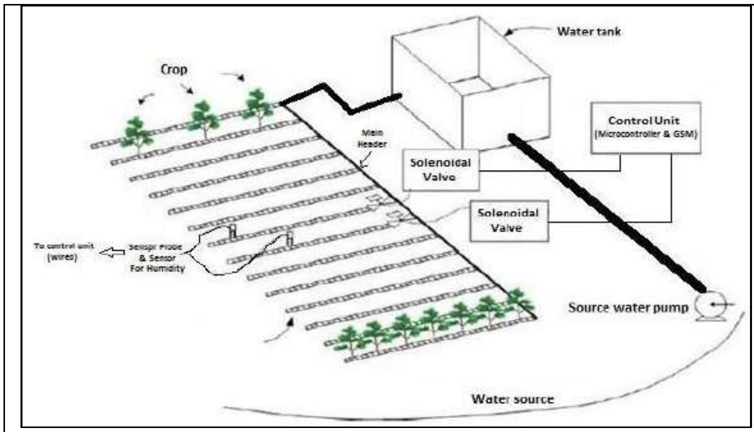
1. Microcontroller.
2. GSM module.
3. 16x2 display module.
4. Relay module.
5. Solenoid valve.
6. Contactor.
7. Source water pump.
8. Power Supply with generator.
9. Power sensing unit,
10. Water sensing unit, and
11. AC to DC converter is used



(Fig – 82 Components of block diagram)

System Description and Operation

As shown in figure, basic setup of components in field is done. The relay, microcontroller and gsm module is in control unit. The solenoid valve is placed at beginning of each Channel. The soil moisture sensor is placed at end of each Channel. A water storage tank is filled up with the help of pump. For power to the whole system, there are 12-volt DC power supply unit/Battery. That starts relay module, GSM as well as controller and solenoid valve, which require 12/24 volts. Now this scheme is used with remote controlling and automation. With this, it can also be operated manually by using simple push button when farmer is on the field Now the operation of the system is explained.



(Fig – 83 Basic view of system)

⇒ First of all, the power supply is sensed by the power sensing unit. It will check whether power is available or not.

⇒ If power supply is not available, then farmer receives the message "Power is not available. To irrigate, please turn on generator or wait for power restoration."

⇒ If available, the power sensor will sense if it is proper or not. This signal is sent to the microcontroller and the microcontroller sends the signal to the gsm module.

⇒ Gsm module sends message to the number stored in memory and display also shows the power supply condition. Farmer receives the message "the power supply is available".

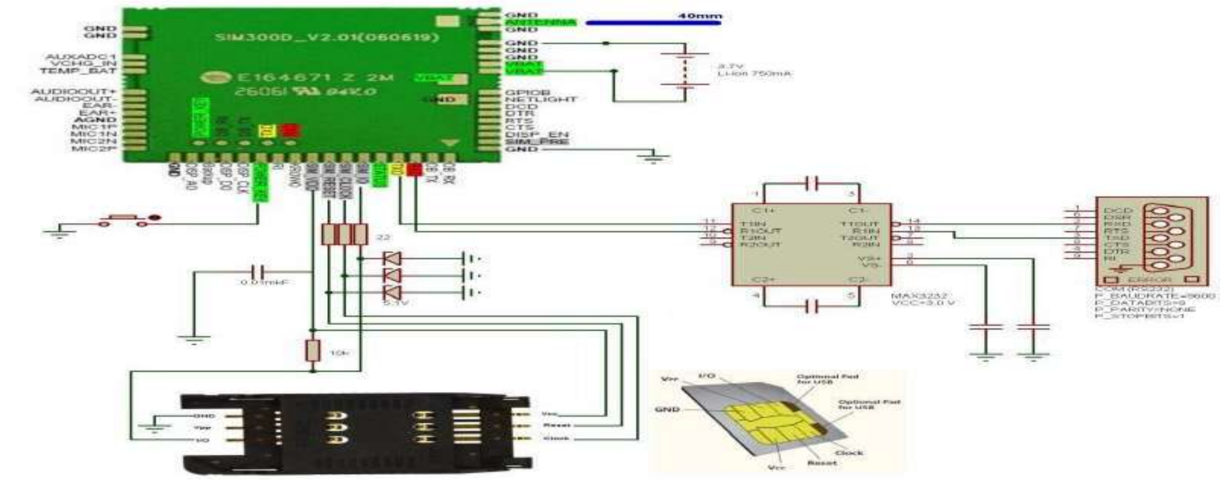
⇒ If the power supply is not proper it will send message after previous message: "the power supply is not proper. The system will not start."

⇒ If the power supply is healthy, it will send signal to GSM by using communication pin Rx, Tx.

⇒ Now further GSM module sends message to the number which is stored on its memory, and display also shows the message about power is available. Now farmer receives the message that “Power available is healthy! Do you want to turn on the system?”

⇒ If the farmer wants to irrigate he will send the message as “YES” and GSM receives “yes” signal. This signal is decoded by Arduino Uno and gives signal to ULN2803/2003, which is relay drive IC.

Circuit Diagram:



(Fig – 84 Circuit Diagram)

⇒ First of all, switch off the power supply of GSM Module. Then insert the SIM Card into the SIM socket, which is available on the GSM Module board, properly.

⇒ Now give the 12V supply to the GSM Module using DC power adapter.

⇒ Turn ON the GSM Module.

⇒ Now wait for about 1 minute and note down the rate of blinking of the LED (Status LED or Network LED). It requires about 1 minute establishing the connection between GSM Module and network.

If the connection is established properly, then the LED will continuously blink at the constant time-period. (If it is not happening so, there would be some error in connection) Now we can make a call to GSM Module, it will ring, if it is so, then the network connection is established successfully.

Components	Remarks	Cost of Component
Microcontroller (Arduino)		1000
Relay Driver	8 channel	900
Solenoid Valve	Per piece ₹1200	9700
Contactor	Used at supply mains	700
Moisture sensor	Per Sensor ₹80	700
Battery	Capacity considered of 3Ah	1500
Supply Sensor	According to type of supply i.e. single phase or 3 phase	300
Display Module	16x2 LCD display	200

AC to DC Convertor	12v convertor for dc supply	500
Diesel Generator	6000 VA Supply for 1 phase 12.5 VA for 3 phase approx. price	60000
Additional Cost	Wiring cost, labor cost (wire fitting, programming, etc.)	5000
	TOTAL	**80500**

(Table-61 Cost of Component)

13.2 Reason for Students Recommending this Design

IN CIVIL

Rainwater harvesting: - Through rainwater harvesting people can save lots of water which is runoff in monsoon season and use this saved water at different purposes.

Gym: - It make people fit and healthy by hart and by mentality.

Cybercafé: - In Derdi Kumbhaji there is no any cybercafé people use their own mobile phone and internet connection for internet and browsing activities. By providing cybercafé they can do any computer related work in their own village.

Skill development center: - In Derdi there are many students, women and other peoples who wants to learn new skills and language. By providing skill development center they can learn English, computers, women can learn embroidery work and also people learn to work with new machinery and their repair which is used in industries, which help them to earn money.

Soil testing Laboratory: - In Derdi majority of occupation class is farmer so by providing the soil testing laboratory farmers can know the miners and irons available or deficient in soil and they also know the use of correct and accurate dose of fertilizer and pesticides.

Agriculture Store: - Majority of population in Derdi is farmers by that means it is necessary that there is at least one agriculture store which have all pesticides and fertilizers and some small sand some large equipment. Now people have not to go to city for agriculture related products.

IN ELECTRICAL

CCTV Installation Design: - Derdi is a developing village as compare to other villages and also a big in population and area by providing cctv camera it increase safety in village and provide safety in night for women and children. It help police to do patrolling and in other case.

Solar Rooftop Installation Design: - Solar roof top installation in Derdi Kumbhaji village is very use full because in village there is no shortage of land and due to big houses more area is covered and more green energy is produced. People also generate revenue from solar roof.

Automatic Irrigation System using Arduino: - Automatic irrigation system help farmers in irrigation. It control the flow of water and also give access to the auto cut in power.

13.3About designs Suggestions / Benefit of the villagers

IN CIVIL

Rainwater harvesting: - Less cost. Helps in reducing the water bill. Decreases the demand for water. Reduces the need for imported water. Promotes both water and energy conservation Improves the quality and quantity of groundwater. Does not require a filtration system for landscape irrigation. This technology is relatively simple, easy to install and operate. It reduces soil erosion, storm water runoff, flooding, and pollution of surface water with fertilizers, pesticides, metals and other sediments. It is an excellent source of water for landscape irrigation with no chemicals and dissolved salts and free from all minerals.

Gym: - It help body and mind in this way, It Can Make You Feel Happier. It Can Help With Weight Loss. It Is Good for Your Muscles and Bones. It Can Increase Your Energy Levels. It Can Reduce Your Risk of Chronic Disease. It Can Help Skin Health. It Can Help Your Brain Health and Memory.

Cybercafé: - There are some advantages of visiting a cyber cafe and one of them includes meeting others who might be interested in the same technology as you are. The visitors of a cyber cafe have access to Internet service at a very reasonable price. The prices mostly run on an hourly basis. There are also no restrictions placed on who is allowed to use the Internet. Another advantage is if you are an intense gamer, you could run into other games and connect electronically and compete with each other. Cyber cafes also lend computers out that are installed with the most currently updated games and software. A cyber cafe is equipped with all the software or hardware connection that any visitor would need, making their experience worthwhile. Some may even find that using a computer constantly at a cyber cafe is less expensive than owning a home computer.

Skill development center: - The idea is to raise confidence, improve productivity and give direction through proper skill development. Skill development will enable the youths to get blue-collar jobs. Development of skills, at a young age, right at the school level, is very essential to channelize them for proper job opportunities. There should be a balanced growth in all the sectors and all jobs should be given equal importance. Every job aspirant would be given training in soft skills to lead a proper and decent life. Skill development would reach the rural and remote areas also. Corporate educational institutions, non-government organizations, Government, academic institutions, and society would help in the development of skills of the youths so that better results are achieved in the shortest time possible.

Soil testing Laboratory: - Soil test reports will generally provide you with appropriate fertilizer application recommendations for nitrogen, phosphorous, potassium and limestone. Soil testing also allows for determining the micronutrient requirements of your crop. If you apply too little fertilizer, your crop yields and returns will be lower. Too much fertilizer will waste time and money and risk environmental damage due to nutrient runoff. Consequently, soil testing provides a farm management tool with a potential benefit to the farmer of increased yields, reduced operating costs and superior environmental risk management. Additional benefits include; improved crop maturity and quality, higher tolerance to disease and pest damage, and increased growth.

Agriculture Store: - How often do you get face to face with the person who grew your food? Markets are a great chance to ask questions about how this vegetable was grown, or the best way to prepare the ever-mysterious kohlrabi (we like it raw, shredded in a salad). A face-to-face conversation goes a long way to re-building your trust in the food system – and to rebuilding the food system itself! And since they're passionate about growing delicious, healthy food in harmony with nature, they'll happily talk your ear off about just how they nurtured those juicy tomatoes from seed to your shopping bag. Markets also spread awareness of agricultural issues facing our largely urban society, including the truth about organic farming, genetically modified foods, fair pricing for agricultural products, and the abundant variety of fresh seasonal food available in a locally-networked food system. If you've been wondering what's on your plate, chances are the answers are waiting for you at a farmer's table, nestled among the organic kale.

IN ELECTRICAL

CCTV Installation Design: - Public surveillance Cameras improve Safety of the Public. Surveillance Cameras in Public Areas reduce Crime Rates. This is because when an individual knows he/she is continuously monitored, they are less likely to indulge in a criminal act. Public Video Surveillance helps to track down criminals CCTV cameras in Public Spaces help in gathering Clues and Evidence. Boost overall Convenience

Solar Rooftop Installation Design: - It is Cost savings. It Reduces carbon footprint. It has Low maintenance costs. It Reduce in electricity bills. It is Suitable for Indian climate. No additional space required for installation. Support from the government.

Automatic Irrigation System using Arduino: - Saves Time A programmed water system framework will spare you a lot of time that you in the past would have spent watering your yards, gardens and blooms. You would now be able to have your clocks set, with the goal that watering will occur at the occasions that best suits your scene and the atmosphere where you live. Saves Money With a programmed water system framework there is no cash or water squandered, for everything is coordinated, modified and these frameworks all have rain sensors, so every drop of water is utilized just when it is required. Saves Water You can enable preserve to water with programmed frameworks, for there is no squandering of water, each drop is utilized not squandered away. You can spare somewhere in the range of 30 and 50 percent of the water that you would ordinarily use with other more customary watering strategies. Improves Growth Whenever plants, yields, yards or blossoms are watered with littler measures of water over a more drawn out timeframe, they become quicker, for it is the perfect condition for development. You will appreciate greener and more delicious greenhouses and gardens.

Chapter: 14
Technical Options with Case Studies

14.1 Civil Engineering

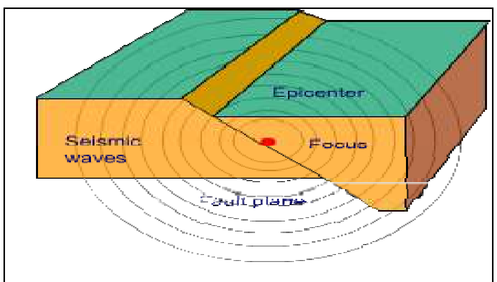
14.1.1 Advanced Earthquake Resistant

INTRODUCTION

Disasters are sudden occurrences which have unfavorably affected humans as the advent of our survival. In response to such occurrences, there have been challenges to mitigate destructive effects of these disasters. Many people have lost their lives owing to the collapse of houses during earthquakes in the past few decades, millions of moneys of financial losses have also been prolonged. Building liability usually results from a shortage of awareness of engineering science and inadequate implementation of building codes. The challenge is most difficult in emerging countries where peoples are increasing, cities and towns are enlarging, and buildings are more subjected to damage. An Earthquake is the cause of an unexpected discharge of energy in the earth's crust that generates seismic waves. Earthquakes are dignified by with seismometers. Earthquakes are so far away unpredictable and unpreventable; the only alternative is to construct and build the building structures which by earthquake resistant. There are so many techniques to withstand earthquake, but they are costly are not used by ordinary people. Here a variety of beneficial small cost techniques to resist earthquake effects. This is sustained by negligible damage devoid of loss of life when relative to severe earthquake attacks developed countries, whereas still a moderate earthquake cause wide-ranging spread destruction in emerging countries as has been observed in recent earthquakes. Earthquake, which is not kills the people, but it is the hazardous in buildings which is at fault for the widespread devastation the present paper sketches the building typologies confronted in the Indian subcontinent and their accomplishment during earlier earthquakes incidents. In addition to efficient and effective seismic design philosophies, it is essential to make sure strict code-compliant construction practices and structural design. The professionals elaborate in the Enterprise/construction of such structures are civil/ structural engineers, who are liable for building earthquake resistant structures and possess the buildings in a safe environment.

Understanding of Earthquake and Basic Terminology

Earthquake is well-defined as an unexpected ground shaking produced by the release of massive stored strain energy at the interface of the tectonic plates. Focus:-It is the point in the earth from point at the seismic waves originate. Focal Depth:-It is the vertical distance between Focus and epicenter. Epicenter:-It is the point on surface of the earth from vertically above the origin of an earthquake.



(Fig–85 Earthquake Engineering Terminology)

MODERN-DAY CONSTRUCTION METHODS FOR EARTHQUAKE RESISTANT BUILDINGS

The Pre-stressed concrete components in seismic risk resistant construction which ensures proper relationship between different elements of a structure. But this methodology have been generally implemented in New Zealand.

Shape-memory alloys

This demonstrate exceptional characteristics desirable in a seismic risk resistant building. They have a capability to disintegrate considerable energy without permanent deformation or considerable destruction. Generally common shape memory alloys are makeup of metal blends comprising, nickel titanium, copper-aluminium-nickel and copper-zinc-aluminium-nickel. This is more suitable for extensive applications.

Seismic Dampers

In Seismic Dampers are the diagonal braces in a moment resisting frame which is used for efficient lateral load resisting scheme. In modern area the structural seismic retort to control have taken the lead to the alternative of these bracings with seismic dampers. These dampers behaves similar to the hydraulic shock absorbers in cars considerably in case the sudden jerks are engaged in the hydraulic fluids and only small is transferred to the chassis of the car. In this case the seismic energy is conveyed through it and dampers is absorbed a small part of it and decrease the magnitude of the force which is acting on a structure. Generally used types of seismic dampers are included the friction dampers (energy is fascinated by surfaces within the friction between them rubbing beside each other), viscous dampers and yielding dampers. The friction dampers were delivered in an 18-story RC frame structure in Gurgaon, India.

Steel Plate Shear walls

Shear walls are deemed as an important component of a lateral load resisting systems and steel is known for its flexible behaviour. Merging these two attractive properties, an efficient load resisting system was established and has noticed wide applications in North America and Japan. These walls are intended and also, they turn as a bend as an alternative of buckling below the action of lateral loads. The walls are substantially lighter and thinner; thus, they reduce the building weight. So, these walls not needed to be cured and consequently, it leads to increase the speed of the construction process.

Carbon Fibbers

The tensile features and the constant nature of a spider web was studied by many researchers in Japan. This is the world’s first seismic reinforcement structure made of carbon fibre material. A seismic risk Resistant Building Rendered with Carbon Fabric and it is redolent of a giant spider web has been erected in Nomi City of Ishikawa Prefecture in Japan.

Ecological ductile cementations composite (EDCC) spray

A many researcher from the University of British Columbia has established a new extreme method to make up the buildings resist against seismic risks. EDCC blends the fly ash, cement with polymer-based fibres, and other extracts in making it ecological and has been provided the molecular level to be malleable and strong at the same time. This material when utilized as a slim coating (10mm), was noticed to have enhanced seismic resistance of the structure by enduring a seismic risk of intensity 9 to 9.1 on Richter scale. So this method has been proposed for retrofitting of the vacant structures such as an uncomplicated school building in Vancouver.

Blue mussels

It is found sea decks and clinging to rocks all laterally the coast of New England. They are affixed in place by a gristly outcrop of cabling that occurs from among their twin shells. Generally the most ferocious of high tides can't pry them very loose. To remain affixed to their precarious perches, mussels secrete sticky fibres well known as byssal threads. These threads are inflexible and stiff while others are flexible and elastic. Researchers are annoying to combine this particular element into structures in order to make up the building endure the seismic risks.

Seismic Invisibility Cloak

A sequence of the borehole is mined about the periphery of the structure that needs to be endangered. These boreholes seem to work as a seismic cloak‖ that could hide a building or possibly a complete city from an earthquake's deadly waves. This makes the use of dampers, isolators, and also other vibration response control devices obsolete.

CONCLUSION

Seismic Invisibility Cloak – A series of the borehole is dug around the periphery of the structure that needs to be protected. These boreholes appear to work as a seismic cloak that possibly will hide a building or perhaps a whole city starting an earthquake's deadly waves. This makes the use of isolators, dampers, and other vibration response control devices obsolete.

14.1.2 Seismic Retrofitting of Buildings

Introduction

Seismic Retrofitting Techniques are required for concrete constructions which are vulnerable to damage and failures by seismic forces. In the past thirty years, moderate to severe earthquakes occurs around the world every year. Such events lead to damage to the concrete structures as well as failures. Thus the aim is to focus on a few specific procedures which may improve the practice for the evaluation of seismic vulnerability of existing reinforced concrete buildings of more importance and for their seismic retrofitting by means of various innovative techniques such as base isolation and mass reduction. So Seismic Retrofitting is a collection of mitigation technique for Earthquake engineering. It is of utmost importance for historic monuments, areas prone to severe earthquakes and tall or expensive structures.

Introduction to Seismic Retrofitting Techniques:

⇒ Earthquake creates great devastation in terms of life, money and failures of structures.
⇒ Upgrading of certain building systems (existing structures) to make them more resistant to seismic activity (earthquake resistance) is really of more importance.
⇒ Structures can be (a) Earthquake damaged, (b) Earthquake vulnerable
⇒ Retrofitting proves to be a better economic consideration and immediate shelter to problems rather than replacement of building.

Seismic Retrofitting of Concrete Structures:

Definition:

It is the modification of existing structures to make them more resistant to seismic activity, ground motion, or soil failure due to earthquakes. The retrofit techniques are also applicable for other natural hazards such as tropical cyclones, tornadoes, and severe winds from thunderstorms.

Need for Seismic Retrofitting:

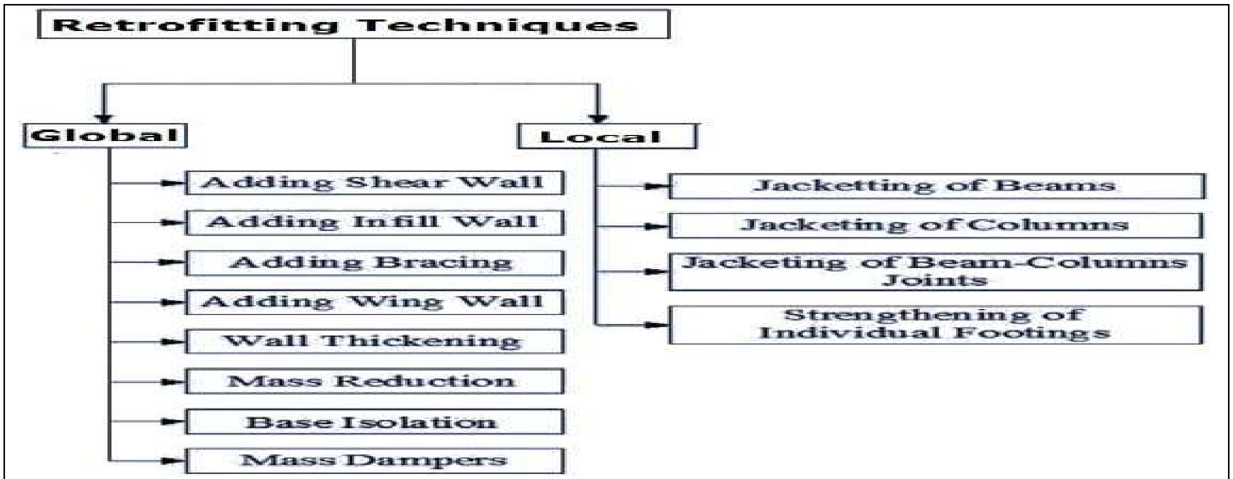
⇒ To ensure the safety and security of a building, employees, structure functionality, machinery and inventory
⇒ Essential to reduce hazard and losses from non-structural elements.

⇒ Predominantly concerned with structural improvement to reduce seismic hazard.
⇒ Important buildings must be strengthened whose services are assumed to be essential just after an earthquake like hospitals.

Problems faced by Structural Engineers are:
Lack of standards for retrofitting methods – Effectiveness of each methods varies a lot depending upon parameters like type of structures, material condition, amount of damage etc.,

Basic Concept of Retrofitting:
The aim is at:
⇒ Upgradation of lateral strength of the structure
⇒ Increase in the ductility of the structure
⇒ Increase in strength and ductility

Classification of Retrofitting Techniques:

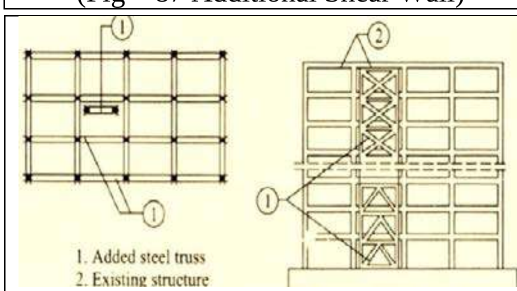


(Fig – 86 Retrofitting Techniques for Reinforced Concrete Structures)

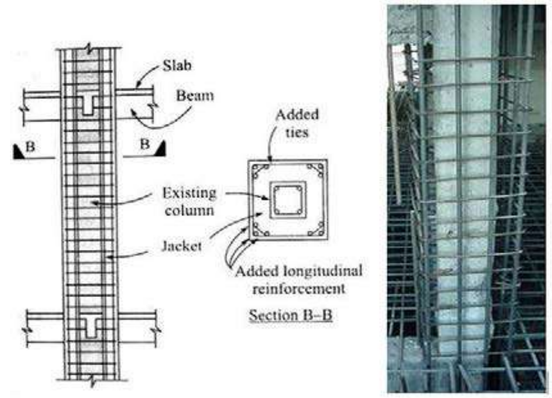
Adding New Shear Walls:
⇒ Frequently used for retrofitting of non-ductile reinforced concrete frame buildings.
⇒ The added elements can be either cast? In? Place or precast concrete elements.
⇒ New elements preferably be placed at the exterior of the building.
⇒ Not preferred in the interior of the structure to avoid interior moldings.


(Fig – 87 Additional Shear Wall)

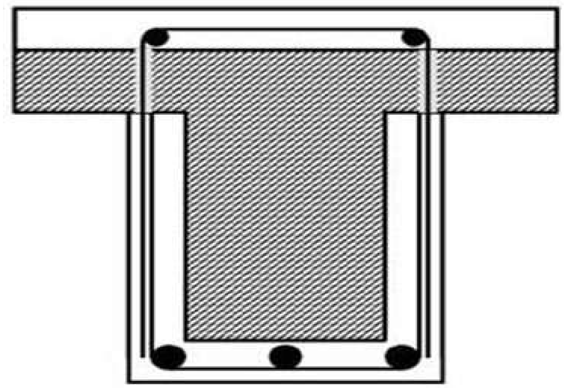
Adding Steel Bracings
An effective solution when large openings are required. Potential advantages due to higher strength and stiffness, opening for natural light can be provided, amount of work is less since foundation cost may be minimized and adds much less weight to the existing structure.



(Fig – 88 Steel Bracing)

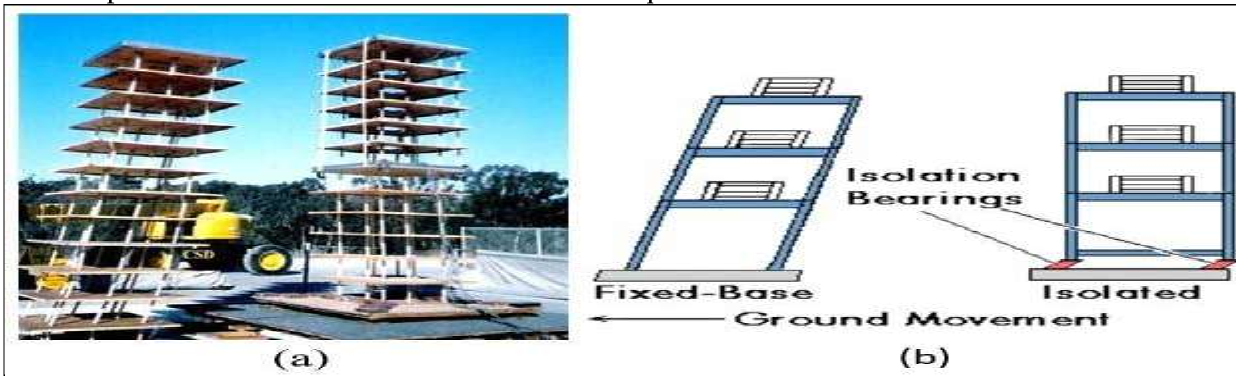


(Fig – 89 Column Jacketing)



(Fig – 90 Beam Jacketing)

Base Isolation (or Seismic Isolation):
Isolation of superstructure from the foundation is known as base isolation. It is the most powerful tool for passive structural vibration control technique.

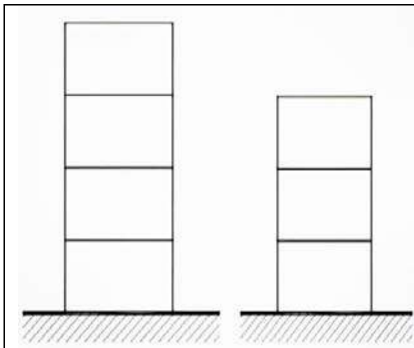


(Fig – 91 Base Isolated Structures (a)Model Under Test, (b) Diagrammatical Representation)

Advantages of Base Isolation
⇒ Isolates Building from ground motion – Lesser seismic loads, hence lesser damage to the structure, -Minimal repair of superstructure.
⇒ Building can remain serviceable throughout construction.
⇒ Does not involve major intrusion upon existing superstructure

Disadvantages of Base Isolation
⇒ Expensive
⇒ Cannot be applied partially to structures unlike other retrofitting
⇒ Challenging to implement in an efficient manner

Mass Reduction Technique of Retrofitting:
This may be achieved, for instance, by removal of one or more story's as shown in Figure. In this case it is evident that the removal of the mass will lead to a decrease in the period, which will lead to an increase in the required strength.



(Fig – 92 Seismic Retrofitting by Mass reduction)

Wall Thickening Technique of Retrofitting:
The existing walls of a building are added certain thickness by adding bricks, concrete and steel aligned at certain places as reinforcement, such that the weight of wall increases and it can bear more vertical and horizontal loads, and also its designed under special conditions that the transverse loads does not cause sudden failure of the wall.

Indian Standard Codes for Earthquake Design of Structures:
- ⇒ IS: 1893-2002 (part-1) Criteria for Earthquake Resistant Design of Structures (Part 1 : General Provision and Buildings) – Code of Practice
- ⇒ IS: 4326-1993 Earthquake Resistant Design and Construction of Buildings – Code of Practice
- ⇒ IS: 13920-1993 Ductile Detailing of Reinforced Concrete Structures subjected to Seismic Forces – Code of Practice
- ⇒ IS: 13935-1993 Repair and Seismic Strengthening of Buildings – Guidelines
- ⇒ IS: 13828-1993 Improving Earthquake Resistance of Low Strength Masonry Buildings – Guidelines
- ⇒ IS: 13827-1993 Improving Earthquake Resistance of Earthen Buildings – Guidelines

Conclusion – Seismic Retrofitting Techniques for concrete structures:
- ⇒ Seismic Retrofitting is a suitable technology for protection of a variety of structures.
- ⇒ It has matured in the recent years to a highly reliable technology.
- ⇒ But, the expertise needed is not available in the basic level.
- ⇒ The main challenge is to achieve a desired performance level at a minimum cost, which can be achieved through a detailed nonlinear analysis.
- ⇒ Optimization techniques are needed to know the most efficient retrofit for a particular structure.
- ⇒ Proper Design Codes are needed to be published as code of practice for professionals related to this field.

14.1.3 Advance Practices in Construction field in Modern Material, Techniques and Equipment's

Morden Materials

Self–compacting Concrete (SCC)
SCC was developed by the Japanese initially as a Quality Assurance measure, but now is being widely used for concrete structures worldwide. In India, one of the earliest uses of SCC was for some components of structures at Kaiga Atomic Power Project. Many components of the structures were very heavily reinforced and the field engineers found it difficult to place and compact normal concrete without honeycombs and weaker concrete. SCC was successfully used. SCC leaving the batching plant is in a semi-fluid state and is placed into the formwork without the use of vibrators. Due to its fluidity, SCC is able to find its way into the formwork and in between the reinforcement and gets self-compacted in the process. SCC is particularly useful for components of structures which are heavily reinforced. The fluidity is realized by modifying the normal mix components. In addition to cement, coarse and fine aggregates, water, special new generation polymer based admixtures are used to increase the fluidity of the concrete without increasing the water content.

Due to its high fluidity, the traditional method of measuring workability by slump does not work. The fluidity is such that any concrete fed to the slump cone falls flat on raising the slump cone; the diameter of the spread of concrete is measured as an indication of workability of SCC. This is called Slump Flow and is in the range of 600 – 800 mm.

Apart from the use of superior grade chemical admixtures, the physical composition of the concrete for SCC has undergone changes. The concrete is required to have more of fine aggregates and compulsorily any of the mineral admixtures – fly ash, ground granulated blast furnace slag (GGBFS), silica fume, metakaolin, rice husk ash etc. Fly ash is abundantly available as a waste product at all the thermal power stations and the Government has encouraged use of fly ash by offering them practically free at the thermal power stations. GGBFS is again a by-product of the steel mills. During the production of steel, a molten steel is poured from blast furnaces and travels in special channels, leaving the impurities on top of the stream. The waste material, being lighter moves on top and easily diverted away from the usable steel.

The diverted slag is quenched and forms small nodules. These nodules are crushed and granulated into very fine product, with particle size smaller than that of cement. The product is marketed in 50 kg bags and available economically in the regions around steel mills with blast furnaces. In other regions, additional transport cost of this bulk material is involved but its use is justified because of contribution to durability of concrete. For the concrete components of the structure for Bandra and Worli sewage outfalls in Mumbai, the German prime contractor insisted on compulsory use of GGBFS for the M40 concrete in order to improve the durability of concrete. GGBFS had to be transported from Vizag in the eastern part of India, in spite of heavy transportation cost. Since then GGBFS is finding widespread use in different parts of India for ensuring durable concrete.

The Use of Mineral Admixtures

After realization of the need for durable concrete structures, the composition of concrete has undergone changes. From being a product made of three or four materials (cement, aggregates, water), today a typical durable concrete consists of six or more materials. The use of low water cement ratio enables a reduction in the volume and size of capillary voids in concrete; this alone is not sufficient to reduce the cement based content of concrete which is the source of micro-cracking from thermal shrinkage and drying shrinkage. To reduce the cement based content, both the water content and cement content must be reduced as much as possible. Concrete mixes with fewer micro cracks can be produced by blending the cement with mineral admixtures either in the batching plant or in the cement plant. This enhances the service life of concrete structures in a cost-effective manner.

Fly Ash

Thermal power stations are left with an undesirable by-product, fly ash, in large quantities which is not able to effectively utilize or dispose of. Currently, (2009) more than 120 million tonne of fly ash are generated annually and the storage and disposal has been costing the power stations substantial unproductive expenditure. Unfortunately, all the fly ash available at the power stations is not fit for use as mineral admixture directly. Fly ash as a mineral admixture should conform to IS: 3812. Such a material is available in the finer streams of Electro Static Precipitators fitted to the power generation system.

The coarser materials are required to be processed (generally with the help of Cyclones) before being considered for use as mineral admixture for concrete. There are only a few processing units in India, including the one as Nashik Thermal Power Station. As per the Euro Code for Concrete, only processed fly ash can be permitted as mineral admixture in concrete. The code limits the use of fly ash. About 35% of cement may be replaced by fly ash; the actual percentage replacement depending on the outcome of trial mixes.

High Volume Fly Ash Concrete (HVFA)

The high volume fly ash concrete (HVFA) represents an emerging technology for highly durable and resource efficient concrete structures. Laboratory and field experience have shown that fly ash from modern coal-fired thermal power plants, when used in large volume (typically 50 - 60% by mass of the total cementitious materials content, is able to impart excellent workability in fresh concrete at a water content that is 15 – 20% less than without fly ash. To obtain adequate strength at early age, further reductions in the mixing water content can be achieved with better aggregate grading and use of super-plasticizers. HVFA concrete has now been successfully used in a few sporadic projects in India. All SCC in India use HVFA, to the extent of 50% cement replacement. Some concrete roads being built by NHAI have also used HVFA concrete, including the Four-Laning of Satara – Kolhapur National Highway.

Ground Granulated Blast Furnace Slag (GGBFS)

The problems associated with the quality of fly ash do not exist in the case of Ground Granulated Blast Furnace Slag GGBFS, as the produce is necessarily the outcome of grinding to the required particle size. Thus the use of GGBFS as a mineral admixture should be preferred, despite long leads for end users in certain parts of India far from the steel plants. GGBFS sold in India is of uniform quality and particle size gradation. For many landmark structures such as the Burj Dubai (the tallest building in the world in 2009) GGBFS has been extensively used as a mineral admixture, even though the material is imported from other countries, resulting in the landed cost being more than that of cement. This was a conscious decision with a view to obtaining a more durable concrete structure.

In India the use of GGBFS has been fairly limited, in spite of all the technical advantages. The Indian Concrete Code permits up to 70% of cement replacement where GGBFS is used. Technically, the use of GGBFS is more effective only at replacement levels of 50% or more. For a number of structures in a port in Andhra Pradesh, typically the M40 concrete mix contained 100 kg of cement and 300 kg of GGBFS. Portland Slag Cement (PSC) is also available and useful for ensuring durability of concrete structures. Due to the proximity to steel mills, PSC is generally produced in locations close to steel plants. Here again due to the bulky nature of the product, the transportation cost predominate. Another issue concerning quality of the PSC is the actual percentage replacement while making PSC; this information is not normally displayed on the bags, leaving the user at a disadvantage. In developed countries, information regarding the percentage of slag utilized in making PSC is generally printed on each bag of cement.

Condensed Silica Fume (CSF)

CSF is a by-product of Ferro-Silicon industry and at present an imported product, easily available in the Indian market. The particle size is very small, about 100 times smaller than that of cement. It can occupy the voids in between cement particles in a concrete mix, reduce the water demand

and thus contribute to a very dense concrete of high durability. Normally, 5 - 10% of cement can be replaced by CSF in order to produce durable concrete. The product is expensive and is used in developed countries only for very high strength concrete (above 75 mPa). Indiscriminate use of CSF for lower grades, barring exceptions, only increases the project cost without corresponding technical benefits. Even when used, the percentage replacement should be based on trial mixes in each case, which may vary from one to 10%. CSF may also be used for High Performance Concrete of lower grades.

Ternary Blends

Ternary blends of mineral admixtures are now recommended for improving the durability of important concrete structures. An outstanding example is the Reconstruction of the New I-35 W St. Anthony Falls Bridge crossing the Mississippi River in Minneapolis, US. The new bridge has been opened to traffic in September 2008, less than 14 months after the collapse. HPC has been used for reconstruction with a target 100 year life span. High Performance Concrete containing silica fume and fly ash was used for low permeability.

Two gleaming white concrete sculptures tower 9 m high at each end of the bridge. The sculptures were pre-cast using an SCC mix that included photo-catalytic cement with self-cleaning and pollution reducing characteristics. The photo-catalytic cement is one of the new developments in the construction materials industry. The SCC concrete resulted in a marble-like, smooth white finish to the concrete surface. With a low water cementitious material ratio (w/cm), air entrainment and a rapid chloride permeability test (RCPT) value of less than 1500 coulombs at 28 days, the monument will also be a durable feature in the severe environment adjacent to the I-35 W Roadway.

For the drilled shaft foundations of the I-35 Bridge, SCC was used. To control temperature during curing, fly ash and slag were incorporated as the majority of the cementitious material. This reduced the heat of hydration by approximately 50%. The concrete mixes for the footings and piers were proportioned for mass concrete and durability through the use of fly ash and slag. As the components were massive in size, concrete mixes were modified by cementitious materials, chilled water and cooled aggregates, use of form insulation and internal cooling pipes.

Hydrophobic Concrete Waterproofing System

A typical patented product uses three materials to achieve a water-tight concrete structure, a super-plasticizer which reduces batching water requirements, thus limiting the volume of the capillary pour network in the concrete; a reactive hydrophobic pour blocking concrete admixture and product specific water stop protection at construction dams.

Other accessory products include an operation retardant, curing compound, water stops and polypropylene fiber reinforcement. The patented product is typically added while concrete mix is being prepared to assist waterproofing. One product is applied at the rate of 5 liter per of concrete. Typically the manufacturer provides a warranty period of 10 years. The performance warranty provides for repairing water leakage through industry accepted and approved means for a period of 10 years. The product however has some negative impact on the rate of gain of strength of concrete. As a rough indication, the specified characteristic 28-day strength of concrete will not be achieved at 28 days but at 56 days or more.

The cementitious content of concrete using the integral waterproofing compound shall not be less than 325 k g / c u m with up to 50% fly ash or slag replacement. The water cement ratio shall be adjusted to compensate for the water in the waterproofing compound and super-plasticizer and maintain the required workability. The water cement ratio shall not exceed 0.42. The product is of American origin, represented by an Indian company which provides the necessary technical expertise.

Photo-catalytic Cement

This is a patented Portland cement developed by Italcementi Group. The photo-catalytic components use the energy from ultra-violet rays to oxidize most organic and some inorganic compounds. Air pollutants that would normally result in discoloration of exposed surfaces are removed from the atmosphere by the components, and the residues are washed off by rain. This cement can be used to produce concrete and plaster products that save on maintenance cost while they ensure a cleaner environment. In addition to Portland cement binders, the product contains photo-catalytic titanium dioxide particles. The cement is already being used for sound barriers, concrete paver blocks and façade elements. Other applications include pre-cast and architectural planners, pavements, concrete masonry units, cement tiles etc.

Exterior Self–levelling Concrete Topping

This is a Portland cement based product for fast track resurfacing and smoothing of concrete. It produces a smooth flat hard surface and dries quickly without shrinking, cracking or spalling. Pourable or pump-able when mixed with water, it installs 6 to 20 mm thick in one application and up to 50 mm thick with the addition of aggregate. It is pourable or pump-able when mixed with water. It can be used on, above or below grade and it makes spalled or damaged concrete look like new. Once sealed it creates an excellent wearing surface.

Carbon Dioxide (CO_2)

As part of a future global atmospheric stabilization strategy, industrialized countries may lead to use large amounts of carbon dioxide. CO_2 may be used for curing pre-cast concrete units. Manufacturers of concrete masonry units could use CO_2 to reduce energy consumption. Steam curing which is conventionally used is energy intensive. Although CO_2 curing provides slower strength development than steam curing, the performance can be improved if the blocks are properly pre-conditioned before CO_2 curing. It has also been noted that the water absorption of CO_2 cured blocks is lower than that of steam cured blocks.

Self–curing, Shrinkage-free concrete

Italian researchers have produced a concrete by the combined use of

a. A water reducing admixture based on poly-carboxylate in order to reduce both the mixing water and cement.
b. a shrinkage reducing admixture
c. An expansive agent based on a special calcium oxide.

The combined use of an expansive agent and a PC based water reducing super-plasticizer results in a shrinkage-free concrete even in the absence of any wet curing. Due to the water reduction caused by the PC based super-plasticizer at a given w/c, there is a reduction in the volume of cement paste and a corresponding increase in the amount of aggregates. Both are responsible for significant reduction in the drying shrinkage.

Application of Nano Technology

Reducing particle size of a material to Nano–scale often imparts new properties or enhances existing ones. This is typical of Nano particles of titanium dioxide, which maintains its photocatalytic activity even when mixed with cement. External cement based surfaces become strongly photocatalytic, leading to a much better appearance and a significant reduction in concentration of pollutants in the surrounding air.

The photoactive titanium dioxide was found to be a more powerful photocatalytic agent when its particle size decreased to non-size. This makes it an ideal vehicle for application in construction. A cement binder containing about 5% of active titanium dioxide produces concrete with a smooth surface and also converts the pollutants, removes them from the surrounding air. In a typical application on a building in France completed in 2000, the quality of concrete surface have remained unchanged till date. The structure looked as if it were freshly built.

Advanced Techniques in Construction

Modern construction methods (MMC) are methods that are developed in construction industry with proper planning and design so that each project reduces the construction time, cost and maintain overall sustainability. There are many methods followed and constructed in the present scenario widespread. Most famous and highly applied methods of modern construction are listed and explained below.

1. Precast Flat Panel System
2. 3D Volumetric Modules
3. Flat Slab Construction
4. Precast Cladding Panels
5. Concrete Wall and Floors
6. Twin Wall Technology
7. Precast Concrete Foundation
8. Concrete Formwork Insulation

Precast Flat Panel System

This method of construction involves the procedure of making floor and wall units off site. For this, separate factory outlets and facilities is required. Once the panel units are made as per the design specification and requirements, they are brought to the site and placed. This method is best suited for repetitive construction project activities.

(Fig – 93 Precast Flat Panel System)

3D Volumetric Construction

As the name implies, the 3D volumetric construction involves the manufacture of 3D units in the form of modules in off site. At the time of installation, they are brought to the site and assembled module by module. Each modular unit manufactured are 3D units, hence this construction is called as 3D volumetric construction or modular construction. The transportation of the modules can be carried out in various forms or methods. This can involve the transportation of the basic structure or a completed unit with all the internal and external finishes, services installed within it, that the only part remaining is

(Fig – 94 3D Volumetric Construction)

the assembly. The factory construction brings different unit of same product maintaining their quality throughout. Hence this method is best suited for repetitive projects so that rapid assembly of the products is possible.

Flat Slab Construction

The flat slabs are structural elements that are highly versatile in nature. This is this versatility that it is used widely in construction. The flat slab provides minimum depth and faster construction. The system also provides column grids that are flexible. Wherever it is necessary to seal the partitions to the slab soffit as a reason of acoustic and fire concerns, the flat slabs are a desirable solution. When compared with other forms of construction, the flat slabs are faster and more economic in nature. The construction of flat slabs can be completed with good surface finish for the soffit, this enables to utilize he exposed soffits. The flat slab construction is also a means of increasing the energy efficiency as this allows the exploitation of building thermal mass in the design of ventilation, heating and the cooling requirements.

(Fig – 95 Flat Slab Construction)

Precast Concrete Foundations

For the rapid construction of foundation, the precast concrete system can be employed. This method is more suited for a bespoke design. Here, the elements required for the construction of foundation are constructed separately in the factory (off site) and brought to the site and assembled. The manufactured product must have the assured quality as specified by the designer. The foundation assembled is mainly supported by concrete piles. During assembling, both the systems are connected together. These foundation systems helps in increasing the productivity, increase quality, decrease the soil excavation quantity. This is best suited for extreme and adverse weather conditions. When the construction is dealt on a highly contaminated ground, this system of construction is a best choice.

(Fig – 96 Precast Concrete Foundations)

Twin Wall Technology

The twin wall technology is a hybrid solution of wall system that combines the qualities of erection speed and precast concrete with the structural integrity of in-situ concrete. This type of wall system guarantees structural integrity and waterproof reliability for the structure. The twin wall system has two walls slabs that are separated as shown in the fig. The two slabs are separated by a cast in lattice girders. The procedure involves:

1. The wall units are placed in the site.
2. The twin units are propped temporarily.
3. The wall units are later joined by means of reinforcing.
4. The gap between the walls units are filled by means of concrete.

(Fig – 97 Twin Wall Technology)

This system of construction is faster than normal construction methods and economical. The twin wall system is mainly employed in association with the construction of precast floors.

Insulating Concrete Formwork

The system of insulating concrete formwork (ICF) have twin walled panels that are either polystyrene panels or blocks are employed. These are built quickly to create the formwork as the wall of the buildings. The formwork that is made is filled with concrete. This concrete is factory produced that have quality assurance so that a ready – mixed concrete. Mostly the mix is ready mix concrete. Higher level of thermal insulation is provided by expanded polystyrene blocks. The concrete core will provide good robustness and better sound insulation.

(Fig – 98 Insulating Concrete Formwork)

Precast Cladding Panels

The cladding system is the installation of a material over another that finally act as a skin or a layer. This system of layer is not only intended for aesthetics, but it can help in controlling the infiltration of the weather elements. No kind of waterproof condition is provided by the cladding. Instead, the cladding is a control measure against water penetration. This safely help in directing the water or the wind so that there is control of the runoff. This helps to prevent the infiltration into the building structure.

(Fig – 99 Precast Cladding Panels)

Concrete Walls and Floors

Concrete walls are mainly applied for seat walls, retaining wall, decorative exterior, and interior finishes. The concrete is also used a flooring material. As per the latest technology, the concrete floors can be provided with good finish to provide smooth and attractive flooring. When compared with any other material, the concrete floors provide a wide variety of material for applications like acid-stained painted, radiant floors, overlays, and micro toppings. The concrete flooring can also be called as cement flooring. When compared with other flooring types, concrete flooring is affordable and maintenance is easy. Proper sealing of concrete flooring can be cleaned by a dust mop.

Morden equipment’s

Modern Construction equipment’s play a vital role in the construction industry where business objectives are strictly time and margin driven. The modern construction equipment is very swift and reliable with high-quality control measures embedded into them as they have evolved over the years. Proper utilization of these equipment helps in the economy, quality, safety, speed and timely completion of the project. It optimizes the usage of material, manpower, finance, and the shortage of skilled and efficient labour and at the same time keeps a direct check over the quality measures that are being used.

The following machinery list helps any construction industry:

- ⇒ Hydraulic Mobile Stone Crusher
- ⇒ Self-Loading Concrete Mixer
- ⇒ Mini Dumper
- ⇒ Concrete pipe truck
- ⇒ Excavators
- ⇒ Backhoe Loaders
- ⇒ Bulldozers
- ⇒ Skid-Steer Loaders
- ⇒ Motor Graders
- ⇒ Crawler Loaders
- ⇒ Trenchers
- ⇒ Scrapers
- ⇒ Common Dump Trucks

Earth moving Equipment

Construction methods there are many different types of earthmoving equipment, including excavators, loaders, motor graders, trenchers, bulldozers, and backhoes. These machines are used to shift large amounts of dirt, dig foundations, and landscape areas. Excavators, for example, are commonly used to dig trenches, cut brush in forests, demolish buildings, and dredge rivers. Backhoe loaders typically combined with a tractor and have a front bucket or shovel with a small backhoe in the rear.

- ⇒ Construction Safety and Health
- ⇒ Objectives of Construction Management
- ⇒ Mining Equipment Manufacturers
- ⇒ Construction Equipment Hauling

Material handling equipment

Some of the most common types of material handling equipment include cranes, forklifts, hoists, and conveyors. You'll often see cranes at construction sites lifting and lowering heavy materials and transporting them to other areas. Cranes are operated by a series of cables and are frequently used in engineering projects that require temporary structures. Forklifts can be used everywhere from retail stores to warehouses and construction sites. Larger forklifts are able to lift about 50 tons.

Construction equipment

Construction equipment is a broad term to describe machines like concrete mixers, pavers, heavy-duty pumps, stone crushers, road rollers, and tunnelling equipment. Tunnel boring machines, also known as moles, are used to excavate underground spaces and are able to bore through sand, dirt, and rock. Road rollers or roller-compactors are engineering vehicles used to make concrete, soil, or asphalt more compact. These are often used at construction sites, agricultural fields, and waste landfills.

Engineering vehicles

The most common vehicles used at modern construction sites are tankers, trailers, tippers, and dumpers. They're specifically designed for civil engineering tasks and often involve earth moving. Dumpers differ from dump trucks because their load is in front of the driver instead of behind the cab. Tip trucks are frequently used for mining and quarrying operations because they are durable and manoeuvrable. As you can see, construction equipment ranges from large and heavy to light and portable. Some jobs require lots of heavy machines, while others only need a few pieces of equipment. To learn more about specific pieces of equipment, check out Hamdija Velaic's informative slideshow about the various types and uses of construction equipment. As technology continues to advance in the industry, we expect to see some exciting future changes in civil engineering machines of all shapes and sizes.

Modern construction machinery

The way customers do business has changed. Today, they research equipment and dealership services online using multiple devices – laptops, smart-phones, and tablets – while referencing what hundreds of others have said about their sales and service experience with you. Heavy Equipment and Truck clients have always expected a high level of personalization, and those high expectations are only increasing. A "one size fits all" customer model no longer works for the modern Heavy Equipment and Truck dealership dedicated to delivering the optional customer experience. Silo department unable to share customer information leave clients disappointed. Yesterday's technology, never designed for today's heavy demand, is unable to keep pace.

Excavator construction equipment

Excavator is large machinery that can be driven on wheels or tracks, but tracks are more standard for such large machinery. An excavator has a long arm attached to a pivoting cab that can rotate 360 degrees. The long arm is operated off the cab with a high vision facility.

The most common uses for an excavator include:

- ⇒ Material handling
- ⇒ Excavating trenches, dugouts, and foundations
- ⇒ Brush cutting with hydraulic attachments
- ⇒ Destruction
- ⇒ Rough grading
- ⇒ Heavy lifting and pipe installation
- ⇒ Mining

Backhoe loader

Backhoe loaders have a body that is similar to a farm tractor an adjustable shovel is attached to the back for digging. This machine is in a medium-sized construction facility. It is capable of working in a limited space, and it can perform various operations like moving dirt, backfill excavations, dig holes and trenches, and place pipes and other materials. The bucket in the back can be changed to dig trenches of different widths.

Bulldozer

A bulldozer is a powerful, extremely heavy machine employed to move dirt. Bulldozer considered the strongest and most solid heavy machinery in the construction industry. Bulldozers have a wide, flat blade in front of the cabin and are operated using two hydraulic pistons to move the blade in a limited range of angles and depths. A bulldozer's heavyweight can crush the solid stones in the way of its operations.

14.1.4 Engineering Aspects of Soil mechanics - Environmental Impact Assessment

Integration of geotechnical/ geological aspects in EIA

Several authors conducted a study in integrating hydro geotechnical aspects in EIA. One such case is in Delta State, Nigeria, wherein although EIA is used, the authors argued that an expanded study is necessary, providing relevant hydro-geotechnical information (e.g. groundwater flow directions) for an effective EIA. By integrating hydro geotechnical information, the authors argue that "the effects of projects on the environment (water and soil) are properly evaluated and mitigated where necessary". Some studies demonstrated that typical geotechnical engineering methods can be integrated in the conduct of EIA such as the conduct of soil investigation and drilling up to 10m in depth, wherein soil and water samples were brought in the laboratory for analysis. The authors posit that since geotechnical engineering procedures are the first that are being conducted in any construction process, they are very significant because they influence the sustainability of the engineering structure. Geo-structures are essential components of all infrastructures. The failure of these structures will undoubtedly pose threat and danger on the surrounding environment. In reference to the result of the case study in Ogorode, Sapele, Delta State, Nigeria, it was revealed that the soil was fine-grained/ clay, with high plasticity overlying the aquifer. Flooding and erosion are the identified problems of the authors in the said area.

EIA in Mining Industry

Another necessary integration of hydrogeological aspects in EIA studies is in mining sites, with particular focus on the groundwater system. Mining provides livelihood and power generation among other benefits to mankind. Mining, however, leads to adverse changes in the quality of the air, water, and soil. Mineral exploitation has historically caused extensive impacts on the environment. There are several methods performed in the environmental assessment of mining projects. A research study identified the Folchi method coupled with the Takagi-Sugeno fuzzy neural network (TSFNN) to have been used in conducting EIA for mining projects. Another method is an improved Analytic Hierarchy Process (AHP), also used for EIA in mining projects. Their study shows that the impact on the geological environment is the primary factor that needs to be considered in the EIA. A study in Ghana examined the coverage and inadequacies of hydrogeology guidelines in the EIA report by mining sites. The authors have found out that in Ghana, there is a strict requirement for the submission of EIA before mining lease concessions are awarded to mining companies. Mining companies are to conduct a sequential exploration model in the development of their mining sites. However, hydrogeological report guidelines are not adequately comprehensive in terms of inspection. There are EIA reports that contain no or little hydrogeological information. Oftentimes, the hydrogeological aspects were neglected in the report. The conduct of the sequential exploration model for mining sites involves seven phases which include: Desk studies, Regional reconnaissance, detailed survey, exploration drilling, outline drilling, evaluation drilling, and feasibility study. Though there was a robust implementation of EIA in mining sites in Ghana, there are many EIA reports that do not have the necessary groundwater information because essential data for assessment are not collected. Similarly, the study revealed the conduct of exploration for mining entails a significant or high expenditure for the project. The author argues that if the scope of EIA is expanded, valuable benefits can be derived. As an example, the movement and quality of aquifers can be determined and water-rock interactions can be predicted. Considering also the study of land subsidence in a mining area requires a thorough understanding of the geological, geotechnical and hydrogeological setting so that a proper plan of action could be implemented to mitigate the phenomenon. Cost-wise, the aftermath of groundwater contamination will entail a more serious budget expenditure and environmental problem.

Conclusion

The inclusion of hydrological, geotechnical and geological aspects of susceptible areas in EIA studies is important. Hydro-geotechnical/ geological considerations will provide useful subsurface information that can be beneficial during the pre-construction and post-construction stages of geohazard prone project sites, providing invaluable insights into the decision making process. By incorporating hydrological, geotechnical and geological considerations in the EIA process, precautionary measures, appropriate environmental remediation, and protection can be integrated and implemented at an earlier stage, thereby minimizing ground disturbances and possible loss of life and property, resulting to sustainable use of natural resources. The implementation of engineering projects will not bring adverse impacts to the environment if there is a well-planned and systematic construction methodology that will be followed throughout the course of the project's construction and operational lifetime. Similarly, strict implementation and compliance of the policies and regulations of relevant authorities will help in saving the environment. Incorporating geological/ geotechnical aspects in EIA studies would almost certainly entail an additional cost to the project. Cost-wise, however, the repercussion of an environmental disaster that could come up due to inadvertent neglect of geological/geotechnical considerations in the EIA of a project will result in a more serious budget expenditure and environmental problem. For studies focusing on landfills, some aspects were not explained completely in the EIA report/s. This could be attributed to public resistance to the landfill construction. Landfill projects are, by nature, highly environmentally sensitive, oftentimes entailing multiple environmental and technical problems which include the geological/geotechnical hazards. For studies focusing on mining exploration, the review shows that geological problem is the dominant factor in the conduct of the EIA. The review also revealed that generally, the common method employed in the EIA methodology in mining was the Analytical Hierarchy Process (AHP). Geological considerations are commonly considered in EIAs of mining projects. Among the literature that has been reviewed, the lack of integration of geological aspects in flood structures and for oil and gas projects in their EIAs is obvious. Over-all, there are very few journals or published papers that deal with the integration of geotechnical and geological aspects for areas susceptible to geo-hazards in EIA. There is a gap in the literature, and perhaps in the compliance of EIA practitioners, in the incorporation of geological and geotechnical considerations in EIAs of projects relevant to EGGA.

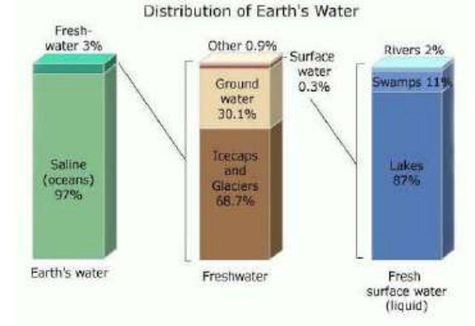
14.1.5 Water Supply-Sewerage system-Waste Water- Sustainable development techniques

What is water sustainability?

Sustainable water management means the ability to meet the water needs of the present without compromising the ability of future generations to do the same. Achieving sustainable water management requires a multidisciplinary and holistic approach in which technical, environmental, economic, landscape aesthetic, societal and cultural issues are addressed.

Sustainable water solutions: the basics

Sustainable water systems should provide adequate water quantity and appropriate water quality for a given need, without compromising the future ability to provide this capacity and quality, according to the IWA. The association states: Water systems in the realm of sustainable development may not literally include the use of water, but include systems where the use of water has traditionally been required. Examples include waterless toilets and waterless car washes, whose use helps to alleviate water stress and secure sustainable water supply



(Fig – 100 Distribution of earths water)

Sustainable water management strategies: three examples

Sustainable water strategies will be devised by the regional and national governments and will vary depending on a variety of factors: maturity of water infrastructure, impact and risks from climate change, level of governmental ambition, regulation and access to finance, among others. According to the IWA, sustainability is as much an outcome as a goal. The conceptual framework for Sustainable Water Resources Management considers water as a renewable, but finite resource with global and regional constraints. This should integrate ecological, economic, and social considerations through institutional and legal/regulatory constructs to move toward sustainable water resources. There are multiple case studies where government-led sustainable water management strategies have been developed, taking into account national regulations. Below we have listed three very different examples, from city to state and country wide in scope

Country-wide sustainable water: A long-term water strategy for Northern Ireland

This wide-ranging strategy focuses on the sustainable management of water in rivers, lakes, loughs and aquifers used for domestic, agricultural and industrial cases. The document proposes how excess rainwater can be managed sustainably locally to reduce the impact of flooding on communities. It also examines how we can reduce the amount of energy needed to move and treat drinking water and wastewater.

State-wide: sustainable water strategies for Victoria, Australia

In a statuary process for state-wide water resource planning in the Australian state of Australia, there are four regional water strategies. Driven by The Water Act 1989, these sustainable water strategies have to be reviewed at least every 10 years. The review of the Central Region Sustainable Water Strategy started in 2016 and is now complete. The five-year assessments of the Western Region and Gippsland Region sustainable water strategies began in 2017 and are also complete. The review of the Northern Region Sustainable Water Strategy is expected to start in late 2019.

City-wide: Rotterdam – leading the way in urban resilience

The Dutch city of Rotterdam topped the Arcadis' Sustainable Cities Water Index list. The city has been innovative and proactive in its approach to water management, including heavy investment into its reservoir catchment system. Rotterdam has become a showcase in urban resilience that directly leads to sustainable water supply: the city is among the highest in the world in terms of water reserves.

Sustainability Assessment of Sewerage Infrastructure

METHODOLOGY

A comprehensive review of the literature and reports collected from Bahrain (e.g., the National Master Plan for Sanitary Engineering Services, operations and maintenance reports, quality assurance reports, and procedure manuals) related to sewerage assets gave the following steps:

1) Reviewing the project management life cycle and the sustainability assessment research on sewerage infrastructure projects
2) Identifying the sustainability element of the sewerage failure
3) Determining the sustainability issues in the sewerage infrastructure projects, and
4) Defining the links to the sustainability development of the wastewater collection system. Based on these four steps, the preliminary sustainability assessment framework for sewerage infrastructure projects was developed.

SUSTAINABILITY ASSESSMENT FRAMEWORK FOR SEWERAGE INFRASTRUCTURE PROJECTS

The proposed framework aims to assess sewerage infrastructure projects throughout their life cycle. The reduction of the risk of sewerage failure and the contribution to the sustainable development of wastewater collection systems are considered in this framework. The preliminary sustainability assessment framework for sewerage infrastructure projects throughout their life cycle is presented in Fig. The framework contains six stages: the current sewerage system; contextualizing the project; planning, designing, and implementation; operation and maintenance; periodic assessment; and rehabilitation/upgrading with major considerations and expected outputs in every stage.

Stage 1: Sewerage System

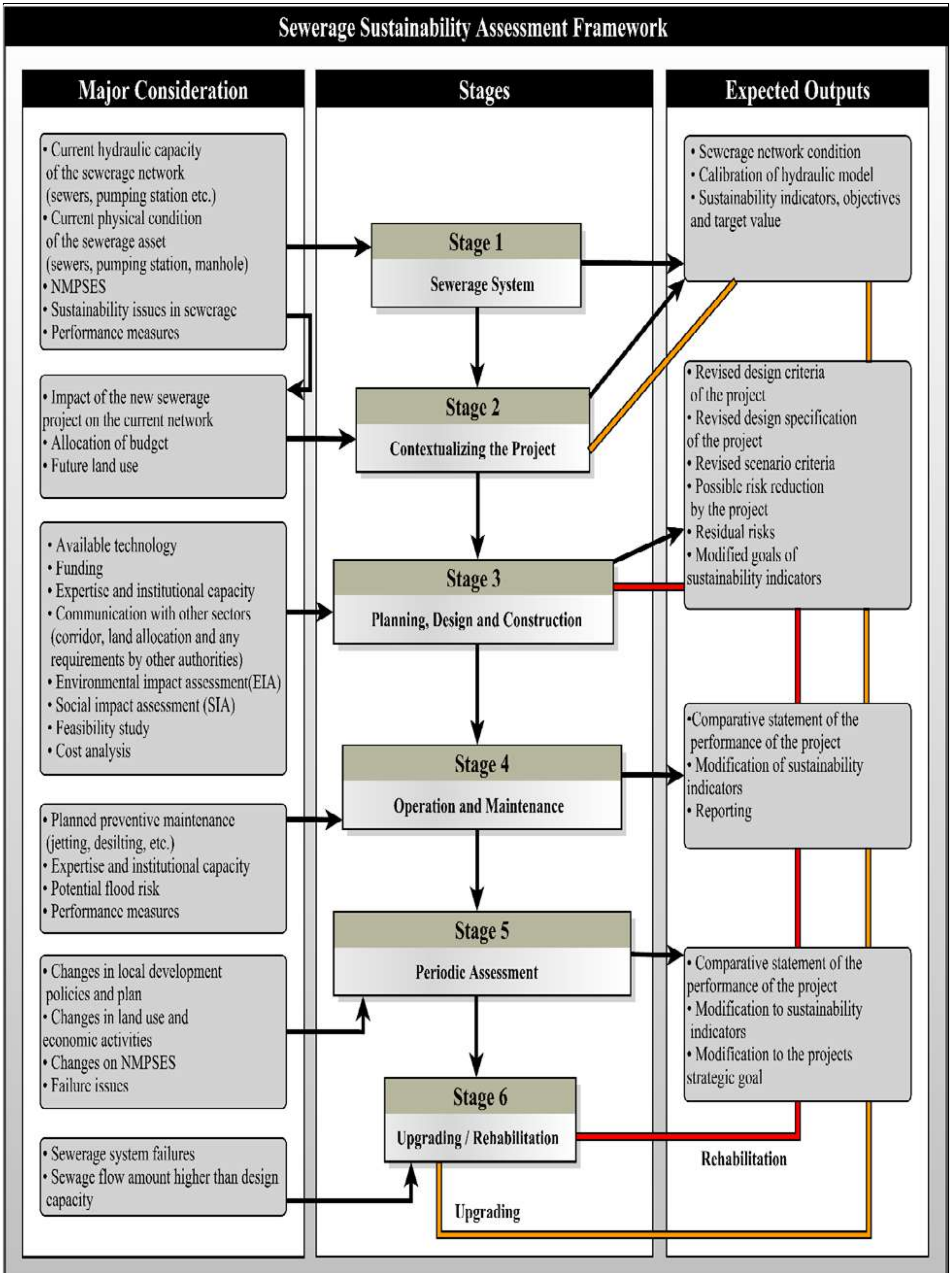
Identifying and understanding the existing sewerage network are crucial to apply the framework. The two main aspects that should be considered are the hydraulic and the physical conditions of the network. The hydraulic condition should be assessed using the hydraulic model software to measure the system capacity. The hydraulic model needs to be calibrated frequently to reflect the actual condition of the pipelines and pumping stations. The physical condition should also be assessed by inspecting the pumping stations and the closed-circuit television of the pipelines. The network should have an inventory of the physical and hydraulic conditions of the network, so that future studies can be performed on the network. At this stage, sustainability issues need to be clearly identified to ensure all risks are considered in the engineering solutions.

Stage 2: Contextualizing the Project

At this stage, the scope of work of the proposed sewerage project is developed by entering the proposed scenarios into the hydraulic model and analyzing the outputs. This stage involves defining the budget that needs to be allocated as part of the Ministry of Works’ program for design, supervision, and construction. The proposed project can require the allocation of land for the proposed pumping stations. The process of allocating lands for public services needs to be initiated. Furthermore, the state’s sustainable development policy should be considered, and the project should be rejected if it does not comply with that policy [51]. Moreover, the sewerage infrastructure project should be categorized into one of the four types of projects: newly developed area projects, extension projects, rehabilitation projects, and upgrade projects. Based on this choice, indicators are selected while accounting for the sustainable development plans and policies. Moreover, the criteria and indicators for the sustainability assessment should be stratified under two objectives: reducing the risk of sewerage failure and contributing to the sustainable development of wastewater disposal systems.

Stage 3: Planning, Designing, and Implementing the Project

After selecting the type of project with the proper indicators, the second stage covers the planning, designing, and construction. Based on the type of project, various alternatives and scenarios can be compared, as there are four possible sewerage projects: 1) newly developed area projects this project features more flexibility in the possible scenarios, and it can include a newly developed area that is not connected to the current network. This project usually involves a treatment plant. The process used is similar to that in another study. However, the indicators are different because each one is compared to provide a better decision-making process based on the sustainability criteria. 2) Extension projects linked to the network the alternatives are limited in this kind of



(Fig – 101 Preliminary sustainability assessment framework for sewerage infrastructure projects.)

Project, and the 3) Rehabilitation projects Rehabilitation technologies are assessed to suit the type of damage in the pipes. Some rehabilitation technologies, such as curing the pipes in place, can slightly reduce the pipe size and thus decrease the pipe capacity. Therefore, a hydraulic assessment needs to be completed to ensure that the project does not cause any interruptions in the service. 4) Network upgrades in this project, various scenarios are compared to find the most sustainable one. The process is the same as that in another study, although the indicators are different. After defining the type of project, the next phases are conducted using the specified project type. Planning and Designing Phase generally, in the planning and designing stage of the project, the availably of construction technologies in Bahrain must be considered. For example, deep gravity sewer projects require specialized contractors to perform micro-tunneling.

This technology may not be available in Bahrain when construction works are scheduled, as contractors from nearby countries provide it and no local contractors are available. Further, ensuring the availably of contractors requires attracting contractors from nearby countries. This step requires prior advertisement and invitations to participate in the tender of the project. As some projects require specialized staff to engage in the design and construction processes, ensuring that the required expertise is available within the Ministry of Works is important. A comprehensive feasibility study needs to be performed on the proposed options and scenarios. The project funding becomes clear as the design progresses. Cost analysis of the project's financial requirements, starting from the design up to the operation and maintenance, must be performed to control the expenditures as the project progresses.

CONCLUSION

Sewerage infrastructure projects face a variety of challenges and threats to their sustained performance throughout their life cycle. These challenges lead to the enhanced risks of failure, for example, sewer leakage, overflow, and odor. Such issues can have serious impacts on the environment, public health and safety, the economy, and the service lives of assets. Limited research, if any, has been conducted on the sustainability assessment throughout the entire life cycle of a sewerage asset with consideration of all aspects of sustainability. Thus, this research proposed a framework to assess the sustainability of the Kingdom of Bahrain's sewerage infrastructure projects to ensure the long-term sustainability of these projects. This sustainability assessment framework intends to support the decision-making process throughout the life cycle of assets. It provides greater transparency for stakeholders and contributes to the sustainable development of wastewater management. This work-in-progress, with results forthcoming from the second segment of the research as a mixed methods approach, will be utilized to further enhance the framework. A qualitative study followed by a quantitative study is conducted. In the qualitative phase, semi-structured interviews will be conducted with experts to verify the framework. Then, a quantitative study will be performed using a questionnaire design to statistically test the framework. Once the final research framework is developed, it will be applied to selected cases in Bahrain by utilizing the case study methodology.

Sustainable regional water management in the Yamuna River basin: case study of the Delhi region (India)

INTRODUCTION

Water is essential for human life, economic development, social welfare and environmental sustainability. Rapid urbanization and industrialization is placing an unprecedented pressure on water quality and demand. There are numerous other constraints such as inefficient infrastructure, ill-designed urban regulations, weak municipal institutions, inadequate financial services and arrangements for urban development. These factors together induce low productivity, an increase in the number of the poor, and deterioration in environmental quality. Currently, more than one billion people live in cities where the effect of air, water, land and other pollutants on their health is very alarming (Singh, 1999, 2000; Hardoy *et al*, 1992).

The water need in rural Delhi is mainly confined to drinking water supply for its growing population. The water supply in the National Capital Territory (NCT) of Delhi is under severe pressure because the population size as well as industrial activities are multiplying at an increasing rate. The unabated immigration of more people has magnified these problems, resulting in flouting of land-use regulations and deterioration of the green cover. The water supply situation in Delhi provides an ideal subject for study. The average per capita consumption, officially estimated to be 250 litres per household per day, can be compared to consumption levels of developed countries. Most studies in Delhi (urban and rural) report problems related to water supply in various localities of the city. If one look into the reasons for Delhi's water distribution problems, one may find that the problem lies more in inefficient management of the supply network rather than in scarcity of water resources. Secondly, contrary to most other Indian cities, a larger part of Delhi's population gets water around the clock. So far, studies on the consequences of unreliable water supply have been conducted in cities where the unreliability has affected the entire population. The present study has been based on a comparison of behavioural patterns between households with a regular water supply and households with intermittent and irregular supply (Misra, 1998; Druijven & Singh, 1996; Gurumukhi, 1992).

STUDY AREA AND METHODOLOGY

As per the 1991 census, the population of Delhi was 9.4 million, and is projected to reach 14.1 million in 2001. An additional floating population of 0.3 to 0.4 million per day is a recurring feature in Delhi. According to a recent survey, more than 50% of Delhi's population live in about 1304 unauthorized colonies, 1080 *Jhuggi Jhonpari* (slums) clusters, 44 resettlement colonies and 209 rural villages (Fig. 1). From the administrative point of view, the NCT is divided into two districts: Delhi and Mehrauli with 209 villages, 3 statutory towns and 29 census towns. The Delhi NCT comprises both urban and rural population, yet the Delhi urban agglomeration does not include all the urban population of the Delhi NCT. Delhi is one of the largest urban agglomerations in the world with an estimated population of approximately 11 million in 1997. There are 22 census towns and three statutory towns. The urban area consists of the Delhi Municipal Corporation (MCD), the New Delhi Municipal Corporation (NDMC) and the Delhi Cantonment Board (DCB). In order to understand the implications of a changing water status on the society, four sample villages were chosen from the Alipur and Najafgarh Development Blocks of rural Delhi. Four villages are selected from the Alipur Block: Qadipur, Hiranki, Bankauli and Sanoth; and another four villages were chosen from the Najafgarh Block: Dichoan Kalan, Kair, Ujwa and Dhansa. A 10% sample of households was taken from each of the selected villages, reflecting the social composition of the local society. The sample population was interviewed on the basis of a pre-printed questionnaire containing questions about the social placement of an individual, literacy, and income levels, and of course the amount and means of water supplied, storage, quality etc. The feudal/traditional caste segregation is still inherent to the areas surrounding the metropolitan Delhi. In a typical Delhi village, Jats and Brahmins are the most dominant castes along with

Rajputs, although the Scheduled Castes have significant presence. Water quality has been considered on the basis of household perception.

RESULTS AND DISCUSSION

Access to water concept

"Access to water", explained as "access to potable water" varies from region to region. For a rural household, access to water means that a member of the family does not have to spend a disproportionate amount of time for collecting water. This definition, however, lacks clarity as the problem lies more in the cost of the accessibility. From various official sources, the percentage of population with access to potable water was taken into account and was considered a relevant measure to evaluate the level of services available. Though this indicator makes international comparisons possible, the importance to the quality of service provided is not taken into account. This binary approach poses two-fold problems. Firstly, it presumes that there are households with access to water compared to those without water, even though the hurdle is more in the cost of access. Secondly, there exist quantitative approaches, which assume that once the accessibility of water is established, there is hardly any difference between the method of supply and the level of services. Yet, the level of user's satisfaction differ according to the mode of supply. So, most village surveys usually cover only households supplied by collective sources, thereby neglecting households connected to a network and presumed to benefit from a higher level of services. The reality, however, is more complex. Even for households with an in-house municipal connection, water is not supplied round the clock.

(Fig – 102 Map of the study area of rural Delhi.)

Sources of water

The total annual rainfall in the NCT of Delhi is 611.5 mm. The amount of rainfall increases from southwest to northeast; about 81 % of the annual rainfall is received as winter rains and as cyclonic rain during pre- and post-monsoon months. There are large variations in rainfall from year to year. In Delhi, the major source of supplied surface water is from the River Yamuna. Delhi is largely dependent upon its neighbours, especially during the summer. Groundwater represents only approximately 11% of Delhi's water resources. Delhi water board has now become Delhi Jal Board. In 1996, the optimum production was assessed as 2728 x 106 l d a y _ 1 with a daily average of 2634 x l f / l d a y " 1 . The fi gures remained the same in 1999. The board made a determined effort to increase the availability of water. Since 1961, water production has multiplied six fold, and despite the growth in population there has been an increase in the average per capita consumption, i.e. 166, 221 and 248 litres per person per day in 1961, 1981 and 1996, respectively. As far as surface water is concerned, Delhi can use only a share released by Haryana from the Tajewala dam situated 250 km upstream from Wazirabad. The construction of three new dams aimed to augment water resources are either underway or envisaged in the long term, and today Delhi has to depend on neighbouring states to get a higher allocation of water from the Yamuna.

Groundwater resources are limited and diminishing. The Central Ground Water Board conducted studies in Delhi, which revealed that subsurface water has become polluted. Moreover, the water table level decreased by 2 to 4 m between 1983 and 1994. Groundwater represent another important source of water for Delhi. In order to increase its production the DJB has planned to increase the number and the yield of its running wells. These studies showed that there is an urgent need to develop a policy for protecting the groundwater resources. It is rather difficult to estimate the annual quantity of pumped groundwater, because of the large number of private tube wells dug by households and the industrial sector for their own supply. Similarly, many tanker and bottled water companies are using and selling groundwater. The lack of regulation related to private or individual extraction of groundwater aggravates this situation.

Mode of access to water

A number of municipal connections, as well as hand pumps, water tankers, wells, tube well, public water taps and other sources are available in the fringe area of Delhi. Bankauli village, with a high concentration of well-off households, has benefited from a better supply, obtaining 77% of its water from municipal connections in comparison to Sanoth (68%), Dichaon Kalan (63%), Kair (51%), Ujwa (49%), Hiranki (43%), Qadipur (33%) and Dhansa (25%). The surveyed villages have received water from all seven source types. Water tanker supply contributed 19% to Kair and Dhansa, while water tanker supply to the other five villages is below 10%o. Hand-pump source supply was: Dhansa 41%, Qadipur 33%, Hiranki 24%, Ujwa 23%, Kair 21%, Sanoth 11%, and Dichaon Kalan 11%, respectively. Tube well supply was: Hiranki 22%o, Dichaon Kalan 15%, Dhansa 12%, and in the other five villages below 10% (Table 1). The main source of urban water supply is governmental, and far exceeds the private and other sources. Out of the eight villages, Sanoth received most water from private sources.

Villages	**Municipal supply line**	**Water tanker**	**Hand pump**	**Well**	**Tube well**	**Public water tap**	**Others**
Qadipur	32.73	30.91	32.73		1.82	1.82	
Hiranki	43.08	9.23	24.62		21.54	1.54	
Bankauli	77.08	6.25	10.42		2.08	2.08	2.08
Sanoth	68.15	2.96	11.11		6.67	11.11	
Dichaon Kalan	63.30	8.51	10.64	0.53	14.89	1.60	0.53
Kair	51.33	18.58	21.24	2.65	4.42	0.88	0.88
Ujwa	49.00	7.00	23.00		10.00	11.00	
Dhansa	24.74	18.56	40.72	2.06	11.86	2.06	

Villages	**Govern - ment**	**Private**	**Ovmed by others**	**illegal**	**NGO provided**	**Local body provided**	**Others**
Hiranki	49.21	31.75	19.05				
Qadipur	52.00	30.00	10.00		4.00	4.00	
Bankauli	88.10	9.52	2.38				
Sanoth	55.00	40.83	4.17				
Dichaon Kalan	68.07	22.29	6.63	0.60	1.20	0.60	0.60

Kair	44.90	30.61	19.39				5.10
Uj,va	63.77	23.19	5.80			7.25	
Dhansa	32.89	34.21	28.95	0.66	0.66	1.97	0.66
(Table-62 Source of water (%).)							

Quality of water

A number of households found the supplied water unfit for consumption and therefore felt the need for water treatment, even though this is more a matter of perception. The household perception varies from village to village. But more than 50% of the households treated water daily, and approximately 30% when they anticipated risk (either during the monsoon or when a member of their family had fallen ill). The study reveals that out of eight surveyed villages, a large fraction of the households in six villages considered the water potable: Qadipur (100%), Kair (95%), Dichaon Kalan (70%), Sanoth (67%), Hiranki (59%), Ujwa (57%), respectively.

Villages	Potable: Yes	No	Water quality: Unusable	Moderate	Good
Hiranki	59.38	40.63	31.25	50.00	18.75
Qadipur	100.00			53.57	46.43
Bankauli	33.33	66.67	7.69	74.36	17.95
Sanoth	66.67	33.33		58.59	41.41
Dichaon Kalan	70.25	29.75	4.20	65.55	30.25
Kair	94.74	5.26	3.70	35.19	61.11
Ujwa	56.86	43.14	17.3I	53.85	28.85
Dhansa	44.06	6.29	2.80	78.87	15.49
(Table-63 Quality of water)					

A fraction of household responses fall in the categories of moderate and good water quality, while a very low percentage of responses fall under water unusable. The household responses to good quality of water are as follows: Kair (61%), Qadipur (46%), Sanoth (41%), Dichaon Kalan (30%) and Ujwa (29%), respectively, while the remaining three villages are below 20%. The above analysis reveals that at least one third of the households had some doubts about the quality of the supplied water.

Groundwater status

In Delhi's rural periphery, the status of groundwater availability is dictated by the distance from the Yamuna as well as from the urban centre. Alipur Block, which lies on the eastern boundary of the River Yamuna, has a water table with an average depth of 6-9 m, which has fallen from the earlier depth of 3-4.5 m. Najafgarh Block, which is situated away from the Yamuna, has a water table averaging 13.5 m depth, much lower than the level of 6-10.5 m, about 10 years ago. The main cause of this fall in water table has been the increasing population pressure and the rise in the number of tube wells. An ever-increasing influx of population from outside Delhi has stretched the rural infrastructure to the maximum. In the absence of proper civic supply of drinking water, it is the groundwater sources that are facing the brunt of the population pressure. Increasing mechanization of the groundwater extraction process has badly disturbed the local water cycle, and has also contributed to the change of fertile agricultural land into wasteland. Due to lowering of the water table, the water has not remained usable. In the villages of Najafgarh, the water has become intensely salinated, so much so that there are many tube wells of saline water, and sweet water is found only in a few pockets. Although, the water found at depth is supposed to have gone through a natural filtration process making it pure enough for human consumption; a greater lowering of the water table forces the water to mix with the salts and alkalis found near the bed rock, making the extracted water now intensely saline and totally unfit for human consumption.

CONCLUSIONS

Water quality and availability plays an important role in modifying the attitudes, awareness and means of livelihood in the rural urban fringe of Delhi. As is apparent through the data, the importance of agriculture as a means of livelihood declines in areas where water is scarce and of poor quality, as in the case of Najafgarh Block. Here, land becomes a means of earning short-term gains, like leasing out to brick kilns, warehouses, industries etc. or selling it for the same purpose. Thus, water pollution, availability and groundwater level have an indirect bearing on the society. Agenda 21 indicates an existing will to act, but we are still failing to implement sustainable solutions. A major initiative is required to bring about the changes needed and to mobilize public opinion: a freshwater revolution. It can also play a role in the conservation of the groundwater at a time when its depletion is accelerating and threatening the sustainability of the region. A better quality of service, which would reduce individual usage of wells is, however, not enough. Legislative changes on rights to groundwater are necessary. They are envisaged but they should be part of a larger effort on changes, of institutional structures and on the possibility of better coordinated infrastructure policies. We have to treat water as an economic resource. A group of low value users are allowed to consume large quantities of water, forcing high value users to invest high costs in securing water from long distances. So we are getting waste, depletion and ecological disasters. Water pollution in the Yamuna River makes water a life and death issue for millions of people, particularly the poor. It is important to recognize that the poor are victims of bad water management decisions and policies and therefore suffer the most in terms of health hazards and loss of economic opportunities. The key is to generate public awareness, and from it, behavioural change and the political will to create a better future for water resources in the Delhi region. It is suggested that the following measures will improve the situation:

⇒ Reduction of excessive reliance on government for water services.
⇒ Minimizing fragmented decision-making and overlapping responsibilities.
⇒ Involvement of the private sector and water users in water management leading to significant gains in productivity.
⇒ There is a need for water zoning and constraints on water usage in the metropolitan region and the economic activities should be regulated in accordance with such zoning.
⇒ Discontinuation of groundwater quality depletion as a negative consequence of haphazard development in catchment areas of urban and rural Delhi.
⇒ Groundwater recharge projects should be initiated for augmenting available supplies with abstractions regulated to ensure that they do not exceed recharge possibilities.
⇒ Making the treatment of effluent cost-effective by imposing user charges.
⇒ Integration of water management by linking the private sector, local communities and NGOs to ensure an effective and efficient allocation and use of water for all economic, environmental and social needs.

14.2 Electrical Engineering

14.2.1 Design of Power Electronics converter

As the technology for the power semiconductor devices and integrated circuit develops, the potential for applications of power electronics become wider. There are already many power semiconductor devices that are commercially available, however, the development in this direction is continuing.

- **The power semiconductor devices or power electronic converter fall generally into six categories:-**

⇒ Diode Rectifier (Uncontrolled Rectifier)
⇒ DC to AC Converter (Inverter)
⇒ DC to DC Converter (DC Chopper)
⇒ AC to DC Converter (Controlled Rectifier)
⇒ AC to AC Converter (AC voltage regulator)
⇒ Static Switches

The design of power electronics converter circuits requires design the power and control circuits. The voltage and current harmonics that are generated by the power converters can be reduced or minimized with a proper choice of the control strategy.

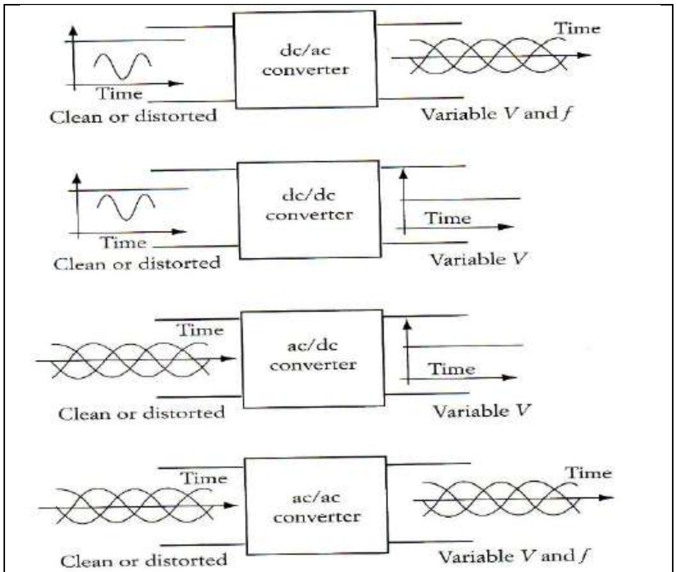
⇒ **Diode Rectifiers:** A diode rectifier circuit converts AC voltage into a fixed DC voltage. The input voltage to rectifier could be either single phase or three phases.

⇒ **DC to AC Converter:** DC to AC converter circuit can convert DC voltage into an AC voltage. The AC output voltage can be controlled by varying the firing angle of the thyristors. The AC output voltage could be a single phase or three phases.

⇒ **DC to DC Converter:** These converters can converter a fixed DC input voltage into variable DC voltage or vice versa. The DC output voltage is controlled by varying of duty cycle.

⇒ **AC to DC Converter:** An AC to DC converter circuit can convert AC voltage into a DC voltage. The DC output voltage can be controlled by varying the firing angle of the thyristors. The AC input voltage could be a single phase or three phases.

⇒ **AC to AC Converter:** This converter can convert from a fixed ac input voltage into variable AC output voltage. The output voltage is controlled by varying firing angle of TRIAC. These type converters are known as AC voltage regulator.

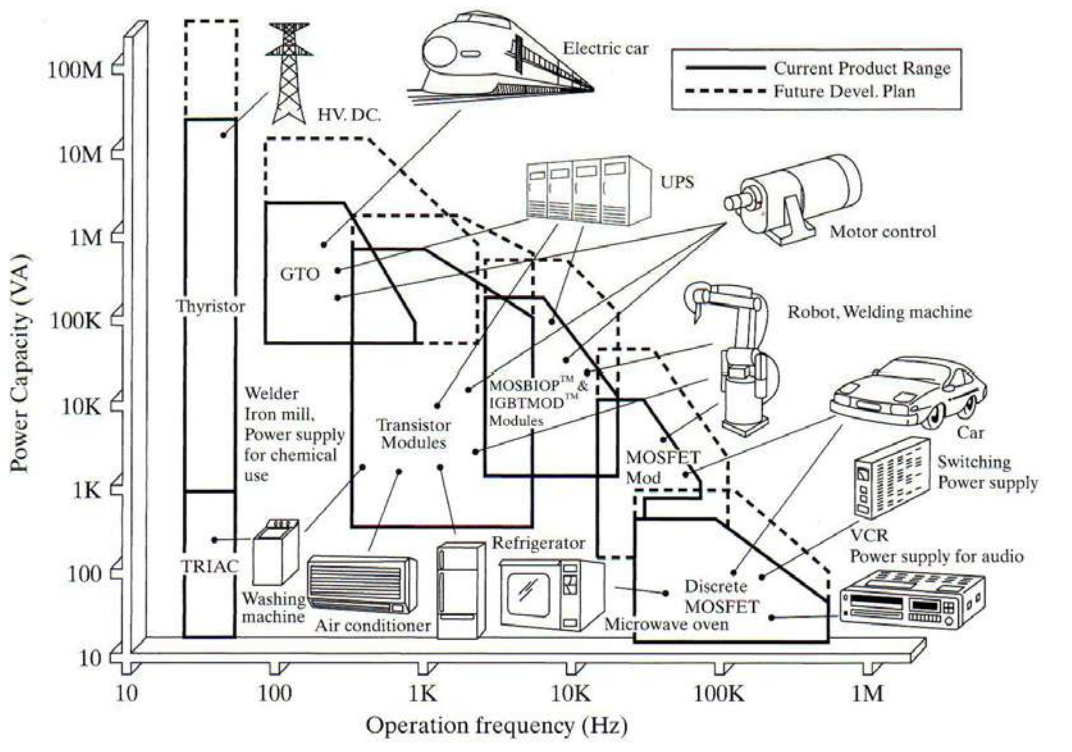


(Fig – 103 Block diagram type of converter)

⇒ **Static Switches:** The power devices can be operated as static switches or contactors, the supply to these switches could be either AC or DC and the switches are called as AC static switches or DC static switches.

➢ **Power Electronics Application:**

Power Electronics defined as the application of solid-state (devices) electronics for the control and conversion of electric power. Power electronics have already found an important place in modern technology and are now used in a great variety of high- power product, including heat controls, light controls, electric motor control, power supplies, vehicle propulsion system and high voltage direct current (HVDC) systems.



(Fig – 104 Power Electronics Application)

14.2.2Electronic Soft Starter for 1/3 Phase Induction Motor for Agriculture

A Soft Starter is a device that starts motors with reduced power supplied at start-up. Reducing the power reduces potentially damaging electrical and mechanical shocks on the system.
Soft Starters are a combination of a controller and overload protection.

CONTROLLERS - Turns electric current to the motor on and off. A contactor is a controller that is controlled by an electromagnet.

OVERLOAD PROTECTION - Protects a motor from drawing too much current and "burning out" from overheating. The overload relay is the motor overload protection used in soft starters. It limits the time the overload current is drawn and protects the motor from overheating. Soft Starters place a device called a reduced voltage starter, or soft starter, between the motor and the incoming utility line to regulate the amount of current fed to the motor. Soft Starters enable the AC induction motor to speed up in smaller, resulting in less current drawn than with a traditional motor starter. Due to decreased voltage, torque is also reduced resulting in a soft, or easy start. Soft Starters are used on all types of AC and DC motors. They are most commonly used with the AC squirrel cage induction motor because of its simplicity, ruggedness and reliability.

Why Soft Starters are needed?

1. To avoid overloading the power distribution system.
2. To avoid unnecessary wear and tear on equipment by reducing starting torque.

Types of Soft Starters:

1. Primary Resistor
2. Auto Transformer
3. Part Winding
4. Wye Delta
5. Solid State

1) Primary Resistor:

Developed in the early 1900's, this simple unit is one of the first soft starters placed into operation. That there is a resistor for each of the three phases of current. Resistors resist the flow of current. When the motor is started, the resistors resist the current flow resulting in a voltage drop. Approximately 70% of the line voltage is sent to the motor terminals at startup. A timer closes a set of contacts after the motor has accelerated to a pre-determined point. This removes the resistors from the circuit and lets full power through to the motor. Primary resistors starters are known for their smooth starts. They offer two-point acceleration, or one step of resistance. For extra-smooth starting, add additional stages of resistors and contactors.

2) Auto Transformer:

Auto transformer starting is one of the most effective methods of soft starting. It is preferred over primary resistor starting when the starting current is drawn from the line must be held to a minimum, yet the maximum starting torque per line amp is required. Instead of using resistors, this starter uses taps on transformer windings to control the power input to the motor. Taps are usually set up to provide 80%, 65% and 50% of the line voltage, respectively.

These taps provide built-in flexibility. Activating any one of three taps on the windings allows different amounts of current to the motor. In Fig. 6, the motor is receiving voltage through the second of the three taps. This type of starter can supply more current to the motor than other soft starters, while keeping voltage low. The transformer steps up the current making it greater than the line current input during startup.

3) Part Winding:

The part winding method requires dividing the motor windings into two, or more, separate sets. These identical winding sets are intended for parallel operation. At startup, power is applied to only one set of windings. As the motor comes up to speed, power is applied to the other winding set for normal running. When windings are energized in this manner, they produce reduced starting current and reduced starting torque. Most dual voltage (230V/460V) motors are compatible with the part winding starter at 230 volts.

4) Wye Delta:

Wye Delta starting requires the motor have connection points to each of the three coil windings. These are specially wound with six leads for Delta and Wye connections. Illustrates the winding configurations as they are connected at startup. It is called the Wye Configuration because it is shaped like the letter "Y". This connection results in line voltage applied to an electrically larger winding, reducing the line current. It provides 33% of the normal starting torque and 58% of the normal starting voltage.

After a pre-determined time, the starter electrically switches the windings over to a Delta Configuration. This configuration resembles the Greek letter "delta". The windings are connected in their normal run configuration with every winding receiving full voltage. An important consideration with this starter is at the transition point, where the starter switches from Wye to Delta, the motor MUST disconnect and reconnect. This type of Wye Delta starter is known as Open Transition and can have a momentary hitch in operation, allowing a momentary current inrush. Closed Transition is another type of Wye Delta starter. It uses an extra contactor and set of resistors to keep the motor on-line during the transition. It eliminates the inrush concern and the cost is slightly higher than the open transition version.

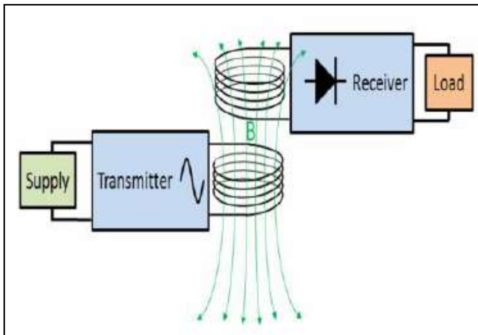
5) Solid State:

The newest soft start method is the solid-state type. It replaces mechanical components with electrical components. The key is the Silicon Control Rectifier or SCR. During motor acceleration, this device controls motor voltage, current and torque. How the solid-state soft starter controls the current draw and the starting torque. The SCR has the ability to rapidly switch heavy currents. This allows the soft starter to provide smooth steeples acceleration - the smoothest of any of the soft start methods.

14.2.3 Advanced Wireless Power Transfer System

One of the major problems in power system is the losses occurring during the transmission of electrical power. The loss of percentage during the transmission is approximated as 26%. The main cause for power loss during transmission is the resistance of wires used in the grid. According to WRI (world resource institute), the electricity grid of India has the highest percentage (27-40%) of power transmission losses in the world. For this reason, Telsa has proposed methods of electricity transmission using an electromagnetic induction method.

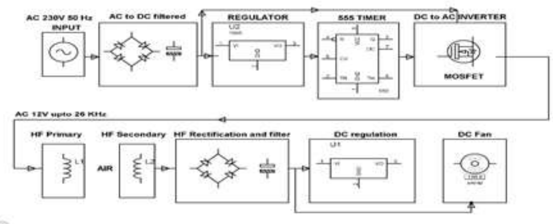
The Serbian scientist “Nikola Telsa” was the first one to research and propose the concept of wireless power transfer in the year 1899, since then many scientists have been working to make his vision a reality. In the same year he has continued research on wireless power transmission in Colorado Springs and writes, the inferiority of the induction method would come into view immense as compared with the distributed charge of ground and air method. In the year 1961, William C. Brown publishes an article exploring possibilities of microwave power transmission. In the year 2009, Sony shows a wireless electrodynamics induction powered TV set.



(Fig – 105 Wireless Power Transfer)

Wireless power can be defined as the transmission of electrical energy from a power source to an electrical load without connecting wires. It is reliable, efficient, fast, low maintenance cost, and it can be used for short range or long range. The basic working principle of wireless power transfer is, two objects having similar resonant frequency and in magnetic resonance at powerfully coupled rule tends to exchange the energy, while dissipating relatively little energy to the extraneous off-resonant objects.

Moreover, this method can be involved in a variety of applications, like to charge mobile phones, laptops wirelessly. And also this kind of charging gives a far lower risk of electrical shock as it would be galvanic ally isolated. This is an emerging technology, and further, the distance of power transfer can be improved as the study across the world is still going on.



(Fig-106 Wireless Power Transfer Block Diagram)

Hardware Requirements of Wireless Power Transfer

The hardware requirements of wireless power transfer include HF-Transformer, HF-diodes, rectifier, basic Transistors, two air filled inductor coils, Voltage regulator and BLDC fan.

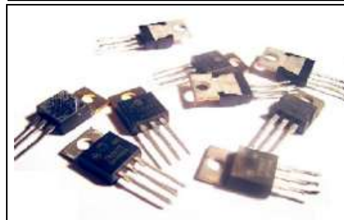
HF-Transformer:

High frequency (HF) transformers transfer electric power and physical size are reliant on the power to be transformed as well as the operating frequency. The emf equation of universal transformer indicates that at a higher frequency, the core flux density will be lower for a given voltage. This implies that a core can have a smaller cross-sectional area.


(Fig-107 HF-Transformer)

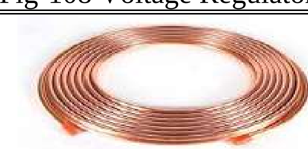
Voltage regulator:

A voltage regulator is an electrical regulator, designed to maintain a constant level voltage automatically. There are three terminal positive voltage regulators are available in many packages and also with several o/p voltages, making them useful in a wide range of applications. Output current up to 1A and o/p voltages is 12. Thermal overload and short circuit protection. Output transistor safe operating area protection.


(Fig-108 Voltage Regulator)

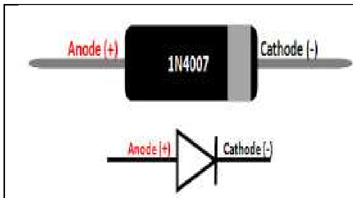
Coil:

An electromagnetic coil is formed when a conductor is wound around a core. Primarily used to transfer energy from one electrical circuit to another by magnetic coupling. Common types of electrical coils are Tesla, barker, choke, Maxwell coil, etc.

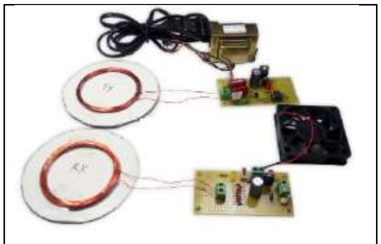

(Fig-109 Coil)

1N4007 Diode:

This diode is used as full wave bridge rectifier circuit in this project. Maximum reverse bias voltage capacity of 50V and max forward current capacity of 1Amp.



(Fig-110 1N4007 Diode)



(Fig-111 Wireless Power Transfer Project)

Project Working:

The main concept of this project is to design a device for the concept of wireless power transfer to eliminate the use conventional copper cables and also current carrying wires. This project is built upon a circuit which converts AC 230V 50Hz to AC 12V, High frequency (HF). The output is fed to a tuned coil shaping as main of an air core transformer. The minor coil develops a voltage of HF 12volt.

Thus the power can be done by the primary to the secondary that is divided with 3cm distance. So the transfer could be seen as the primary transmits and the secondary receives the power to run a load. In addition, this method can be used in several applications, like to charge gadgets like mobile phone, laptop battery, iPod, propeller clock wirelessly. And also this type of charging offers a far lower risk of electrical shock as it would be galvanic ally isolated. This is an emerging technology, and in future, the distance of power transfer can be improved as the study across the world is still going on.

Wireless Power Transfer Advantages:

1. Simple design
2. Lower frequency operation
3. Low cost
4. Practical for short distance

Wireless Power Transfer Disadvantages:

1. High power loss
2. Non-directionality
3. Inefficient for longer distances

Wireless Power Transfer Applications:

1. Consumer electronics
2. Transport
3. Heating and ventilation
4. Industrial engineering
5. Model engineering

Cost Estimation:

Component	No. Of Comp	Cost
HF-Transformer(6KVA)	1	35
HF-Diodes(50V,1A)	10	20
Rectifier	1	480
Basic Transistors	10	650
Air Filled Inductor Coil	15m	5000
Voltage Regulator(12V,1A)	5	260
BLDC Fan	1	89
Other Miscellaneous Charge	-	500
Total Cost		**7034**

(Table-64 Advanced Wireless Power Transfer System)

14.2.4 Industrial Temperature Controller

We can literally say that a Temperature Control System is a device or set of devices that manage, command, direct or regulate the behavior of other devices or systems in order to influence the degree of hotness or coldness of a body or an environment. A Temperature Control System is a more like a programmable thermostat that can keep the environment (home or office) at a desired temperature regardless of fluctuating exterior weather conditions. The advantage of having a temperature control system over a common thermostat is that it saves energy and money by automatically maintaining different temperatures at different times of the day and night. It is usually a feedback system having a control loop, including sensors, control algorithms and actuators/effectors, and is arranged in such a fashion as to try to regulate a variable at a set point or reference value. An example of this may increase the fuel supply to a furnace when a measured temperature drops.

IN THE INDUSTRIES: Many Industries (especially Manufacturing and Pharmaceutical Industries) have growing concerns for the need to store certain production materials within a specific temperature range. Some of these materials could be highly inflammable or explosive at certain extreme temperatures. This necessitates the need for a Temperature Control system.

BASIC COMPONENTS OF A TEMPERATURE CONTROL SYSTEM:

⇒ **Power Supply Unit**: This Unit provides the Temperature Control System with the Electrical Energy that drives it. In this case, the Power Supply Unit consists of a Step- down transformer which works based on the principle of induction. The transformer steps down the voltage received from the power outlet from the national rating of 230V to 15V, which is all the voltage needed to drive the system. This voltage is further rectified (using a bridge rectifier) and filtered (using a power capacitor) to give a perfect and undistorted voltage to the system. Of this 15V input voltage, about 5V drives the microcontroller. The rest are needed to drive the other units of the circuit.

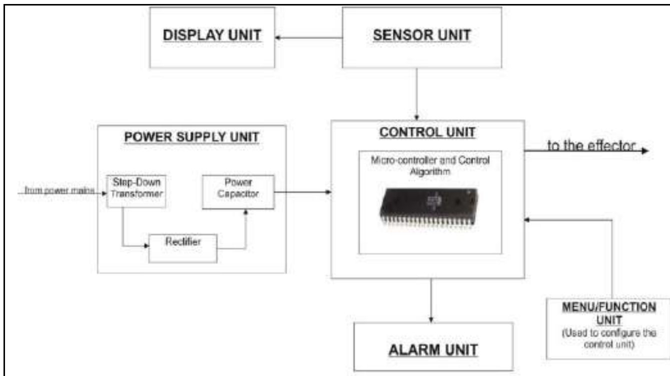
⇒ **Sensor Unit**: This Module consists of devices (thermometers in traditional systems) that detect the current temperature status. These devices sense the current room/surface temperature, and provide its result to be used as input in the Control unit and in the Display Unit.

⇒ **LCD/Display Unit**: This displays the current temperature status of the environment as received from the Sensor Unit. In this case it consists of a 7-bit graphic large-digit display device that reveals the results/reading of the temperature sensor to the external user.

⇒ **Control Unit:** The Control unit houses the Controller and related devices (thermostats in automatic systems) that process information to produce effects/action by the system. In this case, this unit houses the microcontroller (and control program/algorithm) that stores the set-point temperature. The control program receives temperature status from the sensor unit and ensures that it doesn’t compromise the set-point by initiating the appropriate sequence of action.

⇒ **Menu/Function Unit:** This unit consists of input buttons that are used to give commands to the control program and also to program the set-point for the system. In this case, a variable resistor which changes the set-point temperature when its resistance is varied.

⇒ **Alarm Unit:** This unit consists of an alarm system that alerts the inhabitants of the environment of a temperature breach. This is an optional component of Temperature Control Systems. It comes mostly with those systems that are built to specifications (custom systems). Most commercial Temperature Control Systems prefer to maintain a silent profile in the environment where they function.



(Fig-112 Alarm unit)

There are three types of Controller / Control Algorithms for use in the construction and design of most Temperature Control Systems:

⇒ **On/Off Control:**

An on/off controller is the simplest form of temperature control device. The output from the device is either on or off, with no middle state. An on-off controller will switch the output only when the temperature crosses the set-point. For heating control, the output is on when the temperature is below the set-point and off above the set-point. Since the temperature crosses the set-point to change the output state, the process temperature will be cycling continually, going from below the set- point to above, and back below. In cases where this cycling occurs rapidly, and to prevent damage to contactors and valves, and on-off differential, or “hysteresis” is added to the controller operations. This differential requires that the temperature exceed the set-point by a certain amount before the output will turn off or on again. On-off differential prevents the output from “chattering” or making fast, continual switches if the cycling above and below the set-point occurs very rapidly. On-off control is usually used where a precise control is not necessary such as in systems which cannot handle having the energy turned on and off frequently, where the mass of the system is so great that temperatures change extremely slowly, or for a temperature alarm. One special type of on-off control used for alarm is a limit controller. This controller uses a latching relay, which can be manually reset, and is used to shut down a process when a certain temperature is reached.

⇒ **Proportional Control:**

Proportional controls are designed to eliminate the cycling associated with the on/off control. A proportional controller decreases the average power supplied to the effector as the temperature approaches the set-point. This has the effect of slowing down the heater/cooler so that it will not overshoot the set-point, but will approach the set-point and maintain a stable temperature. This proportioning action can be accomplished by turning the effectors on/off for short time intervals. This “time proportioning” varies the ratio of “on” to “off” time to control the temperature. The proportioning action occurs within a “proportional band” around the set-point temperature. Outside this band, the controller functions as an on-off unit, with the output either fully on (below the band) or fully off (above the band). However, within the band, the output is turned on and off in the ratio of the measurement difference from the set-point. At the set-point (the midpoint of the proportional band), the output on: off ratio is 1:1; that is, the on-time and the off-time are equal. If the temperature is further from the set-point, the on-and-off times vary in proportion to the temperature difference. However, if the temperature is below the set-point, the output will be on longer; if the temperature is too high, the output will be off longer.

⇒ **PID Control (proportional–integral–derivative controller):**
The third controller type provides proportional with integral and derivative control, or PID. This controller combines proportional control with two additional adjustments, which helps the unit to automatically compensate for changes in the system. These adjustments, integral and derivative, are expressed in time-based units; they are also referred to by their reciprocals, RESET and RATE, respectively. The proportional, integral and derivative terms must be individually adjusted or "tuned" to a particular system using trial and error. It provides the most accurate and stable control of the three controller types, and is best used in systems which have a relatively small mass, those which react quickly to changes in the energy added to the process. It is recommended in systems where the load changes often and the controller is expected to compensate automatically due to frequent changes in the set-point, the amount of energy available, or the mass to be controlled. Some other controllers exist which are designed to automatically tune themselves. These are known as auto-tune controllers.

14.2.5 Accident Alerts in Modern Traffic Signal Control System -Camera Surveillance System

Vehicle Accident Detection, Prevention and Tracking System:
The presented paper is based on IOT. This framework is utilized to detect the location of the vehicle and prevent the vehicle from an accident by the use of an alarm. The person needs to introduce the application in their cell phone and register by giving the immediate contact numbers to which the alarm message would be sent. For e.g., if the driver feels sluggish while driving and the vehicle is going to be smashed, the alarm buzzes, which makes the driver mindful of his status. This application uses GPS for locating the position of the vehicle. Through this it is additionally conceivable to compute the distance traveled by the vehicle in 'X' seconds by means of its coordinates. To begin sending location to the server, the user has to first login to the application on his phone via the credentials used during the registration.

➢ **Process Flow:-**

⇒ **IoT Device:**
The device comprises of different sensors which are Ultra sonic sensor, Accelerometer, Temperature sensor, GSM module and GPS module. All these sensors and modules are combined and connected to each other through Arduino board, which is the Microcontroller.

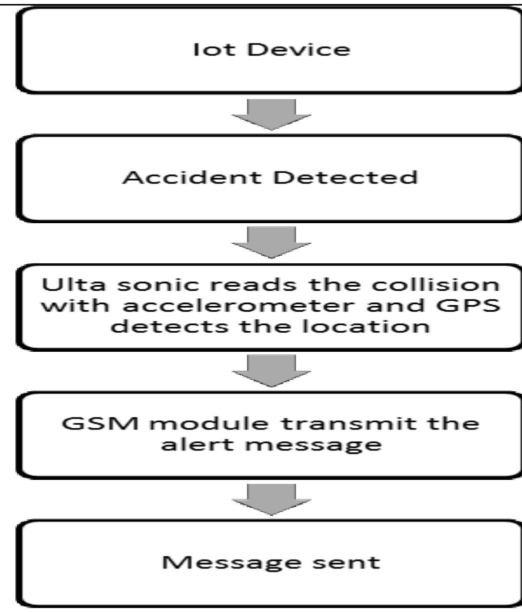
⇒ **Accident Detection:**
The main advantage of this system is that along with the detection of an accident it is also capable of preventing it. The Ultra sonic sensors situated at all the 4 sides of the vehicle will prevent the car from being too close from any object. If in case car meets an accident or small-scale collision, the device will detect the accident.

⇒ **Ultra-Sonic:**
Ultra-sonic will compute the distance between your vehicle and the surroundings. If any object or vehicle draws close to the set limit, it will buzz an alarm which will only turn off if you maintain the specified distance.

⇒ **Accelerometer:**
Accelerometer will trace the X, Y and Z coordinates of the vehicle. These coordinates will help in detecting whether the vehicle is left, right or top tilted. This will also help in detecting the amount of damage during the accident.

⇒ **GPS Module:**
GPS module will trace the location of the vehicle after every 30 seconds by satellite so that if vehicle is fully damaged and all the sensors including the car is destroyed, at least the recent location is tracked.

⇒ **GSM Module:**
GSM module is used to send a message with the current location. When the accident is detected, it will send an alert message to respective people, nearby police station and hospital.



(Fig-113 Process flow of Vehicle Accident Detection, Prevention and Tracking System)

⇒ **Message Sent:**
All the data from the sensors, the message sent and the location are stored in Cloud storage. The alert message will be sent to the people whose mobile numbers would be listed during the time of registration.

Chapter: 15

Smart and/or Sustainable features of Chapter 8 & 13 designs, Impact on society. (For Allocated village development, villagers happiness, comfortable and for enhancement of the village) (With the Smart village development Concept as per Your Idea and Village Visit, modern technology with innovation). With doing small changes, Period, Amount Expenditure and Benefit –

a) Immediately b) Within 1 year c) Long term (3-5 years) along with cost estimation.

If possible, List the sources of the funding available with the Village gram panchayat

Smart and/or Sustainable Feature of Chapter 8 & 13 designs, Impact on Society

In Civil

Public Garden

⇒ Automated watering. Your time's too precious to be stressing over plant watering. ...
⇒ App controlled lighting. ...
⇒ LED grow lights. ...
⇒ Touch-sensitive lamp.

Police Station

Broadly, smart/sustainable reforms are needed on three fronts:
First improvement in capacity and infrastructure of police forces, second revisiting the constitution of police forces in the country through legislative/ administrative changes. Third technological scaling-up. Within each of these three heads, changes are required at several levels. The section below outlines these below.

Community Hall

⇒ As the place for all-community celebrations at various occasions and traditions.
⇒ As the place for public meetings of the citizens on various issues.
⇒ As a place where community members meet each other socially.
⇒ As a place housing local clubs and volunteer activities.
⇒ As a place that community members (and sometimes others), can rent cheaply when a private family function or party is too big for their own home. For instance the non-religious parts of weddings, funerals, etc.
⇒ As a place where local non-government activities are organized.
⇒ As a community venue for entertainment.
⇒ As a place of relief in instances of community tragedies.

Public library

⇒ Active content , Adaptively , Smart technology of content formation
⇒ Smart detection of knowledge, Smart interface (organization of interaction with the user)
⇒ RFID, Bar Code, Smart Card, plagiarism software, IR software,

- ⇒ Wi-Fi /Li-Fi-premises of Library, ETD databases,
- ⇒ Green Library Building, own library web site, library blog,
- ⇒ Sound budget, Standard ILMS, e-library orientation
- ⇒ E-resources(e-databases-books, e-journals-e-reference tools, CD, DVD, Audio sets, e-newspapers, Mandalay reference tools ,)
- ⇒ Library Marketing & Promotion Service, Newsgroups/ Newsletter Services
- ⇒ Ask the librarian /Contac us / Feedback Process, Web-liography
- ⇒ Collaborative Digital Reference Services, Video Podcast
- ⇒ E- Document De
- ⇒ RSS (Really Simple Syndication), Virtual Library Tours, Streaming Media
- ⇒ Value added, aggregator services, Open access publishing, Metadata schemas
- ⇒ Digital and systems library, Use of apps, EBooks — exceeds expectations
- ⇒ E-tool literacy, Library blog, Video & Downloadable Audio

Public Health Care Centre

- ⇒ Low power
- ⇒ Small form factor
- ⇒ System reliability
- ⇒ Quality of service
- ⇒ Enriched user experience
- ⇒ Higher efficiency
- ⇒ Ability to interoperate across different platforms
- ⇒ Ease of deployment
- ⇒ Popularity of the smart health-care system to offer continuous support
- ⇒ Scalability of the system to upgrade to newer versions and technologies
- ⇒ Ample connectivity

Batch Mandali

Even though agriculture is the primary source of income and employment in rural areas, the parody of the situation is that a majority of the people living in rural districts are poor and hungry. Co-operative society plays a vital role in improving the deprived conditions of rural areas the co-operative society helps in enhancing the quality of fertilizers and facilitates better facilities for product marketing, including storage, processing, transport, and availing modern cultivation techniques. The co-operative societies impart several services to poverty-stricken sections, such as access to advanced technologies, proper training in natural resource management, and boost agricultural productivity by increasing the supply of goods. The purpose of co-operative society does not restrain to provide social benefits but also to give financial security to the people performing agrarians' activities. So, co-operatives avail finance through agricultural funds and credits to strengthen the economic position of farmers.

Rain Water Harvesting

- ⇒ Start small, learn as you go, expand as needed; introduction takes time.
- ⇒ Build on existing practice, experience and infrastructure (don't re-invent the wheel).
- ⇒ Focus on local construction materials, local knowledge and techniques, local labour.

⇒ Recognize local customs, social structures and habits.
⇒ Consider existing institutional settings (develop institutional support).
⇒ Ensure political commitment. Find an ‘ambassador’.
⇒ Involve local stakeholders in design and planning (developing ownership and skills), including women.
⇒ Organize operation and maintenance: simple, local, affordable, low frequency, accessible services, e.g. performed by water committees with balanced representation.
⇒ Ensure strict and fair collection of revenues / water tariffs / taxation in relation to benefits. Respond to actual needs (demand responsive).
⇒ Build on co-operation successes in communities.
⇒ Inspire by showing results / successes of other projects.

Cyber café

⇒ Smart services (e.g., personal informing, & Mobile applications usage)
⇒ Creating of smart environment ,Mobile access , New knowledge creation
⇒ High Speed Internet, Uninterrupted Power Supply, Meta Data
⇒ Mobile optimized web site, Easy to use remote access

1. You pay for what you use.

Cyber cafe or internet cafe are payed based on time used. Hence, you as user do not need to pay the monthly internet bill which could be a cost saver if you do not wish to have a home internet. In a cyber cafe, your time logged on is just the amount you pay. Electricity included, internet included, your “space” included. Some even provides webcam, or a headset with microphone. These webcam or headset could provide full internet experience.

2. Convenient

Users need computer to be online if they want to use computer for work, gaming, and home use that are simply cannot be done on WIFI connected smart phones, TVs, and PS4. The shop would provide upgraded units for gamers or users. Also, these cyber cafes could be found at malls, on a conspicuous location in the neighbourhood, or near offices and schools. The convenience of printing and scanning service adds income to cyber cafe owners, but also gives options for a computer user if they do not have printer or scanner at home, or if they do not have computer at all.

3. Fast Internet

Since a cyber cafe is a business, the intent is to make their service give value to cyber cafe customers. That is where speed is the key. Speed of internet refers to how fast a user can stream a video, how fast they upload an attachment, how lagging the Skype session is. This important factor to cyber cafe users are shown on how gamers prefer better and faster internet cafe due to the recommended ping and speed of online multiplayer games. Others need low ping and fast speed, which could be costly if implemented at home.

Skill Development Centre

⇒ The emphasis is to skill the youths in such a way so that they get employment and also improve entrepreneurship.
⇒ Provides training, support and guidance for all occupations that were of traditional type like carpenters, cobblers, welders, blacksmiths, masons, nurses, tailors, weavers etc.

- ⇒ More emphasis will be given on new areas like real estate, construction, transportation, textile, gem industry, jewelry designing, banking, tourism and various other sectors, where skill development is inadequate or nil.
- ⇒ The training programs would be on the lines of international level so that the youths of our country can not only meet the domestic demands but also of other countries like the US, Japan, China, Germany, Russia and those in the West Asia.
- ⇒ Another remarkable feature of the 'Skill India' program would be to create a hallmark called 'Rural India Skill', so as to standardize and certify the training process.
- ⇒ Tailor-made, need-based programs would be initiated for specific age groups which can be like language and communication skills, life and positive thinking skills, personality development skills, management skills, behavioral skills, including job and employability skills.

Gym

Using machine learning processes, clubs can now make predictions and recommendations over a wide variety of club operations to not only improve their bottom line, but to keep members satisfied and on track to complete their goals.

Remember, people are coming to gyms with goals rooted in self-improvement. Any improvements in the way you connect with them can be the difference maker between an incomplete New Year's resolution and a life changed for the long haul and for the better.

Soil Testing Laboratory

- ⇒ It informs the farmer of the current health of the farm's soil and how to improve it
- ⇒ Soil test leads to minimisation of fertiliser expenditure
- ⇒ Soil testing results to limited over-fertilisation
- ⇒ Farmers can easily avoid soil degradation
- ⇒ Farmers with fertile soils can contribute to feeding the world's growing population

Agricultural Store

- ⇒ Selling day-to-day agricultural inputs on a cash basis (fertilizer, seeds, and pesticides, veterinary and livestock products, small scale agricultural materials).
- ⇒ Grouping orders for inputs.
- ⇒ Phytosanitary treatment in collaboration with recognized handlers.
- ⇒ Hiring out small-scale agricultural and veterinary material (equipment for phytosanitary treatment, HATA hoes, seeders, wheelbarrows, carts, motor pumps, etc.).
- ⇒ Advisory support to men and women farmers on agricultural techniques (fertilization, weeding, etc.) and basic veterinary treatments (deworming, livestock vaccination),
- ⇒ Disseminating information on types of inputs available in the shop, as well as on prices and how to apply and/or use products.
- ⇒ Organization of training in methods for using inputs and rented agricultural appliances.

In Electrical

Piezoelectric Speed Breaker Power Generator Design

A system is designed to tap into the energy generated by moving vehicles and produce power by using the speedbreaker as power generating unit.The kinetic energy of the moving vehicles is converted into mechanical energy through rack and pinion mechanism and this mechanical energy is again converted to electrical energy using generator which is used for lighting the street lights. Vehicle pressure on the speed breaker is converted into rotary energy through rack and pinion using hydraulic press. Consequently, the rotary energy rotates generator that generates electrical power which is stored through battery using a charging circuit.

Solar pump system

The installations of solar pumps are flexible & applicable to different applications. It allows people to handle their water supply for drinking, farm animals watering, irrigation, & other housing applications. Generally, the usage of water in summer is utmost. During this season, the PV panels can generate the most power so that more water can be pumped into the water tank. Because of the ease of PV power-driven water pumps, solar technology is consistent, as well as needs small protection.

Solar Street light Installation Design

Most solar lights turn on and turn off automatically by sensing outdoor light using solar panel voltage. Solar streetlights are designed to work throughout the night. Many can stay lit for more than one night if the sun is not in the sky for an extended period of time. Older models included lamps that were not fluorescent or LED. Solar lights installed in windy regions are generally equipped with flat panels to better cope with the winds. Modern designs use wireless technology and fuzzy control theory for battery management. The street lights using this technology can operate as a network with each light having the capability of performing the turning on and off of the network.

AUTOMATIC IRRIGATION SYSTEM USING ARDUINO

A programmed water system framework will spare you a lot of time that you in the past would have spent watering your yards, gardens and blooms. You would now be able to have your clocks set, with the goal that watering will occur at the occasions that best suits your scene and the atmosphere where you live. You can go on that occasion realizing that your gardens and blossoms will be kept up and prospering when you return. With a programmed water system framework there is no cash or water squandered, for everything is coordinated, modified and these frameworks all have rain sensors, so every drop of water is utilized just when it is required.

Solar Rooftop Installation Design

They offer cost savings. The biggest advantage of installing rooftop solar panels is that they offer cost savings. It is a secure investment. It increases access to energy. Support from the government. Reduces carbon footprints. Green source of energy. Low maintenance cost. Suitable for Indian climate.

CCTV Installation Design

Indoor and outdoor camera variants (including pan/tilt and fixed options).Day or night video capabilities. IP and wireless connectivity options. Colour, day/night, and infrared configurations. Video tracking and real-time analytics. Remote computer access through both LAN and off-site systems. Security systems that are secured by smart card technology. Integrated IP monitoring and access control security solutions. Multi-camera remote control systems (ideal for off-premises or overflow room video feeds).

Chapter 8 & 13 designs Impact on Society

In Civil

Public Garden: - Community gardens can mitigate some of the problems that plague urban areas. They can be a beneficial addition to many communities by increasing the availability of nutritious foods, strengthening community ties, reducing environmental hazards, reducing food miles and creating a more sustainable system.

Police Station: - preventing crime and protecting the public. They do this by patrolling on foot in uniform and in police cars. This can stop some forms of criminal behavior. Responding to crimes. When someone calls the police to say that a crime is happening, they must send some police officers to arrive at the scene very quickly. They will try to stop the crime and catch the person doing it. Investigating crime. This means that the police try to find out who did the crime. Arresting and detaining suspects. When the police believe that someone has committed a crime, the police arrest them, take them to the police station and ask them questions. However, it is the prosecutors and not the police who have the final say on whether a suspect gets charged.

Community Hall: - Community building is a field of practices directed toward the creation or enhancement of community among individuals within a regional area (such as a neighborhood) or with a common need or interest. It is often encompassed under the fields of community organizing, community organization, community work, and community development. Activists and community workers engaged in community building efforts in industrialized nations see the apparent loss of community in these societies as a key cause of social disintegration and the emergence of many harmful behaviors. They may see building community as a means to address perceived social inequality and injustice, individual and collective well-being, and the negative impacts of otherwise disconnected and/or marginalized individuals.

Public library: - Place-based economic development stresses the importance of offering attractive, functional, and community-based places, such as libraries, in town squares and depressed neighborhoods. Like a major department store in a mall, libraries attract large numbers of people, creating economic opportunities for a myriad of businesses and organizations in the surrounding area. Large cities, medium-sized ones, and even small towns have successfully transformed their libraries into the hubs of vibrant neighborhoods. As key municipal agencies, and focal points for community education, libraries are major players in creating livable, environmentally friendly cities and towns. The Urban Libraries Council released a report detailing the unique ways in which libraries can further sustainability at the local level. Beyond ensuring that library construction projects consider environmental impact, libraries can take a lead in supporting local foods and artisans, like the Peabody (Mass.) Institute Library's (PIL) partnering with local businesses to pioneer a farmers' market in their courtyard, or the Richmond (Calif.) Public Library's (RPL) seed lending library which "nurtures locally-adapted plant varieties, and fosters community resilience, self-reliance and a culture of sharing."

Public Health Care Centre: - Identifying top public health within the specific geographic area, such as environment and social factor that affect healthy life choices. Developing an intervention plan to address resources gaps in the community health care center, mobile clinics, and outreach programs. Education resident to the benefits of preventative are and healthy behavior to facilities life change providing essential service such as screening social support, and counseling. Helping residents again gain to access to resources such as affordable medical, dental, and mental health care services insurance; translation and transportation services: or housing, food, and education. Reducing the need for expansive emergency care and hospitalizations. Advocating for improved care for at-risk population to state and federal police makers. Working with other community agencies to address the areas mental, physical, cultural, and social characteristics, including nutrition, housing, and transportation.

Batch Mandali: - Even though agriculture is the primary source of income and employment in rural areas, the parody of the situation is that a majority of the people living in rural districts are poor and hungry. Co-operative society plays a vital role in improving the deprived conditions of rural areas the co-operative society helps in enhancing the quality of fertilizers and facilitates better facilities for product marketing, including storage, processing, transport, and availing modern cultivation techniques.

Rain Water Harvesting: - Building the water literate society. Studying the gravity and extent of the problem of drought in selected areas. Researching the livelihoods of people living under conditions of drought. Identifying the availability of resources in the locality. Analyzing community risks and needs in a participatory process that takes people's perceptions into account. Defining the role communities already play in drought preparedness and management. Exploring ways to strengthen the community's ability to deal with drought more effectively - building on indigenous knowledge and reviving traditional disaster coping methods. Discussing the situation of the community with local government institutions and development organizations. Identifying "structural" and "non-structural" risk reduction strategies that are based on local conditions and felt needs. Enhancing livelihood opportunities for communities by sharing information on relevant technologies.

Cyber café: - An Internet cafe is a business that provides public Internet, usually at a time-based rate. Some cafes offer snacks or coffee. In Asia, Internet cafes are commonly set up like computer labs and are geared toward high-speed gaming. In Western countries, Internet cafes are areas that provide Wi-Fi to the public in addition to some computer terminals. Many restaurants, coffee shops and public libraries offer Wi-Fi and Internet service for free. Utilizing public Internet has its advantages and disadvantages. Internet cafes geared toward gaming have high-performance computers. Most PC games have much higher requirements than the average personal computer. If you play the game at an Internet cafe, you will enjoy the game at its full optimization without the burdensome cost of buying a special gaming PC.

Skill Development Centre: - The training programs would be on the lines of international level so that the youths of our country can not only meet the domestic demands but also of other countries like the US, Japan, China, Germany, Russia and those in the West Asia. Another remarkable feature of the ‘Skill India’ program would be to create a hallmark called ‘Rural India Skill’, so as to standardize and certify the training process. Tailor-made, need-based programs would be initiated for specific age groups which can be like language and communication skills, life and positive thinking skills, personality development skills, management skills, behavioral skills, including job and employability skills.

Gym: - One study has findings that suggest that neighbourhood social factors such as local gyms and farmers markets have a connection to childhood obesity. Researchers found that the environment where children grow up, even if they don't frequent the gym, has a strong influence on their habits. Seeing adults taking the time of the day to take care of themselves shows children that exercise is a part of everyday life. Another study has found a connection between the health of workers with offices closer to local gyms and employees that have to add a gym trip to their commute. On companies close to a gym employees reported: improved concentration, sharper memory, enhanced creativity and less medical leaves. The number of workers willing to exercise is changing corporate thinking. Instead of viewing exercise as a luxury, it has been added to paid work time.

Soil Testing Laboratory: - Soil tests are widely used to predict the probability of crop responses to application of fertilizers, particularly phosphorus (P), potassium (K), and in some instances manganese (Mn), copper (Cu), zinc (Zn), and iron (Fe) and application of lime. Soil-test levels at which no response is obtained are defined as critical soil-test levels that have been determined by greenhouse and field experiments. There is interest at present as to whether soil tests can be used to determine if application of fertilizers and/or waste materials will result in pollution of surface and ground waters. Using soil testing to identify the potential for an environmental impact may have value, but only if a comprehensive approach is taken.

Agricultural Store: - Advisory support to men and women farmers on agricultural techniques (fertilization, weeding, etc.) and basic veterinary treatments (deworming, livestock vaccination), Disseminating information on types of inputs available in the shop, as well as on prices and how to apply and/or use products. Organization of training in methods for using inputs and rented agricultural appliances. Fertilizer micro dosing demonstrations (related to research), or other innovative and validated techniques.

In Electrical

Solar Street Light Installation Design: - Outdoor lighting plays a key role in the design of public space and can have a profound impact on its structure. Whether it is used for roads, cycling paths, footpaths, residential areas or parking lots, its quality has a direct impact on the community. Good lighting is not only a way of showcasing specific areas, it can also improve security, strengthen community ties and enhance the attractiveness of towns and cities. Solar lighting takes things one step further. In addition to many benefits such as cost and performance, the use of solar lighting solutions has a lasting positive impact on the environment, helps shape urban communities and accelerates the economic and social development of off-grid populations. More than "switching to green energy", going solar is a way for public stakeholders to provide a better, fairer public lighting service.

Solar Pump System: - The solar hand pump is the only safe source of drinking water existing in the village. Almost all the villagers fetch water from the solar hand pump for drinking purpose. The time consumed to fetch water from the solar hand pump is very less in comparison to the IM II hand pump, as a result of which the villagers get more free time to engage themselves in other activities or to work in the fields which is the main livelihood of the people. The work pressure on women has reduced sufficiently since the men and also the children are now supporting them to fetch water for the family. Earlier the women were primarily responsible for that. Now it is easier to get water within a very short time with less effort. Apart from drinking purpose, the villagers are dependent on solar hand pump for other domestic activities and for the livestock. Agriculture and livestock rearing are the main livelihood the villagers and the solar hand pump is playing an important role by providing water for the livestock. The hygiene practices of women and children have improved evidently due to availability of water. The illness episodes of children have reduced after installation of the hand pump.

Piezoelectric Speed Breaker Power Generator Design: - Traffic energy harvesting does not require consumption of fossil fuel as its source of power can be considered as a renewable energy. Thus, it is environmentally friendly. With zero consumption on fossil fuels, it helps in conserving the natural resources. In this mechanism, the source of power from the potential energy produced by vehicles on the bumper as it comes to a halt is converted to kinetic energy and then electrical energy by the mechanism in the speed breaker. This energy if left untapped will be wasted in the form of heat. Since this energy relies only on the vehicles and the mechanism itself, the energy is available all year round with no shortage of energy source.

AUTOMATIC IRRIGATION SYSTEM USING ARDUINO: - Whatever sort of water system framework you introduce, there will be a more prominent saving money on water. You can enable preserve to water with programmed frameworks, for there is no squandering of water, each drop is utilized not squandered away. You can spare somewhere in the range of 30 and 50 percent of the water that you would ordinarily use with other more customary watering strategies. Whenever plants, yields, yards or blossoms are watered with littler measures of water over a more drawn out timeframe, they become quicker, for it is the perfect condition for development. You will appreciate greener and more delicious greenhouses and gardens

Solar Rooftop Installation Design: - Setting up solar rooftops is also philanthropic in nature. It not only serves the environment but serves society as a whole. There are schools and colleges in various small districts of the nation where the supply of electricity is improper, this poses a threat to education of the pupils, also because of lack of power the students in villages cannot take up digital education, especially during the night they are not able to study because of darkness. All these problems could be overcome by adopting solar techniques. The hospitals will not face any obstacle in treating their patients because of lack of power. The use of cleaner energy will also increase the life expectancy rate among people.

CCTV Installation Design: - Along with CCTV’s perceived high expectations as crime deterrent, there is also a growing controversy over CCTV’s potentially unexpected limitations. For example, the crime displacement (the presence of CCTV will change the locations of crime and its total number will not change) and the diffusion effects of crime control benefits (the crime prevention effect of CCTV may filter through to neighboring areas) are the representative controversial issues. In this study, we aimed to verify the crime displacement and the diffusion of benefit of open-street CCTV by analyzing the crime tendencies empirically. The results showed that the crime prevention effect of the CCTV was significant. The number of robberies and thefts in the areas with CCTV installed reduced by 47.4%, while the areas without CCTV showed practically no change in the number of crimes. The crime displacement caused by the CCTV was not either found or inconsequential and the crime rates in the neighboring areas also decreased slightly.

With doing small changes, Period, Amount Expenditure and Benefit –

a) Immediately b) Within 1 year c) Long term (3-5 years) along with cost estimation.

Sr.	Design name	Period	Amount	Benefits
CIVIL				
1	Public Garden	Within 1 Yr.	2,56,815	⇒ Provide refreshment to the village peoples. ⇒ Children use playground to improve their physical fitness
2	Police Station	Long term	8,32,191	⇒ Increase security in village and nearby area ⇒ Reduce illegal activities and solve local problems
3	Community Hall	Long term	3,13,708	⇒ Use for villagers social gathering and many other functions.
4	Public Library	Within 1 Yr.	3,14,580	⇒ Increase education facilities. ⇒ Learn about modern new technology.
5	Public Health Care Centre	Long term	7,94,880	⇒ Improve health of villagers ⇒ Child care at local and nearby ⇒ Primary health available ⇒ Affordable and effective treatment
6	Batchat Mandali	Within 1 Yr.	4,88,483	⇒ It will provide finance to farmers and students ⇒ It will provide banking ⇒ facilities to villagers
7	Rain Water Harvesting	Immediate	49,500	⇒ Increase ground water level. ⇒ Water can be used during scarcity of water.
8	Gym	Within 1 Yr.	8,23,000	⇒ Improve health and fitness of villagers.
9	Cyber café	Within 1 Yr.	4,67,400	⇒ Villagers can use high speed internet ⇒ Net banking and other online activity ⇒ For Online examination and studies.
10	Skill Development Centre	Long term	6,27,900	⇒ The emphasis is to skill the youths in such a way so that they get employment and also improve entrepreneurship. ⇒ Provides training, support and guidance to farmers

				⇒ To provide skills to women so that they become self-dependent ⇒ To aware villagers regarding new development schemes for their betterment
11	Soil Testing Laboratory	Long term	5,61,340	⇒ Farmers can test soil for use of exact fertilizer and pesticides
12	Agricultural Store	Immediate	2,82,791	⇒ Farmers can by all farming related equipment and pesticides ⇒ Also get part of equipment and related hardware
		ELECTRICAL		
1	Solar street light	Immediate	34,000	⇒ One time Investment reduces the operating cost. ⇒ No Energy Charges, as it will use renewable Energy Source. ⇒ Lighten up roads of village
2	Solar Pump system	Immediate	61,000	⇒ Using Renewable Energy ⇒ Easy pumping of water ⇒ Reduction in running cost
3	Piezoelectric Speed breaker power generator	Within 1 Yr.	51,600	⇒ It will help to generate energy from the pressure and motion of Moving vehicles with the help of Piezoelectric Sensors. ⇒ This energy generated can be used in multiple ways.
4	CCTV installation	Immediate	28,300	⇒ Improve safety. ⇒ Reduce crime rate ⇒ Maintain law & order
5	Solar roof top installation	Immediate	44,853	⇒ It will help Gram Panchayat have continuous Power supply ⇒ It will reduce the energy Charges as it uses Renewable Source of Energy
6	Automatic irrigation system using Arduino	Immediate	80,500	⇒ Farmer have not to irrigate crops manually either it is day or night, by automatic irrigation system

(Table-65 Design and their expenditure, benefits and period)

Chapter: 16
Survey By Interviewing With Talati And/Or Sarpanch

Gujarat Technological University,
Ahmedabad, Gujarat

Vishwakarma Yojana: Phase VIII
Survey with Interviewing

SURVEY BY INTERVIEWING WITH TALATI AND/OR SARPANCH

Vishwakarma Yojana: Phase VIII

ALLOCATED VILLAGE SURVEY

An approach towards **"Rurbanisation for Village Development"**

CHAPTER- 16

Sr.	Questions	Yes/ No	Remarks
1	What are the sources of income in village?	yes	farming, small scale indutry
2	What are the chances of employment in village?	yes	small scale industry
3	What are the special technical facilities in village?	NO	
4	Is any debt on village dwellers?	NO	
5	Are village people getting agricultural help?	yes	
6	Is women health awareness Program organized in village?	NO	
7	Are women having opportunity to work and income?	yes	
8	Child girl education is appreciated in village?	yes	
9	Facility of vaccination to child is available in village?	yes	
10	Are village people aware about child vaccination and done to each and every child as per norms?	yes	
11	Women help line number information is provided to village people?	yes	
12	Is water scarcity in village? How many days per year?	NO	
13	Is village under any debt?	NO	
14	Is any serious issue due to debt from bank or any person happened in village?	NO	
15	Is any suicide like incident observed in village due to government policy, debt or threatening?	NO	
16	Is any death of patient occurred due to unavailability of medical facility in village?	NO	
17	How many disabled (physically challenged) is observed in village? Provide list with Male/female/girl/boy with age and type of disability and reason of disability.	yes	
18	Is village improvement is observed in comparative scenario from past to present?	yes	
19	Is any unavoidable difficulty village people are facing? Any natural calamity is there?	No	
20	Life Living standard of girls and women is appreciated and uplifted in village?	yes	
Nodal officer and students can add more questions. This is a sample. Having Minimum requirement.			

Administration queries/ Difficulties:
GTU VY Section
Contact No – 079-23267588
Email ID: rurban@gtu.edu.in

સરપંચ
દેરડી(કું.) ગ્રામ પંચાયત

Chapter: 17
Irrigation / Agriculture activities And Agro Industry, Alternate Technics and Solution

Agriculture activities and Agro Industry in India

Roughly half of all Indians still derive their livelihood directly from agriculture. That proportion only relatively recently has been declining from levels that were fairly consistent throughout the 20th century. The area cultivated, however, has risen steadily and has come to encompass considerably more than half of the country's total area, a proportion matched by few other countries in the world. In the more fertile regions, such as the Indo-Gangetic Plain or the deltas of the eastern coast, the proportion of cultivated to total land often exceeds nine-tenths. Water availability varies greatly with climate. In all but a small part of the country, the supply of water for agriculture is highly seasonal and depends on the often fickle southwest monsoon. As a result, farmers are able to raise only one crop per year in areas that lack irrigation, and the risk of crop failure is fairly high in many locales. The prospects and actual development of irrigation also vary greatly from one part of the country to another. They are particularly favourable on the Indo-Gangetic Plain, in part because of the relatively even flow of the rivers issuing from the Himalayas and in part because of the vast reserves of groundwater in the thousands of feet of alluvial deposits underlying the region. In peninsular India, however, surface-water availability relies on the region's highly seasonal rainfall regime, and, in many areas, hard rock formations make it difficult to sink wells and severely curtail access to the groundwater that is present.

For such a predominantly agricultural country as India, resources of cultivable soil and water are of crucial importance. Although India does possess extensive areas of fertile alluvial soils, especially on the Indo-Gangetic Plain, and other substantial areas of relatively productive soils, such as the black *(*regur*)* soils of the Deccan lava plateau, the red-to-yellow lateritic soils that predominate over most of the remainder of the country are low in fertility. Overall, the per capita availability of cultivable area is low, and less than half of the cultivable land is of high quality. Moreover, many areas have lost much of their fertility because of erosion, alkalinisation (caused by excessive irrigation without proper drainage), the subsurface formation of impenetrable hardpans, and protracted cultivation without restoring depleted plant nutrients.

Although the average farm size is only about 5 acres (2 hectares) and is declining, that figure masks the markedly skewed distribution of landholdings. More than half of all farms are less than 3 acres (1.2 hectares) in size, while much of the remainder is controlled by a small number of relatively affluent peasants and landlords. Most cultivators own farms that provide little more than a bare subsistence for their families; given fluctuations in the agricultural market and the fickle nature of the annual monsoon, the farm failure rate often has been quite high, particularly among smallholders. Further, nearly one-third of all agricultural households own no land at all and, along with many submarginal landowners, must work for the larger landholders or must supplement their earnings from some subsidiary occupation, often the one traditionally associated with their caste.

Agricultural technology has undergone rapid change in India. Government-sponsored large-scale irrigation canal projects, begun by the British in the mid-19th century, were greatly extended after independence. Emphasis then shifted toward deep wells (called tube wells in India), often privately owned, from which water was raised both by electric or diesel pumps; however, in many places these wells have depleted local groundwater reserves, and efforts have been directed at replenishing aquifers and utilizing rainwater. Tank irrigation, a method by which water is drawn from small reservoirs created along the courses of minor streams, is important in several parts of India, especially the southeast.

The demand for chemical fertilizers also has been steadily increasing, although since the late 1960s the introduction of new, high-yielding hybrid varieties of seeds (HYVs), mainly for wheat and secondarily for rice, has brought about the most dramatic increases in production, especially in Punjab (where their adoption is virtually universal), Haryana, western Uttar Pradesh, and Gujarat. So great has been the success of the so-called Green Revolution that India was able to build up buffer stocks of grain sufficient for the country to weather several years of disastrously bad monsoons with virtually no imports or starvation and even to become, in some years, a modest net food exporter. During the same period, the production of coarse grains and pulses, which were less in demand than rice and wheat, either did not increase significantly or decreased. Hence, the total per capita grain production has been notably less than that suggested by many protagonists of the Green Revolution, and the threat of major food scarcity has not been eliminated.

Crops

Most Indian farms grow little besides food crops, especially cereal grains, and these account for more than three-fifths of the area under cultivation. Foremost among the grains, in terms of both area sown and total yield, is rice, the crop of choice in almost all areas with more than 40 inches (1,000 mm) of average annual precipitation, as well as in some irrigated areas. Wheat ranks second in both area sown and total yield and, because of the use of HYVs, leads all grains in yield per acre. Wheat is grown mainly on the fertile soils of northern and northwestern India in areas with 15 to 40 inches (380 to 1,000 mm) of average annual precipitation, often with supplementary irrigation. Unlike rice, which is mainly grown during the *kharif* (summer) season, wheat is primarily a *rabi* (cool-season) crop. Other important cereals, in descending order of sown acreage, are sorghum (called jowar in India), pearl millet (*bajra*), corn (maize), and finger millet (*ragi*). All these typically are grown on relatively infertile soils unsuitable for rice or wheat, while corn cultivation is also favoured in hilly and mountainous regions. After cereals, pulses are the most important category of food crop. These ubiquitous leguminous crops—of which the chickpea (gram) is the most important—are the main source of protein for most Indians, for whom the consumption of animal products is an expensive luxury or is proscribed on religious grounds.


(Fig-114 Crops)

Nonstaple food crops, eaten in only small amounts by most Indians, include potatoes, onions, various greens, eggplants, okra, squashes, and other vegetables, as well as such fruits as mangoes, bananas, mandarin oranges, papayas, and melons. Sugarcane is widely cultivated, especially in areas near processing mills. Sugar is also obtained by tapping the trunks of toddy palms (*Caryota urens*), which are abundant in southern India, but much of this syrup is fermented, often illegally, to make an alcoholic beverage. A wide variety of crops—mainly peanuts (groundnuts), coconuts, mustard, cottonseed, and rapeseed—are grown as sources of cooking oil. Others, such as the ubiquitous chilies, turmeric, and ginger, are raised to provide condiments or, in the case of betel leaf (of the pan plant) and betel (areca nut), digestives. Tea is grown, largely for export, on plantations in Assam, West Bengal, Kerala, and Tamil Nadu, while coffee is grown almost exclusively in southern India, mainly in Karnataka. Tobacco is cultivated chiefly in Gujarat and Andhra Pradesh.

Foremost among the commercial industrial crops is cotton. Maharashtra, Gujarat, and Punjab are the principal cotton-growing states. Jute, mainly from West Bengal, Assam, and Bihar, is the second leading natural fibre. Much of it is exported in processed form, largely as burlap. An even coarser fibre is derived from coir, the outer husk of the coconut, the processing of which forms the basis for an important cottage industry in Kerala. Coconuts and oilseeds are also important for the extraction of industrial oils.

Livestock

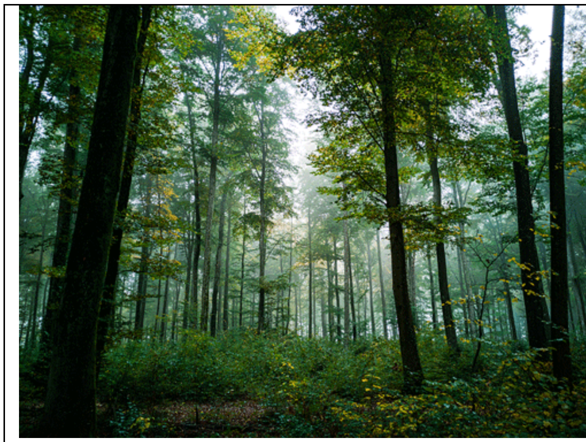
Despite the fact that Indians eat little meat, livestock raising plays an important role in the agricultural economy. India has by far the largest bovine population of any country in the world. Cattle and buffalo are used mainly as draft animals but also serve many other purposes—to provide milk, as sources of meat (for those, including Muslims, Christians, and Scheduled Castes, for whom beef eating is not taboo), and as sources of fertilizer, cooking fuel (from dried cow-dung cakes), and leather. Milk yields from Indian cattle and buffaloes are quite low, although milk from buffaloes is somewhat better and richer on average than from cattle. Because cow slaughter is illegal in many states, scarcely any cattle are raised expressly for providing meat, and most of what little beef is consumed comes from animals that die from natural causes. Rather than being slaughtered, cattle that outlive their usefulness may be sent to *goshala*s (homes for aged cattle maintained by contributions from devout Hindus) or allowed to roam as strays. In either case, they compete with humans for scarce vegetal resources.

(Fig-115 Livestock)

While many orthodox Indians are vegetarians, others will eat goat, mutton, poultry, eggs, and fish, all of which are produced in modest quantities. Sheep are raised for both wool and meat. Pork is taboo to members of several faiths, including Muslims and most Hindus, but pigs, which serve as village scavengers, are raised and freely eaten by several Scheduled Castes.

Forestry

Commercial forestry is not highly developed in India. Nevertheless, the annual cutting of hardwoods is among the highest of any country in the world. Species that are sources of timber, pulp, plywood, veneers, and matchwood include teak, deodar, *Sal*, sissoo, and chir pine. Virtually any woody vegetation is used for firewood, much of it illegally gathered, and substantial amounts go into making charcoal. Minor forest products include bamboo, cane, gum, resins, dyes, tanning agents, lac, and medicinal plants.



(Fig-116 Forestry)

The principal areas for commercial forestry, in order of importance, are the Western Ghats, the western Himalayas, and the hill regions of central India. In an effort to counteract forest depletion, the central and state governments have vigorously supported small-scale afforestation projects; these have met with mixed success, both economically and ecologically.

Population growth has, over the centuries, resulted in a continuous diminution of forest land. Most of India's formerly forested area has been converted to agricultural use (though some of that land is no longer productive), and other large areas have been effectively turned into wasteland from either overgrazing or overexploitation for timber and firewood. The problem of obtaining sufficient firewood, mainly for cooking, is particularly acute. In many areas forests have ceased to exist, and the only trees of consequence are found in protected village groves, often planted with mangoes or other fruit trees, where people and animals can seek shade from the fierce summer sun. In some areas, especially the northeast, bamboo thickets provide an important substitute for wood for structural purposes. Official figures on the amount of forested land (roughly one-fifth of India's total area) are virtually meaningless, as much of the area officially classified as forest contains little but scrub. Among the ecological consequences of deforestation in India are the reduced groundwater retentiveness, a concomitant rapid runoff of monsoon rains, a higher incidence of flooding, accelerated erosion and siltation, and an exacerbated problem of water scarcity.

Fishing

(Fig-117 Fishing)

Fishing is practiced along the entire length of India's coastline and on virtually all of its many rivers. Production from marine and freshwater fisheries has become roughly equivalent. Because few fishing craft are mechanized, total catches are low, and annual per capita fish consumption is modest. The shift to mechanization and modern processing, however, has been inexorable. Thus, an increasingly large part of the catch now comes from fishing grounds that the small craft of coastal fishing families are unable to reach. The problem is most severe in Kerala, the leading fishing state. Major marine catches include sardine and mackerel; freshwater catches are dominated by carp. Intensive inland aquaculture, for both fish and shrimp (the latter of which has become an important export), has increased significantly.

Agro Industry introduction

Agriculture is the primary source of livelihood for about 58% of India's population. Gross Value Added (GVA) by agriculture, forestry and fishing was estimated at Rs. 19.48 lakh crore (US$ 276.37 billion) in FY20 (PE). Growth in GVA in agriculture and allied sectors stood at 4% in FY20. The agriculture, forestry and fishing gross value added (GVA) growth is likely to be 3% in the second quarter of FY21.

The Indian food industry is poised for huge growth, increasing its contribution to world food trade every year due to its immense potential for value addition, particularly within the food processing industry. Indian food and grocery market is the world's sixth largest, with retail contributing 70% of the sales. The Indian food processing industry accounts for 32% of the country's total food market, one of the largest industries in India and is ranked fifth in terms of production, consumption, export and expected growth. Essential agricultural commodities export for the April-September period of 2020 increased by 43% to Rs. 53,626 crore (US$ 7.3 billion) over Rs. 37,397 crore (US$ 5.1 billion) in the same period last year.

Market Size

During 2019-20* crop year, food grain production was estimated to reach a record 295.67 million tonnes (MT). In 2020-21, Government of India is targeting food grain production of 298 MT. Production of horticulture crops in India was estimated at a record 320.48 million metric tonnes (MMT) in FY20 as per second advance estimates. India has the largest livestock population of around 535.78 million, which translates to around 31% of the world population. Milk production in the country is expected to increase to 208 MT in FY21 from 198 MT in FY20, registering a growth of 10% y-o-y. Sugar production in India reached 26.46 MT between October 2019 and May 2020 sugar season according to Indian Sugar Mills Association (ISMA).

India is among the 15 leading exporters of agricultural products in the world. Agricultural export from India reached US$ 38.54 billion in FY19 and US$ 35.09 billion in FY20. The total agricultural export was US$ 10.40 billion between April and October 2020. The organic food segment in India is expected to grow at a CAGR of 10% during 2015-25 and is estimated to reach Rs. 75,000 crore (US$ 10.73 billion) by 2025 from Rs. 2,700 crore (US$ 386.32 million) in 2015.

Investments

According to the Department for Promotion of Industry and Internal Trade (DPIIT), the Indian food processing industry has cumulatively attracted Foreign Direct Investment (FDI) equity inflow of about US$ 10.20 billion between April 2000 and September 2020.

Some major investments and developments in agriculture are as follows:

⇒ In March 2020, Fact, the oldest large-scale fertilizer manufacturer in the country, crossed one million production and sales mark.

⇒ Nestle India will invest Rs. 700 crore (US$ 100.16 million) in construction of its ninth factory in Gujarat.

⇒ In November 2019, Haldiram entered into an agreement for Amazon's global selling program to E-tail its delicacies in the United States.

⇒ In November 2019, Coca-Cola launched 'Rani Float' fruit juices to step out of its trademark fizzy drinks.

⇒ Two diagnostic kits developed by Indian Council of Agricultural Research (ICAR) - Indian Veterinary Research Institute (IVRI) and the Japanese Encephalitis lgM ELISA were launched in October 2019.
⇒ Investment worth Rs. 8,500 crore (US$ 1.19 billion) have been announced in India for ethanol production.

Government Initiatives

Some of the recent major Government initiatives in the sector are as follows:

⇒ In November 2020, the government inaugurated a mega food park in Punjab worth Rs. 107.83 crore (US$ 14.6 million) that will be spread across over 55 acres of land.
⇒ In October 2020, the Tribal Cooperative Marketing Development Federation of India (TRIFED) included 100 new Forest Fresh Organic Products sourced from tribes across India on its e-marketplace (tribesindia.com).
⇒ In October 2020, Agri-lender Nabard (National Bank for Agriculture and Rural Development) proposed plans to set up a subsidiary to provide guarantee for loans under agriculture and rural development.
⇒ In October 2020, the government announced that it is putting up a common data infrastructure for farmers in the country. PMFBY (Pradhan Mantri Fasal Bima Yojana), PM-Kisan and the Soil Health Card will be integrated through a common database, along with land record details.
⇒ In September 2020, the government launched the PM Matsya Sampada Yojana, e-Gopala App and several initiatives in fisheries production, dairy, animal husbandry and agriculture. Under this scheme, an investment of Rs. 20,000 crore (US$ 2.7 billion) will be made in the next 4-5 years in 21 states.
⇒ In May 2020, Government announced the launch of animal husbandry infrastructure development fund of Rs. 15,000 crore (US$ 2.13 billion).
⇒ In September 2019, Prime Minister, Mr Narendra Modi launched National Animal Disease Control Programme (NADCP), expected to eradicate foot and mouth disease (FMD) and brucellosis in livestock. In May 2020, Rs. 13,343 crore (US$ 1.89 billion) was allocated to the scheme.
⇒ The Agriculture Export Policy, 2018 was approved by the Government of India in December 2018. The new policy aimed to increase India's agricultural export to US$ 60 billion by 2022 and US$ 100 billion in the next few years with a stable trade policy regime.
⇒ The Government of India is going to provide Rs. 2,000 crore (US$ 306.29 million) for computerization of Primary Agricultural Credit Society (PACS) to ensure cooperatives are benefitted through digital technology.
⇒ The Government of India launched the Pradhan Mantri Krishi Sinchai Yojana (PMKSY) with an investment of Rs. 50,000 crore (US$ 7.7 billion) aimed at development of irrigation sources for providing a permanent solution from drought.
⇒ Government plans to triple the capacity of food processing sector in India from the current 10% of agriculture produce and has also committed Rs. 6,000 crore (US$ 936.38 billion) as investments for mega food parks in the country, as a part of the Scheme for Agro-Marine Processing and Development of Agro-Processing Clusters (SAMPADA).
⇒ The Government of India has allowed 100% FDI in marketing of food products and in food product E-commerce under the automatic route.

Achievements in the sector

⇒ In November 2020, the planting of winter crops exceeded by 10% compared with the last year and witnessed 28% increase in area under pulses. The total area acreage under pulses increased to 8.25 million hectares from 6.45 million hectares last year.

⇒ Out of the total 37 mega food parks that were sanctioned, 21 mega food parks are operational, as of November 2020.

⇒ In November 2020, Minister of Consumer Affairs, Food and Public Distribution, Mr. Piyush Goyal announced that the Food Cooperation of India and state agencies are set to procure a record quantity of 742 LMT (lakh metric tonnes) paddy during the ongoing Kharif crop season as against 627 LMT paddy last year.

⇒ The Electronic National Agriculture Market (e-NAM) was launched in April 2016 to create a unified national market for agricultural commodities by networking existing APMCs. It had 16.6 million farmers and 131,000 traders registered on its platform until May 2020. Over 1,000 mandis in India are already linked to e-NAM and 22,000 additional mandis are expected to be linked by 2021-22.

⇒ Sale of tractors in the country stood at 804,000 units in 2019 with export of 80,475 units.

⇒ During FY20 (till February 2020), tea export stood at US$ 709.28 million.

⇒ Coffee export stood at US$ 742.05 million in FY20.

Road Ahead

India is expected to achieve the ambitious goal of doubling farm income by 2022. The agriculture sector in India is expected to generate better momentum in the next few years due to increased investment in agricultural infrastructure such as irrigation facilities, warehousing and cold storage. Furthermore, the growing use of genetically modified crops will likely improve the yield for Indian farmers. India is expected to be self-sufficient in pulses in the coming few years due to concerted effort of scientists to get early maturing varieties of pulses and the increase in minimum support price.

In the next five years, the central government will aim US$ 9 billion in investments in the fisheries sector under PM Matsya Sampada Yojana. The government is targeting to raise fish production to 220 lakh tonnes by 2024-25. Going forward, the adoption of food safety and quality assurance mechanisms such as Total Quality Management (TQM) including ISO 9000, ISO 22000, Hazard Analysis and Critical Control Points (HACCP), Good Manufacturing Practices (GMP) and Good Hygienic Practices (GHP) by the food processing industry will offer several benefits. The agro export from India is likely to reach the target of US$ 60 billion by the year 2022.

Alternative Farming Techniques and Solution

Organic Farming

The principles of organic farming is the maintenance of soil fertility by bio-intensive nutrient management, recycling of agricultural wastes, vermicomposting, avoidance or reduction of external inputs, use of natural forms of pest management and weed control (Goldsmith and Hildeyard 1996; Hansen et al. 2006). The organic movement began in the 1930s and 1940s as a reaction to the growing reliance of agriculture on synthetic fertilizers. Organic farming is a form of agriculture which excludes the use of synthetic fertilizers and pesticides; plant growth regulators, livestock feed additives, and genetically modified organisms. Organic agriculture can be considered a subset of sustainable agriculture, the difference being that organic implies certification in accordance with legal standards. Sir Albert Howard was widely considered to be the father of modern organic farming worked as an agricultural adviser in Pusa, Bengal from 1905 to 1924. He documented traditional Indian farming practices and came to regard them as superior to conventional agriculture, Rudolf Steiner a German philosopher made influential strides in the earliest organic theory with his biodynamic agriculture. More work was done by Rodale in the United States, Lady Eve Balfour in the United Kingdom and many others across the world-such as Masanobu Fukuoka, Aldo Leopold, William Albrecht, Louis Bromfield, Edward Faulkner, Ehrenfried Pfeiffer, Alan Chadwick, Wes Jackson, and Garth Youngberg. One of the earliest recorded examples of research on organic farming is the comparison of organic and conventional farming systems at Hughley, Suffolk, England initiated by Eve Balfour. But the practice of organic farming is as old as the early history of agriculture-if we track back some 12,000 years and beyond into prehistory. Organic agriculture is distinct from conventional agriculture through alternative agricultural practices, in their view and values. Organic agricultural methods are standard, internationally regulated and legally enforced International Federation of Organic Agriculture Movements (IFOAM) an international umbrella organization for organic organizations established in 1972. This is known as certification. Certification of organic food products is advantageous for both producers as well as consumers. Farmers fallowing certification are rewarded with eliminating the risk of exposure to toxic agrochemicals, premium prices and better market access. Several countries have already adopted community certification of organic food. Organic agriculture world over involves certain basic steps as like:

(Fig-118 Organic Farming)

⇒ Green manuring
⇒ Bio fertilizers
⇒ Crop rotation
⇒ Cover cropping
⇒ Soil Health Management

Green Manuring

A green manure is a type of cover crop grown primarily to add nutrients and organic matter to the soil for soil improvement and soil protection. Typically a green manure crop is grown for a specific period, plowed and incorporated into the soil.

⇒ Leguminous green manures contain nitrogen-fixing symbiotic bacteria in root nodules that fix atmospheric nitrogen in a form that plants can use.
⇒ Green manures increase the percentage of organic matter (biomass) in the soil, thereby improving water retention, aeration, and other soil characteristics.
⇒ The root systems of some varieties of green manure grow deep in the soil and bring up nutrient resources unavailable to shallower-rooted crops.
⇒ Common cover crop functions of weed suppression and prevention of soil erosion and compaction are often also taken into account when selecting and using green manures.

⇒ Some green manure crops, when allowed to flower, provide forage for pollinating insects.

The green manure crops could contribute 30–60 kg nitrogen per hectare annually to the subsequent crop and is an inexpensive source of organic fertilizer to build up or maintain soil fertility (Amanullah 2008). For instance, the rice yield could be significantly improved by incorporating green manure and stem nodulating green manure has the capacity to fix approximately 150–220 kg N ha1 in 50–60 days. Green manuring alone (without fertilizer nitrogen) manifested an yield increase of toria by 122% equivalent to solitary application of 60 kg N ha1 and the residual effect of green manuring on the following sunflower crop resulted in an additional yield of 317 kg ha1 (Bahi and Pasricha 2001). Organic agriculture is no longer a phenomenon of developed countries. It is now commercially practiced in 120 countries, representing 31 million ha of certified croplands and pastures (0.7% of global agricultural lands and an average of 4% in the European Union), 62 million ha of certified wild lands (for organic collection of bamboo shoots, wild berries, mushrooms and nuts) and a market of US$40 billion in 2006 (2% of food retail in developed countries). Although difficult to quantify, non-certified organic systems e.g. indigenous models that follow organic principles by intent or by default) of several million small farmers may represent at least an equivalent share in subsistence agriculture of developing countries (FAO 2007).

Bio fertilizers

Bio fertilizers are the substance which contains symbiotic nutrients fixating living microbes which are capable of colonizing in rhizosphere and enhances plant growth by increasing the availability of primary nutrients or by synthesizing growth promoting. The plant inoculation with Azospirillum promoted the uptake of KC, NO 3 and H2PO 4, releases various metabolites such as auxines, cytokines, riboflavin and vitamins leading to higher growth in various legume and non-leguminous plant (Saubidet et al. 2000; Matriu and Dakora 2004). Azospirillum and Pseudomonas fluorescens colonize plant roots and exert beneficial effects on plant growth and development (Bashan et al. 2004; Choong et al. 2005). Rhizobium, Azospirillum and phosphobacteria encourage plant growth by producing growth regulators, facilitating nutrient uptake, accelerating mineralization, reducing plant stress, stimulating nodulation and promoting nitrogen fixation.

(Fig-119 Bio fertilizers)

Crop Rotation

Crop rotations serve to provide new above-and below-ground habitats as each new crop has a distinct chemical and biological make-up, introducing new vegetation types to the landscape eventually increases crop residues to the soil ecosystem. Different crop residues promote or inhibit different soil organisms which may have inhibitory or growth promoting effects to subsequent crops. By interrupting the continuous presence of a crop host, crop rotation serves to break the build-up in the cycles of weeds and insects and diseases, thus eliminating the need for pesticide application. Fallow periods i.e. ground left uncultivated for an extended period of time, allow a limited amount of secondary succession to advance and hence the recovery of the diversity of both terrestrial and below-ground species are possible.

Cover Cropping

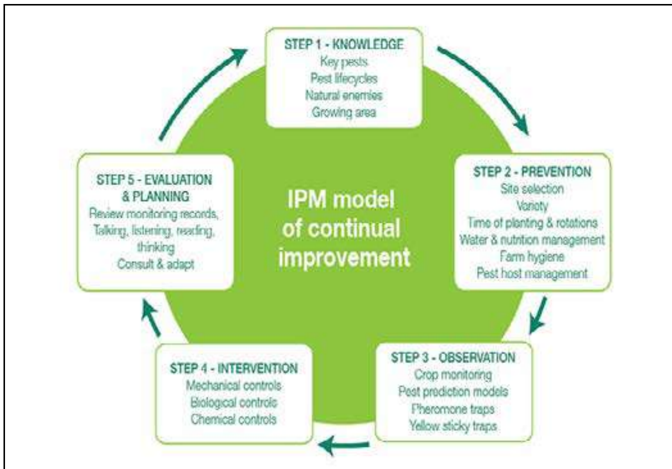
Cover cropping is an ideal cropping pattern adopted specifically for soil improvement purposes. Both annual and perennial cover crops used to harnessing natural resources effectively in above-and below-ground biodiversity. Cover crops may provide a physical temporary habitat for many different species of ground-nesting birds, small mammals as well as nectar and pollen sources for many species of insects. The habitat value of cover crops varies by species and variety therefore cover crops must be carefully selected to meet specific management objectives. Cover crops root system improves water penetration and prevents soil erosion. Cereal cover prevents, excessive water consumption, nutrient leaching into sensitive water ways and can be an important source of organic matter when incorporated into the soil. The use of perennial cover crops in farms is an effective means of enhancing the biodiversity and productive capacity of cropping systems by minimizing the environmental risks associated with chemical use.


(Fig-120 Cover Cropping)

Soil Health Management enhancing soil quality is essential for maintaining agricultural productivity and minimizing environmental degradation. Organic farming plays a key role in maintaining soil quality. Intensive chemical agricultural practices either depletes soil nutrients or resulting in over-reliance of inorganic fertilizers leading to nutrient build up can be harmful to yields and the environment. The use of naturally occurring soil mineral amendments e.g. rock phosphate, sulphate of potash, serves to supply essential plant nutrients and reduces nutrient leaching and runoff. Compost is used to improve and maintain soil organic matter levels. The Higher soil biodiversity in organic farms has shown to increase the rate of nutrient cycling, improve soil aggregation and aggregate stability and improve the disease suppression of agricultural soils. Additionally in order to work effectively, manures, vermicompost and enriched phospho-composts must be incorporated into the soil. This provides the double benefit of increasing availability for crop use and decreasing potential for runoff.

Integrated Pest Management

Since 1960s, chemical pesticides have been the dominant approach in controlling and eliminating pests resulting in more consistent crop yields as well as a reduction in labor needed to manage the crops. Crops grown in healthy soils tend to be more resistant and resilient to pest and pathogens which require little to no applications of pest control materials. Integrated Pest Management addresses both the concern of the farmer by regarding the increasing amounts of pesticide to maintain the same effectiveness on insects and human as well as ecosystem health. However, there is an imminent danger that it can unwittingly promote the corporate interest by unnecessarily emphasizing the use of avoidable pesticides and fungicides against the locally available more economically, ecologically and culturally appropriate pest control solutions. For instance the effectiveness and relevance of panchagavya, bio-fertilizers and biopesticides have been rediscovered recently by the scientific community.



(Fig-121 Integrated Pest Management)

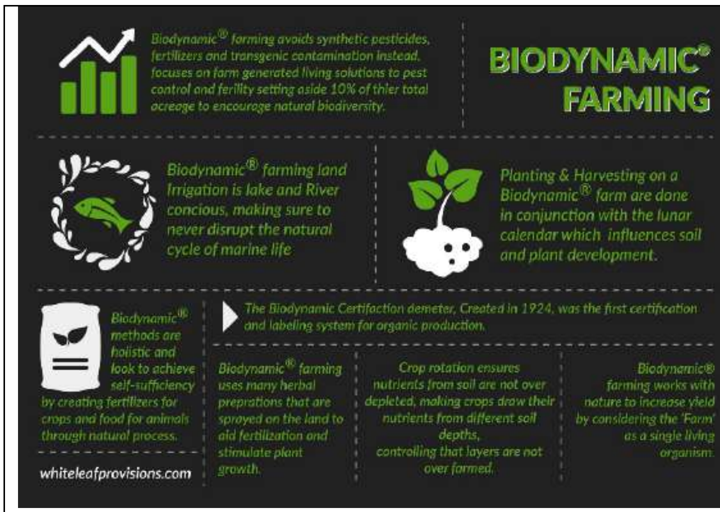
Potentials

Production of safe and healthy products, increasing preference for environmentally friendly processes and products, growing demand for organic products in the markets and reduced input cost with return of diverse income are the significant benefits.

Constrains

The following are some of the notable constraints-poor access to productive land, inputs and credit; poor access to water and resources especially for small-scale farmers; lack of awareness of niche markets for organic produce; problems with accessing local, national and international markets; dependence on standards set by northern hemisphere countries, which limits the development of local standards; lack of technical skills by farmers in organic production; and lack of efficient extension service in organic production systems.

Bio-Dynamic Farming



(Fig-122 Bio-Dynamic Farming)

Biodynamic agriculture was the first ecological farming systems arise in response to commercial fertilizers and specialized agriculture after the turn of the century yet it remains largely unknown to the modern farmer. Biodynamic farming places great importance on the rhythmic positions of moon, sun and planets when sowing seeds, transplanting, applying liquid manures or spraying fruit trees and crops. Biodynamic (BD) agriculture is an advanced organic farming system which gains increased attention of farmers and consumers for its emphasis on food quality and soil health. There are about 4,200 Biodynamic certified farms in 43 countries over 128,000 ha, according to Demeter standards. Biodynamic agriculture developed out of eight lectures on agriculture given in 1924 by Rudolf Steiner (1861–1925) an Austrian scientist and philosopher to a group of farmers near Breslau. Biodynamic farming is a combination of biological and dynamic practices; it also involves animal manures, crop rotations, and care for animal welfare, looking at the farm entity and local distribution systems. BD farming practices are also gaining importance in the face of increasing climate change, energy scarcity and population growth, where they indicate a more resilient, diverse and efficient system.

No Tillage Farming

Tillage is a critical soil management practice used for weed control, seed bed preparation, root growth stimulation, soil moisture control, soil temperature control, soil compaction alleviation and incorporation of crop residues and manure. Masanobu Fukuoka wrote a book “The One-Straw Revolution” was one of the pioneers work about No tillage farming or Fukuoka Farming. Producing crops usually undergo regular tilling that agitates the soil in various ways and it’s usually done by tractor-drawn implements. Usually this tilling practice affects the soil compaction, loss of organic matter, degradation of soil aggregates, death or disruption of soil microbes including mycorrhiza, arthropods, and earthworms and soil erosion.

(Fig-123 No Tillage Farming)

No-till farming avoids these effects by excluding the use of tillage practice. By this way of farming, crop residues or other organic amenities are retained on the soil surface, sowing and fertilizing is done with minimal soil disturbance. It sometimes involves in problems like residue management, increased weed and disease infestations and this can be avoided by crop rotations and cover crops. No-tillage farming is effective in terms of economic and soil erosion control, than any other cost effective practices which are commonly used. Tebr¨ugge and B¨ohrnsen (1997) reported that No-tillage is a very profitable cultivation system compared to conventional tillage because of the cost savings from lower machinery costs and lower operation costs.

Urban and Periurban Farming

Urban and Periurban agriculture is the practice of cultivating, processing and distributing of producing vegetables and fruits within urban environments for household consumption as well as for sale to the rapidly growing urban population. Urban farming is generally practiced for income-earning or food-producing activities though in some communities the main impetus is recreation and relaxation. Urban agriculture contributes to food security and

(Fig-124 Urban and Periurban Farming)

food safety in two ways: first, it Increases the amount of food available to people living in cities, second, it allows fresh vegetables, fruits and meat products to be made available to urban consumers. The recognition of environmental degradation within cities through the relocation of resources to serve urban populations has inspired the implementation of different schemes of urban agriculture across the developed and developing world. Great population pressure in and around cities, coupled with the economic crises throughout the region has led to a tremendous increase in the last decade of total city area under food production. This activity is known as urban and peri-urban agriculture. Urban and peri-urban agriculture is practiced for a variety of purposes like commercial reasons, food self-sufficiency and food security.

Natural Farming

Do-Nothing Farming also known as Natural Farming (NF) is an alternative farming method to chemical or traditional farming. Natural framing is used to emphasize the importance of "spatially" and "temporarily" overlapping the growing crops, plants and animals so that we can utilize their synergistic effects. Natural Farming with indigenous microorganisms is a distinctive approach to organic farming practiced successfully in more than 30 countries, in home gardens and on a commercial scale. Natural Farming is unique in that it is not meant to be commercialized but rather practiced by individual farmers with cheap, easily available ingredients and microbes or mycorrhizae indigenous to each locale or farm. These microorganisms are:

⇒ cultured in a simple wooden box of rice
⇒ mixed with brown sugar and stored in a crock
⇒ Further propagated on rice bran or wheat mill run mixed with soil and cultured again.
⇒ The resultant product is then mixed with compost, added to potting soil or spread on beds before planting, the process takes 3–4 weeks.

There are also procedures for water soluble calcium made from eggshells, water-soluble calcium phosphate made from animal bones and vinegar, fish amino acid made from fish waste, lactic acid bacteria, seed soak solution and insect attractants made from rice wine. There are half dozen more inputs that can be made simply and easily at home which are used according to the nutritive and growth cycle of the plants. Many of these inputs are made from waste residues and materials (Prell 2010).

Eco-Farming

Eco-farming or site-appropriate agriculture involves treating both regions used for agriculture and individual farms as ecological systems. "Site" restricted to natural conditions like soil, climate and temperature. The demand for stability and sustainability stems from the obligation of each generation to pass on to future generations an environment that remains capable of guaranteeing the fundamentals of human existence. Consideration must also be given to economic development i.e. price– cost ratios, incomes, farm-specific conditions i.e. access to factors of production and the internal forces influencing a farm's operations like self-sufficiency, risk minimization and preservation of soil fertility. Countries must develop forms of agriculture that permit a high degree of self-sufficiency and decentralization at national and regional levels. The essential characteristics of these Eco farming systems are:

⇒ maximal but sustainable use of local resources
⇒ minimal use of purchased inputs, only as complementary to local resources

⇒ emphasis on subsistence cropping, combined with complementary production for the market
⇒ ensuring the basic biological functions of soil-water-nutrients-humus
⇒ maintaining a diversity of plant and animal species as a basis for ecological balance and economic stability, with primary emphasis on local species, varieties and races
⇒ conserving life support systems and ecosystem services
⇒ Creating an attractive overall land cape which gives satisfaction to the local people.

Permaculture

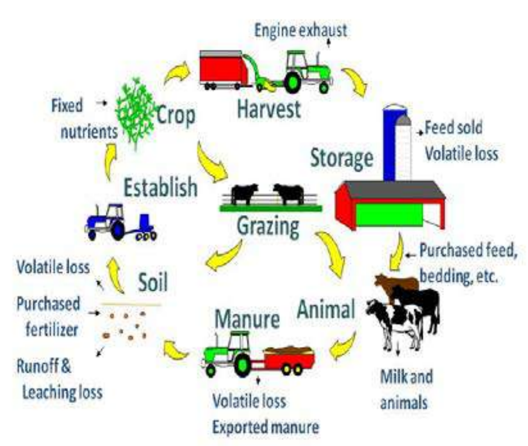
Permaculture is a design system and philosophy developed by Bill Mollison. Permaculture is the conscious design, maintenance of agriculturally productive ecosystems, stability and resilience of natural ecosystems. It is the harmonious integration of landscape, food, energy and shelter. Without permanent agriculture there is no possibility of a stable social order.


(Fig-125 Permaculture)

Polyculture several agronomists recently proposed that traditional multispecies systems models for designing sustainable cropping systems. Polyculture will (a) produce adequate yields of edible grain over several years without tillage or re-sowing; (b) yield as much as or more than an equivalent set of monocultures; (c) manage insects, pathogens and weeds; and (d) compensate for N, phosphorus, and other nutrients removed in harvest. In agroecosystems, biodiversity (1) contribute to constant biomass production and reduce the risk of crop failure in unpredictable environments, (2) restore disturbed ecosystem services, such as water and nutrient cycling, and (3) reduce risks of invasion, pests and diseases through enhanced biological control or direct control of pests. Specific features of biodiversity in natural systems may offer a basis for designing multispecies systems.

Integrated Farming Systems

Combining crops with livestock spatially and temporally has the potential to maintain ecosystem function, prevent agricultural systems from becoming too brittle and increased capability to absorb shocks to the natural resource base promotes multi-functionality i.e. multiple roles assigned to agriculture in Integrated farming systems. Multi-functionality agriculture has an activity is entrusted with performing four main functions-economic functions and social functions, environmental functions and food security. The difference between mixed farming and integrated farming is that enterprises in the



(Fig-126 Integrated Farming Systems)

integrated farming system are mutually supportive and depend on each other. Integrated farming systems are effectively systems that have traditionally been undertaken by farmers in countries that include Indonesia, China, Malaysia, Vietnam, Rwanda and Thailand. However in many countries these traditional self-reliant subsistence systems have been replaced by the establishment of commercial cash crop production systems that have been promoted by governments.

Floating Farming

Floating farming is an ancient and traditional farming system, practiced in some regions of the world. This form of in-situ hydroponics or soil-less culture is sustainable and comparable with cultivation techniques. The wetland ecosystems are very important to the economy and lives of the people of the country, as their livelihoods and subsistence are very much linked with the productivity of wetlands. In such places, these floating farming are sustainable in all aspects.

(Fig-127 Floating Farming)

Chapter: 18

Social Activities – Any Activates Planned By Students E.g. Teaching Learning activities, awareness camp, business idea for SELF HELP GROUP OR ANY OTHER

Tree plantation

We do tree plantation in village as a social activity. We plant tree in front of panchayat buildings plane area, and also in school of Derdi village. Due to covid-19 we not together many people, plantation done by our team of 3 people. We also request principal of school to do plantation I school as well as in village after pandemic is over and they give us good response for that suggestion. We also request serpanch and talati to do tree plantation and take care of trees until they grew up and they also give very good response to our suggestion.

Awareness for Covid-19 and importance of mask, sanitizer and social distancing

We all are very well know about current scenario so instead of gathering people we decide to spread awareness about covid-19 and importance of mask, sanitizer and social distancing through social media and through WhatsApp. We type a message in which we write how covid-19 spread, how we can break chain of spread of covid-19, how can we protect our self from covid-19, how we can improve our immune system and how proper use of mask and sanitizer are used for protection.

We also send some photos and videos regarding how wear mask properly and some home remedies for improve immune system. We also suggest some medicine which are use full for normal fewer and cold. We also suggest some medicine for those who are home quarantine because of covid-19 or who are infected. We suggest some medicine like zinc, vitamin B-12, iron-manganese, vitamin-C and paracetamol.

We will try our best to do some small activity with following all precaution from covid-19, so we will try to spread awareness in social media other than that we hadn't do any activity in village due to covid-19.

Chapter: 19

DERDI KUMBHAJI VILLAGE SAGY Questionnaire Survey form with the Sarpanch Signature

SAANSAD ADARSH GRAM YOJANA (SAGY) Baseline Household Survey Questionnaire

Village: Derdi Kumbhaji Gram Panchayat: Derdi Ward No. 2

Block: 7 District: Rajkot

State: GUJARAT L S Constituency: PORBandar

1. Family Identity and Size

Name of Head of Household	Sanjaybhai Bhagvanbhai Padmani							Male/ Female	2/2
SECC Survey ID:		Family Size	4	Over 18	3	6 to 18	1	Under 6	–

2. Category & Entitlement Details (Tick as appropriate)

Social Category[1]		Life Insurance	1. All Adults 2. Some Adults 3. None	AABY	1. Yes 2. No	Kisan Credit Card	Yes / ~~No~~
Poverty Status Year[2]:	1. BPL 2. APL	Health Insurance	1. All Adults 2. Some Adults 3. None	RSBY	1. Yes 2. No	MGNREGS Job Card Number	
PDS (If NFSA is not implemented)		Annapurna	Antyodaya	BPL	APL	Is any woman in the family member of an SHG? Yes / ~~No~~	
PDS (If NFSA is implemented)		Annapurna	Antyodaya	Priority	Other		

2. Adults (above 18 years)

Name	Age	Sex M/F/O	Disability Status Y/N	Marital Status[3]	Education Status[4]	Adhaar Card (Y/N)	Bank A/C (Y/N)	Social Security Pension[5]
Sanjaybhai Padmani	46	M	N	–	B.A	–	–	NO

3. Children from 6 years and up to 18 years

Name	Age	Sex M/F/O	Disability Y/N	Marital Code*	Level of Education: Code#	Going to School /College (Y/N)	Current Class	Computer Literate Y/N
Girija Padmani	15	F	N	–	10th	Y	10	Y

4. Children below 6 years

Name	Age	Sex M/F/O	Disability Yes/No	Going to School (Y/N)	Going to AWC Y/N	De-worming Done	Fully Immunised Y/N	Mother's Age at the time of Child's Birth
–	–	–	–	–	–	–	–	–
–	–	–	–					
–	–	–						

[1] Scheduled Caste 1, Scheduled Tribe 2, Other Backward Castes 3, Other 4

[2] Enter the BPL Survey round being used in the Gram Panchayat for identification of BPL Families (e.g. 1997/2002/2011)

[3] *Marital Status: Not Married – 1, Married – 2, Widowed – 3, Divorced/Separated – 4*

[4] *Level of Education: Not Literate – 01, Literate – 02, Completed Class 5 - 03, Class 8th – 04, Class 10th-05, Class 12th-06, ITI Diploma-07, Graduate-08, Post Graduate/Professional – 09 (write the highest level applicable)*

[5] No Pension – 0, Old Age Pension – 1, Widow Pension – 2, Disability Pension – 3, Other Pension – 4 (mention)

SAANSAD ADARSH GRAM YOJANA (SAGY) Baseline Household Survey Questionnaire

5. Hand washing

	Always		Sometimes		Never
After use of Toilet	Soap	Other ✓	Soap	Other ✓	
Before Eating	Soap	Other	Soap	Other	

6. Use of Mosquito Net

Children: Yes / No Adults: Yes / No

7. Do members take Regular Physical Exercise

	Yoga	Games	Other Exercises
Adults	Yes / No	Yes / No	Yes / No
Children	Yes / No	Yes / No	Yes / No

8. Consumption of Tobacco

	Smoking	Chewing
Adults	✓	✓
Children	×	×

9. House & Homestead Data

Own House: Yes / No	No. of Rooms: 3
Type: Kutcha / Semi Pucca / Pucca	
Toilet: Private / Community / Open Defecation	
Drainage linked to House: Covered / Open / None	
Waste Collection System	Door Step / Common Point / No Collection System
Homestead Land: Yes / No	Kitchen Garden : Yes / No
Compost Pit: Individual/ Group/ None	Biogas Plant: Individual/ Group/ None

10. Source of Water (Distance from source in KMs)

Source of Water		Distance
Piped Water at Home	Yes / No	2 KM
Community Water Tap	Yes / No	2 KM
Hand Pump (Public / Private) Yes / No		–
Open Well(Public / Private) Yes / No		–
Other (mention):		–

11. Source of Lighting and Power

Electricity Connection to Household: Yes / No
Lighting: Electricity/Kerosene/Solar Power
Mention if Any Other: None
Cooking: LPG/Biogas/Kerosene/Wood/Electricity
Mention if Any Other: None
If cooking in Chullah: Normal/ Smokeless

12. Landholding (Acres)

1. Total	0.7	2. Cultivable Area	0.2
3. Irrigated Area	0.2	4. Uncultivable Area	0.5

13. Principal Occupations in the Household

Livelihood	Tick if applicable
Farming on own Land	✓
Sharecropping /Farming Leased Land	
Animal Husbandry	
Pisciculture	
Fishing	
Skilled Wage Worker	
Unskilled Wage Worker	✓
Salaried Employment in Government	
Salaried Employment - Private Sector	
Weaving	
Other Artisan(mention)	
Other Trade & Business (mention)	

14. Migration Status

Does any member of the household migrate for Work: Yes / No. If Yes Entire Year / Seasonal

Does anyone below 18 years migrate for work: Y/N

15. Agriculture Inputs

Do you use Chemical Fertilisers	Yes/No
Do you use Chemical Insecticides	Yes/No
Do you use Chemical Weedicide	Yes/No
Do you have Soil Health Card	Yes/No
Irrigation: None/ Canal/ Tank/ Borewell/Other	
Drip or Sprinkler Irrigation: Drip /Sprinkler / None	

16. Agricultural Produce in a normal year (Top 3)

Name	Unit	Quantity
Cottone	Kg	6000
ground nutt	kg	4000

17. Livestock Numbers

Cows: –	Bullocks: –	Calves: –
Female Buffalo: –	Male Buffalo: –	Buffalo Calves: –
Goats/ Sheep: –	Poultry/ Ducks: –	Pigs: –
Any other: Type –	No. –	
Shelter for Livestock: Pucca / Kutcha / None		
Average Daily Production of Milk(Litres): –		

18. What games do Children Play

computer games
street games

19. Do children play musical instrument (mention)

NO

Schedule Filled By:
Principal Respondent: સરપંચ
Date of Survey: દેરડી(કું.) ગ્રામ પંચાયત

Saansad Adarsh Gram Yojana (SAGY) Panchayat Details Survey Questionnaire

(Note: Please aggregate information from village level questionnaires wherever relevant)

I. Basic Information

a. Gram Panchayat: Dersdi Kumbhoji
b. Block: 2
c. District: RAJKOT
d. State: GUJARAT
e. Lok Sabha Constituency: PORBANDER
f. Number of Wards in the Gram Panchayat: 7 WARDS
g. Number of Villages in the Gram Panchayat: one
h. Names of Villages: Desdi Kumbhaji

Demographic Information

Number of Households 1405 Total Population 9400 Male – Female –

SC HHs – ST HHs – OBC HHs – Other HHs –

I. Access to Infrastructure / Facilities / Services

	Infrastructure Facilities / Services	Located within the GP Yes (Y)/No (N)	If located elsewhere (N), distance from the GP office
a.	ANM/ Health Sub Centre	Y	
b.	Nearest Primary Health Centre (PHC)	Y	
c.	Nearest Community Health Centre (CHC)	N	N
d.	Nearest Post Office		N
e.	Nearest Bank Branch (Any)	Y	
f.	Nearest Bank with CBS Facility		N
g.	Nearest ATM	Y	
h.	Nearest Primary School		N
i.	Nearest Middle School		N
j.	Nearest Secondary School		N
k.	Nearest Higher Secondary School / +2 College		N
l.	Nearest Graduate College		N
m	Nearest ITI / Polytechnic Centre		N
n	Kisan Seva Kendra		N

1

Saansad Adarsh Gram Yojana (SAGY) Panchayat Details Survey Questionnaire

(Note: Please aggregate information from village level questionnaires wherever relevant)

	Infrastructure Facilities / Services	Located within the GP Yes (Y)/No (N)	If located elsewhere (N), distance from the GP office
o	Agriculture Credit Cooperative Society		N
p	Nearest Agro Service Centre	Y	
p	MSP based Government Procurement Centre		N
q	Milk Cooperative /Collection Centre	Y	
r	Veterinary Care Centre		N
s	Ayurveda Centre		N
t	E – Seva Kendra		N
u	Bus Stop	Y	/
v	Railway Station		N
w	Library		N
x	Common Service Centre		N

IV. Sports Facilities in the Gram Panchayat

a. Number of Play Grounds in the GP: Total N0 Public – Private -

b. Mini Stadium : No Yes(Y) /No (N) *(Playground with equipment and sitting arrangement)*

V. Education, ICDS

a. Number of Angan Wadi Centres: 6

b. Number of villages without Angan Wadi Centres -

Names of such villages: –

c. Schools (Number)

Primary Private: 3 Primary Govt.: 1

Middle Private: 3 Middle Govt.: 2

Secondary Private: 3 Secondary Govt.: 2

Higher Secondary Private: 2 Higher Secondary Govt: 1

VI. Public Distribution System

	Item	Private Contractor	Women's SHG	Gram Panchayat	Cooperative	Other (Mention)	Location in GP (mention Location)	If outside GP, Location & distance from GP HQrs)
a.	Cereal (Rice/ Wheat/ Millets)	Yes	NO	NO	NO	NO	NO	NO
b.	Kerosene	Yes	NO	NO	NO	NO	NO	NO
c.	Other (mention)	-	-	-	-	-	-	-

2

Saansad Adarsh Gram Yojana (SAGY) Panchayat Details Survey Questionnaire

(Note: Please aggregate information from village level questionnaires wherever relevant)

VII. Coverage of Villages under different Facilities & Services

	Parameter	Villages Status[1]	Names of Villages Covered	Names of Villages not Covered
a.	Piped Water Supply Coverage to Villages	Covered yes Not Covered	Derdi Kumbhaji	-
b.	Hand Pump Coverage in Villages:	Covered Not Covered NO	Derdi	-
c.	Coverage under Covered Drains:	Covered yes Not Covered	Derdi	-
d.	Coverage under Open Drains:	Covered yes Not Covered	Derdi	-
e.	Villages with Household Electricity Connection (Numbers)	Connected yes Not Connected	Derdi	-

VIII. Land and Irrigation

	Private Land	Area in Acres		Common Land	Area in Acres		Irrigation Structure	No.
a.	Cultivable Land	-	d.	Pasture / Grazing Land	–	g.	Check Dam	1
b.	Irrigated Land	-	e.	Forests/ Plantations	-	h.	Wells/Bore Wells	2
c.	Un-irrigated Land	-	f.	Other Common Land	–	i	Tanks /Ponds	4

[1] Mention the number of Villages Covered and Not Covered

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3 દેરડી(કું.) ગ્રામ પંચાયત

Saansad Adarsh Gram Yojana (SAGY) Panchayat Details Survey Questionnaire

(Note: Please aggregate information from village level questionnaires wherever relevant)

IX. Parameters relating to Households & Institutions

		Number
a)	Number of eligible Households for pension (old age, widow, disability)	96
b)	Number of Households receiving pension (old age, widow, disability)	78
c)	Number of eligible Households who are not receiving pension	18
d)	Number of Households eligible for Ration Card	1300
e)	Number of eligible HHs having ration cards	1300
f)	Number of households covered under RSBY (Rashtriya Swasthya Bima Yojana)	NO
g)	Number of HHs covered under AABY (Aam Aadmi Bima Yojana)	NO
h)	Number of active Job Card holders under MGNREGA	NO
i)	Number of Job Card holders who completed 100 days of work during 2013-14	-
j)	Number of shops selling alcohol	-
k)	Number of BPL families	1300
l)	Number of landless households	143
m)	Number of IAY beneficiaries	-
n)	Number of FRA[2] beneficiaries	-
o)	Number of Community Sanitary Complexes	-
p)	Number of Households headed by single women	-
q)	Number of Households headed by physically handicapped persons	-
r)	Total number of Persons with Disability in the village	-
s)	Number of SHGs	-
t)	Number of active SHGs	-
u)	Number of SHG Federations	-
v)	Number of Youth Clubs	-
w)	Number of Bharat Nirman Volunteers	-

Name and Signature of Surveyor and Respondent'

Padmani maharshi Surveyor	PRI Respondent (Preferably Gram Panchayat Chairperson)	Official Respondent (Preferably seniormost Government official in the Gram Panchayat)	7-5-2021 Date of Survey

[2] The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006

4

SAANSAD ADARSH GRAM YOJANA (SAGY) Village Details Survey Questionnaire

This questionnaire should be filled for each of the villages in the selected Gram Panchayat[1]

I. Basic Information

a. Village: Derdi Kumbhaji
b. Ward Number: 2
c. Gram Panchayat: Derdi
d. Block: 3
e. District: Rajkot
f. State: Gujrat
g. Lok Sabha Constituency: Porbandar
h. Number of Habitations / Hamlets in the Gram Panchayat: 10

i. Names of Habitations / Hamlets:

Demographic Information

Number of Households 1405 | Total Population 9400 | Male - | Female -

SC HHs - | ST HHs - | OBC HHs - | Other HHs -

II. Access to Infrastructure/Amenities etc.

i.	Access to Infrastructure / Facilities / Services	Located in the Village Yes (Y)/No(N)	If located elsewhere (N), distance in kms from the village
a.	Nearest Primary School	Y	
b.	Nearest Middle School	Y	
c.	Nearest Secondary School	Y	
d.	Kisan Seva Kendra		N
e.	Milk Cooperative /Collection Centre	Y	
g.	Health Sub Centre	Y	
h.	Bank	Y	
i.	ATM	Y	
j.	Bus Stop	Y	
k.	Railway Station		N

[1] While filling this the surveyor must collect the information from the Ward Member/s and relevant government officials

1

SAANSAD ADARSH GRAM YOJANA (SAGY) Village Details Survey Questionnaire

i.	Access to Infrastructure / Facilities / Services	Located in the Village Yes (Y)/No(N)	If located elsewhere (N), distance in kms from the village
l	Library	Y	
m	Common Service Centre		N
n	Veterinary Care Centre		N

ii. Road Connectivity

a. Habitations connected by All-weather Roads (*1-All 2-None 3-Some)*

If 3 mention the name of the habitations where not available: 2

iii. Drinking Water Facilities

a.Piped Water Supply Coverage to Habitations: 2 (*1-All 2-None 3-Some)*

If 3 mention the name of the habitations not covered: 2

b.Hand Pump Coverage in Habitations: ________ (*1-All 2-None 3-Some)*

If 3 mention the name of the habitations not covered: 1

iv. Coverage of Habitations under Waste Management System

a. Coverage under Covered Drains: ________ (*1-All 2-None 3-Some)*

If 3 mention the name of the habitations not covered: 1

b. Coverage under Open Drains: 1 (*1-All 2-None 3-Some)*

If 3 mention the name of the habitations not covered: 1

c. Coverage under Doorstep Waste Collection: (*1-All 2-None 3-Some)*

If 3 mention the name of the habitations not covered: 2

v. Coverage of Habitations under Electrification

a. Coverage under Household Connections: (*1-All 2-None 3-Some)*

If 3 mention the name of the habitations not covered: 1

b.Coverage under Street Lighting: All(*1-All 2-None 3-Some)*

If 3 mention the name of the habitations not covered: 1

vi. Sports Facilities in the Village

a.Number of Play Grounds in the Village (minimum size 200 square meters): N

b.Mini Stadium : N Yes(Y) /No (N)

vii. Education, ICDS

a. Number of Anganwadi Centres: 6

c. Schools (Number)

Primary Private: 3 Primary Govt.: 1

Middle Private: 3 Middle Govt.: 2

Secondary Private: 3 Secondary Govt.: 3

Higher Secondary Private: 2 Higher Secondary Govt: 2

2

SAANSAD ADARSH GRAM YOJANA (SAGY) Village Details Survey Questionnaire

viii. Land Category		Area in Acres		Land Category	Area in Acres		Irrigation Structure	No.
a.	Cultivable Land	-	d.	Pasture / Grazing Land	-	g.	Check Dam	1
b.	Irrigated Land	-	e.	Forests/ Plnatations	-	h.	Wells/Bore Wells	2
c.	Un-irrigated Land	-	f.	Other Common Land	-	I	Tanks /Ponds	4

ix. Entitlement Related Parameters		
1	Number of active Job Card holders under MGNREGA	-
2	Number of active Job Card holders who have completed 100 days of work	-
3	Number of shops selling alcohol	-
4	Number of BPL families	1300
5	Number of landless households	143
6	Number of IAY beneficiaries	
7	Number of FRA beneficiaries	-
8	Number of common sanitation complexes	-
9	Number of SHGs	-
10	Number of active SHGs	-
11	Existence of SHG Federation in the Village (Yes / No)	-
12	Number of Youth Clubs	-
13	Number of Bharat Nirman Volunteers	-

Name and Signature of Surveyor and Respondent'

Padmani maharshi Surveyor	PRI Respondent (Preferably a ward member from a ward that is fully or partially covered under the Village)	Official Respondent (Preferably seniormost Government official in the Gram Panchayat)	7-5-2021 Date of Survey

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Chapter: 20

TDO-DDO-Collector email sending Soft copy attachment in the report

6/9/2021 Gmail - DEVELOPMENT SCENARIO OF DERDI KUMBHAJI VILLAGE, TAL. KOTDA SANGHANI & DIST. RAJKOT.

Gmail Krutik Hirapara <krutikhirpara@gmail.com>

DEVELOPMENT SCENARIO OF DERDI KUMBHAJI VILLAGE, TAL. KOTDA SANGHANI & DIST. RAJKOT.

1 message

Krutik Hirapara <krutikhirpara@gmail.com> 9 June 2021 at 12:52

To: ddo-raj@gujarat.gov.in

Respected sir/madam

We are students of Shri Labhubhai Trivedi Institute of Engineering and Technology, District Rajkot affiliated to gujarat technological university-GTU. Gtu has been assigned to vishwakarma yojana phase- VIII in which students survey the various villages and design various amenities to deliver it to them making them ideal for living a better life as per requirement and village problem statements. We attach a report of Derdi Kumbhaji village, Ta:- Kotda Sanghani, Dit:- Rajkot.

We attach a village development report for Phase-1 and Phase-2. We add the estimate, costing and drawings of designs.

As a part of vishwakarma yojana guidelines, we have been asked to inform all the respected officers about our project in which we will shortly notify about Derdi kumbhaji village profile of issues for development and our design work for them that is below.

Sr No.	Design name	Period	Amount (Rs.)
1	Public garden	Within 1 Year	2,56,815
2	Police Station	Long term	8,32,191
3	Community Hall	Long term	3,13,708
4	Public Library	Within 1 Year	3,14,580
5	Public Health Care Centre	Long term	7,94,880
6	Batch Mandali	Within 1 Year	4,88,483
7	Rain water harvesting	Immediate	49,500
8	Gym	Within 1 Year	8,23,000
9	Cyber cafe	Within 1 Year	4,67,400
10	Skill Development Centre	Long term	6,27,900
11	Soil testing Laboratory	Long term	5,61,340
12	Agricultural store	Immediate	2,82,791
1	Solar street light	Immediate	34,000
2	Solar pump system	Immediate	61,000
3	Piezoelectric speed breaker power generator	Within 1 Year	51,600
4	CCTV installation	Immediate	28,300
5	Solar rooftop installation	Immediate	44,853
6	Automatic irrigation system using Arduino	Immediate	80,500

GTU-VY-PHASE-VIII-PART-2-S.L.T.I.E.T.DERDI KUMBHAJI-DDO-TDO.pdf
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Chapter: 21
Comprehensive report for the entire village

We study ideal village and smart village concept through different source. We study some case study for ideal village and smart village development, identify new techniques and learn about sustainable development techniques. Smart Villages access to sustainable energy services acts as a catalyst for development - enabling the provision of good education and healthcare, access to clean water, sanitation and nutrition, the growth of productive enterprises to boost incomes, and enhanced security, gender equality and democratic engagement. It can be help to develop the other village as increase basic amenities and after that smart amenities on any country with the help Smart (Ideal) Village visit and solid and liquid waste water management system Survey and Analysis. And it's also help to increase GDP Of state And Also increase country image in front of world as Good infrastructure; Good Economic Profile and Good Employment Solution; Good (Ideal Example) Smart Example of New infrastructure with Uses Of renewable energy Solution Country.

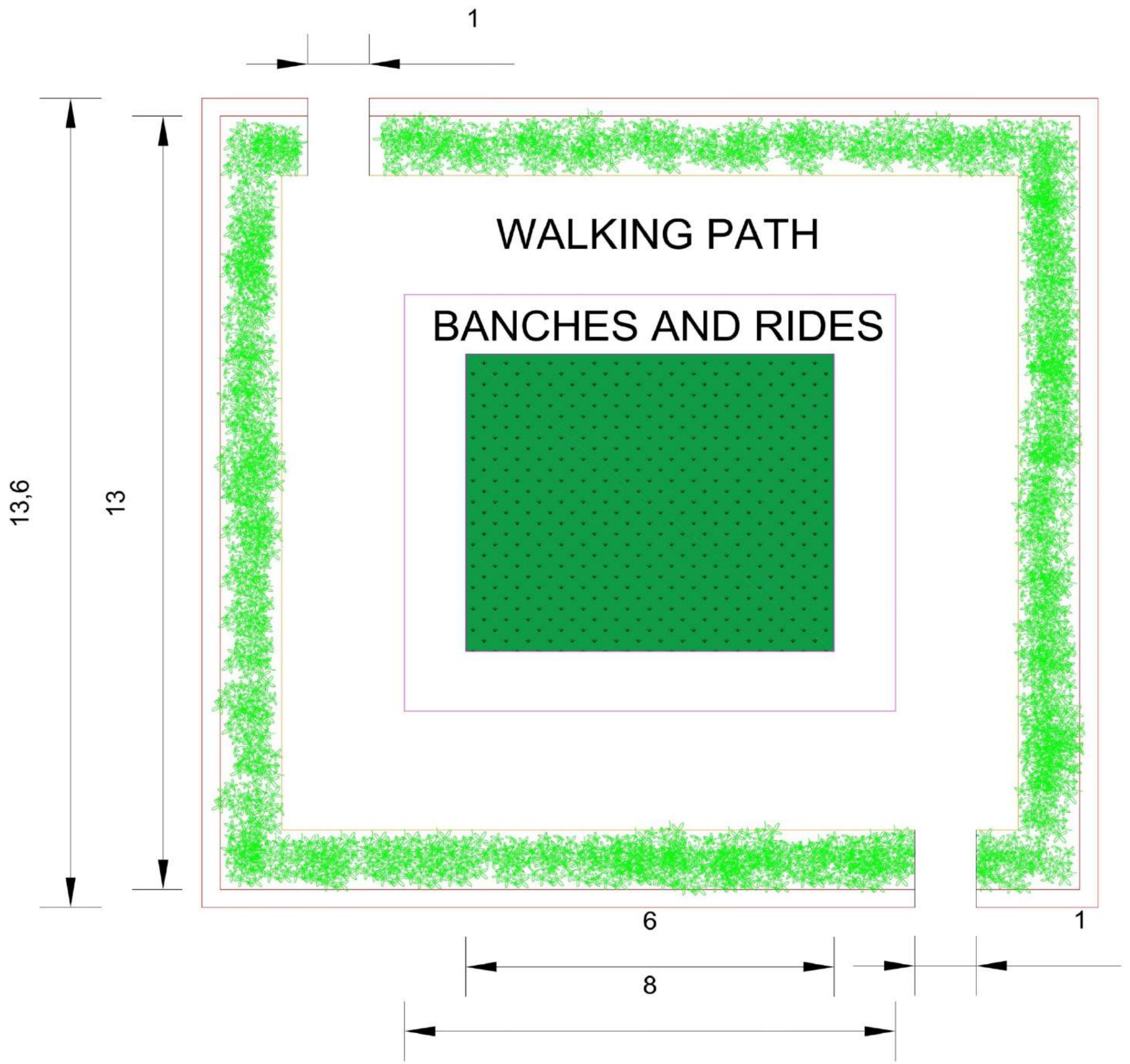
We visit ideal village and smart village for study and know the existing situation of village. We see all facilities in village and see their condition. Major facilities are in good and workable condition. Over all village condition is good. We interact with both village serpanch and talatikam mantri. We discuss village condition with them and ask for necessary data for our survey. Also they say about dome facilities May not in workable condition in their respective village. They also say about some of its facilities may require maintenance.

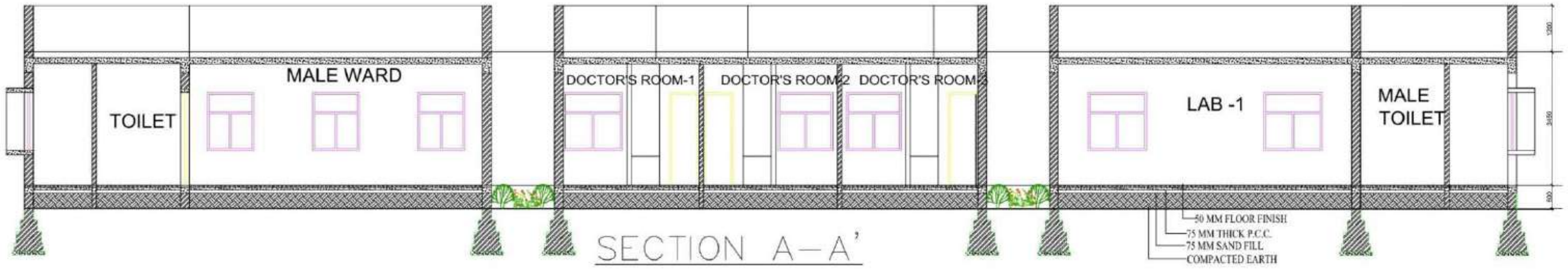
After visiting ideal village and smart village we visit our allocated village Derdi Kumbhaji. We visit village interact with sarpanch and talatikam mantri and a few of villagers. We see all the existing facilities of village take some good photograph of them we seem some lack of facilities in village and talk about that with serpanch. Sarpench told us about their condition. Majority of facilities are need some maintenance and some of them are in very good condition. Likewise, panchayat building is newly constructed. High school and primary school are at good condition. Water storage facilities need some maintenance.

After study the village and facilities at village we do gap analysis and then we identify some facilities that are not at village. We short list 6 design that are most important and we gave their plane elevation and section. We also give 3 electrical design. We also give another 6 electric designs in pahse-2 and also give 3 new designs in electrical. We try to give design as per norms. We make sure that, which design we gave is maintain time by time and for that we give some method, recommended and new material introduce to serpanch and talalti.

We study and identify problems related with electrical and try to solve them with knowledge and new technique. Over village have 24/7 electricity so no major problem is faced. We gave sustainable or can say one time investment for electrical designs.

We try our best to full fill our project moto which is "Developing village with a 'rural soul' but with all urban amenities that a city may have" and we also learn new thing and we seeing forward to develop our village under Vishwakarma Yojana.


1
WALKING PATH
BANCHES AND RIDES
13,6
13
6
1
8



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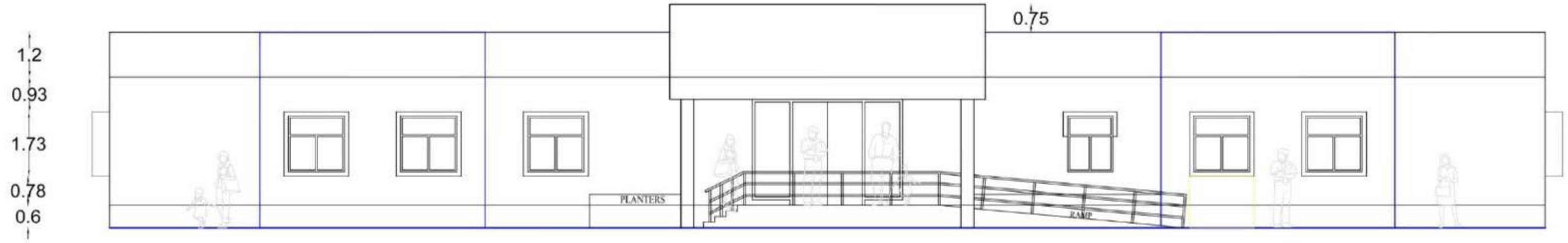
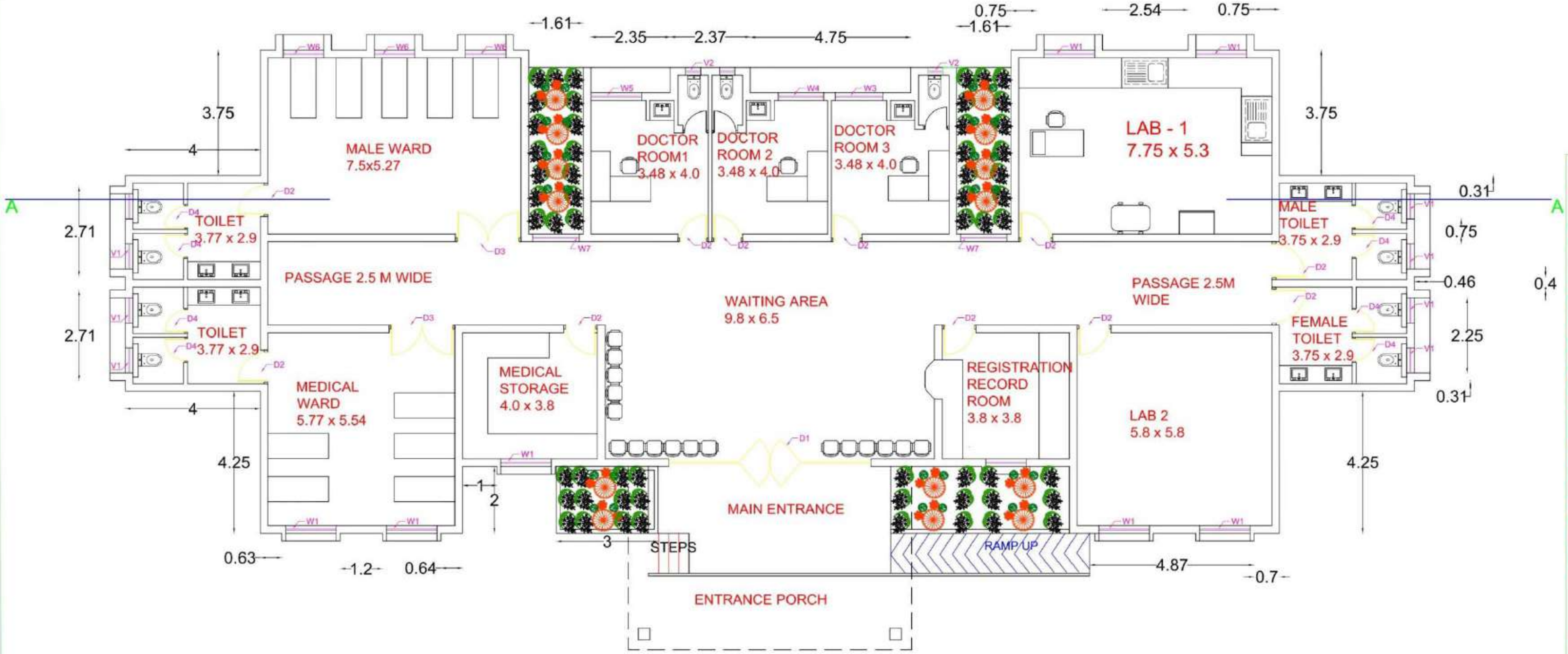


FRONT ELEVATION



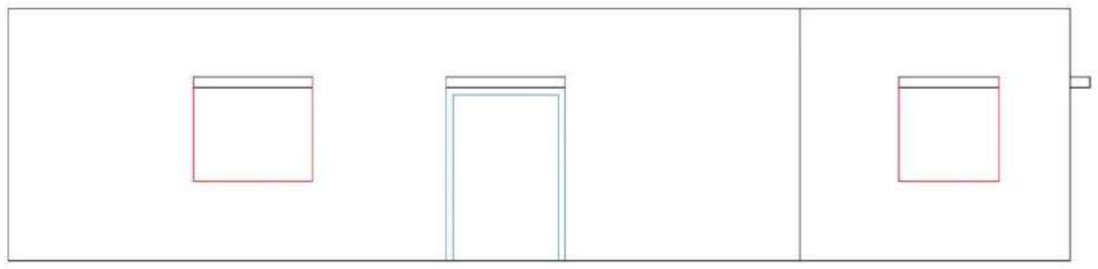
GROUND FLOOR PLAN

TITLE: PROPOSED PRIMARY HEALTH CARE CENTER PLAN
AT VILLAGE: DERDI KUMBHAJI, TA.: GONDAL, DIT.: RAJKOT

SCHEDULE:-
W1- 1500*1200
W2- 1350*1200
W3- 1408*1200
W4- 1550*1200
W5- 1510*1200
W6- 1200*1200
W7- 1382*1200
V1- 750*600
V2- 450*600
D1- 2000*2600
D2- 1000*2600
D3- 1950*2600
D4- 750*2600

ALL DIMENSIONS ARE IN MM

N



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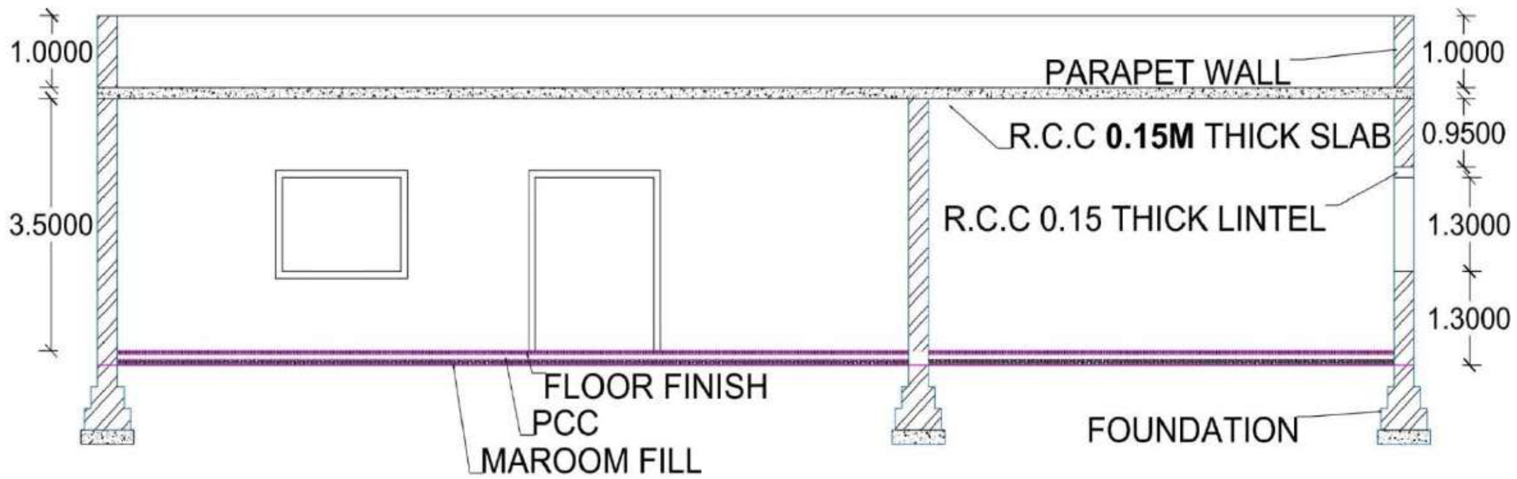
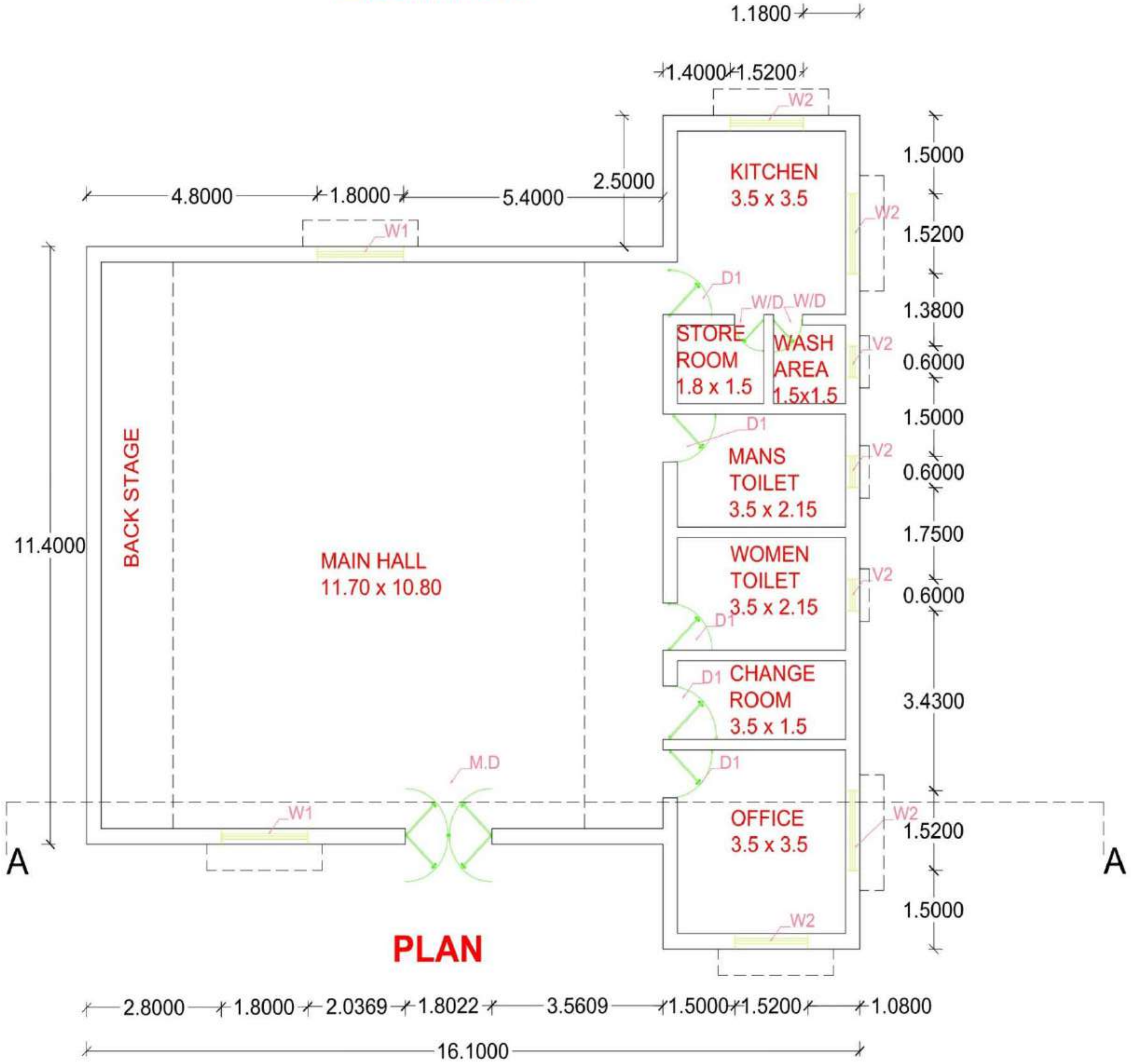


SECTION A- A



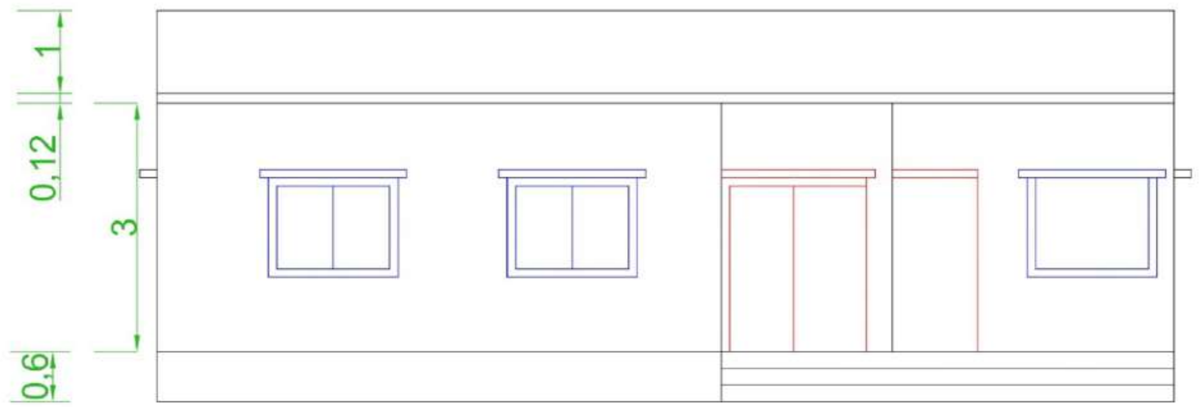
PLAN

N

TITLE: COMMUNITY HALL
PROPOSED COMMUNITY HALL PLAN
AT VILLAGE: DERDI KUMBHAJI, TA.: GONDAL,
DIT. RAJKOT

SCHEDULE:-
M.D.- 1.8 x 2.2
D1- 0.9 x 2.1
W/D- 0.6 x 2
W1- 1.8 x 1.3O
W2- 1.52 x 1.20
V1- 0.60 x 0.60

ALL DIMENSIONS IN METER.



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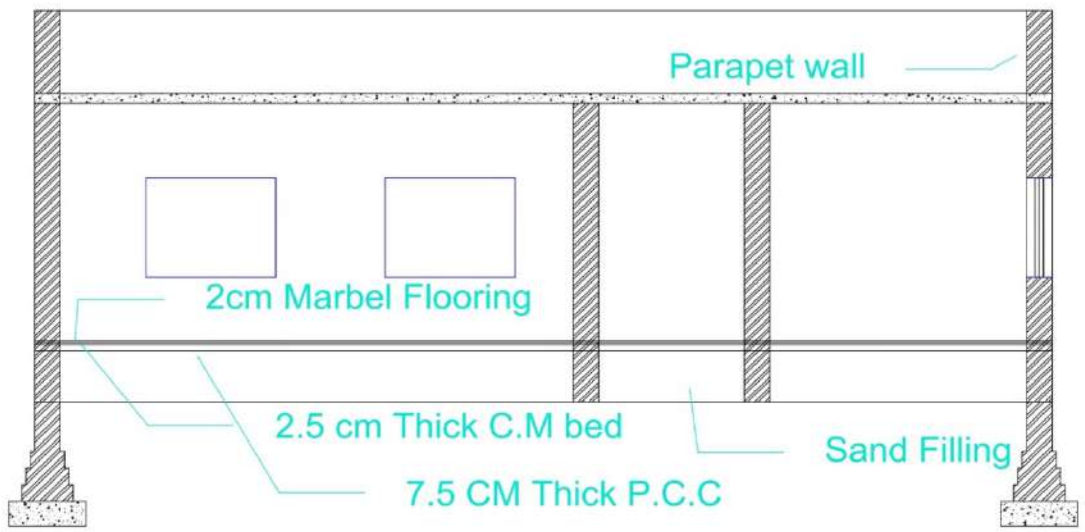
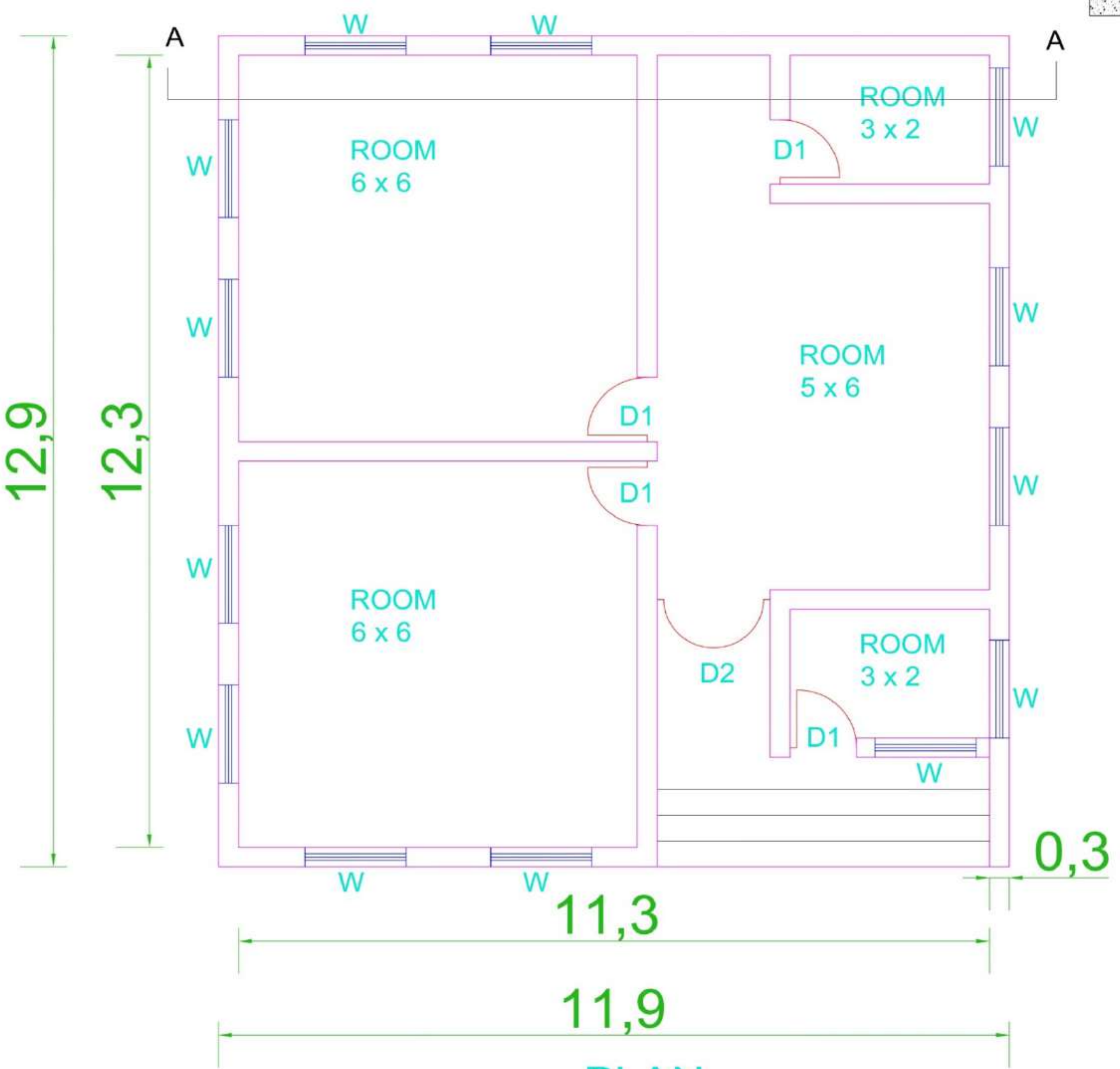
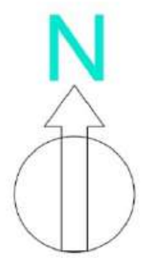


SECTION A - A



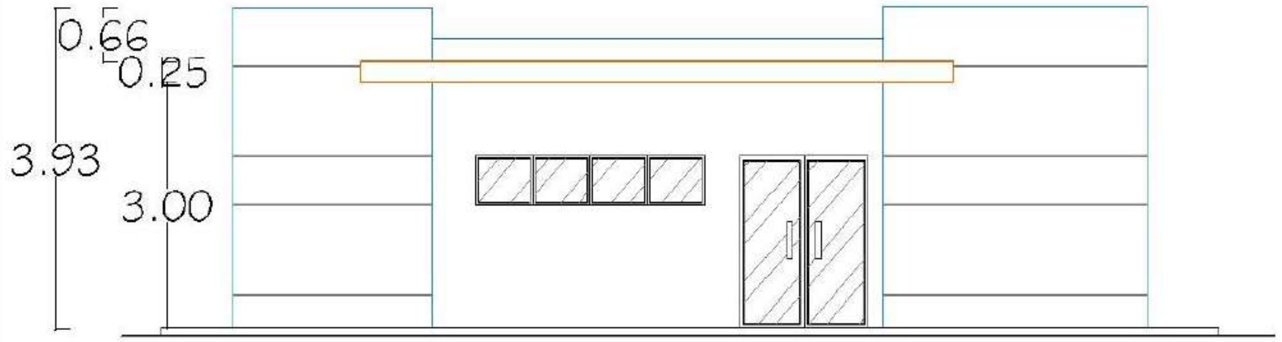
PLAN



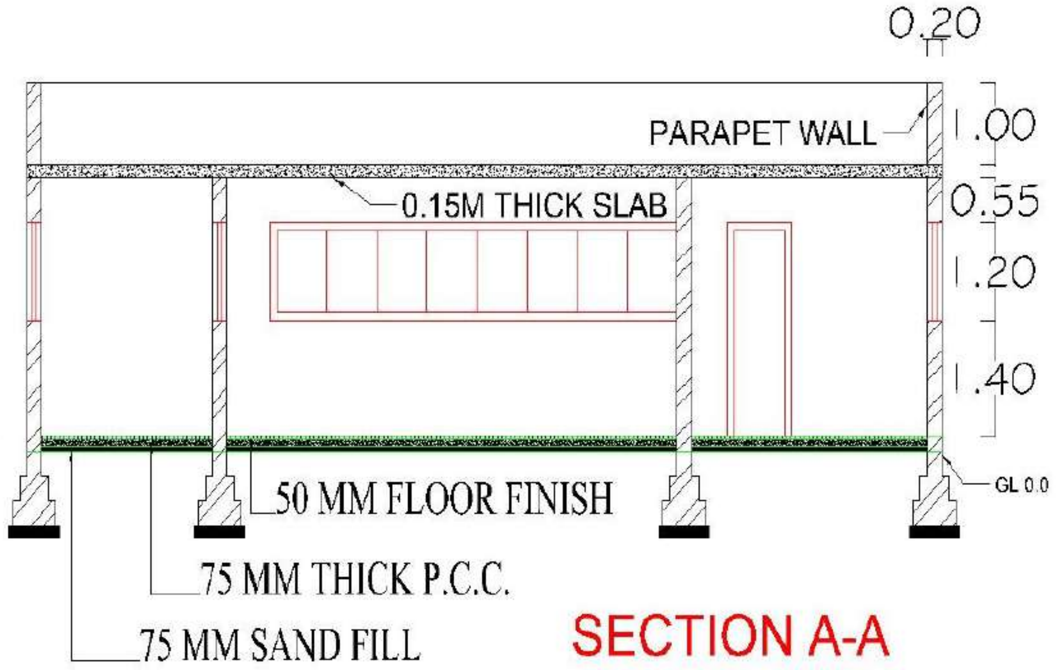
TITLE
PROPOSED BATCHAT MANDLI PLAN
AT VILLAGE: DERDI KUMBHAJI , TALIKA: GONDAL,
DISTRICT: RAJKOT

SCHEDUL:
W = 1.52 x 1.22
D1 = 1.00 x 2.30
D2 = 1.7 x 2.30

ALL DIMENSIONS ARE IN METER.



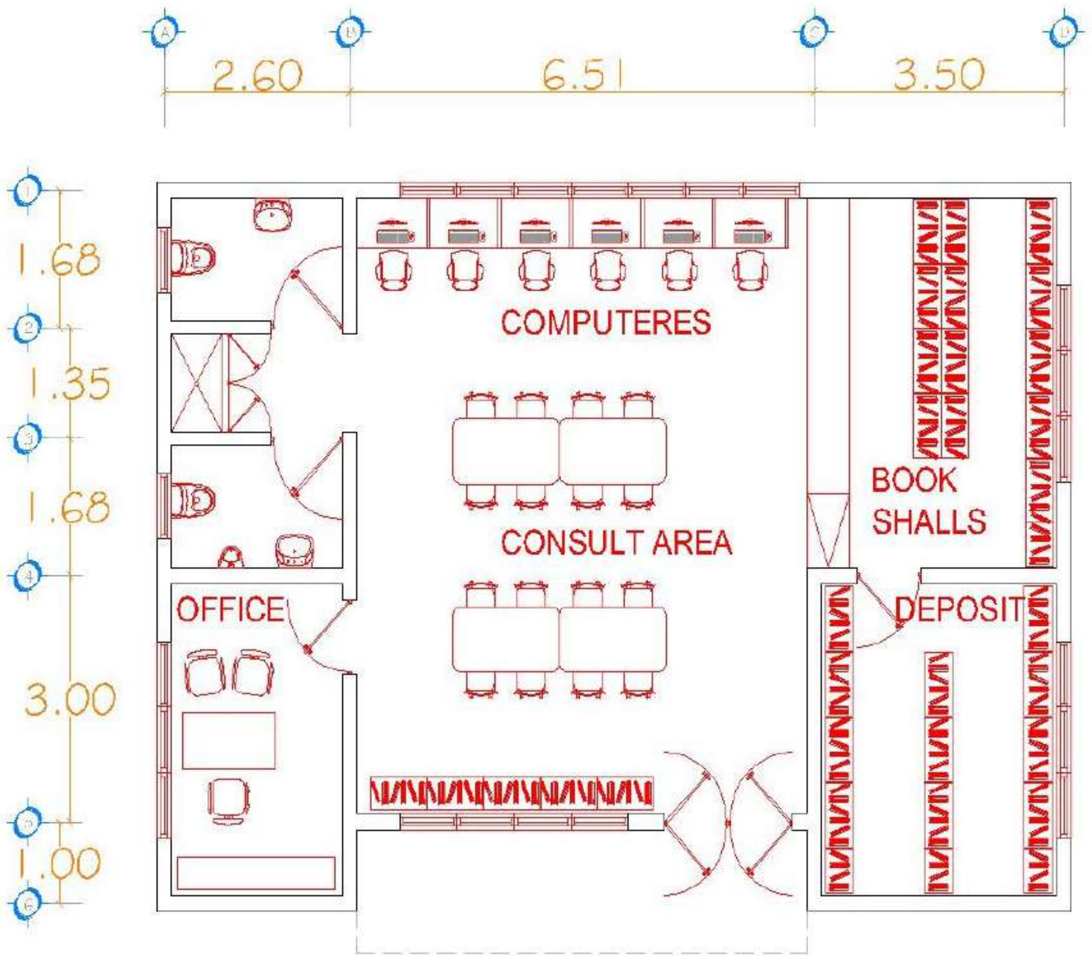
ELEVATION FRONTAL



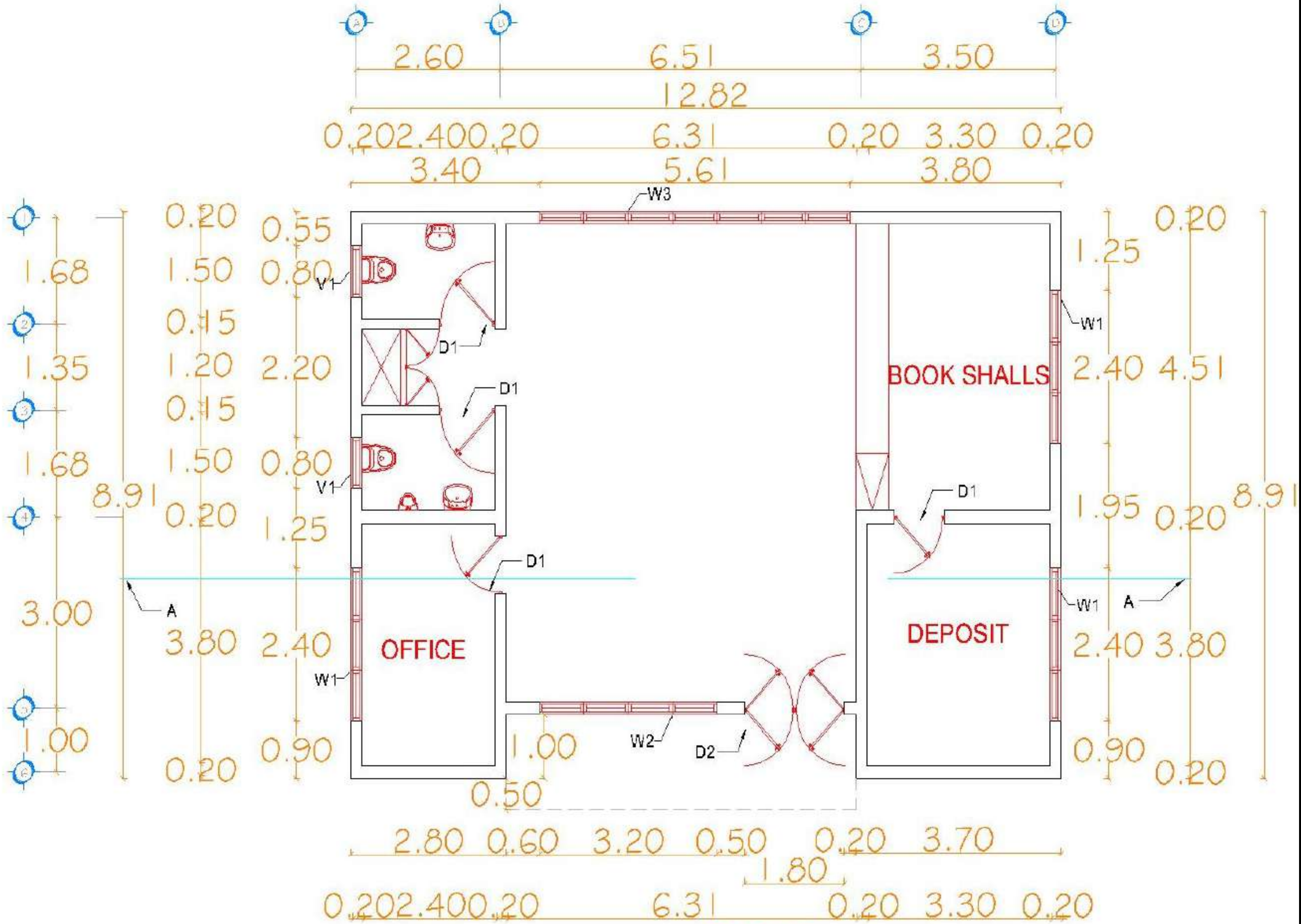
SECTION A-A

TITLE: PROPOSED LIBRARY PLAN
AT VILLAGE: DERDI KUMBHAJI,
TA.: GONDAL, DIT.: RAJKOT
SCHEDULE:
D1 = 0.90 x 2.60
D2 = 1.80 x 2.60
W1 = 2.40 x 1.20
W2 = 3.20 x 1.20
W3 = 5.61 x 1.20
V1 = 0.80 x 0.60
ALL DIMENSIONS
ARE IN METER

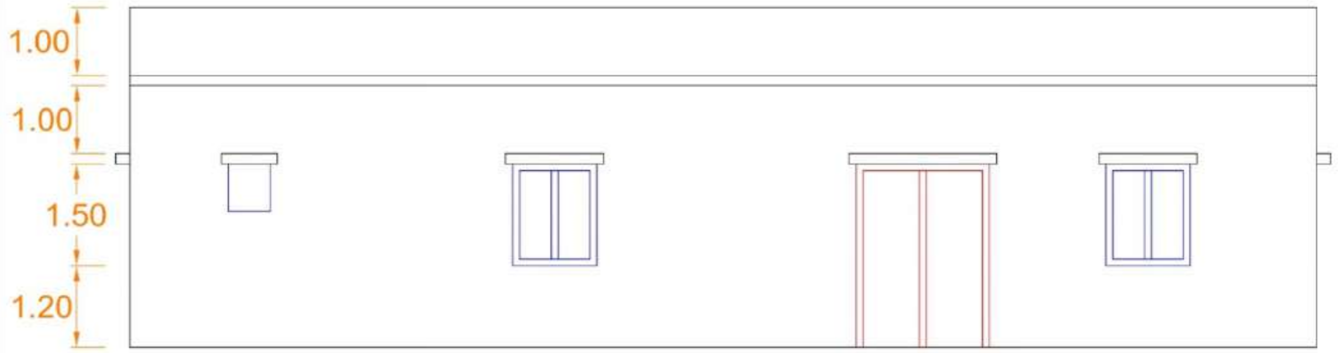
N



PLAN



PLAN



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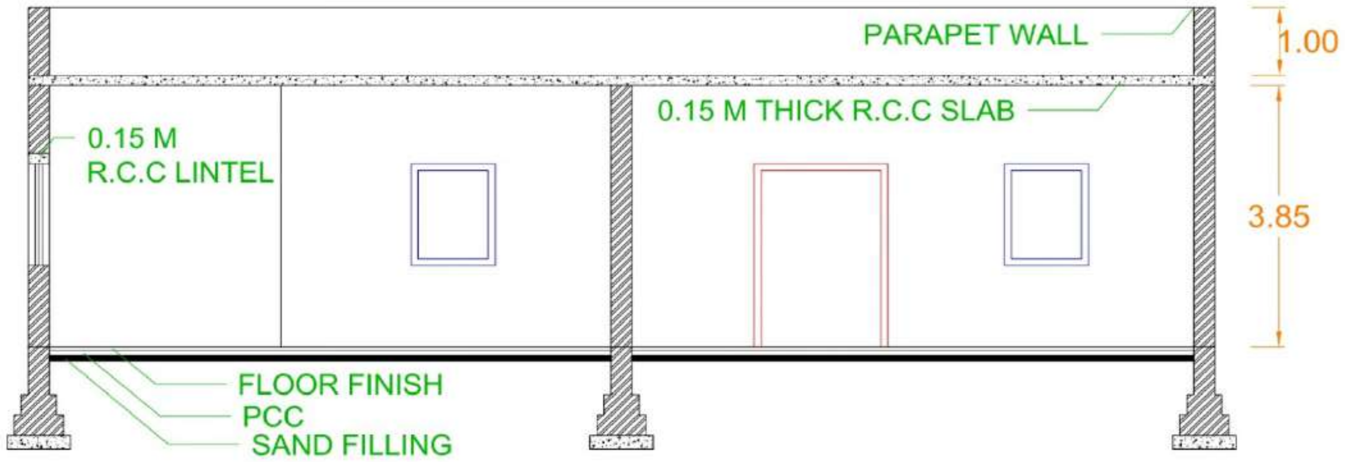
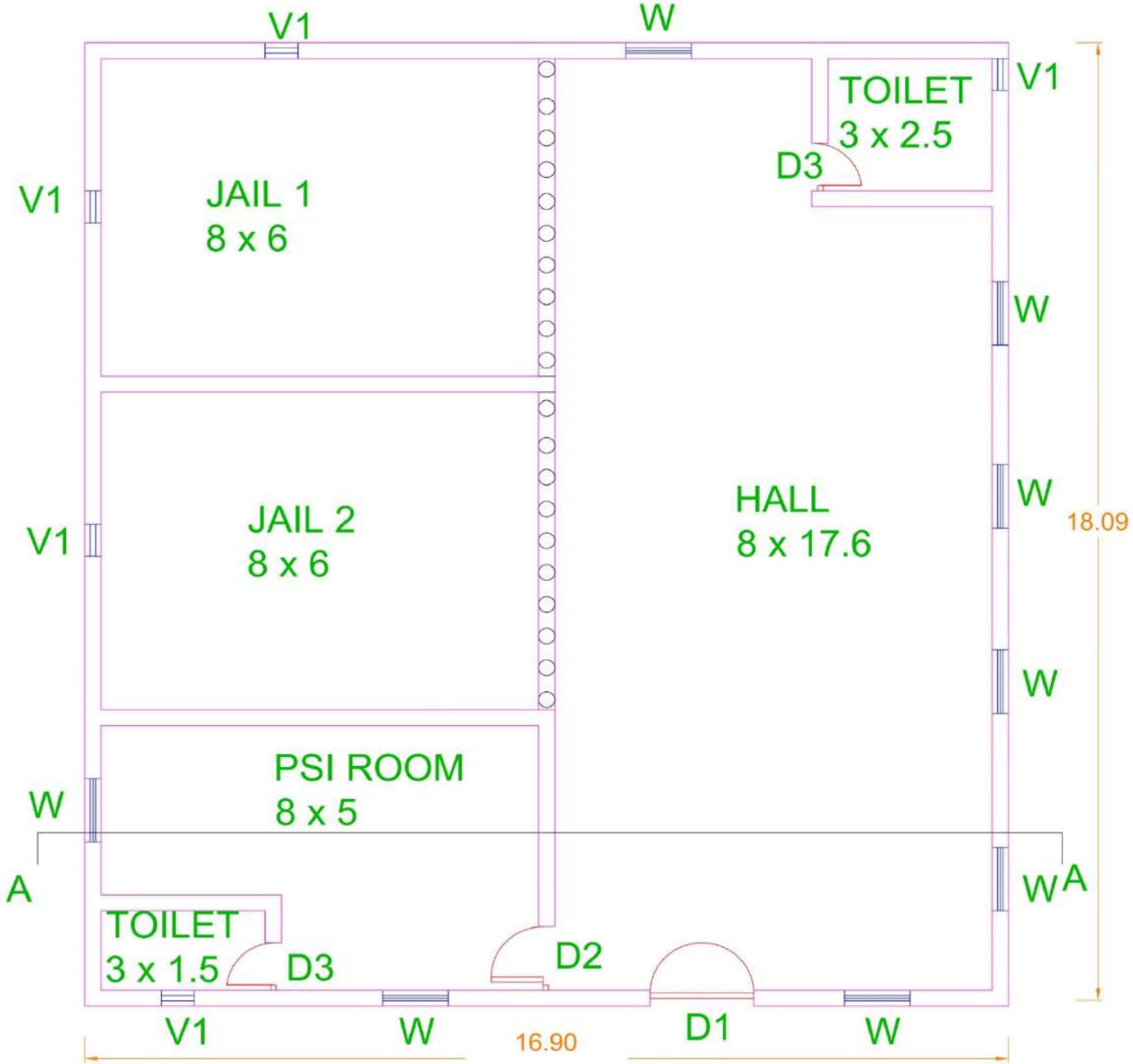
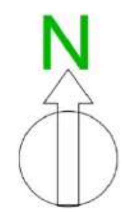


SECTION A-A



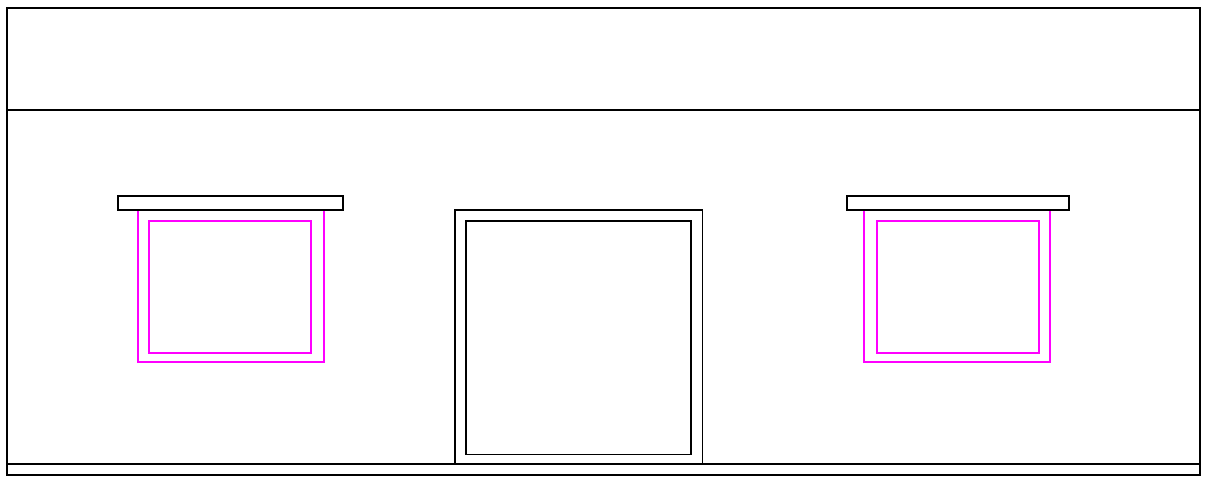
PLAN



TITLE: PROPOSED POLICE STATION PLAM
AT VILLAGE: DERDI KUMBHAJI, TA.: GONDAL, DIT.: RAJKOT

SCHEDULE:
D1 = 1.90 x 2.5
D2 = 1.20 x 2.2
D3 = 0.9 x 2
W = 1.2 x 1.5
V1 = 0.6 x 0.7

ALL DIMENSIONS ARE IN METER.



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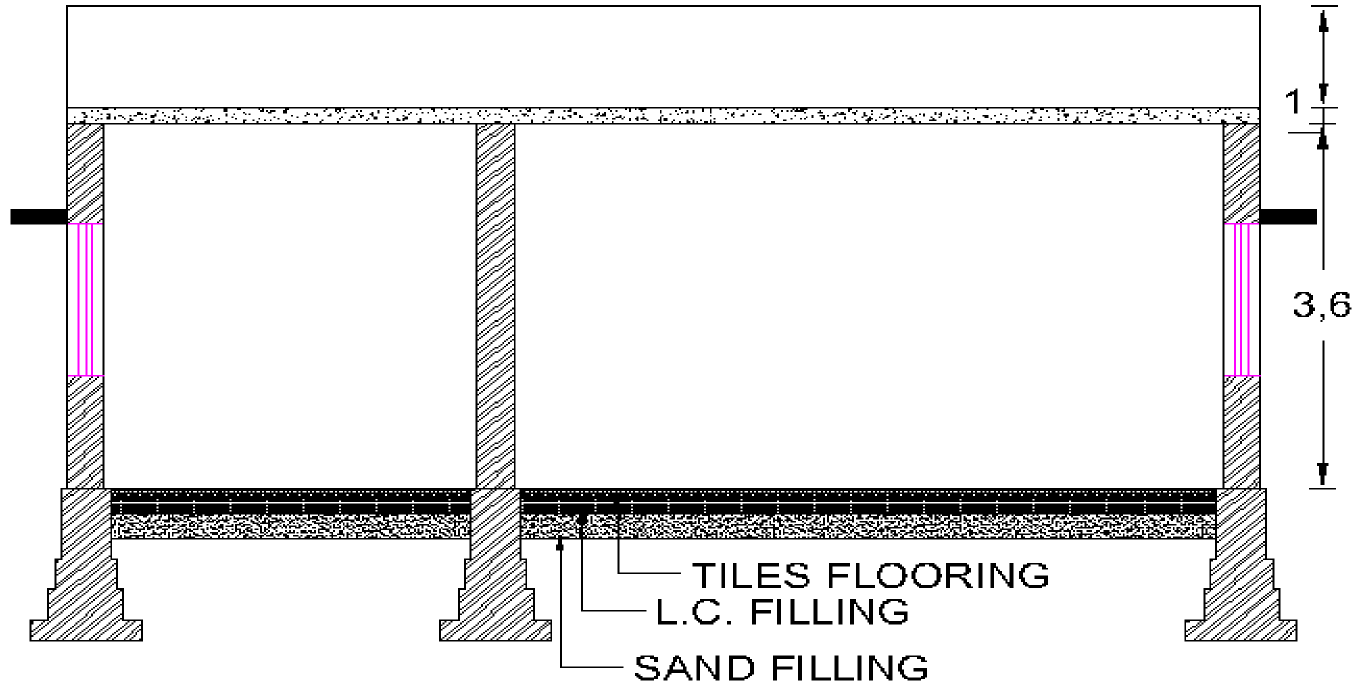

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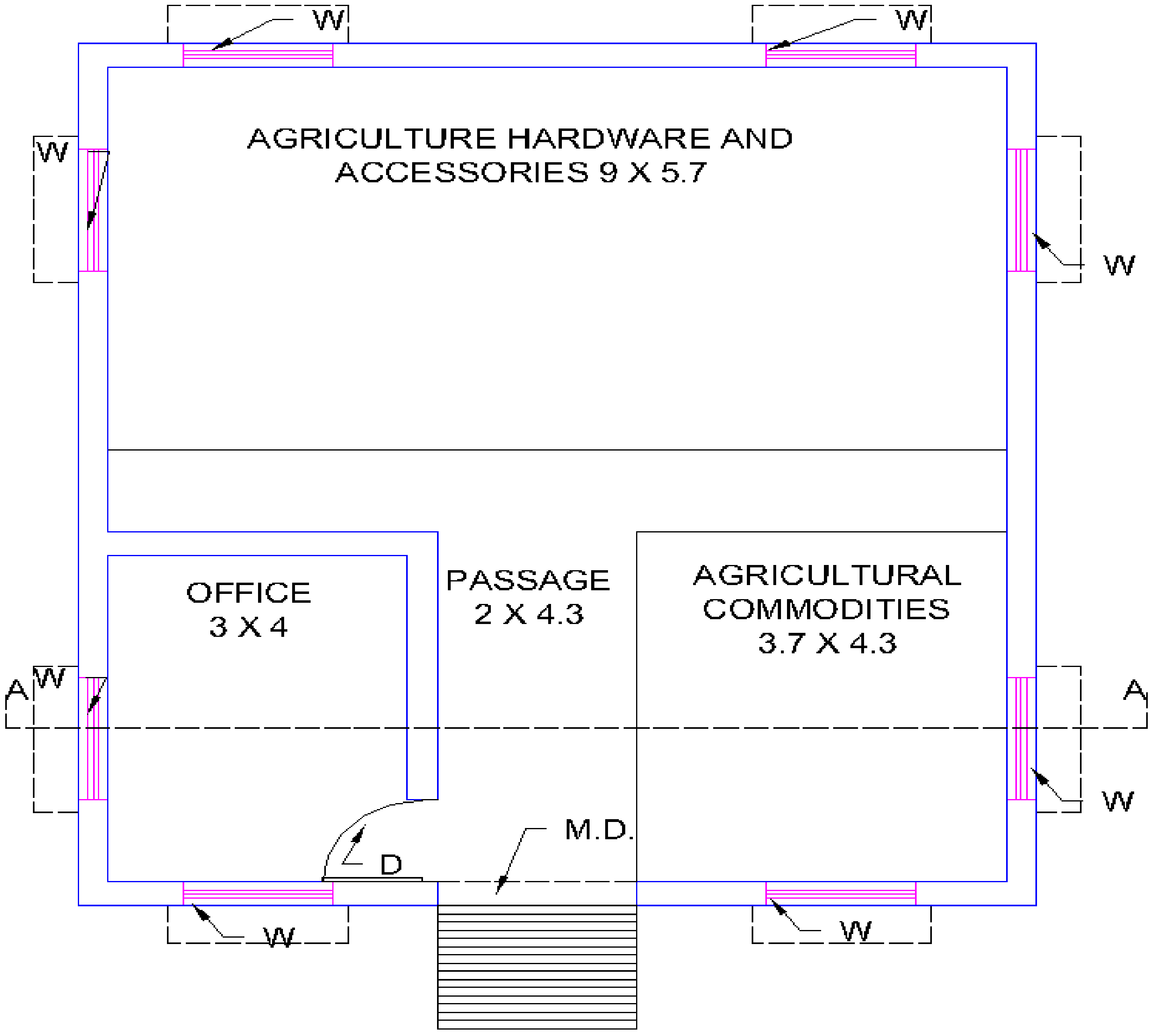
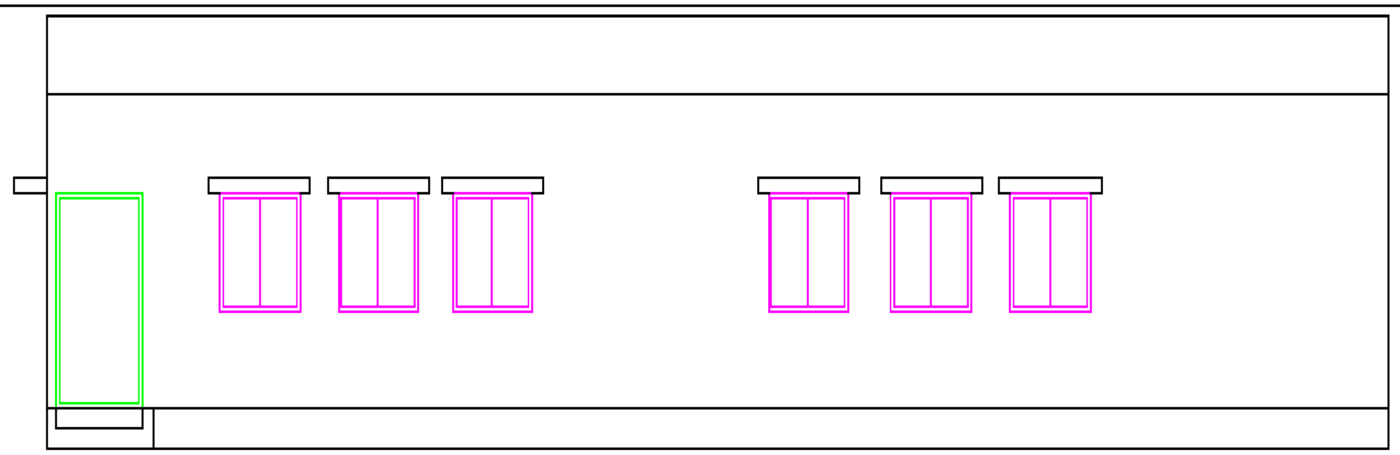


PLAN

TITLE:
PROPOSED AGRICULTURE STORE PLAN AT
VILLAGE :DERDI KUMBHAJI , **TALUKA** : GONDAL,
DISTRICT : RAJKOT.
FOR VISHVAKARMA YOJANA PHASE - 8

SCHEDULE:
MD : 2 X 2
D : 1 X 2
W : 1.5 X 1.5

ALL DIMENSIONS ON METER



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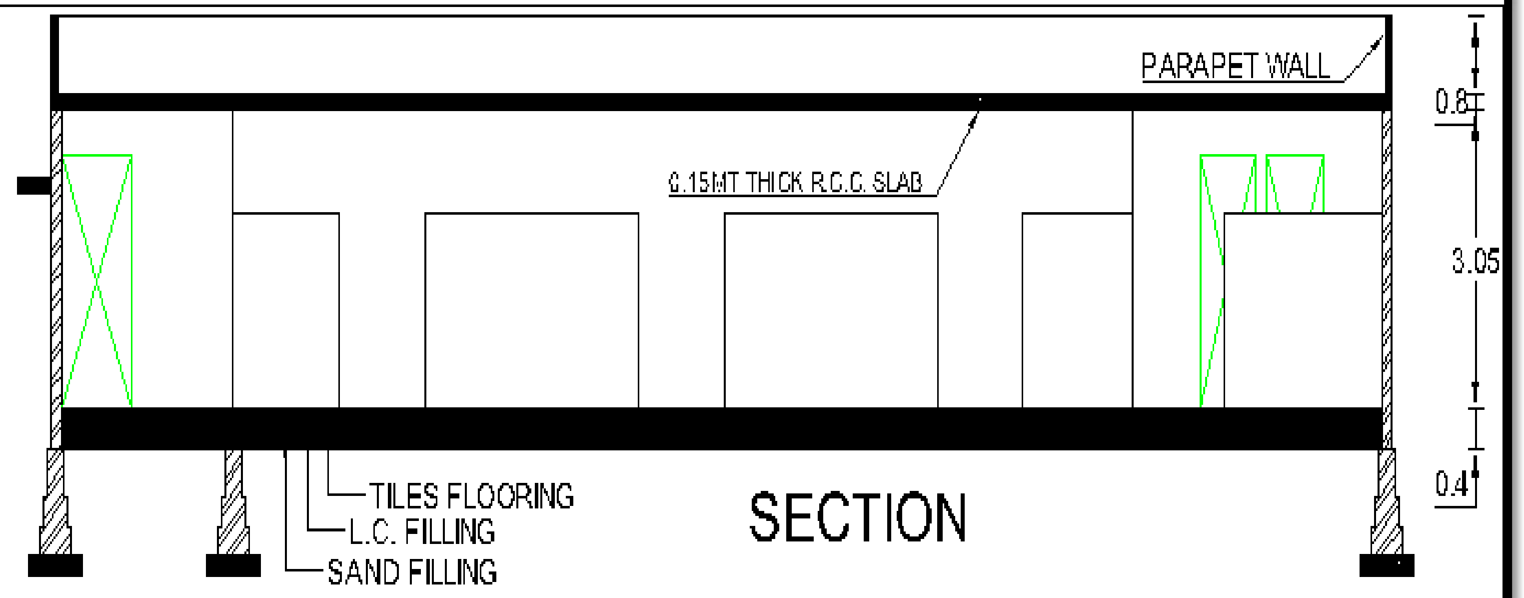

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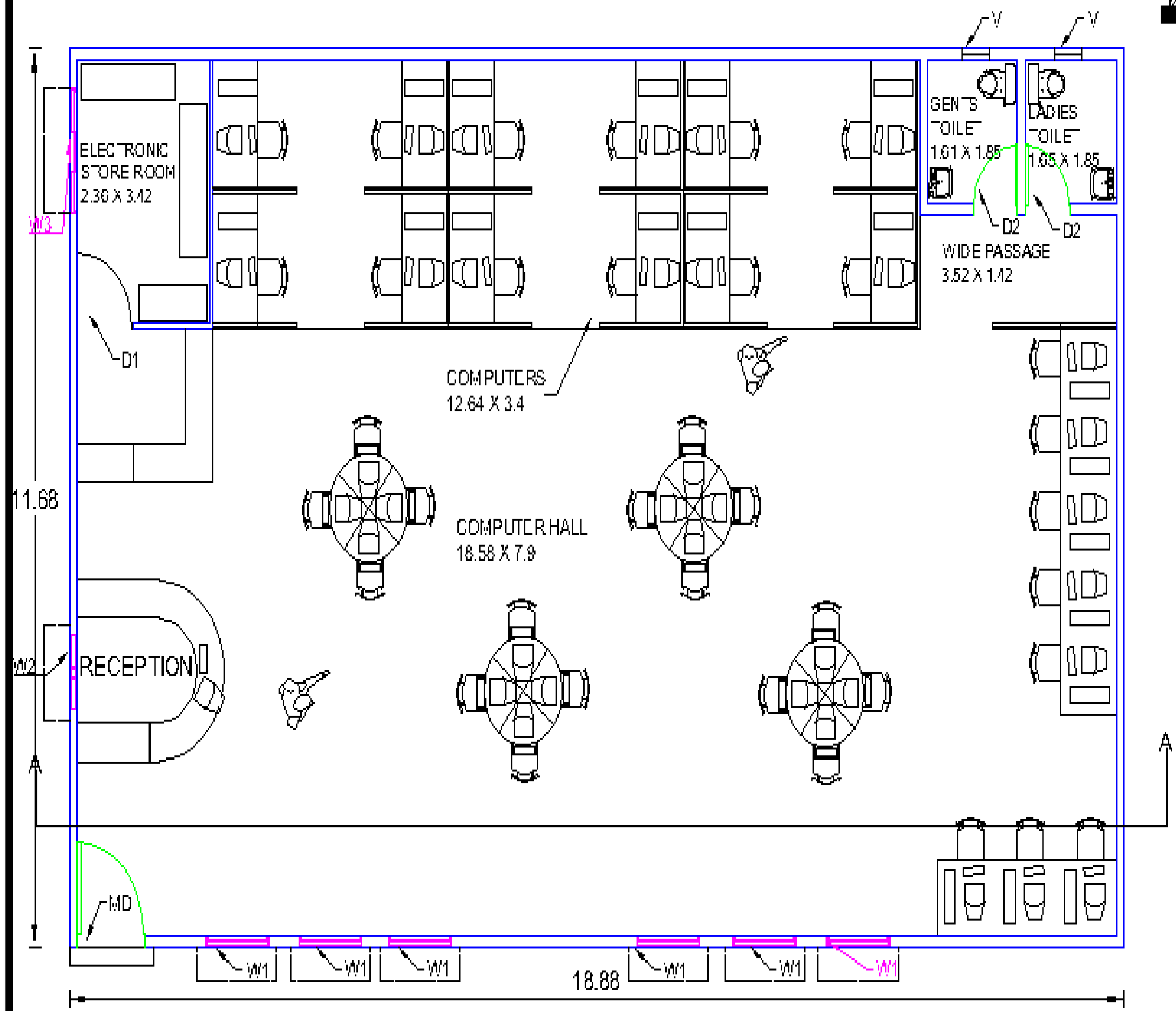
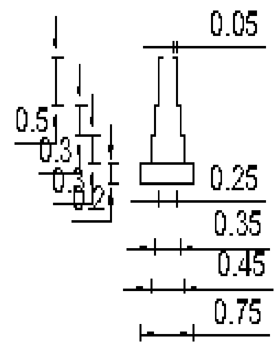


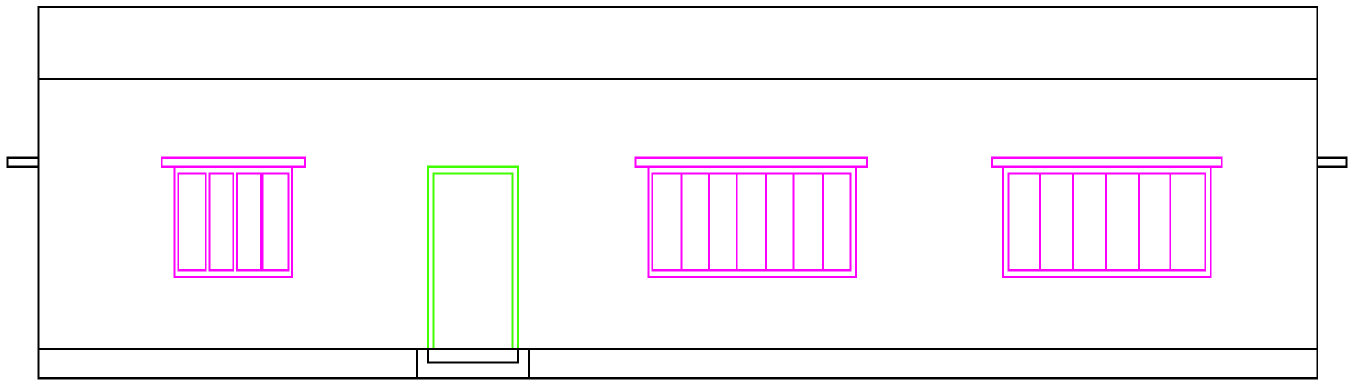
PLAN



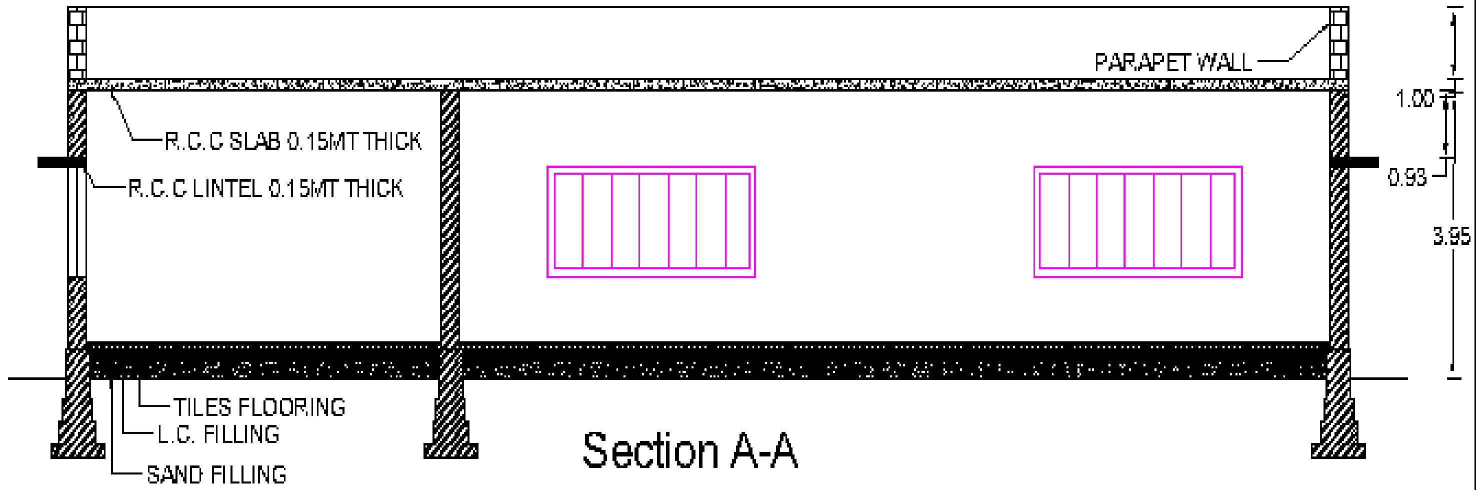
TITLE:
PROPOSED CYBERCAFE PLAN AT
VILLAGE : DERDI KUMBHAJI , **TALUKA** : GONDAL, **DISTRICT** : RAJKOT.
FOR VISHVAKARMA YOJANA PHASE - 8

SCHEDULE:
MD : 2 X 2
D1 : 1 X 2
D2 : 0.8 X 2
W1 : 1.12 X 1.2
W2 : 0.95 X 1.2
W3 : 1.63 X 1.2
V : 0.5 X 0.5

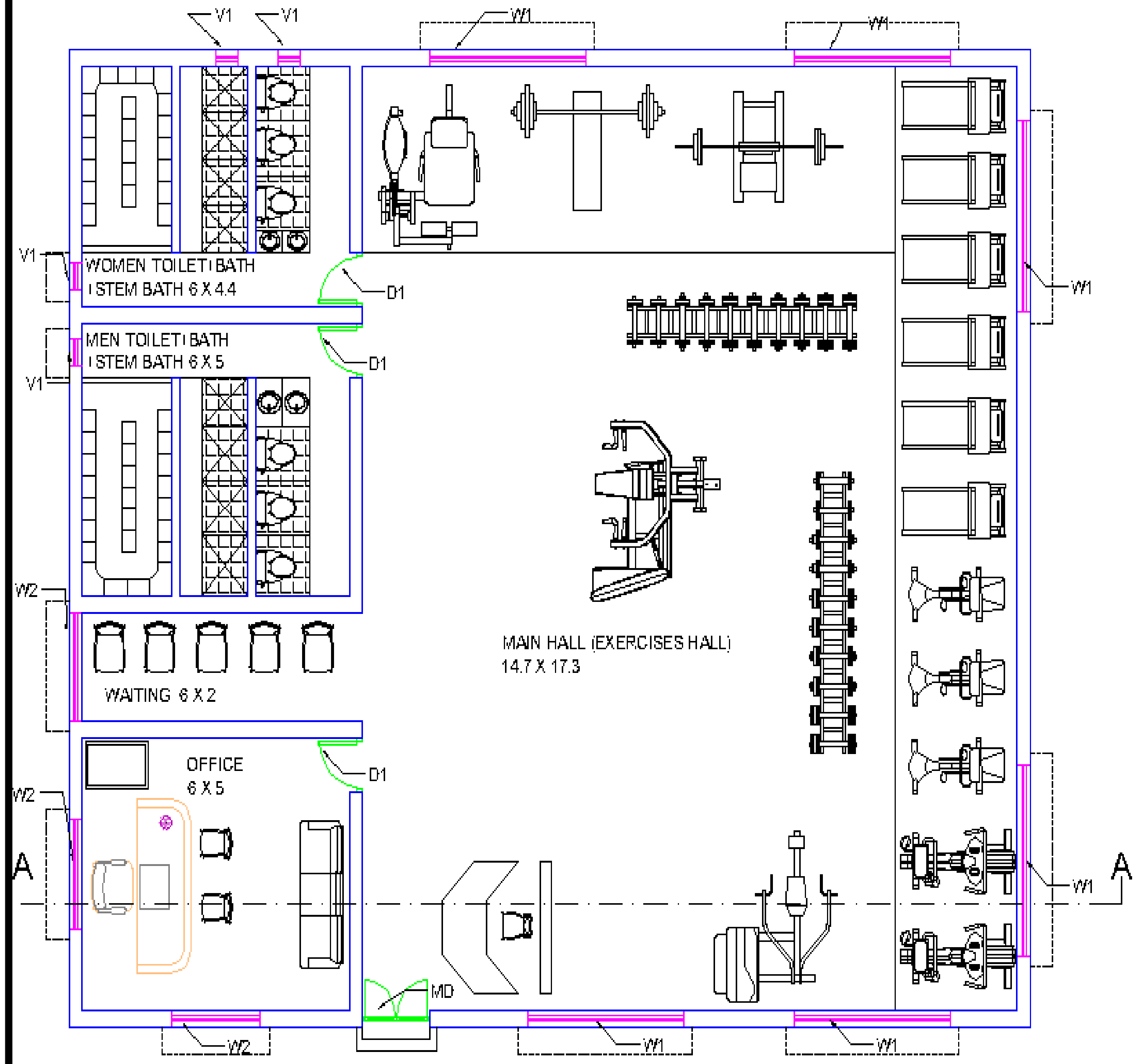
ALL DIMENSIONS ON METER



Elevation



Section A-A

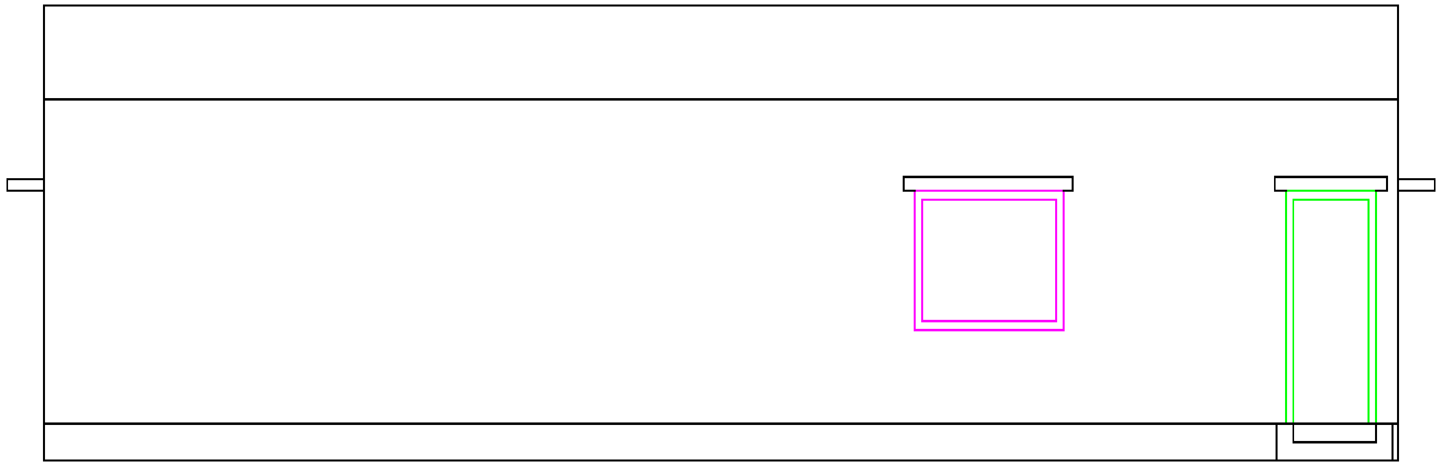


Plan

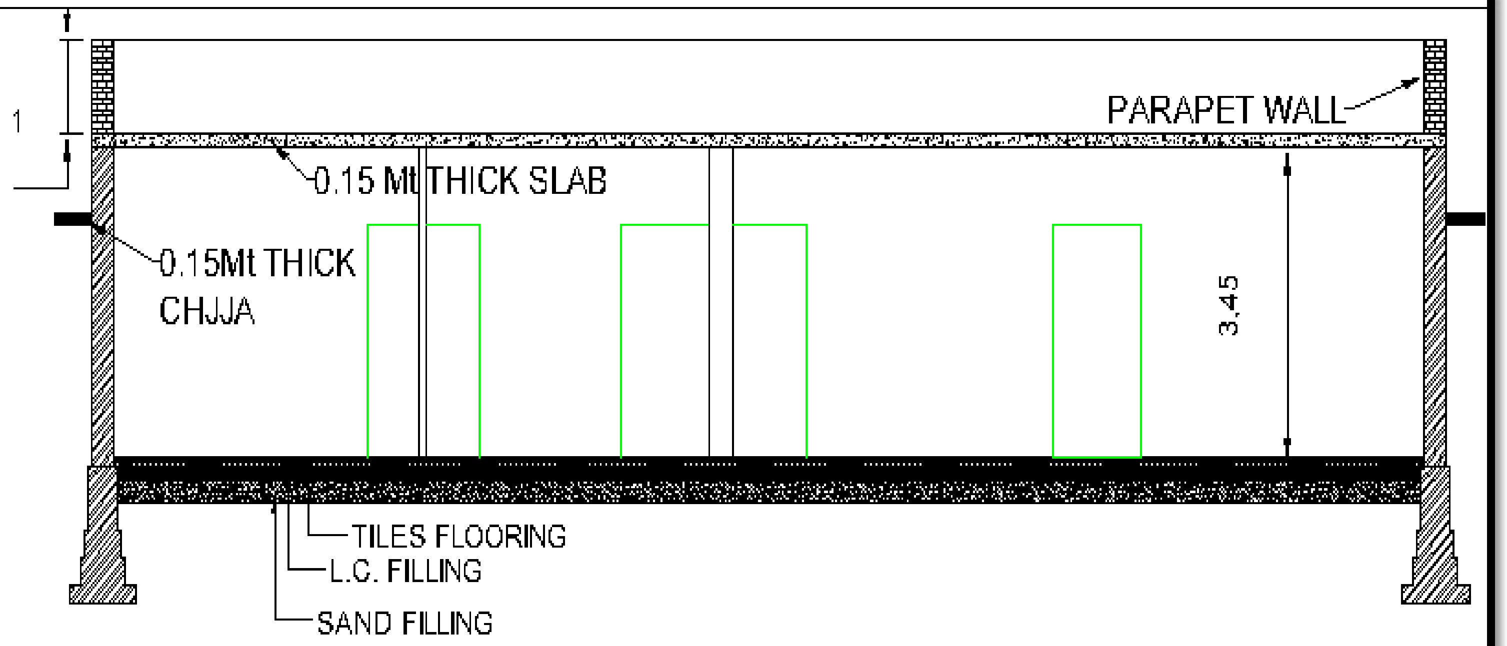
TITLE:
PROPOSED GYM PLAN AT
VILLAGE :DERDI KUMBHAJI , **TALUKA** : GONDAL, **DISTRICT** : RAJKOT.
FOR VISHVAKARMA YOJANA PHASE - 8

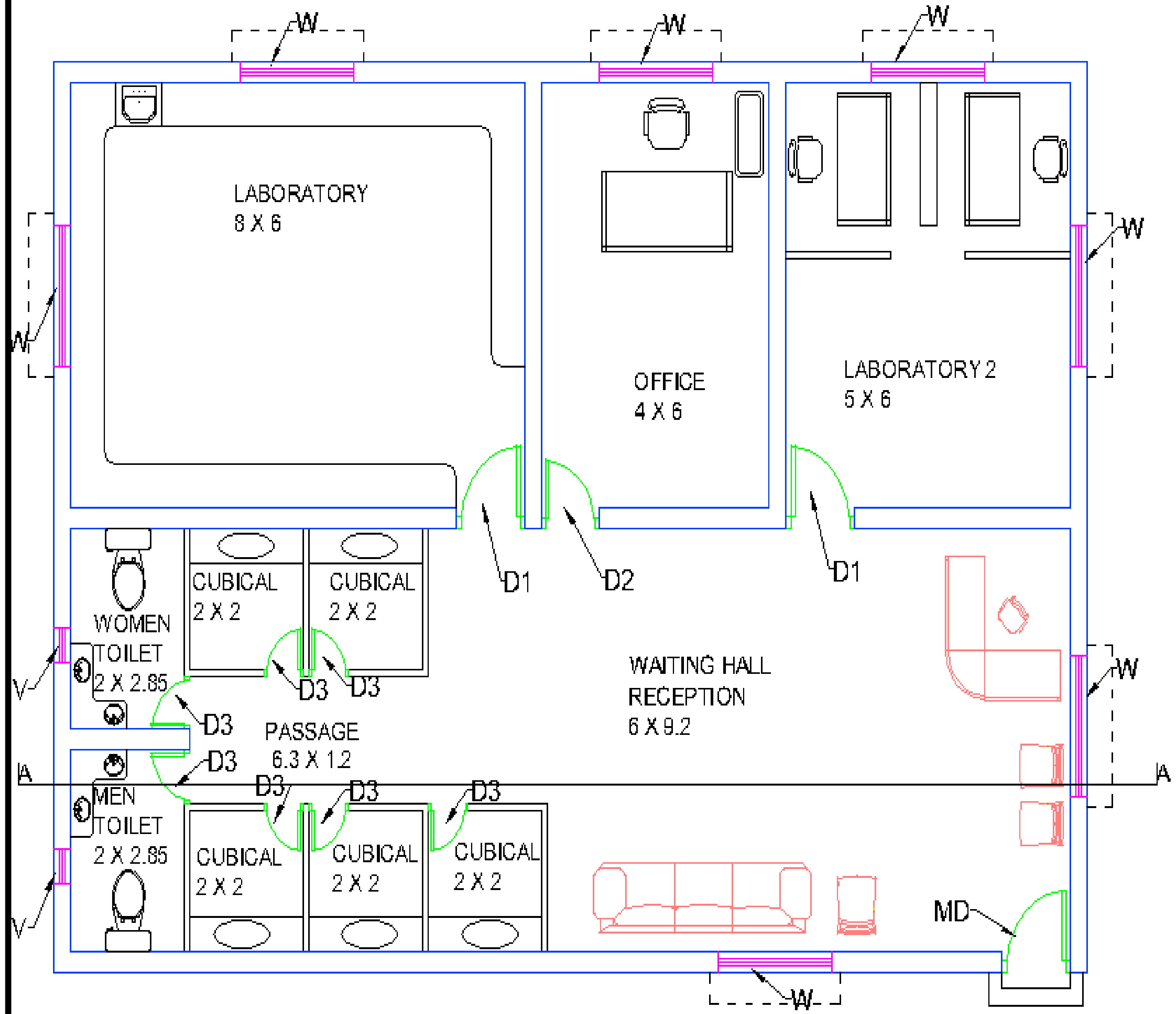
SCHEDULE:
MD : 1.5 X 2
D1 : 1 X 2
W1 : 3.5 X 1.5
W2 : 2 X 1.5
V1 : 0.5 X 0.5

ALL DIMENSIONS ON METER



ELEVATION

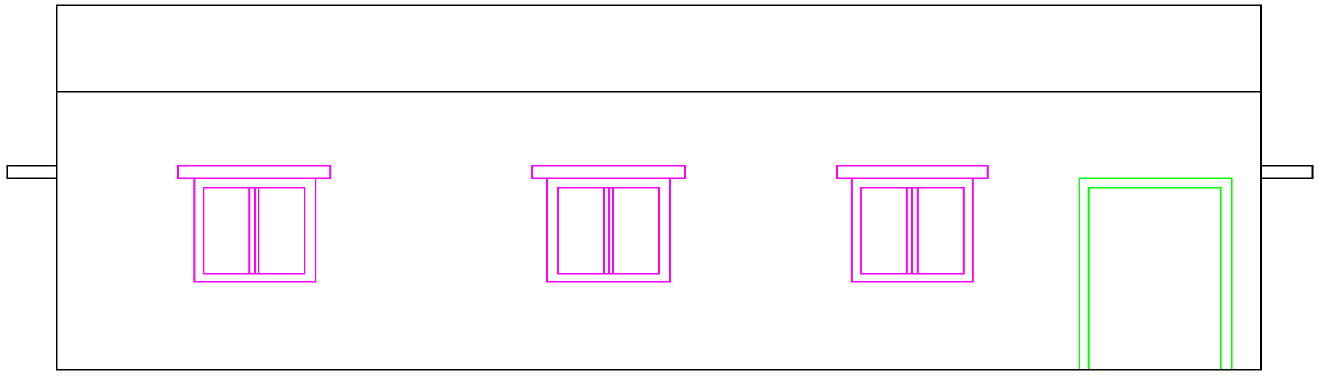




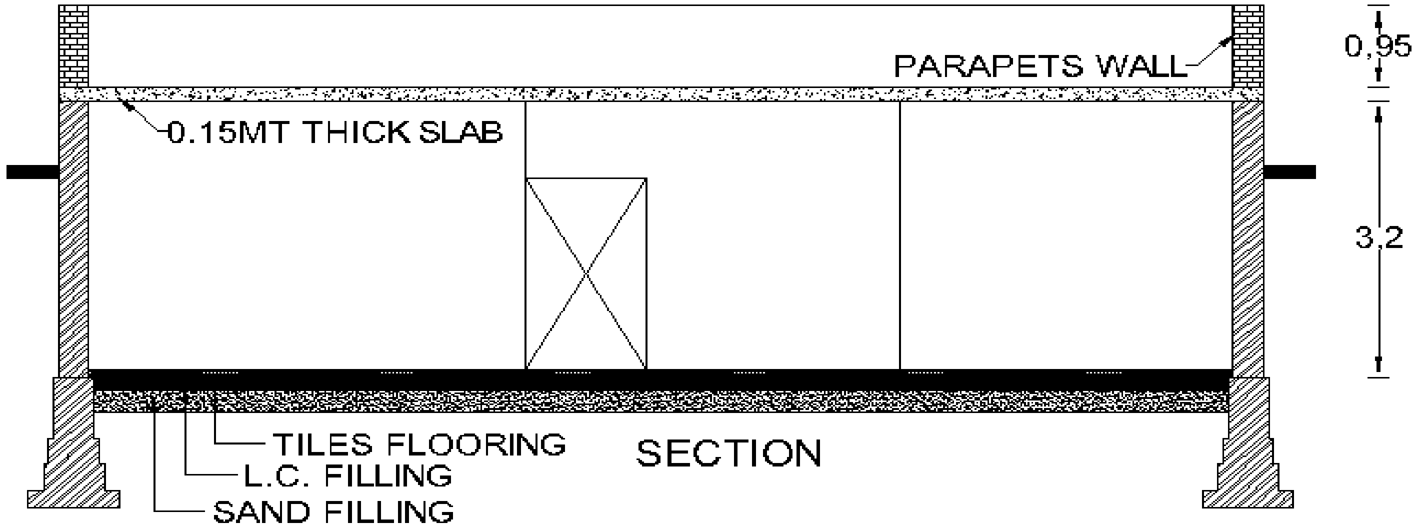
TITLE:
PROPOSED SOIL TESTING LABORATRY PLAN AT
VILLAGE :DERDI KUMBHAJI, **TALUKA** : GONDAL, **DISTRICT** : RAJKOT
FOR VISHVAKARMA YOJANA PHASE - 8

SCHEDULE:
MD : 1.2 X 2
D1 : 1.2 X 2
D2 : 1 X 2
D3 : 0.7 X 2
W : 2 X 1.5
V : 0.5 X 0.5

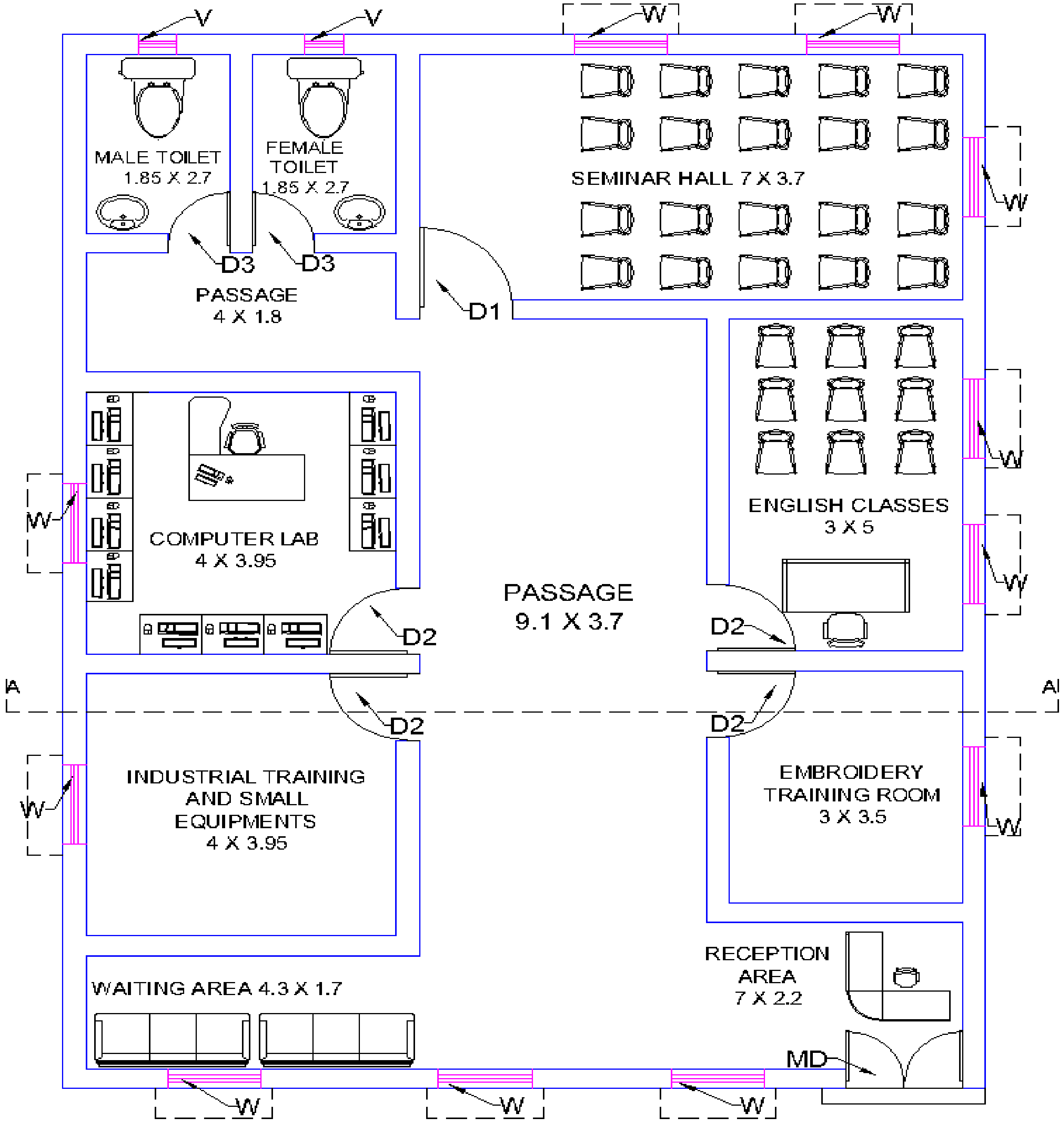
ALL DIMENSIONS ON METER



ELEVATION



SECTION



PLAN

TITLE:
PROPOSED SKILL DEVELOPMENT CENTRE PLAN AT
VILLAGE :DERDI KUMBHAJI , **TALUKA** : GONDAL, **DISTRICT** : RAJKOT.
FOR VISHVAKARMA YOJANA PHASE - 8

SCHEDULE:
MD : 1.5 X 2
D1 : 1.2 X 2
D2 : 1 X 2
D3 : 0.8 X 2
W : 1.2 X 1.2
V : 0.5 X 0.5

ALL DIMENSIONS ON METER

SLTIET