DETAIL PROJECT REPORT

VISHWAKARMA YOJNA: VIII
AN APPROACH TOWARDS RURBANISATION

KalakachhaVillage
Navsari District

PREPARED BY

STUDENT NAME	BRANCH NAME	ENROLLMENT NO
Shaikh Mo.Anash Mo.Azhar	Civil	181103106011
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Mistry Aishan Jatin	Electrical	171100109004

GIDC DEGREE ENGINEERING COLLEGE, NAVSARI

NODAL OFFICERS NAME
Prof. Sunil V. Jaganiya
Prof. Ankur P. Desai

YEAR: 2020-21

GUJARAT TECHNOLOGICAL UNIVERSITY
Chandkheda, Ahmedabad– 382424 Gujarat

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CERTIFICATE

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

Detail Project Report for,

VILLAGE: Kalakachha

DISTRICT: Navsari

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 under our supervision and guidance.

STUDENT NAME	BRANCH NAME	ENROLLMENT NO
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Date of Report Submission:	**09-04-2021**
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College Name:	**GIDC Degree Engineering College, Abrama**
College Stamp:	

ABSTRACT

"Vishwakarma Yojana: An Approach towards Rurbanisation" is a scheme launched by government of Gujarat for development of villages, which is implemented by GTU. "Design to Delivery" solution for development of villages in 'City' areas will be provided by Vishwakarma Yojana. Vishwakarma Yojana is one of the approaches to reduce urban city pressure and lower the migration rate by developing village with a RURAL SOUL but with all URBAN AMENITIES that a city may have.

According to census 2011 information the location code or village code of Kalakachha village is 396415. Kalakachha village is located in Jalalpore tehsil of Navsari district in Gujarat, India. It is situated 10km away from sub-district headquarter Jalalpore and 42km away from district headquarter Navsari. As per 2009 status, Kalakachha village is also a gram panchayat. The total geographical area of village is 1235 hectares. Kalakachha has a total population of 5032 peoples. There are about 1048 houses in Kalakachha village. Jalalpore is nearest town to Kalakachha which is approximately 10km away.

The village condition is moderate their road is made of C.C. but some area is broken of road some of the houses are well developed and some are made but cow dung. The village boundary is so week and full of waste material.

In Kalakachha village development is needed in some of the road is broken and the drainage system is less so, we need to put an open channel for slop road and also put a solar street light and also suggest that the India is going to smart India so we put CCTV camera and WI-FI facility and also provide 24x7 power & water supply.

The study will focus the development trend, intensity of growth of the village, and find out the problems related to the Socio- Cultural or physical development of the area, social infrastructure services, and the administrative systems of the village. Project proposal and sustainability aspect aren't considering in micro level, it is only guide the way. The study of village gives the reason where there is need of sustainable facilities like infrastructure facilities, community hall, primary health center, post office , general market, pure drinking water, road network, schools, electricity, sanitation, library, Anganwadi, overhead tank, police station, fire station, etc. are available or no.

In Kalakachha village development use idea infrastructure facilities, community hall, primary health center, post office , general market, pure drinking water, road network, schools, electricity, sanitation, library, Anganwadi, overhead tank etc.

Keywords:

Smart village development
Sustainable infrastructure
Rural development
Rurbanisation

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.

We wish to express our deep sense of gratitude to **Prof.(Dr.) Navin Sheth**, **Hon'ble Vice Chancellor, Gujarat Technological University-Ahmedabad**, for his encouragement and giving us the wonderful project.

We also express our gratitude to **Dr. K.N.Kher**, **Registrar, Gujarat Technological University-Ahmedabad** for giving us complete support.

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We express our sincere thanks to **DDO, TDO, Sarpanch, Talati and staff members of Navsari** District for providing us with requisite data whenever we approached them. Especially our thanks are to all villagers and stake holders for their support during Survey.

We are also thankful to our Principal **Dr.Niraj Sharma**, faculties of our colleges for their encouragement and support to complete this project work.

An act of gratitude is expressed to our internal guide / Evaluator / Nodal Officer, **Prof.Sunil V. Jaganiya and Prof.Ankur P. Desai (GIDC Degree Engineering College, Abrama, Navsari)** for their invaluable guidance, constant inspiration and active involvement in our project work.

We are also thankful to all the experts who provided us their valuable guidance during the work. We express our sincere thanks to, **Dr. Jayesh Deshkar, Hon'ble Director of Vishwakarma Yojana project and Principal, V.V.P Engineering College and Core Committee member of Vishwakarma Yojana project Prof(Dr.)Jigar Sevalia**, Professor, SCET, Surat, **Prof.K.L.Timani,** Associate Professor,VGEC, **Prof.Rena Shukla**, Associate Professor, LD Engineering College, **Prof.Y.B.Bhavsar,** Associate Professor,VGEC, **Prof.Jagruti Shah**, Assistant Professor, BVM Engineering College for providing us technical knowledge of this project work.

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ABBREVIATIONS

SHORT NAME	FULL NAME
SWOT	STRENGTH, WEAKNESS, OPPORTUNITIES, THREATS
SC	SCHEDULED CASTE
ST	SCHEDULED TRIBE
APMC	AGRICULTURAL PRODUCE MARKET COMMUNITY
GDP	GROSS DEVELOPMENT PRODUCT
PMGSY	PRADHAN MANTRI GRAM SADAK YOJANA
MGNREGA	MAHATMAGANDHI NATIONAL RURAL EMPLOYMENT GUARANTEE ACT
GHG	GREENHOUSE GAS
RO	REVERSE OSMOSIS
LED	LIGHT EMITTING DIODE
CCTV	CLOSED CIRCUIT TELEVISION
NGO	NON GOVERNMENT ORGANIZATIONS
DPR	DETAILED PROJECT REPORT
BIM	BUILDING INFORMATION MODELLING
CAD	COMPUTER-AIDED DESIGN
WBM	WATER BOUND MACADAM
HSP	HYDRAULIC SUBMERSIBLE PUMP
PVC	POLYVINYL CHLORIDE
HPEC	HIGH POWER EXPERT COMMUNITY
ULBs	URBAN LOCAL BODIES
MOHUA	MINISTRY OF HOUSING AND URBAN AFFAIRS
SLB	SERVICE LEVEL BENCHMARKING
GPR	GROUND PENETRATING RADAR
RLEGP	RURAL LANDLESS EMPLOYMENT GUARANTEE PROGRAMME
BPL	BELOW POVERTY LINE
PMAGY	PRADHAN MANTRI ADARSH GRAM YOJANA
PCIC	PER CAPITA INVESTMENT COST
PHC	PRIMARY HEALTH CENTRE
ATM	AUTOMATED TELLER MACHINE
AGRSARI	ACADEMY OF GRASS ROAD STUDIES AND RESEARCH OF INDIA
WBM	WATER BOUND MACADAM
RCC	REINFORCED CEMENT CONCRETE
CHC	COMMUNITY HEALTH CENTRES
NSSO	NATIONAL SAMPLE SURVEY ORGANISATION
TRC	TAX RESIDENCY CERTIFICATE
PUC	POLLUTION UNDER CONTROL

CHAPTER 1: Ideal village visit from District of Gujarat State (Civil & Electrical Concept)

1.1 Background & Study Area Location:

➢ **Background:**

- Abrama is a Village in Jalalpore Taluka in Navsari District of Gujarat State, India. It is located 12 KM towards South from District head quarters Navsari. 14 KM from. 310 KM from State capital Gandhinagar
- Abrama's Pin code is 396406 and postal head office is Abrama.
- Kharsad (2 KM) ,Kalthan (3 KM) , Sultanpur (3 KM) , Karod Kothva (4 KM) , Hansapor (4 KM) are the nearby Villages to Abrama.
- Abrama is surrounded by Navsari Taluka towards North, Jalalpore Taluka towards North, Chikhali Taluka towards East, and Valsad Taluka towards South.
- Navsari, Surat, Vyara, Valsad are the nearby Cities to Abrama
- Abrama is a Village in Jalalpore Tehsil, Navsari district and Gujarat State.
- Abrama Village Total population is 6462 and number of houses are 1492. Female Population is 49.8%. Village literacy rate is 87.8% and the Female Literacy rate is 43.9%.
- For the Techno- economic survey, first of all we gone to the Sarpanch of respective village at the meeting with him we gave details about Vishwakarma Yojana and get permission for the do work related to survey in village Abrama. With his co-ordination and his help we got all data and information related to village Abrama.

➢ **Study Area Location:**

- Locality Name: Abrama
- Taluka Name: Jalalpore
- District: Navsari
- State: Gujarat
- Language: Gujarati & Hindi
- Elevation / Altitude: 18m / 59 ft
- Telephone Code/ Std.Code: 02637

Fig 1: Map of Gujarat

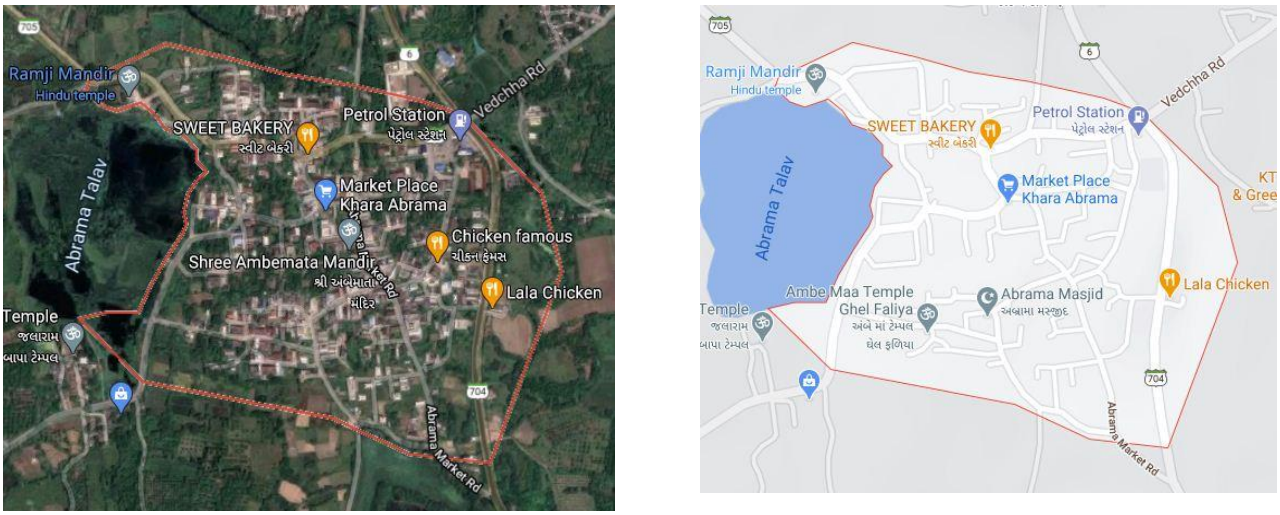

Fig 2: Map of Ideal village (Abrama)

1.2 Concepts: Ideal Village, Normal Village:

1.2.1 Objectives

- To trigger processes which lead to holistic development of the identified Gram Panchayat..
- To substantially improve the standard of living and quality of life of all sections of the population through
  - Improved basic amenities
  - Higher productivity

1.2.2 Example / Live Case studies of ideal village of India/Gujarat

➢ Odanthurai Village, Tamilnadu

- Odanthurai is the first ever-powered village in India undertaken by a local body. In a year, the wind farm produces 7.5 lakhs of electricity. In addition, Panchayat has made inroads into other renewable energy sources. It's got a 9KW installed. Biomass gasifies the power generation system for pumping drinking water to replace the grid electricity.

Fig 3: Odanthurai Village, Tamilnadu

➢ Kumbalangi, Kerala

- Kumbalangi is located in Kerala State's Ernakulum district & is basically a fishing village that has been developed as a unique rural tourist destination. The Kumbalangi project was launched in 203 to help through tourism the local people, the economy and the locality. The major attractions were strengthened in Kumbalangi, the roads and canals, and 600 biogas plants were set up for waste management.

Fig 4: Kumbalangi, Kerala

➢ Punsari (Gujarat)

- Punsari, located in Gujarat, puts most metros to shame. Funded by the Indian government and the village's own funding model, Punsari is no NRI-blessed zone. The village also boasts of a mini-bus commute system and various other facilities.

Fig 5: Punsari, Gujarat

1.2.3 The Idea of a model/Smart Village

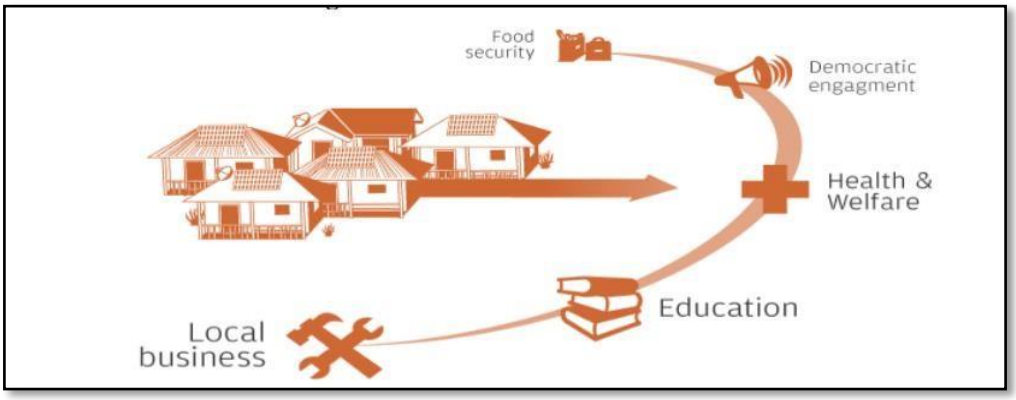

Fig 6: Idea of model village

- An ideal Indian village will be so constructed as to lend itself to perfect sanitation. The cottages will have courtyards enabling householders to plant vegetables for domestic use and to house their cattle. The village lanes and streets will be free of all avoidable dust. It will have wells according to its needs and accessible to all. It will have houses of worship for all, also a common meeting place, a village common for grazing its cattle, a co- operative dairy, primary and secondary schools in which industrial education will be the central fact, and it will have Panchayat for settling disputes.

- This is roughly my idea of a model village. Task just now is to discover what the villagers can do to help themselves if they have mutual co-operation and contribute voluntary labor for the common good. There are in our villages' inexhaustible resources not for commercial purposes in every case but certainly local purposes in almost every case. The greatest tragedy is the hopeless unwillingness of the villagers to better their lot.\

1.2.4 Ancient History Civil / Electrical concept about Indian Village / Foreign Countries Perspective and its Development

➢ **CIVIL**

- The history of civil engineering is closely associated with the history of advancement in these sciences. In ancient history, most of the construction was carried out by artisans, and technical expertise was limited. Tasks were accomplished by the utilization of manual labor only, without the use of sophisticated machinery, since it did not exist. Therefore, civil engineering works could only be realized with the utilization of a large number of skilled workers over an extended period of time. During the era of battles or operations, the engineers were engaged to assist the soldiers fighting in the battlefield by making catapults, towers, and other instruments used for fighting the enemy. However, during peace time, they were concerned mainly with the civil activities such as building fortifications for defense, making bridges, canals, etc.

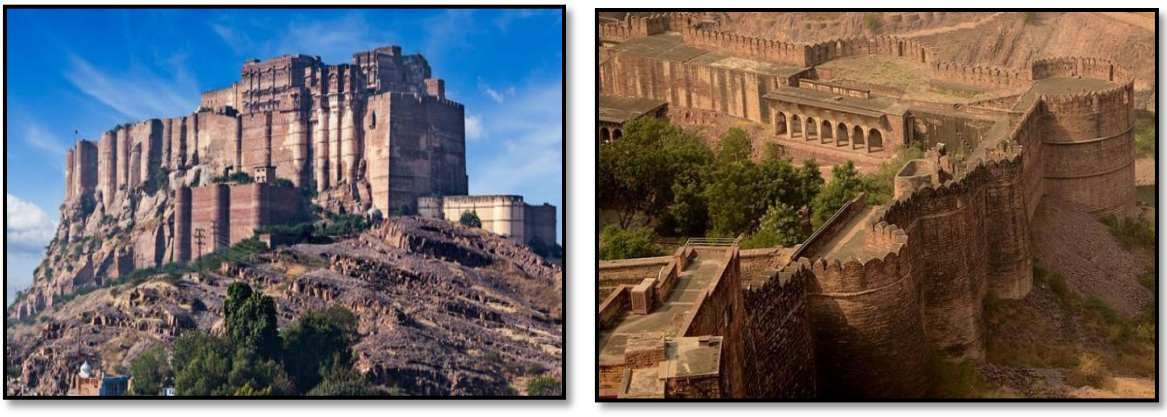

Fig.7: Ancient History Civil Indian forts

➢ ELECTRICAL

- Electric power was introduced in India 10 years after it was introduced in London and 17 years after that in New York. It was charged at one rupee per unit, which was comparableto the price in London.
- **PRE-INDEPENDANCE PERIOD** Electricity was introduced in India by the British during the colonial period. They electrified the major cities, office centers and ports. PW Flurry & Co. used light bulbs to demonstrate electricity on the streets of Calcutta in 1879. Kilburn and Co., which later became Calcutta Electricity Supply Co., electrified Harrison Road (renamed MG Road) in Calcutta in 1889. This was the first street to have electric light bulbs in India. The Electricity Act of India was framed in 1910. It allowed private companies to generate and supply electricity. Most of the early power stations in India were owned and operated by private companies. The first government installation was in Aruvankadu, Nilgiris. Some of the major companies were the Damodar Valley Corporation (DVC), Calcutta Electric Supply Corporation Ltd.
- **POST-INDEPENDENCE DEVELOPMENTS** IN ELECTRIC POWER The evolutionof the power sector in India began in 1948, when the Electricity Supply Act was passed. This marked the beginning of functioning of State Electricity Boards (SEBs). These SEBs were autonomous in that they could step up the generation capacity as well as transmission and distribution in their respective states. The Act also gave the Boards the autonomy for optimal utilization of resources in their states. Under this act, the Central Electricity Authority was formed for operating the generating facilities at the Central level.
- The total power generating capacity from all sources of power in India has increased from a meager 1,362 MW in 1947 to 267,000 MW at the end of March 2016. The per capita electricity consumption in India, which was a mere 16.3 kWh in 1947, has increased to 1,510 kWh in 2015–2016, according to the Ministry of Power (MOP).

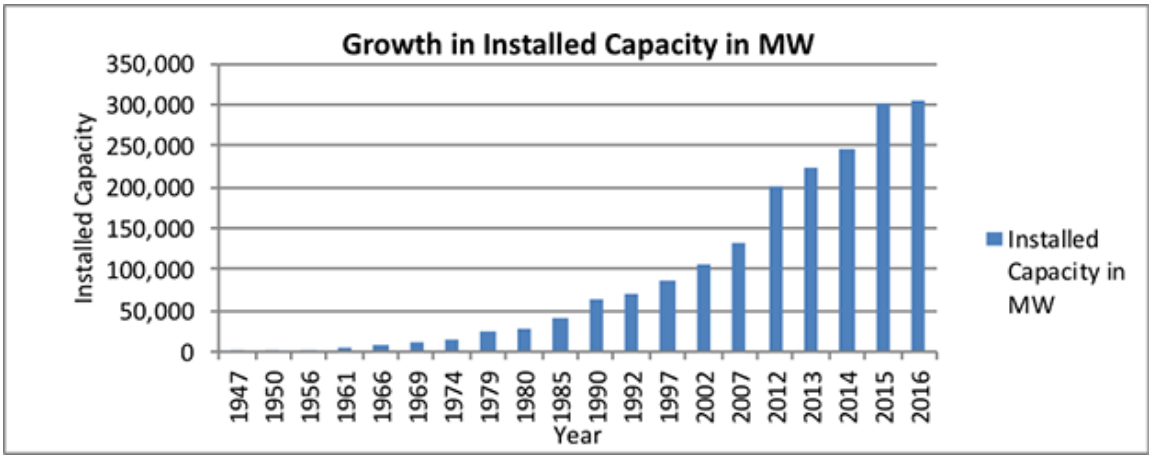

Fig.8: Electrical history India

1.3 Detail study (Socio economic, physical, demographical and infrastructure details) of Ideal village / Smart Village with photograph:

➢ **Physical**

- There are various facilities such as public gardens, one mobile tower, several public toilets and one community hall in village.
- In village use 100 % of people LPG in home.
- In education Govt Primary, Private Primary, Govt Secondary and private SecondarySchools are available in this Village.
- For health 1 Community Health care centre , 3 Primary Health Sub-Centers , 1 Veterinary Hospital ,4 RMP doctors , 10 Medical Shops are available in this village.
- Auto Rickshaw, bus and private vehicle are used for transport purpose within the village.
- The village also has a sanitation and drainage system, which is completely underground.
- There is railway station and bus stand with medium good condition.

➢ **Demographical**

Abrama Village Total population is 6462 and number of houses are 1492. Female Population is 49.8%. Village literacy rate is 87.8% and the Female Literacy rate is 43.9%.

Census Parameter	Census Data
Total Population	6462
Total No of Houses	1492
Female Population %	49.8 % (3219)
Total Literacy rate %	87.8 % (5671)
Female Literacy rate	43.9 % (2837)
Scheduled Tribes Population %	29.4 % (1903)
Scheduled Caste Population %	2.2 % (142)
Working Population %	43.5 %
Child(0 -6) Population by 2011	580
Girl Child(0 -6) Population % by 2011	45.5 % (264)

Table 1: Census data of Abrama

➢ **Socio Economic**

- Schedule Caste (SC) constitutes 7.75 % while Schedule Tribe (ST) was 0.18 % of total population in Abrama village.

Particulars	Total	Male	Female
Total No. of House	**1492**		
Population	**6462**	**3043**	**3219**
Child (0-6)	**580**	**316**	**264**
Schedule Caste	**142**	**-**	**-**
Schedule Tribe	**1903**	**-**	**-**
Literacy	**5671**	**2840**	**2837**
Total Workers	**2779**	**2500**	**279-**
Main Worker	**2109**		
Marginal Worker	**523**	**200**	**323**

Table 2: Social Detail of Abrama

- In Abrama village out of total population, 4056 were engaged in work activities. 87.11 % of workers describe their work as Main Work (Employment or Earning more than 6 Months) while 12.89 % were involved in Marginal activity providing livelihood for less than 6 months. Of 4056 workers engaged in Main Work, 598 were cultivators (owner or co-owner) while 1131 were Agricultural laborers.

➢ Infrastructures facilities (All Types)

❖ Drinking-Water and Sanitation

- Tube well is main source of drinking water.
- Four overhead tanks are available in the village.
- 10,000 liter rounded overhead tank. Rounded (small) water tank.

❖ Drainage facility is available 100% in the village.

- Underground drainage lines 80 %
- Open drainage 20%
- Now in present sanitation facility is 5 available in village near about of all differentplaces. It is not good condition.
- No, Not any waste management facility is available in the village it is directly dumpedinto the Mining.

❖ Education Facilities

- **Anganwadi: -** 2 nos. Anganwadi are working in Abrama village so Anganwadi is adequate.
- **Primary school (include girls & boys):-**This village in which the 2 Government (boys and girls) Schools are available.
- Secondary high school in the standards 9^{th} and 10^{th} only.
- There is one Engineering College also available.

Fig 9: Overhead Tank at village

- **Primary School:** Primary school in Abrama village was constructed 20 years ago. The actual condition of this school is good but some drainage maintenance is needed moreover after 4 to 5 year pass it will be need structural elements strength may be decrease.

- **High School:** High school in this village was constructed 10 years ago so that's way the condition of this school was good and structural elements also a good condition as well as Exterior condition also good in this school. In this school arriving the students in nearby village like Mandir, Eru, Krushnapur and Abrama village.

- **Engineering College:** In this village Engineering College Name is GIDC Degree Engineering College Abrama, Navsari. The college condition is excellent with a good exterior design. The construction of college was good and condition also good. In this college arriving students are from Bilimora, Navsari, Eru, Vijalpor, Dandi, and Surat**.**

❖ **Health Facilities**

- In village PHC, CHC center it available in the village. In Abrama Private Clinic and hospital also available.
- Animal Husbandry is also available.
- **Public health center** condition is good and newly constructed in Abrama village so that does why no need to repair. The PHC center workout is good schedule and enough facilities provided by government officers so that's a good point for the village peoples
- **Veterinary clinic** was a good condition of structure but some repair is there like painting, plastering in outer side. Otherwise it is good.

❖ **Gram panchayat**

- Panchayat building is available in this village but good condition and running works in this village like Aavak vero, light bill, and other work transferred from community hall.

❖ **Transportation & Road Network**

- **Bus stop:-**The condition of bus stop was good. Mobility of vehicles is easily happened
- There are 3 bus stop available in this village 2 are a metal structure and one is masonry structure. The steel structure was a good condition but the masonry was bad condition so it is a need to repair like painting and plastering work.

❖ Technology Mobile/ WIFI / Internet Usage Details

- All people 100 % use personal mobile and internet, but in this village are not any WIFI facilities available.

❖ Play ground

- There is special playground available in near village and also school playground is available.

❖ Other Facilities

- **Post Office:-**A post office is available in a private owned house at a rent of rupees 100 per month. Govt. post office building is required.
- **Telecommunication Network / STD booth:-**Generally public use mobile network for telecommunication. Mobile network also provide facility of STD & ISD.
- **Bank Facility:-**There is one bank available in village. With ATM facilities.

Fig 10: Engineering College in village

Fig 11: Primary School in Village

Fig 12: Secondary School in Village

Fig 13: Primary School in Village

Fig 14: PHC in Village

Fig 15: Veterinary Clinic in Village

Fig 16: Gram panchayat of Village

Fig 17: Bus Stop in Village

Fig 18: Bank-ATM in Village

1.4 SWOT Analysis of Ideal Village:

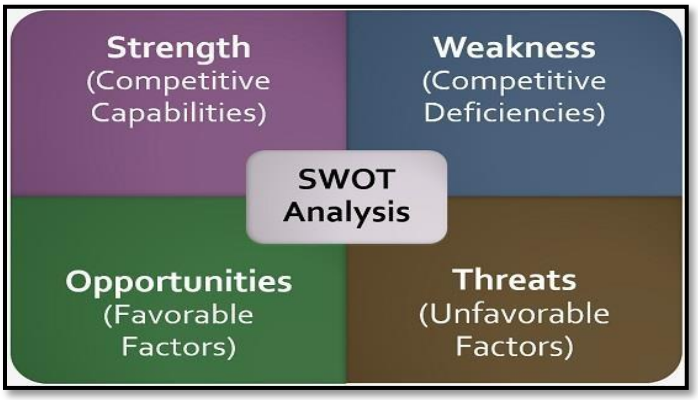

Fig.19: SWOT analysis

Strengths: Strengths of the Smart Villages are written as: 24 hr power Supply should available, there should be a Health Centre allocated in village, Roads & Gutters should be in Good condition, Primary & Secondary should be there, Water supply system should be proper and providing Clean water to homes, Village will be having Security, There should be Good and adequate offices, There should be a Milk Dairy where all the Farmers can give milk, There should be better provocations for Agricultural Associations, The village shall promote handicraft activities.

Weakness: Possible Weaknesses of Smart Village are: Low Literacy rate, Low wage payment to daily wages workers, Low savings habit, Accessibility & Connectivity to cities, Strong village funds, Lack of Sufficient foods, Old age and Disabled persons, Urban apathy, Misconceptions of People, Narrow mildness, lacks modern technical knowledge

Opportunity: Opportunities for Smart villages are listed: Use of modern technology, more n more use of Renewable Energy, Government schemes, Demand for Agriculture NFTP, NGO invention, Young voters, Non-Government agencies and other partnership agencies, Media and Entertainment

Weaknesses: Possible threats are as below listed: Laziness of people, Daily earner in rural areas prefer earning over voting, lack of information, lax attitude of people, Terrain & demography.

1.5 Future Aspects of Village:

- Converting the village with the Wi-Fi facility.
- Segregation of waste i.e. Plastic and other garbage is going to be planned for the effective waste management.
- A mechanism to use sewage water for plantation.
- Pond development and redesigning of public garden.
- Reduce the Illiteracy rate.
- Opening Skill Development Centers.
- Increase Source for high wages.
- To provide an infrastructure facilities like, water harvesting system, Different types of renewable energy source, Water conservation system.
- In this village also maintains for the bus stand, public toilet should be provide and drainage facilities etc. in existing public facilities are need in this village.

1.6 Benefits of the Visit of Ideal Village:

- This visit to the village proved to be useful in a variety of ways and also gave an idea for the various development sectors still needed in Indian rural areas that need special attention and concern. Also, different methods and techniques were known which, when actually applied, require a lot of concern. Overall, this visit was useful for the further work of the project.
- Discover real life problem faced by village dweller.
- Improved Communication Skills.
- Identify the condition of village in India and factor affecting in development.

1.7 Electrical concept of Ideal Village:

- In Abrama village there is 3 phase 4 wire distribution system are used.
- 1 phase supply is connected in all household in village.
- 24 hours electrical supply is comes out in village.

Fig 20: Pole mounted Transformer

➢ **3phase 4 wire system**

- The 4th or neutral wire is taken from the star point of the star-connection as shown in Figure and is of half the cross-section of the outers or line conductors. If V is the voltage of each winding, then line voltage is 3 V.

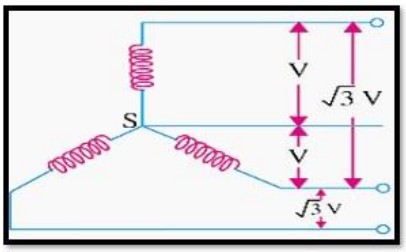

Fig 21: Star connection of secondary Side of transformer

CHAPTER 2: Literature Review (Civil & Electrical Concept

2.1 Introduction: Urban & Rural.

❖ **Rural area**

- The word 'Rural' means are
- Area, which is marked by the non-urban style of life, occupational structure, social organization, and settlement pattern.
- Rural is noticeably agricultural, its settlement system consists of villages or homesteads Socially it signifies greater interdependence among people, more deeplyrootedcommunitylife,andaslow-movingrhythmoflifebuiltaroundnature and natural phenomenon; and occupationally it is highly dependent on crop farming, animal enterprises, tree crops, and relate activities.

❖ **Urban area.**

- An urban area or urban agglomeration is a human settlement with high population density and infrastructure of the built environment. Urban areas are created through urbanization and are categorized by urban morphology as cities, towns, conurbations, or suburbs.

Name	**Population**
City	50000 to 100000
Great city	100000 and over
Super City	More than 300000
Metropolis	1000000 and above
Mega polis	5000000 and above

Table 4: Urban Town Population

2.2 Importance in Rural Development

- 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.
- Ruraldevelopmentactionsareintendedtofurtherthesocialandeconomicdevelopment 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 the participation of rural people themselves, to meet the required needs of rural communities.

2.3 Ancient Villages/ Different Definition of Rural area / Villages.

- By the Numbers in the United States, the Census Bureau classifies a rural area as a town with lesser than 1,000 people per 2.6 square kilometers (square mile) and surrounding areas with lesser than 500 people per 2. Square kilometers (square mile).
- A rural area is an open swath of land that has few homes or other buildings, and not very many people. A rural areas population density is very low. Many people live in a city, or urban area. Their homes and businesses are located very close to one another.
- In a rural area, there are fewer people, and their homes and businesses are located far away from one another.
- 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.
- Wildlife is more frequently found in rural areas than in cities because of the absence of people and buildings. Rural areas are often called the country because residents can see and interact with the countries native wildlife.

2.4 Scenario: Rural / Urban village of India population Growth

The number of Rural Units (or Villages) in India:

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

Population by Rural-Urban Residence – India – 2011

- Total: 1,210,193,422
- Rural: 833,087,662
- Urban: 377,105,760

Rural-Urban Distribution Persons (in %):

- Total: 100.0 %
- Rural: 68.84 %
- Urban: 31.16 %

2.5 Scenario: Rural / Urban India & Gujarat as per Census 2011.

- As per the Official Census, the population of India has reached 1.21 Billion (121 Chore) in 2011 which is an increase of 17% from the earlier figure of 103 Croce of 2001.Although the population growth rate has decreased actual population continues to rise. As per estimates, it is expected that India would be the most populous country by 2025 overtaking china.

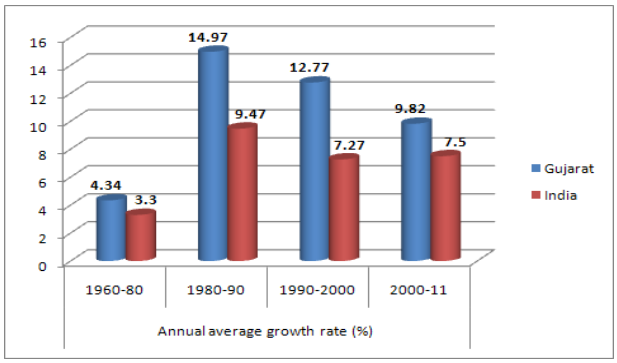

Fig 23: Rural and Urban Population growth

- Gujarat Population Census Data shows that it has a Total Population of 6.03 Croce which is approximately 4.99% of the total Indian Population. The literacy rate in Gujarat has seen an upward trend and is 79.31% as per the 2011 population census. Of that, male literacy stands at 87.23% while female literacy is at 70.73%.
- The Urban Population of the State is 42.6%, which used to be at 37.4% in 2001. The rural population in the state in 2011 fell to 57.4% from 62.6% in 2001.
- Ahmadabad is the most populated district in the State, with 7.20 million people, up 11.94% from 2001, followed by Surat with 6.07 million people, up 10.07%, as per Gujarat's Directorate of census operations.

2.6 Rural Development Issues & Concerns and Measures

- **Education:**

  Education is an empowering right and one of the most powerful tools by which economically and socially marginalized children and adults can lift themselves out of poverty.

- **Empowering Girls:**

  When a girl has the opportunity to be educated and healthy, not only does she benefit society as a whole benefit.

- **Environment:**

  Environmental is the major issue in the rural area as well as urban area. Nowadays peoples and governments are very well aware and taking the necessary steps toward sustainable cities.

- **Gender Discrimination:**

  Even though women in developing countries provide nearly 70 percent of the agricultural labor.

- **Health:**

  In 2016, almost 36.7 million people were living with HIV/AIDS. Worldwide, 1.8 million people became newly infected with HIV. This is the scenario of current society.

- **Hunger:**

  About 795 million people suffering from chronic hunger, 98 percent live in the developing world. Unlike famines that receive emergency-aid, chronic hunger is a silent, invisible, day-after-day condition

- **Poverty:**

  Poverty, food prices, and hunger are inextricably linked. Poverty causes hunger. Not every poor person is hungry, but almost all hungry people are poor.

Measures:

- Rural development can be defined as "an integrated development of the area and the people through optimum development and utilization of local resources-physical, biological and human and by bringing about necessary institutional, structural, and attitudinal changes of the rural public."
- Many Programs / Plans such as IRDP, DDP, DPAP, ITDP, NREP, SFDA, MFAL, and TRYSEM, etc. have been developed and implemented for raising the socio-economic status of the rural people.
- Policy for developing uplifting the lifestyle of the farmers.
- The policy of rural industrial development - integration of farming and industries, farmer's Industrial co-operatives, and industrial enterprises.

2.7 Various Infrastructure and Guidelines /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, to gather the support and resources required for poverty reduction effort in the district. It shall be their endeavor and objective to secure inter-sectorial and inter-departmental coordination and cooperation for reducing poverty in the district. They can coordinate and bring about a convergence of approaches 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 the actual implementation, which will be by the Panchayati Raj and other Institutions. The DRDAs will monitor closely the implementation through obtaining periodic reports as well as frequent field visits. The purpose of the visit should be to facilitate the implementing agencies in improving the implementation process, besides ensuring that the quality of 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. The special report, as and when called for, shall be provided.
- The DRDAs shall take the 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

2.8 Ancient/Existing Electrical Concept Literature review for the village

- Rural electrification is the process of bringing electrical power to rural and remote areas. Rural communities are suffering from colossal market failures as the national grids fall short of their electricity demand.
- GRID is an Indian start-up aimed at facilitating sustainable economic and social development through low-cost energy solutions in rural areas. Outside of micro grid systems; GRID has utilized solar energy to solve a myriad of issues that plague rural communities. For example, Grid has setup solar-powered reverse osmosis filtration plants in rural India to help eliminate water insecurity.
- GRID's filtration plant can provide 20,000 to 30,000 liters of clean water per day which helps to alleviate this issue and reduce the spread of water-borne illness. Additionally, the ease of distribution has reduced the amount of time spent collecting water, allowing for more time on productive tasks and a reduction in time poverty. Finally, GRID employs locals in the community to run the plants day to day operations. From the ground up, GRID's business model fosters the development of rural communities and they plan to scale their operations across India.

2.9 Other Schemes & Projects.

1. Pradhan Mantri Adarsh Gram Sadak Yojana (PMAGSY):

- Rural connectivity is one of the major goals of Bharat Nirman.
- About 6 lakh villages are located in the plain, hilly, desert, tribal pocket, etc.
- Duetoimproperplanningsomevillageshavingfourroadsforconnectivityandsome villages not having any single road.

2. Bharat Nirman Yojana:

It was launched in 2005 for building infrastructure and basic amenities in rural areas. It comprises six components.

- Rural housing,
- Irrigation,
- Drinking water,
- Rural roads,
- Electricity

CHAPTER 3: Smart Cities/ Village Concept as per our Idea and its Visit

3.1 Understanding Smart Cities (Concepts, Definitions, and Practices)

A smart city may be a city that has been provided with all types of facilities such as Educational facilities, Health facilities, Infrastructure, communication, internet services, Transportation facilities, sanitation facilities with an improved method of disposal (waste management), etc.

The smart city is an urban area that uses different types of electronic data collection sensors to supply information used to manage assets and resources efficiently. The smart city concept integrates information and communication technology and various physical devices connected to networks to optimize the efficiency of operation and services. The smart city may also be defined as the application of electronics and digital technologies to communities and cities. It also includes making more efficient use of physical infrastructure (roads, environment) through artificial intelligence and data analytics to support a strong and healthy economic, social, cultural development.

- **Smart Village**

In 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.

- **Concept of Smart Village**

S	Social, Skilled and Simple	Zero tolerance, for Caste and Creed or better no caste & creed and no discrimination on Gender and Religion Everyone is Literate and Skilled Simple living and high thinking.
M	Moral, Methodical and Modern	Moral values of Gandhiji, Swami Vivekananda etc. Methodical using Total literacy and latest techniques Modem like cities.
A	Aware, Adaptive and Adjusting	Highest level of awareness on global social & economic issues Adaptive and adjusting lo fast than environments
R	Responsive and Ready	Responsive to collective wisdom, cooperative movement & larger social issues Reedy to generate own resources for self-sufficiency and self-reliance
T	Techno-Savvy and Transparent	Techno-savvy for IT and Mobile usage Transparent in harmonic relations and delivery of services.

Table 5: Smart village concept

3.2 Vision-Goals, Standards, and Performance Measurement Indicators

❖ **Benchmarks:**

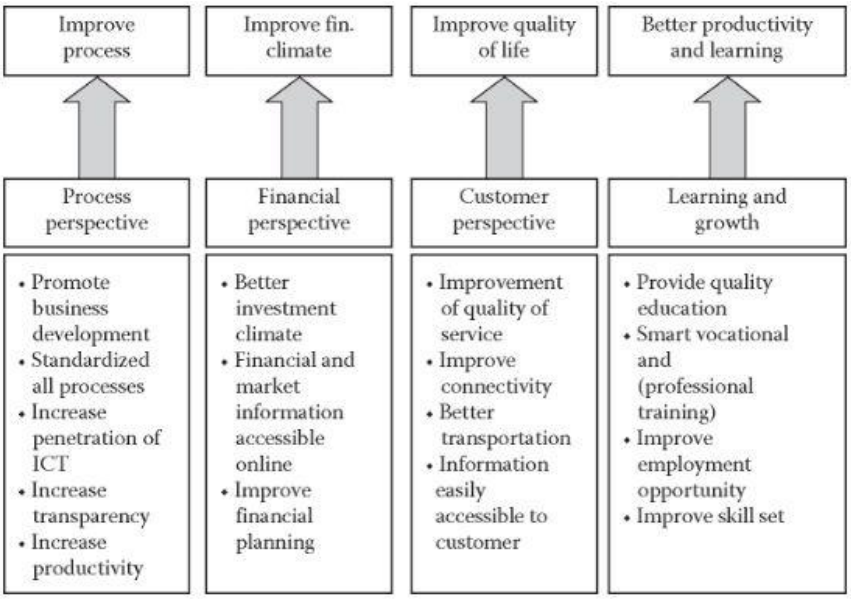

Fig 24: Benchmarks for Smart Village

❖ **Smart Cities Standards:**

- 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.
- A reliable foundation for use of big data and the information explosion to assist cities in building core knowledge for city decision-making, and enable comparative insight.
- Evaluate the impact of infrastructure projects on the overall performance of a city.

❖ **Smart Cities Performance Measurement Indicators:**

- Electricity infrastructure.
- Uses of renewable sources like biogas, solar, etc.
- Smart primary health care 27 X7.
- Medaled road and streets.
- Smart primary and secondary education.
- Solar energy plants to preserve electricity at the village level it.
- Proper sanitation, disposal of rainwater.
- Hygienic drinking water and R.O. system.
- Connectivity through the internet, Wi-Fi mobile tower.
- Availability of Banks, ATMs, post offices, etc.

3.3 Technological Options for Smart Cities.

1. **Smart buildings: -** Automated Intelligent Buildings, Advanced Heating Ventilation, and Air conditioning systems (HVAC), Lighting Equipment.

2. **Smart mobility: -** Intelligent mobility; Advanced traffic management system (ATMs), Parking management, ITS-enabled transportation pricing system.

3. **Smart governance and smart education: -** Government-on-the-Go; e-Government-Education, Disaster management solutions.

4. **Smart healthcare: -** Intelligent Healthcare, Technology, Use of e-Health m-Health systems, Intelligent and connected medical devices.

3.4 Road Map and Safe Guards for Smart Cities

- A smart city is defined as a city that engages its citizens and connects its infrastructure electronically. A smart city can integrate multiple technological solutions, securely, to manage the city ‘s assets-the city ‘s assets include, but are 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 resident’s needs. Business drives technology and large-scale urbanization drive 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 Smart City mission has two components: area-based development for smaller areas within the city and pan-city development where one idea is implemented throughout.
- According to officials from the Ministry of Urban Development (MoUD), among other things, area-based plans allow for the purchase of buses and other means to augment public transportation.

3.5 Smart cities: Issues and Challenges by Smart City Council India:

- **Retrofitting existing legacy city infrastructure to make it smart:**
  There are several 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.

- **Financing smart cities:**
  The High Power Expert Committee (HPEC) on Investment Estimates in Urban Infrastructure has assessed a per-capita investment cost (PCIC) of Rs 43,386 for 20 years. Using an average figure of 1million people in each of the100smart cities, the total estimate of investment requirements for the smart city comes to Rs 7 lakh crore over 20 years (with an annual escalation of 10 percent from 2009-20 to 2014-15). This translates into an annual requirement of Rs 35,000 crore. One need to see how these projects will be financed as the majority of project need would move through complete private investment or PPPs (public-private partnership).

- **Availability of master plan or city development plan:**
  Most of our cities don't have master plans or a city development plan, which is the key to smart city planning and implementation and encapsulates all a city needs to improve and provide better opportunities to its citizens. Unfortunately, 70-80 percent of Indian cities don't have one.

- **Financial sustainability of ULBs**:
  Most ULBs are not financially self-sustainable and tariff levels fixed by the ULBs for providing services often do not mirror the cost of supplying the same. Even if additional investments are recovered in a phased manner, inadequate cost recovery will lead to continued financial losses.

- **Technical constraints of ULBs:**
  Most ULBs have limited technical capacity to ensure timely and cost-effective implementation and subsequent operations and maintenance owing to limited recruitment over several years along with the inability of the ULBs to attract the best of talent at market competitive compensation rates.

- **Three-tier governance:**
  Successful implementation of smart city solutions needs effective horizontal and vertical coordination between various institutions providing various municipal amenities as well as effective coordination between central government (MoUD), state government, and local government agencies on various issues related to financing and sharing of best practices and service delivery process.

- **Providing clearances promptly:**
  For timely completion of the project, all clearances should use online processes and be cleared in a time-bound manner. A regulatory body should be set up for all utility services so that a level playing field is made available to the private sector and tariffs are set in a manner that balances financial-sustainability-with-quality.

- **Dealing with a multi vendor environment:**
  Another major challenge in the Indian smart city space is that (usually) software infrastructure in cities contains components supplied by different vendors. Hence, the ability to handle complex combinations of smart city solutions developed by multiple technology vendors becomes very significant.
- **Capacity building programs:**
  Building capacity for 100 smart cities is not an easy task and most ambitious projects are delayed owing to a lack of quality manpower, both at the center and state levels. In terms of funds, only around 5 percent of the central allocation may be allocated for capacity building programs that focus on training, contextual research, knowledge exchange, and a rich database. Investments in capacity building programs have a multiplier effects they help in time-bound completion of projects and in designing programs, developing faculty, building databases as well as designing toolkits and decision support systems. As all these have a lag time, capacity building needs to be strengthened right at the beginning.
- **Reliability of utility services:**
  For any smart city in the world, the focus is on the 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:

Smart infrastructure provides the foundation for all of the key themes related to a smart city, including smart people, smart mobility, smart economy, smart living, smart governance, and smart environment. The core characteristic that underlies most of these components is that they are connected and that they generate data, which may be used intelligently to ensure the optimal use of resources and improve performance

3.7 Cyber security:

Cyber security is the body of technologies, processes, and practices designed to protect networks, computers, programs, and data from attack, damage, or unauthorized access. In a computing context, security includes both cyber security and physical security.

It is important because the government, military, corporate, financial, and medical organizations collect, process, and store unprecedented amounts of data on computers and other devices.

A significant portion of that data can be sensitive information, whether that is intellectual property, financial data, personal information, or other types of data for which unauthorized access or exposure could have negative consequences. An organization transmit sensitive data across networks and to other devices in the course of doing business, and cyber security describes the discipline dedicated to protecting that information and the systems used to process or store it.

Ensuring cyber security requires coordinated efforts throughout an information system. Elements of cyber security include:

- Application security
- Information security
- Network security
- Disaster recovery/business continuity planning
- Operational security
- End-user education

3.8 Greenfield Development District Cooling

District heating is a system for distributing heat generated in a centralized location for residential and commercial heating requirements such as space heating and water heating. The heat is often obtained from a cogeneration plant burning fossil fuels but increasingly also biomass, although heat-only boiler stations, geothermal heating, heat pumps, and central solar heating area is used, as well as a nuclear power. District heating plants can provide higher efficiencies and better pollution control than localized boilers. According to some research, district heating with combined heat and power is the cheapest method of cutting carbon emissions and has one of the lowest carbon footprints so fall fossil generation plants.

Combination of CHP and centralized heat pumps are used in the Stockholm multi-energy system. This allows the production of heat through electricity when there is an abundance of intermittent power production and cogeneration of electric power and district heating when the availability of intermittent power production is low. District cooling is the cooling equivalent of district heating. Working on broadly similar principles to district heating, district cooling delivers chilled water to buildings like offices and factories needing cooling. In winter, the source for the cooling can often be seawater, so it is a cheaper resource than using electricity to run compressors for cooling.

3.9 Strategic Options for Fast Smart Cities Development:

- The strategic components of area-based development in the Smart Cities Mission are city improvement (retrofitting), city renewal (redevelopment), and city extension (green field 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 livable. 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 services in the identified area and the vision of the residents, the cities will prepare a strategy to become smart. Since existing structures are largely to remain intact in this model, it is expected that more intensive infrastructure service levels and a large number of smart applications will be packed into the retrofitted smart city. This strategy may also be completed in a shorter time frame, leading to its replication in another part of the city.

- The redevelopment will effect a replacement of the existing built-up environment and enable the 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.
- 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 to address the needs of the expanding population. One well-known example is the GIFT City in Gujarat. 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).
- Pan-city development envisages the 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 wastewater 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

Traditionally water supply in India was limited to the major cities within the spread of the process of urbanization. Declining health standards in the rural areas urged the post-Independence government to take serious initiatives to improve the rural drinking water and sanitation. Now, one of the most important aims of the government is to ensure a safe watersupplytotheruralareas.ThisinitiativewasfirsttakenupbyAcceleratedRuralWater Supply Program (ARWSP) in 1972-73. Between the years 1972 to 1986, ARWSP aimed to ensure safe water supplies to rural areas. ARWSP was renamed Rajiv Gandhi National Drinking

Water Mission in 1991-92 with further stress on rural water supply coupled with community planning and management of drinking water. Five factors were kept in focus:

- Sustainability of water supply
- Portability
- Adequacy
- Convenience
- Affordability & equity

❖ **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 nuclear energy and solar energy also.

- **Environment-friendly Plasma technologies:**
  Solid waste dumping sites or land fill sites need more amount of land which is not available in urban areas. The 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 Paralyzed or Gasified, converted to flue gases (H2&CO) & Lower hydrocarbon gases when operated at low temperature (500 – 600OC). Disposal of the carcass is also being thought of using plasma paralysis.

- **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.

  Benefits of MSBT are No Surplus of Organic Sludge, No Odor problem, the drastic reduction of electrical Power usage which minimizes operating costs, No need for return sludge pumping.

3.11 Initiatives in village development by local self-government

- Under the scheme, during 2019-24, MPs will be able to select one village every year for integrateddevelopmentaimedatimprovingtheoverallqualityofrurallife.Theproject also envisages turning villages into model villages not just through infrastructure development but gender equality, peace, and harmony.
- It also aims to instill the spirit of community service, cooperation, self-reliance, local self-government and drive transparency and accountability in public life.
- The program also aims to inspire a sense of pride among people by giving them ownership of the development schemes and through initiatives like honoring village elders, celebrating village day and folk art festivals, and driving them to develop their 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 Lok 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

- Stabilization pond system for waste water treatment
- Duckweed based wastewater treatment with pisciculture
- Root zone treatment system
- Anaerobic Decentralized Waste Water Treatment System
- Aerobic DEWATS
- Study Technological Options at Household Level Management like
- Kitchen Garden with Piped Root Zone System, Kitchen Garden without Piped Root
- Zone System and Leach Pit
- Pile Method, NADEP Method, Bangalore Method, Indoor Method, and Coimbatore Method
- Vermi composting
- Windrow Composting
- Thermophilic Composting
- MARC Method
- Biogas Technology
- Toilet Linked Biogas Plant

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

- The government of India has launched the scheme "Deendayal Upadhyaya Gram Jyoti Yojana" for rural electrification. The erstwhile Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) scheme for village electrification and providing electricity distribution infrastructure in the rural areas has been subsumed in the DDUGJY scheme. Rural Electrification Corporation is the Nodal Agency for the implementation of DDUGJY.

- Under DDUGJY-RE, the Ministry of Power has sanctioned 921 projects to electrify 1, 21,225 un-electrified villages, intensive electrification of 5, 92,979 partially electrified villages, and provide free electricity connections to 397.45 lakh BPL rural households. As of 30th June 2015, works in 1, 10,146 un-electrified villages and intensive electrification of 3, 20,185 partially electrified villages have been completed and 220.63 lakh free electricity connections have been released to BPL households.

3.14 How to implement other Countries smart villages projects in the Indian village context

By following these steps, we can make Indian Villages SMART

1. Identify people's needs and priorities.
2. Define activities that can mobilize the complete community.
3. Use resources from running government schemes.
4. Repair and renovate existing infrastructure.
5. Strengthen the Gram Panchayat.
6. Promote transparency and accountability.

3.15 Electrical Concept

Rural electrification under Minimum Needs Program launched in1974 Kutir Jyoti Yojana to provide single point light to below poverty level (BPL) families in. DDUGJY AIMSAT

- Separation of agriculture and non-agriculture feeders.
- Strengthening and augmentation of sub-transmission and distribution infrastructure in rural areas including metering of distribution transformers feeders/consumers.
- Photovoltaic Technology
- Renewable off-grid enterprises have emerged in many areas to meet the demand for electricity in rural communities. Wind mechanical water pumps
- Small wind electric Diesel solar hybrid power systems: especially for telecommunications worldwide.
- Micro hydro is very widely implemented in Nepal, Vietnam, and China.
- Hybrid power is also widely used where a number of different technologies are combined to provide a single power source.
- LED street light with solar panel
- Digital energy meter
- Use of necessary device for reducing looses
- Low cost with good quality wiring system infrastructure
- Regular checkup& maintenance
- Planned power distribution system
- More use of LED Bulbs

CHPTER 4: About Kalakachha Village

4.1 Introduction

4.1.1 Introduction about Abrama village

We are allocated with a village named Abrama located in Navsari District of Gujarat. Kalakachha Village Gram Panchayat name is Kalakachha. Kalakachha is a 14 km distance from Sub District Headquarter Jalalpore and it is a 14 km distance from District Headquarter Navsari. The nearest Statutory Town is Navsari in 14 km Distance. Kalakachha Total area is 554.2 hectares and the Total irrigated area is 310.2 hectares. Kalakachha village Pin code is396415 and postal head office is Dabhel. Kalakachha Village Total population is 1334 and the number of houses is 286. The female Population is 50.9%. The village literacy rate is 62.2% and the Female Literacy rate is 29.1%.

❖ Connectivity

- A Public Bus service is available in this village. The nearest Railway Station is 5 - 10 km. Autos Available in this Village. Tractors are available in this Village. Animal Driven Carts are there in this Village.
- The nearest National Highway is in 5 - 10 km. The nearest State Highway is in 5 - 10 km. Nearest District Road is in 5 - 10 km.
- Pucca road, Kuccha Road, and Foot Path are other Roads and Transportation within the village. Simlak (2 KM), Chokhad (4 KM), Asana (5 KM), Sisodra (Ganesh) (5 KM), Parthan (5 KM) are the nearby Villages to Kalakachha.
- Kalakachha is surrounded by Navsari Taluka towards the South, Jalalpore Taluka towards the South, Chorasi Taluka towards the west, Surat Taluka towards the North. Navsari, Surat, Vyara, Valsad are the nearby Cities to Kalakachha.
- It is near to the Arabian Sea. There is a chance of humidity in the weather.

❖ Population

Kalakachha Village's total population is 1334 while the total no of houses is 286.

❖ Education

Govt Primary School is available in this Village. Nearest Govt Disabled School, Private Pre Primary School, Govt Secondary School, Govt Senior Secondary School, Govt Arts, and Science Degree College, Govt Engineering College, Govt Medical College, Govt Polytechnic College, and Govt ITA College are in Navsari. The nearest Private MBA College is in Surat.

❖ Health

1 Primary Health Sub-Centre, 1 Maternity and Child Welfare center, 1 Family Welfare center are available in this village.

❖ Agriculture

Sugarcane, Paddy, and Banana are agricultural commodities grow in this village. 8 hours of agricultural power supply in summer and 8 hours of agricultural power supply in winter are available in this village. The total irrigated area in this village is 310.2 hectares from canals 125 hectares, from Boreholes/Tube wells 3.2 hectares, and from Lakes or tanks, 4 hectares are the Sources of irrigation.

❖ Drinking-Water & Sanitation

Treated Tap Water Supply all-round the year and also available in summer. Covered Well, Uncovered Well, Hand Pump, and Tube Wells/Boreholes are other Drinking. Open Drainage System Available in this Village. House to House waste Collection available. There is a system to collect garbage on street. Drain water is discharged directly into water bodies.

❖ Communication

Sub Post Office is available in this Village. Landline is available. Mobile Coverage is available. Internet Centre is available in this village. No Private Courier Facility in less than 10 km.

❖ Other Amenities

This Village has a Power supply with a 24-hour power supply in summer and a 24-hour power supply in winter, Anganwadi center; ASHA, Birth & Death registration office, Public library; Daily News Paper, and Polling station are the other amenities in the village

.

4.1.2 Study justification/ Need of the study

Village studies have their importance. These have enriched the knowledge of the Indian Society in general and rural India. These have given great encouragement to the growth of rural society. After independence, planners in India realized that unless Indian villages were properly studied, no real progress could be made.

Scholars now began to pay more and more attention to village studies.

1. Village studies help in planning rural reconstruction.
2. Village studies provide useful information to other disciplines.
3. Village studies provide useful knowledge about Indian social reality.

4.1.3 Study Area (Broadly define)

Present status and techno-economic survey of villages in given District of the state in terms of basic and public amenities, essential commodities, other infrastructural facilities for the need of people and on the adequacy of the available resource concerning the population of the village and growth of the area with the collection of Local revenue income and authorities, TDO and DDO the future need of the village keeping to mind the need of days, future targeted population growth, growth of surrounding town or Taluka places, etc.

4.1.4 Objectives of Study

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

- Basic Socio-cultural Infrastructure–Community hall, Public library recreation facilities should be the priority focus and be provided.
- Basic Sustainable Infrastructure – Rainwater harvesting system, solid waste management system, solar street light facilities, the toilet should be provided and ensure the proper delivery of facilities to village people.
- Promote integrated development of rural areas with the provision of quality housing, better connectivity employment opportunities, and supporting physical and social infrastructure.

4.1.5 Scope of Study

- To provide some urban amenities to a village without affecting the soul of the village.
- Due to providing urban facilities development of village will be possible.
- Most of the people lived in the village so first to developed the village as per the Rurbanisation term.

4.1.6 Methodology Framework for Development of Village

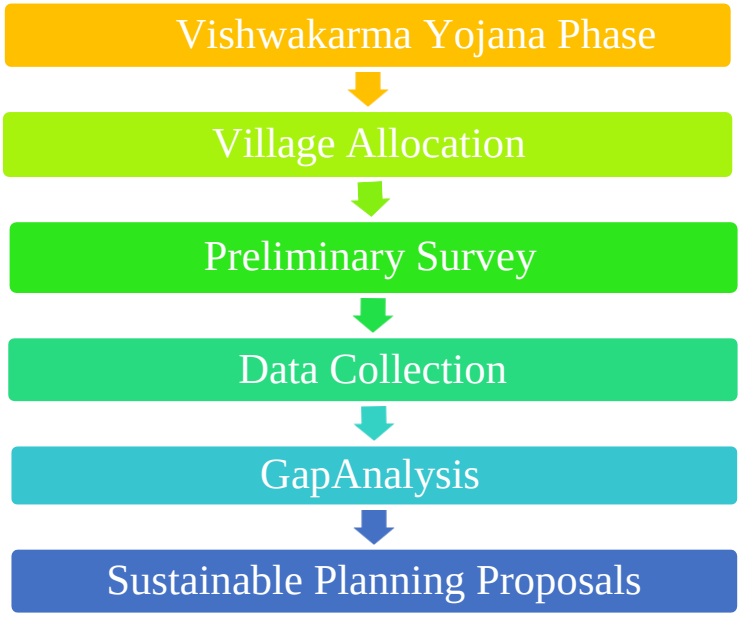

Fig 25: Flow chart of Methodology

4.1.7 List of Objects Available Related to Civil Methodology:

- Gram Panchayat
- Temple
- Drainage System
- Overhead Water Tank
- Bus Stop
- R.C.C Roads
- Paver Blocks
- Electricity 24*7
- Milk Co-Operative Society.
- General Provision Street.
- Water Supply System
- Solid Waste Collection

4.2 Kalakachha Study Area Profile

4.2.1 Study area location

Locality Name: Kalakachha (□□□□□□□□)
Taluka Name: Navsari
District: Navsari State: Gujarat
Language: Gujarati and Hindi
Time zone: IST (UTC+5:30)
Elevation / Altitude: 9 meters. Above Sea level
Telephone Code / STD Code: 02632

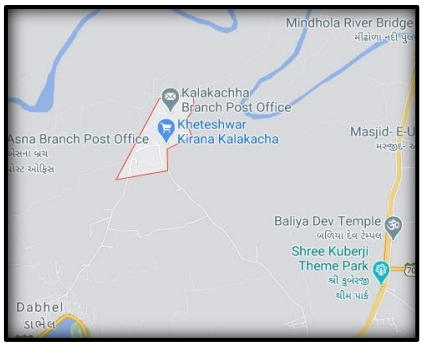

Fig 26: Location of the village

- Brief history

- Kalakachha Panchayat is situated in Navsari District. People of this village are living in very peaceful manner. This village having very proud history. Agriculture is the main profession of this village. Still this village is waiting for Industrial development. Education, Drinking water, Road and Electricity are the main concern of this village. Young generation is more attracted towards mobile, Laptop and computer technology these days. If banks and finance institutions proved loan and other financial support to the villagers, this village will see the real development. Medical and health services have to be improved.

4.2.2. Base Location Map, Land Map

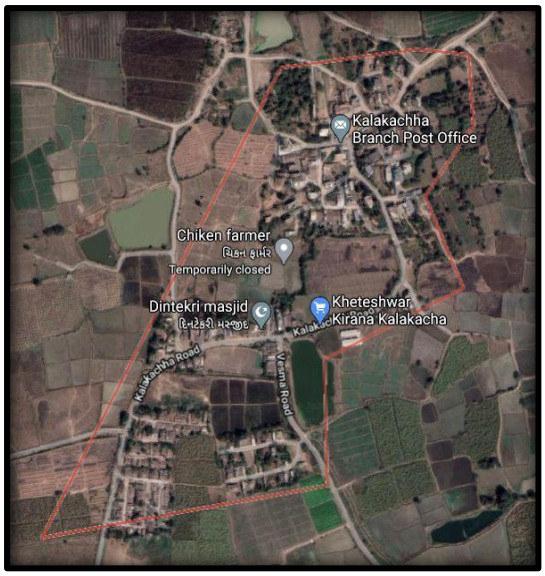

Fig 27: Map of Kalakachha Village

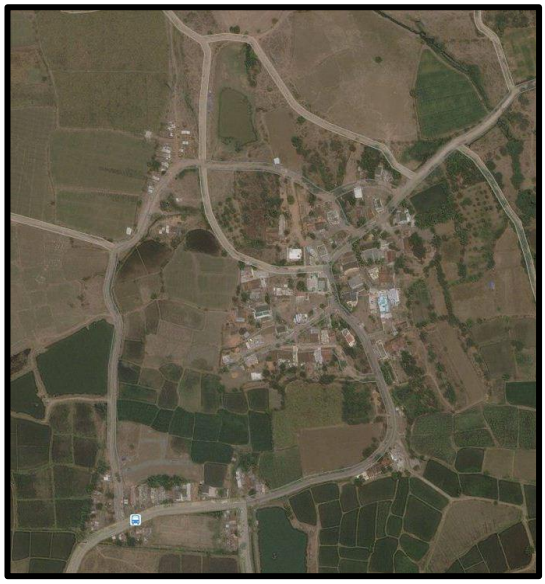

Fig 28: Land Map of Kalakachha Village

4.2.3 Physical & Demographical Growth

- Physical Growth

- Kalakachha Total area is 1235 hectares and Total irrigated area is 926.01 hectares
- In Kalakachha village out of total population, 600 were engaged in work activities. 45.6% of workers describe their work as Main Work (Employment or Earning more than 6 Months) while 27.30 % were involved in Marginal activity providing livelihood for less than 6 months. Of 600 workers engaged in Main Work, 256 were cultivators (owner orco-owner) while 113 were Agricultural laborers.

- Demographical Growth

- Kalakachha is a large village located in Jalalpore Taluka of Navsari district, Gujarat with total 250 families residing. The Kalakachha village has population of 1334 of which 659 are males while 679 are females as per Population Census 2011.
- In Kalakachha village population of children with age 0-6 is 153 which make up 8.45 % of total population of village. Average Sex Ratio of Kalakachha village is 872 which is lower than Gujarat state average of 919. Child Sex Ratio for the Kalakachha as per census is 771, lower than Gujarat average of 890.
- Kalakachha village has lower literacy rate compared to Gujarat. In 2011, literacy rate of Kalakachha village was 62.63 % compared to 78.03 % of Gujarat. In Kalakachha Male literacy stands at 78.06 % while female literacy rate was 29.94%.

Census Parameter	Census Data
Total Population	1334
Total No of Houses	286
Female Population %	50.9 % (679)
Total Literacy rate %	62.2 % (830)
Female Literacy rate	29.1 % (388)
Scheduled Tribes Population %	56.7 % (757)
Scheduled Caste Population %	7.4 % (99)
Working Population %	45.0 %
Child(0 -6) Population by 2011	153
Girl Child(0 -6) Population % by 2011	51.0 % (78)

Table 6: Census data of Kalakachha

4.2.4 Economic profile / Banks

In Kalakachha village out of total population, 600 were engaged in work activities. 45.6 % of workers describe their work as Main Work (Employment or Earning more than 6 Months) while 27.30 % were involved in Marginal activity providing livelihood for less than 6 months. Of 600 workers engaged in Main Work, 256 were cultivators (owner orco-owner) while 110 were Agricultural laborers.

4.2.5 Actual Problem faced by Villagers and Smart Solution

➢ Storage

- Landlords, traders and common population in villages, store their food for long duration in large containers, sacks, drums or bags, at homes or in warehouses. One common problem is infestation due to insects, damage due to temperature or moisture and attack by rodents. One of simple solution is to check for moisture using a moisture sensor that can measure and alert when the threshold is breached. Likewise we can design a solution to check if a particular sack or container or bag is damaged or leaking and inform the owner before the damage spreads.

➢ Precision Farming

- IoT in agriculture has become one of the fastest growing fields. Today, farmers, ranchers, and conservationists need a method to more effectively utilize and conserve resources. The most effective way to do this is through actionable data, and utilizing M2M communication makes the ongoing collection of that data simple and affordable.
- Sensors designed to monitor moisture, soil quality, fertilizers level, climate control, weather forewarning, optimized warehousing and planned storage can lead to direct benefit for the farmers and land owners. Moisture and nutrients sensors, which are common these days.

4.2.6 Preservation of Traditions, Festivals, Cuisine

➢ Traditions

- A tradition is a belief or behavior passed down within a group or society with symbolic meaning or special significance with origins in the past.
- Gujarat carries its own culture and tradition which is clearly visible in day to day activities of people. Fairs and festival of Gujarat are very popular and there are about 1000 festivals celebrated in Gujarat.
- Gujarat has its own wedding tradition too, their marriage is performed according to Vedas which consist of prayers, invocations, and vows recited in Sanskrit. The wedding ceremony takes place in mandap and the four pillars which surround the mandap are the parents of the bride and the groom.
- The ceremony is performed before a sacred fire, or agniaa, which is the eternal witness of the marriage and all vows are taken.

➢ Festivals

- A festival is an event ordinarily celebrated by a community and centering on some characteristic aspect of that community and its religion or cultures. It is often marked as a local or national holiday, mela, or eid. Gujarati folk music is called as Sugam Sangeet, while the instrument used are turi, bungal, pava, ravan hattho, ektaro, and jantar. The folk dance raas-garba is very popular of Gujarat when chaniya choli is worn by women while kedia is worn by men and they dance during Navratri celebrations.

➢ Cuisine

- Gujarati cuisines are one of the healthiest cuisines in India and are primarily vegetarian.A Gujarati thali consists of roti, dal, rice, and sabzi with Indian pickle. Gujarati dishes are dhokla, pathra, samosa, Khaman while sweet dishes are mohanthal, jalebi, doodh Pak.

4.2.7 Migration Reasons/Trend:

➢ Reasons of migration

People migrate for a number of reasons.

- Environmental – Better climate, calamities, and natural disasters are examples of environmental causes or reasons.
- Economic – Moving to find work or moving to follow a particular career path is an example of economic cause or reason.
- Cultural – Religious freedom and education is an example of cultural cause or reason.
- Political – Civil war or escaping from political persecution is an example of political cause or reason.
- Social – Moving for a better quality of life or moving closer to a family member or friendis an example of a social cause or reason.

➢ Trends of migration

- Urbanization in India began to accelerate after due to the country's adoption of a mixed economy, which gave rise to the development of the private sector. Urbanization is taking place at a faster rate in India. Population residing in urban areas in India, according to 1901 census, was 11.4%.This count increased to 28.53% according to 2001 census, and crossing 30% as per 2011 census, standing at 31.16%. In 2017, the numbers increased to 34%, according to The World Bank. According to a survey by UN State of the World Population report in 2007, by 2030, 40.76% of country's population is expected to reside in urban.

➢ Problems and potentials of migrants

- When evaluating urbanizing process in Indian perspective, it is observed that major problems of urbanization in this nation are Urban Sprawl, Overcrowding, Housing, Unemployment, Slums and Squatter Settlements, Transport, Water, Sewerage Problems, Trash Disposal, Urban Crimes, and Problem of Urban Pollution.

4.3 Data Collection:

4.3.1 Methods for Data Collection

- There are many method for data collection but go to the village & observe think ask to people realized about their condition is best method to collect data of real situation. For further information we can meet the Sarpanch, Talati, school teacher, and member of gram Sabha, doctor. For map & other information about village we can take data from Google. Office record of concerned office department like-TDO office, Revenue department, Meteorological Department, Water supply department, R&B Department, etc. Interaction with Sarpanch, villagers, etc. Visit to different parts of village.
- Data collection is done by filling two forms namely:
  - ❖ Smart village survey form
  - ❖ Techno-economic survey form

4.3.2 Primary Survey Details

- Kalakachha is a Village in Jalalpore Taluka in Navsari District of Gujarat State, India. It is located 14 KM towards North from District head quarters Navsari. 15 KM from. 285 KM from State capital Gandhinagar
- Kalakachha Pin code is 396415 and postal head office is Dabhel.

4.3.3 Average Size of the House

- The Average sizes of the house are normal size house. The majority house has 2rooms1kitchen 1 hall with open space.
- Approximate ratio of the houses is 65% house Pucca and 35% kutcha and the average bungalow type houses are more preferable to build by the dwellers.
- Total no. house of village is 286

4.3.4 No. of Human Being in One House

- In the village, there are average 4-5 persons per household

4.3.5 Material available locally ine the village and Material out Sourced by Villagers

- There is approximate 65% Pucca house which made from brick masonry or some are brick masonry with plaster or some are roof tiles houses.
- Major economic option of the village is farming so there are no more locally material available like standard bricks, aggregates, concrete and reinforcements. So, this materialis brought from nearest city for construction of the houses.

4.3.6 Geographical Detail

Sr. No	Description	Information/Detail
1.	Area of Village (Approx.)	611.8 hectares
2.	Forest Area	-------
3.	Agricultural Land Area	423.3 hectares
4.	Residential Area	188.5 hectares
5.	Other Area	---------

Table 7: Geographical Details

4.3.7 Demographical Detail

Sr. No	Census	Population	Male	Female	Total Number of House Holds
1.	2011	1334	655	679	286

Table 8: Demographical Details

4.3.8 Occupational Detail

Name of Three Major Occupation groups in Village	1. Farming
	2. Labor work
	3. Animal husbandry

Table 9: Occupational Details

4.3.9 Agricultural Details

Major crops grown in the village:	1. Groundnut
	2. Mango Trees farm
	3. Wheat

Table 10: Agricultural Details

4.3.10 Physical Infrastructure Facilities – Manufacturing Hub/ Ware Houses

- There is no Manufacturing Hub or Ware Houses available in Kalakachha Village.
- The physical infrastructure facilities like piped water bore well, water tank, approach road, main road, transportation facilities, sanitation and irrigation facilities are available in Kalakachha village.
- Post office, small community hall is present and primary and secondary schools and one PHC is present.

4.3.11 Tourism Development

- There is no tourism cluster involved with village.

4.4 Infrastructure Details

4.4.1 Drinking Water/ Water Management Facilities

- Drinking water is provided by the overhead water tanks in the Kalakachha village.
- Treated Tap Water Supply all round the year and in summer also available. Covered Well, Uncovered Well, Hand Pump and Tube Wells/Boreholes are other Drinking Water sources.
- 2 overhead Tank of 10,000 L, 3 uncovered and covered wells are in the village.

Fig 29: Overhead Water tanks

4.4.2 Drainage Network/Sanitation Facilities

- Underground Drainage System Available in this Village. Drain water is discharged into wastelands.
- By use of tractor the solid and liquid waste gets disposed.
- No public Toilet available.

4.4.3 Transportation & Road Networks

- For local transportation auto, chakras, private vehicles etc.
- Govt. GSRTC bus also running on village route and bus stop is in village in badcondition.

- Village approach road are some kutcha (gravel) and some are black topped Pucca.
- Village road from NH08 is good but the, but the village their internal road network is normal condition and need proper maintenance.

4.4.4 Housing Condition

- In Kalakachha village approximate 65% Pucca houses and 35% kutcha houses.
- Total number of houses is 286. Most of houses have toilet facility and electricity.

Fig 30: Road condition of Village

Fig 31: House of Village

4.4.5 Social Infrastructure Facilities, Health, Education, Community hall, Library

- **Social infrastructure** can be broadly defined as the construction and maintenance of facilities that support **social** services.

  - **Health Facilities**

    PHC is available in village.

  - **Education Facilities**

    Primary school is available in village.

Fig 32: Primary School in Village

Fig 33: PHC in Village

4.4.6 Existing Condition of Public Buildings & Maintenance of Existing Public Infrastructure

Public Building gram panchayat, Post Office and Library are in only one building and the condition is not that good.

4.4.7 Technology Mobile/ Wi-Fi/ Internet Usage

- The 60% people used smarts phone and internets. And others 40% used normal mobile. No WIFI available in village.
- Less technology use compare to city.

4.4.8 Sports Activities as Gram Panchayat

- There is no sports activity by gram panchayat.
- Khel mahakumbh registration is available in gram panchayat various competitions.

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

- **Public Garden :** No Public Garden available in village
- **Pond/Lake:** There is one lake in Village

Fig 34: Lake in Village

4.4.10 Other Facilities

No other Facilities are available in Village.

4.4.11 Sustainable Infrastructure Facilities &Repair & Maintenance

- There are no sustainable facilities available in the village like bio – gas plant, solid waste management plant and rain water harvesting system.
- There some electrical street light is old condition that required a repair and maintenance.
- Solid waste management plant is also needed because they just dumped the waste on the land and it create foul environment.
- Village needs better and closed drainage system. They flush all the sewage into water bodies.
- Village needs a bio gas plant so that use of unconventional fuel is reduced.

- The roads of the village are block road and some is RCC road and need repair so the maintenance of the road is required 20 to 30 %.

4.5 Electrical Concept

4.5.1 Renewable energy source planning particularly for villages

- Nearly 73 % of India's population lives in more than 5.5 lakh villages. The ministry has been supporting programs for the use of renewable energy products and devices such as biogas plants, solar thermal systems, photovoltaic devices; biomass gasifies, etc. as well as the Integrated Rural Energy Program. Renewable energy is derived from natural processes that are replenished constantly. In its various forms, it derives directly from the sun, or from heat generated deep within the earth. Included in the definition is electricity and heat generated from solar, wind, ocean, hydropower, biomass, geothermal resources, and bio fuels and hydrogen derived from renewable resources. Renewable energy source plans like Biogas power generation, storing of rain water by rainwater harvesting system, use of solar energy, use of wind power etc. may be used. These renewable energies may be used for power generation, heating and for transportation purpose

4.5.2 Irrigation Facilities.

- The main sources of irrigation are Pond, bore and well.
- For Irrigation purpose Power supply is for 8 hour a day.

4.5.3 Electricity Facilities with Area

- In the Kalakachha village the no local source of electrical energy is available. Source of Electrical energy is only one that is Governmental electrical energy which is supplied from substation.
- Under the Jyoti gram Yojana government provide 24 hour power supply to respective village power produced GETCO and distribute by DGVCL (private sector).
- Electricity is the basic need for the better facilities.

4.6 Existing Institution like - Village Administration – Detail Profile

4.6.1 Bachat Mandali

- Bachat mandli is the small mandala or a group in which the villagers could save some money day by day or in any way. It is like a small bank.
- In village there is Bachat mandala available there is only one bank is available where people can make account and save money

4.6.2 Dudh Mandali

- In the village there is one Dudh mandala called as 'Dudh utpadan Kendra' available in the whole village the peoples who have animals at their house they sell milk at that small scale dairy and then the small scale dairy will give milk to the big dairy that is large dairy for further processing.

4.6.3 Mahila forum

- Mahila forum is the forum where any ladies of the village can go and tell their problems and the manila forum will help her out to solve its problem.
- In village there is manila forum available. Where ladies can go and their problem can be solve and learn many things.

4.6.4 Plantation for the Air Pollution

- Plants improve air quality through several mechanisms: they absorb carbon dioxide and release oxygen through photosynthesis, they increase humidity by transpiring water vapor through microscopic leaf pores, and they can passively absorb pollutants on the external surfaces of leaves and on the plant root-soil system.
- In village there is no institution for plantation of trees

4.6.5 Rain Water Harvesting

- Rainwater harvesting is the accumulation and storage of rainwater for reuse on-site, rather than allowing it to run off. The water collected is redirected to a deep pit (well, shaft, or borehole), a reservoir with percolation. Its uses include water for gardens, livestock, irrigation, domestic use with proper treatment, etc. The harvested water can alsobe used as drinking water, longer-term storage, and for other purposes such as groundwater recharge.
- Water harvesting scheme by Government is provided for Provisions development for rain water harvesting and recharging of wells
- In village there is no institution for Rain Water Harvesting

4.6.6 Agricultural Development

- For Irrigation Purpose Farmers rest on well, pond, rain, Water and Canal by Government side. Some Farmers Use Drip Irrigation and Sprinkler Irrigation Scheme. They also use Furrow Irrigation System.
- Gramin Bhandaran Yojana is by government for Creation of scientific storage capacity with allied facilities in rural areas to meet the requirements of farmers for storing farm produce, processed farm produce and agricultural inputs. Improve their marketability through promotion of grading, standardization and quality control of agricultural produce.

4.6.7 Any Other

- No there is no other institution

CHAPTER 5: Sustainable Technical Options with Case Studies of the Existing Village

5.1 Concept Civil

5.1.1 Advance Sustainable Construction Techniques

5 Techniques for Sustainable Building Construction

For contractors, a strategy for saving time and materials can lead to higher profitability and the good feeling of not creating unnecessary waste. Here's a look at five techniques that are having the greatest impact on sustainable building construction

1. Prefabricating Materials in Controlled Environments

Constructing as much of a structure in a controlled environment as possible has improved the quality of buildings and resulted in less trash, says Spencer Finseth, principal of Minneapolis-based Greiner Construction.

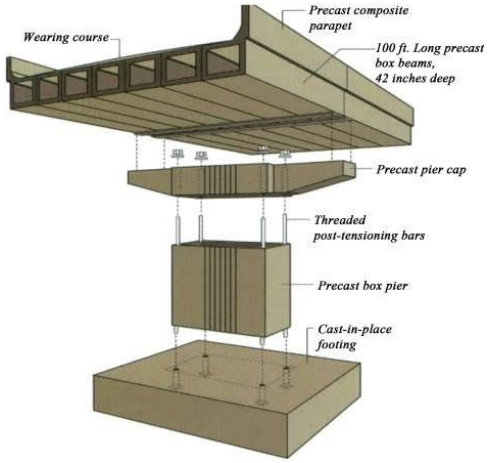

Fig 35: Construction of Bridge

Being able to cut materials precisely decreases waste and creates buildings that are strong enough to allow contractors to use wood framing as high as five stories, he says.
Mechanical contractors use Building Information Management (BIM) systems to cut sheet metal for duct work in a controlled environment instead of outside to avoid the shape-changing problems caused by cold or hot weather, according to Mike Smoczyk, director of professional development for Minneapolis-based Kraus-Anderson. That same duct work is delivered to a project "wrapped and sealed tightly and kept out of the elements" to avoid damage, he says. He estimates that prefabrication probably accounts for 15% of any project and likely more for hotels.

Roseville-based McGough Construction is prefabricating forms for use in creating the concrete superstructure of the $39 million, 57,000-sq.-ft. addition for the Ordway Center for Performing Arts addition in downtown St. Paul, according to Dan Brenteson, McGough's lean enterprise system director. McGough first creates 3D models then pre-builds forms at its White Bear Lake warehouse, a much better environment than being outside at a work site exposed to the elements and "in a constrained environment," he says.

Fig 36: Construction Work

The resulting forms are then transported — in this case to the Ordway site — where concrete is poured into them and the pieces are assembled in an Erector Set-style fashion. It's a common practice for McGough that saves time and improves quality because the planning and assembly of formwork were done in a warehouse with access to equipment not readily available on tight jobsites, such as the Ordway, Brenteson states.

2. Construction Waste Management

Reducing waste is becoming more achievable for contractors as haulers have grown more sophisticated in recent years. Where jobsites once had trash bins for different types of waste, they now need just one, in many cases, because haulers use pickers to separate materials. "Through haulers, we can achieve 75% landfill avoidance through their process and we don't need to separate materials to do it," says Dale Forsberg, president of St. Louis Park-based Watson-Forsberg. "On a couple of sites, we've hit 95%."

Fig 37: Pile of Waste

For inner city projects with small footprints, having haulers handle materials in a single container makes all the difference because space is at a premium, Forsberg says. Some materials are recyclable on site — in particular, concrete that can be crushed and used for foundations or as aggregate beneath parking lots.

The three largest construction projects underway in the Twin Cities all have a recycling rate of more than 90%, according to Zachary Hansen, environmental health director, St. Paul-Ramsey County Public Health department, speaking at a recent conference sponsored by the Minneapolis-based Environmental Initiative. The projects include the Vikings Stadium in Minneapolis, the St. Paul Saints Ballpark and the Ford plant in St. Paul.

3. Managing the Site for Improved Environment

Storm water pollution prevention has become a "big deal" to municipalities and the state and federal government, says Smoczyk at Kraus-Anderson. "Municipalities do not want a [construction] development that dumps a bunch of bad water into the storm sewer system and overflows it," he says.

Runoff is now contained by silt fencing surrounding an area. A number of "best practice" approaches can be used to treat water on site and avoid having it flow into the local sewer system, Smoczyk says. Kraus-Anderson is now making plans to avoid runoff during construction of its new office building in downtown Minneapolis.

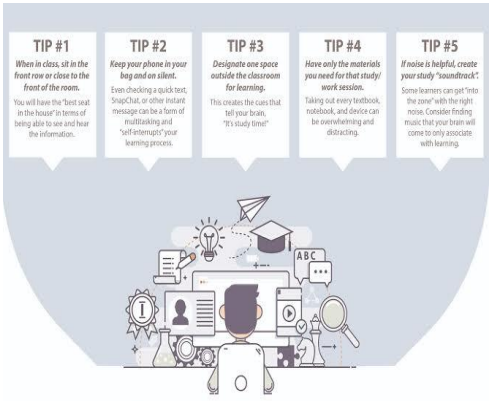

Fig 38: Management Techniques

Forsberg says worker safety has led to restrictions and the institution of simple ways to reduce pollution. There's no smoking on the site, for example. When workers enter a building, they travel over "walk-off mats" that remove dirt, lead and other potentially dangerous chemicals from their shoes. Contractors also bring recycling containers for food to decrease organic waste.

4. Lean Manufacturing to Reduce Energy

McGough's Brenteson says his company encourages rethinking construction approaches through lean thinking. "It's finding the wasteful activities we're doing and eliminating them," he explains.

One success involved a McGough employee who modified a brush that works in conjunction with snow blowers to reduce the amount of time required to clean metal floor decks in winter. The process begins with a brush-mounted snow blower — again, modified a bit by McGough — that takes off the majority of the snow. Then, workers used brushes mounted on broom handles to remove snow caught in the grooves of the metal decks.

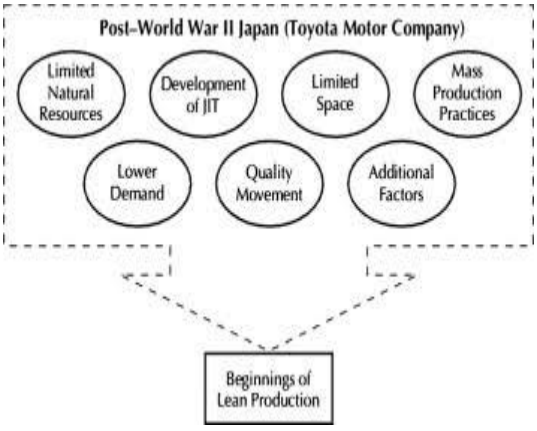

Fig 39: Lean Production of Toyota

Although a snow-shoveling brush might not seem like a big deal, it has made life easier for McGough's staff. "It saved a substantial amount of time and manpower and that's important when talking about waste and sustainability," says Brenteson.

McGough also uses tool sheds — all designed by trades people — that are organized the same way regardless of the work site. The system eliminates wasted time searching for the right drill bit or wrench. Fewer tools are lost and have to be replaced using the system, and contractors work more efficiently since they can find what they need, says Brenteson. The company was so proud of both approaches it made YouTube videos — one on the snow brush and the other on tool sheds — to showcase them.

LEED doesn't give contractors points for lean construction techniques, but many contractors use them anyway. Ted Beckman of RJM Construction in Minneapolis says his company sits down with foremen from various subcontractors to share schedules so "everyone knows what they're responsible for."

The materials are delivered "just in time" to avoid having rebar and other materials sitting outside well before installation. The just-in-time system brings supplies on or around the day they are needed, Beckman says.

"It saves time, eliminates theft on the jobsite, eliminates damage, eliminates wasted time moving things," he adds. "Those are lean practices but they are sustainable things, too, in a sense."

5. Material Selection

Architects and clients seeking LEED can achieve many points by selecting materials manufactured from recycled products and from local sources. The materials can be anything, from renewable products such as bamboo for floors, to wood from vendors approved by the Minneapolis-based Forest Stewardship Council.

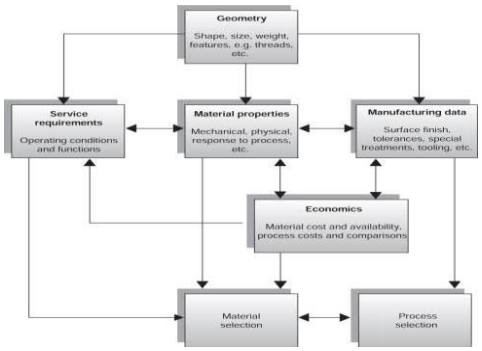

Fig 40: Material Selection

LEED points are also available for installing water-saving dual-flush toilets and low-flow faucets and other features, says Smoczyk. Water reduction has become a major issue, even in the Land of 10,000 Lakes, he notes.

As buildings become greener, so do construction sites. Off-site fabrication, improved on-site maintenance, lean practices, landfill avoidance and green materials acquisition have begun to fundamentally, albeit slowly, transform the way buildings are constructed today.

5.1.2 Soil Liquefaction

Soil liquefaction, also called **earthquake liquefaction**, ground failure or loss of strength that causes otherwise solid soil to behave temporarily as a viscous liquid. The phenomenon occurs in water-saturated unconsolidated soils affected by seismic *S* waves (secondary waves), which cause ground vibrations during earthquakes. Although earthquake shock is the best known cause of liquefaction, certain construction practices, including blasting and soil compaction and vibro flotation (which uses a

Fig 41: Damaged Road

Vibrating probe to change the grain structure of the surrounding soil), produce this phenomenon intentionally. Poorly drained fine-grained soils such as sandy, silty, and gravelly soils are the most susceptible to liquefaction.

Loma Pieta earthquake of 1989: soil liquefaction

Road cracking from soil liquefaction near Moss Landing, California, resulting from the Loma Pieta earthquake in 1989.

USGS

Granular soils are made up of a mix of soil and pore spaces. When earthquake shock occurs in waterlogged soils, the water-filled pore spaces collapse, which decreases the overall volume of the soil. This process increases the water pressure between individual soil grains, and the grains can

then move freely in the watery matrix. This substantially lowers the soil's resistance to shear stress and causes the mass of soil to take on the characteristics of a liquid. In its liquefied state, soil deforms easily, and heavy objects such as structures can be damaged from the sudden loss of support from below.

Fig 42: Effects of Earthquake

Buildings constructed on loose soil pitch and tilt easily when liquefaction occurs, since the soil no longer supports the structures' foundations. In contrast, structures anchored to bedrock or stiff soils in earthquake-prone areas suffer less damage, because less vibration is transmitted through the foundation to the structure above. In addition, buildings anchored to bedrock have a reduced risk of pitching and tilting.

We can and do build buildings on wet, sandy soil since the weight of the grains and the friction between them makes the soil behave as a solid most of the time. But in an earthquake, soil particles repeatedly jostle back and forth so much that the water can't flow away. Loosely packed dry soils tend to compress under stress, but with incompressible water unable to escape the gaps between drains, the soil can't compress and the water takes the load.

Fig 43: Effects of Flood

Unfortunately, water as a liquid doesn't have much structural integrity, so if the saturated soil is forced to compress too much too quickly, it'll start to act like a liquid, and dense objects resting on the now-liquefied soil will sink. You can experience liquefaction for yourself in the water-soaked sand near the edge of a beach. It feels pretty solid if you stand still, but if you wiggle your feet, the movement causes the sand to liquefy beneath you and you start sinking.

On a larger scale, earthquake-induced liquefaction can swallow cars, roads, and even enormous apartment complexes. In other words, earthquakes can create quicksand except that when the shaking stops and the soil particles are no longer suspended in water, the ground solidifies again, and anything that sank becomes stuck, which is what happened to this car.

5.1.3 Sustainable Sanitation

What is sustainable sanitation?

The main objective of a sanitation system is to protect and promote human health by providing a clean environment and breaking the cycle of disease.

To qualify as **sustainable sanitation**, a sanitation system has to be economically viable, socially acceptable, technically and institutionally appropriate, and protect the environment and natural resources.

Most sanitation systems have been designed with these aspects in mind, but they fail far too often because some of the criteria are not met. In fact, there is probably no system which is absolutely sustainable. The concept of sustainability is more of a **direction** than a state to reach. Nevertheless, it is crucial that sanitation systems are evaluated carefully with regard to all dimensions of sustainability.

Fig 44: Sustainable Sanitation Techniques

Since appropriateness to the context is such a core criterion for sustainable sanitation, there is no one-size-fits-all sanitation solution. However, taking into consideration the entire range of sustainability dimensions, it is important to observe some basic principles when planning and implementing a sanitation system (see below).

SuSanA believes that the following sustainability dimensions (or "criteria") should all be considered in the design or upgrade of a sanitation system.

Health and hygiene

Includes the risk of exposure to pathogens and hazardous substances that could affect public health at all points of the sanitation system, from the toilet via the collection and treatment system, to the point of reuse or disposal and downstream populations.

This dimension also includes hygiene aspects as well as possible impacts on nutrition and health resulting from the application of a certain sanitation system.

Environment and natural resources

Includes issues such as the water, energy and other natural resources required for construction, operation and maintenance of the system, as well as the potential emissions to the environment resulting from use. Also includes aspects of safe recycling and reuse of excreta (and any associated effects, for example reusing wastewater, returning nutrients and organic material to agriculture).

Furthermore, it includes effects on consumption of non-renewable resources (for example excreta-derived biogas replacing fossil fuel use).

Technology and operation

Incorporates the functionality of the system, and the extent to which the entire system – including collection, transport, treatment and reuse and/or final disposal – can be constructed, operated and monitored by the local community or the technical teams of the local utilities.

Furthermore, the robustness of the system, its vulnerability to power cuts, water shortages, floods, etc. are also included in this criterion. Finally, the flexibility and adaptability of its technical elements to the existing infrastructure, geology, and projected demographic and socio-economic developments should also be taken into account.

Financial and economic issues

This dimension includes the capacity of households and communities to finance the sanitation system, including the construction, operation, maintenance and necessary reinvestments in the system. In such calculations, direct benefits – for example income or savings from recycled products – and external costs and benefits have to be taken into account alongside such direct costs.

The external costs might include environmental pollution and health hazards. Benefits may include increased agricultural productivity and subsistence economy, employment creation, improved health and reduced environmental risks.

Socio-cultural and institutional aspects

The criteria in this category evaluate if the sanitation system is socio-culturally acceptable and appropriate for the users. Further considerations include the following aspects: Convenience, perceptions, gender issues, religious or cultural issues, impacts on human dignity, compliance with the legal framework, and stability of institutional settings.

Principles for planning and implementing sustainable sanitation systems

The following principles for planning and implementing sanitation systems were developed by a group of experts and were endorsed by the Water Supply and Sanitation Collaborative Council as the "Bellagio Principles for Sustainable Sanitation" during its 5th Global Forum in November 2000:

1. Human dignity, quality of life and environmental security at household level should be at the centre of any sanitation approach.
2. In line with good governance principles, decision making should involve participation of all stakeholders, especially the consumers and providers of services.
3. Waste should be considered a resource, and its management should be holistic and form part of integrated water resources, nutrient flow and waste management processes.

5.1.4 Transport Infrastructure

Transport infrastructure in the Mediterranean region lacks integrated planning at the municipal level and between public bodies. This makes the provision of a reliable service difficult to develop.

Mediterranean cities should develop adequate public transport infrastructure (such as dedicated bus lanes and bus stations) to meet transport demand and ensure a reliable service.

Developing dedicated pedestrian prioritization and bike routes will help promote walking and cycling. Local authorities should enhance their technical capacity internally or through third-party provision, so that planned infrastructure projects can be efficiently realized (considering both the implementation and operation phases)
In many cases, investments and available funds (either public or private) proved to be insufficient to expand or improve the transport infrastructure to meet increasing transport demand and maintain acceptable transport conditions.

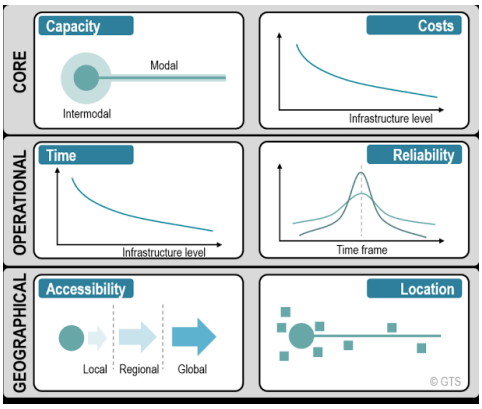

Fig 45: Travel Information

Considering that transport infrastructure plays a predominant role toward supporting urban public transport systems, there is a clear need for a coherent policy enabling the development of comprehensive and integrated solutions.

➢ The Economics of Transport Infrastructure

2.1.3 The Public Role of Infrastructures and the Role of Public in Infrastructure Planning

Transport infrastructures represent the fixed component of the transport system (Button, 1982) and determine a wide range of scale and scope economies; therefore, as underlined by Riveted (1994), they are usually supplied as a collective input into production. It is quite common that transport infrastructures serve a multiplicity of users—in Riveted and Bruins (1998) this same characteristic of infrastructures is referred to as *polyvalence*. For instance, either passenger together with cargo or, in the case of transport of passengers, the same infrastructure is used for leisure travels as well as for commuting, etc. When infrastructure serves a specific user (as in the case of a port terminal serving an industrial plant), they are strictly managed to maximize the profit of the industrial plant and the magnitude of the external impacts is limited or even null. Therefore, in this book we will concentrate on common infrastructures. Terminal facilities serve a multiplicity of users too; even if some cases of dedicated terminals are more common to be found. This is the case of some port or air terminals dedicated to a specific segment of transport demand (such as containerized cargo or cruise passengers) or also some airports in United States, but also in these cases they rarely are dedicated to a single transport operator.

Transport infrastructures determine the accessibility degree of locations and regions, thus contributing to their differentiation in the localization decision process of firms and families. Both will be more attracted by regions and locations with a higher degree of accessibility due to the possibilities of transforming accessibility into value.

The two abovementioned characteristics contribute to generate agglomeration economies (Rodriguez, Comtois, & Slack, 2006); such economies attenuate rapidly with distance (Rosenthal & Strange, 2003). This results in the formation of clusters, thus an uneven regional distribution of the economic agents. In consequence, if transport infrastructure investments, in general, determine positive economic benefits, not all regions impacted by the same infrastructure receive the same benefit, in some cases the effects may be even negative (in terms of reduction of jobs, localization disadvantages, etc.) for some regions. This kind of consequences will be further discussed in Chapter 3.

It is also in relation to these characteristics that investment in infrastructure usually involves public capital, and governments have a high interest in controlling the level of supply. Even in periods of poor public finance, the leading role of governments in infrastructure providing remains strategic for several reasons.

5.1.5 Vertical Farming

Imagine walking into your local grocery story on a frigid January day to pick up freshly harvested lettuce, fragrant basil, juicy sweet strawberries, and ripe red tomatoes – all of which were harvested at local farm only hours before you'd arrived. You might be imagining buying that fresh produce from vertical farms where farmers can grow indoors year-round by controlling light, temperature, water, and oftentimes carbon dioxide levels as well. Generally, fresh produce grown in vertical farms travels only a few miles to reach grocery store shelves compared to conventional produce, which can travel thousands of miles by truck or plane.

Beyond providing fresh local produce, vertical agriculture could help increase food production and expand agricultural operations as the world's population is projected to exceed 9 billion by 2050. And by that same year, two out of every three people are expected to live in urban areas. Producing fresh greens and vegetables close to these growing urban populations could help meet growing global food demands in an environmentally responsible and sustainable way by reducing distribution chains to offer lower emissions, providing higher-nutrient produce, and drastically reducing water usage and runoff.

Fig 46: Vertical Farming

Recently, USDA and the Department of Energy held a stakeholder workshop focused on vertical agriculture and sustainable urban ecosystems. At this workshop, field experts shared thought-provoking presentations followed by small group discussions focusing on areas such as plant

breeding, pest management, and engineering. Workshop attendees from public and private sectors worked together to identify the challenges, needs, and opportunities for vertical farming. A report on this workshop will be released to help inform Departmental strategic planning efforts for internal research priorities at USDA and external funding opportunities for stakeholders and researchers.

We're excited about the potential opportunities vertical agriculture presents to address food security. That's why USDA already has some of these funding and research opportunities in place. The National Institute for Food and Agriculture has funding opportunities (PDF, 1.22 MB) that could support future vertical agriculture conferences and research. Similarly, the Agricultural Research Service is working on a project to increase U.S. tomato production and quality in greenhouses and other protected-environments. We look forward to continuing our partnership with our customers, both internal and external.

Agricultural Efficiency

Traditional farming's arable land requirements are too large and invasive to remain sustainable for future generations. With the ever-so-rapid population growth rates, it is expected that arable land per person will drop about 66% in 2050 in comparison to 1970.

Resistance to Weather

Crops grown in traditional outdoor farming depend on supportive weather and suffer from undesirable temperatures rain, monsoon, hailstorm, tornado, flooding, wildfires, and drought. "Three recent floods cost the United States billions of dollars in lost crops

Environmental Conservation

Up to 20 units of outdoor farmland per unit of vertical farming could return to its natural state, due to vertical farming's increased productivity. Vertical farming would reduce the amount of farmland, thus saving many natural resources

5.1.6 Corrosion mechanism prevention and repair measures of R.C.C.

Penetration of chlorides into concrete

Reinforcement corrosion is one of the major deterioration mechanisms of reinforced concrete structures worldwide. The presence of chlorides increases the severity of the corrosion attack considerably. Chlorides can penetrate into concrete which is in contact with de-icing salts or seawater. Typical structures that are damaged by chloride-initiated reinforcement corrosion include bridges, car parking structures, and off-shore structures such as piers, dams, docks, and harbor structures.

Critical amounts of chlorides may also be present in the fresh concrete mix even though at present very few admixtures used in concrete contain chlorides. If seawater is used in producing concrete, chlorides are introduced into the mix.

When chlorides penetrate into concrete from outside, they are usually in a water solution. In moist concrete, the main transport mechanism is diffusion, but the capillary transport mechanism is also possible if concrete is exposed to drying and wetting cycles. Cyclic freeze–thaw loads can effectively increase the chloride content in concrete pore water. It is common practice to measure the maximum concentration of the chloride front penetrating from the surface of the concrete cover over reinforcement some centimeters inside the exposed surface (Fig. 1.7). Even though drying of concrete complicates the theoretical modeling of the phenomenon, Fick's second law is commonly applied in mathematical modeling of chloride intrusion into concrete

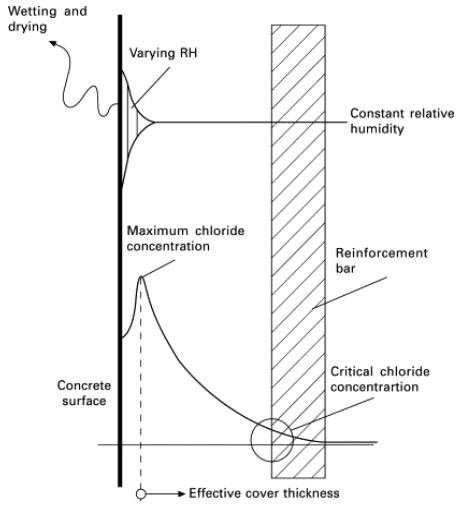

Fig 47: Concrete Structure

The three most important variables that govern the chloride intrusion into concrete and the corrosion of the reinforcement are concentration of chlorides at the surface, concentration threshold value which initiates corrosion of steel, and the transport rate of chloride ions in the concrete cover layer. Without coating the surface of concrete, there are usually very limited means to decrease the concentration at the surface. If this chloride concentration is high, it is nearly impossible to hinder the penetration of chlorides to the reinforcement during long exposure times (50–100 years). At normal chloride exposure concentrations (seawater or de-icing agents), by selecting binders that cause a high OH^--concentration into pore water, the chloride threshold value that initiates corrosion of steel can be increased. Similarly, some binders react with chlorides and this decreases the free chloride concentration in pore water solution. These binders contain large amounts of C_3A or GGBS. This is only a temporary relief, because during carbonation large volumes of these bound chlorides dissolve back into pore water

The transport rate of chloride ions can be decreased by producing a more impermeable concrete cover by using lower water/cement ratio and by applying longer wet curing. The rate of chloride-induced corrosion is reduced considerably in structures situated in environments where relative humidity is less than 80%.

After initiation of chloride-induced reinforcement corrosion, it usually takes less than 10 years for the concrete cover surface to deteriorate to such an extent that repair measures have to be applied.

Monitoring of reinforced concrete corrosion

Reinforcement corrosion induced by chloride contamination is a leading cause of structural damage and premature degradation in reinforced concrete (RC) structures, with significant implications for safety, reliability, economics, and environmental performance. According to the American Society of Civil Engineers (ASCE), approximately 56,007 bridges built in the United States are classified as structurally deficient in 2016, representing approximately 9.1% of the total number of bridges in the country (ASCE, 2016). Remediation projects for concrete bridges

undertaken as a direct result of chloride-induced rebar corrosion was estimated to cost U.S. highway departments $5 billion per year (Glass and Buenfield, 2000), aside from other economic, social, and environmental implications. Concern is the greatest in coastal and northern states where these structures are exposed to marine environments and deicing salts, respectively, such as in the States of California, Oregon and Massachusetts.

Many agencies are faced with the difficult and expensive task of more-frequent, routine corrosion inspection of aging infrastructure to enhance on-time maintenance decision-making. For instance, the Oregon Department of Transportation (ODOT) has historic RC bridges along the Pacific coast that experience serious corrosion and degradation. ODOT currently conducts labor-intensive corrosion surveys of its coastal bridges to determine the timing and type of remedial action they require. Fig. 4.1 shows a typical corrosion damage pattern for ODOT coastal bridges. Consequently, ODOT tends to focus on obtaining chloride content profiles and rebar corrosion status on the side of the girder near the bottom where corrosion damage is most likely. This would be a likely location to embed corrosion sensors. A method of obtaining frequent corrosion information would provide better condition assessment at much lower cost than the periodic hands-on surveys.

Considering the aging infrastructure and dwindling maintenance budget, it is necessary to develop a small, reliable, embedded, multi-parameter sensor system to be deployed at distributed locations of the existing RC structure, which can capture the critical data indicative of chloride ingress, corrosion initiation, and possibly early-age corrosion propagation. Such an effective, adaptive, field-deployable system can meet the urgent agency needs for corrosion monitoring, detection, and diagnosis, for the assessment of the remaining life of RC structures, and for the capability of timely intervention based on early warning.

In this context, this chapter will provide a brief overview on the state of the art in online monitoring of rebar corrosion, followed by recent advances in embeddable sensors that help assess the corrosion-relevant parameters in concrete. Subsequently, this chapter will present a case study of testing embeddable sensors in an accelerated manner, and conclude with a discussion of future research needs. Note that the focus of this chapter is on technologies enabling *online* and *in situ* monitoring of rebar corrosion, instead of those enabling periodic, non-destructive testing and evaluation of the RC structure itself (e.g., radiography, acoustic emission, and ground penetrating radar). Yet, both groups of technologies are vital to condition assessment, health monitoring, reliability engineering, and resilience preservation of RC structures.

5.1.7 Sewage Treatment Plant

Human health and environment are mainly affected by the direct disposal of industrial and human effluents into natural resources without any treatment. Sewage treatment is necessary to reduce the toxicity of sewage and maintain a safe and healthy environment, as well as promote human welfare.

Sewage Treatment Process

Sewage contains a huge amount of organic matters which are toxic. Microorganisms are widely used in the sewage treatment plant for removing this toxic organic matter. Sewage or wastewater treatment plant consists of two stages.

- **Primary Treatment**

It involves the removal of large or small-sized components in the wastewater through physical processes.

- **Biological Treatment:**

Aerobic microorganisms are inoculated into the sewage treatment plant. These microbes utilize the organic components of the sewage and reduce the toxicity. This can be measured by BOD (Biological oxygen demand).

After the biological treatment, the sludge is pumped from the treatment plant into a large tank. This large tank consists of anaerobic bacteria which lead to the digestion of sludge. During digestion, biogas is produced and it is used as an energy source. Hence, Sewage treatment plant design and sewage management play a crucial role in the maintenance of human welfare

Energy generation

Microorganisms which are involved in the production of energy are called microbial fuel cells. Microbial fuel cells are used to generate a variety of energy sources like biogas and electricity. Agricultural waste, manure, and domestic wastes are used as raw materials for the generation of biogas. Biogas generation is done in the large concrete tank which is called a biogas plant.

Biomasses (Bio wastes) are collected at the biogas plant and the slurry is fed. Biomasses are rich in organic matter. Some of the bacteria can grow an aerobically inside the biogas plant. These bacteria can digest the biomasses which are present in the slurry and sewage. During digestion, a huge amount of mixture of gases is released inside the tank. The mixture of these gases is called the biogas. Biogas is removed from the biogas plant through a separate outlet.

Microbial fuel cells are also used to generate electricity from wastewater. Microbial fuel cells utilize the organic matter from the wastewater treatment plant. During digestion, organic matters are converted into the simple molecule and release the carbon dioxide and electrons. Those electrons are absorbed by the electrode and used as the source of electricity.

5.2 Concept Electrical

Local/out Source of energy

❖ Case study of Main Sources available in the state:

1. Central Grid/Grid Extension

A major focus of the Indian government's electrification strategy has been to extend the central grid to rural villages. However, this might be a suboptimal strategy if universal electrification is a priority for the government. More specifically, extending the grid to remote villages is not always the most cost-effective solution.

Reliability: The reliability of grid-based electricity supply has been a constant problem; in some states, even the limited goal of supplying at least 6 hours of electricity a day by the central grid has not been met. In Bihar, villages surveyed in 2008–2009 receive anywhere from 1.3 hours to 6.3 hours, depending on the month. Moreover, there was no correlation between the number of years a village had been electrified, the proportion of households electrified, and the hours of power available. This shows that grid power reliability is not necessarily increasing with time.

Price and Cost: The price of power for grid electricity consumers pay commonly cited by experts to be Rs. 3/kWh, though the actual price varies from state to state and for each consumer category. Moreover, this does not reflect the actual cost of producing power, especially the cost of producing power and setting up transmission lines for areas that are very distant from the source of generation. Look at the actual cost of grid power in villages that are very distant from the central grid. They estimate the cost of generating, transmitting, and distributing electricity from a coal thermal power plant to remote areas of the country to range between Rs.3.18/kWh to Rs.231/kWh for villages that are between5 and 25 km away from the central grid. They find that for villages with about 20households and a peak load of 5 kW that are 5 km from the grid, the cost of electricity is about Rs. 26/kWh. This cost of generation, transmission, and distribution increases to Rs. 95/kWh if the required grid extension is about 10km.

Loads: In general, the electricity demand is surpassing the ability of the central grid to supply it, which has led to regular shortages during times of peak electricity demand. For all of India, there is a deficit of about 3261 MW of a total 144,225 MW required during peak demand. However, for certain regions and states, the deficit is much higher. For example, the deficit for Uttar Pradesh is 2794 MW, which is 19.4% of the total electricity required during peak demand.

Generation Sources: The current electricity generation capacity mix in India is about 56% coal, 20% hydropower, with the remainder divided between other renewable sources and gas. Nuclear energy comprises about 2% of the total electricity generation capacity

2. Solar Home Systems

In India, by 2012, there were 500,000 SHS and 700,000 solar lanterns distributed across the country. These SHS are standalone electricity systems that include a set of solar PV panels, a battery storage system, an optional battery charging controller, and various end-use equipment such as fluorescent lighting. Because solar PV panels generate DC electricity, the end-use equipment is limited to DC appliances such as light bulbs, unless an inverter is included in the setup.

Reliability: SHS are designed to provide reliable electricity for a set load, so there is a lower likelihood of a power shortage assuming that the amount of solar irradiation does not experience drastic variation. However, to ensure that the power demanded does not exceed the supply capacity; households must be familiar with the capacity of the system to not compromise its reliability. There liability and power quality of an SHS can be negatively affected by the low quality of its components as well as sub-optimal operations and maintenance. According to a survey of SHS set up in Zambia in the early 2000s, over three years none of the households surveyed had experienced any problems with the solar PV panels. However, 25–30% of the batteries needed replacement within two years due to sub-optimal operations and maintenance.

Price and Cost: The cost of installing a solar home system varies depending on the type and size of the solar panel module and any storage units included. Small solar systems that can power a few light bulbs, fans, and a television set have an upfront cost of around Rs. 45,000, while larger systems like a 1-kW solar home system can cost between Rs. 120,000 to Rs. 180,000. A typical unit cost of generation is Rs. 37/kWh. With solar PV systems in general, the efficiency of the components of the system, such as the batteries and inverter, improves with the capacity of the system. Because efficiency is higher with larger capacity modules, larger modules will have a lower unit cost of generation and unit cost of storage.

Capacity: The capacity of a solar home system is determined by both the size of the PV panel array as well as the battery storage unit. SHS typically only support small loads such as a few household light bulbs, a fan, and an outlet for charging mobile phones. Adding PV panels or purchasing a battery with a larger storage capacity can increase the system's capacity. However, the capacity of a typical SHS is low, around 100 watts, so there is limited ability to add income generating loads to the system or to handle varying connected loads. Besides, SHS provides DC electricity, so typical systems will only be able to support DC-compatible appliances, which are less widely available and more expensive. Installing an inverter to the system can allow them to utilize conventional AC- compatible appliances; however, as inverters are quite expensive, this is likely to significantly drive up the costs of generation.

Generation Source: SHS relies on individual household PV units and uses solar irradiation to generate electricity.

3. Micro grids

The term micro grid refers to a single electric power sub system linked to a small number of distributed generators that can be powered by either renewable or conventional sources of energy, along with different load clusters. The key feature of micro grids is that they can operate independently of the central grid. This can help improve the power quality and reliability, as well as allow the local community to have more control over their power network. Even once the micro grid is connected to a central grid network, the community can still retain some level of control.

The basic micro grid architecture is comprised of the following components: DG resources, an energy storage system (optional), a distribution system, and a communication and control system. The main criteria for distinguishing different kinds of micro grids are: (a) whether it is connected to a central grid; and (b) what kinds of generation sources are connected to the micro grid.

Reliability: Micro grids can suffer from some power quality and reliability issues associated with renewable energy sources in general and electricity distribution. For example, some renewable energy sources may face limitations based on natural variations in the environment (e.g., exposure to solar radiation for solar PV). Besides, common problems affecting the distribution network include voltage-based sagging/swelling, voltage imbalance, and flicker. However, compared to SHS, the power quality is better in large part because the components of a micro grid and appliances powered by a micro grid are generally of higher quality than those for an SHS.

Price and Cost: Typical costs of generation are around Rs.23 to 33/kWh based on the type of generation used in the micro grid, with monthly payments of around Rs.100 to 200 per month. As the cost of renewable energy generation falls due to technological improvements and more efficient manufacturing processes, micro grids are becoming more competitive as a cost-effective means of providing rural households with access to electricity. For example, based on analysis conducted by Harish et al., including interruption costs, standalone micro grids are competitive with grid extension at distances more than 17 km. Harish et al. look at a case study that does not include the fuel subsidies that are provided for kerosene and diesel but concludes that if these subsidies were included in the economic analysis, the social cost of unreliable grid supply would only increase and make standalone DG more attractive. Overall, the literature reflects that DG becomes an increasingly more cost-effective option with larger distances.

Generation Sources: In general, micro grids can accommodate a variety of DG sources. These include renewable sources (e.g., biomass, micro-hydro, solar, and wind), non-renewable sources (e.g., diesel), and hybrid sources (e.g., biomass-diesel and solar-diesel). However, the DG sources that are best suited to a micro grid largely depend on the climate and topography of the region.

Geographic- or Location-Based Constraints: Micro grids that use generation sources such as hydropower are geographically constrained, but others such as solar power or biomass are very flexible in terms of where they can be used since solar irradiation and biomass resources are locally available across India. Micro grids are also comparatively easier to install than extending the grid in areas that are especially hilly or forested. In general, because micro grids can be used with a variety of generation sources, they can be suitable for many locations and geographic contexts.

Here are some calculations based on some input figures provided by Gram Urja

Micro grid Cost Calculations:

	Expenses	Quantity /Units	Cost Per Unit (Rs.)	Life (Years)	Total (Rs.)	Monthly Capex Recovery (Rs.)
Capital Expenses	PV module including inverter	7.6 kWp	100,000	25	760,000	7,974
	Construction costs			25	450,000	4,740
	Battery	19.2 kWh	10,000	5	170,000	3,844
	Distribution	30 poles	20,000	25	600,000	6,319
Maintenance Costs	Labor (cleaning panels, simple maintenance)	Cost of labor per month	2,000			2,000
	Periodic visit from project developer	Once a month	500			500
				Total Monthly Expenses		**25,377**

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Table 11: Micro-Grid Cost Calculation

5.2.1 Programmable Load Shedding

ABSTRACT:

Electricity is one of the most important requirements of modern civilization. Without which various Indispensable applications will bind to bring to a standstill. As we know that demand of electricity is increasing now day, so electric utilities prefer load shedding when the demand exceeds the supply. Thus in a distribution system it needs to be precisely measured for specific period of time. Programmable load shedding time management system is a reliable & effective load shedding technique that takes over the manual task of switch ON/OFF the electrical supply with respect to time .It uses real time clock (RTC) interfaced to the 8051 family microcontroller. The paper "effective load shedding technique for utility department" will provide real & competent load shedding techniques such that distribution substation can be monitored & load shedding from one particular place.

INTRODUCTION:

The project is an automatic load operation system that controls load operation, multiple numbers of times according to programmed instruction. The project eliminates the manual ON/OFF switching of load. A real time clock (RTC) is used to track the time and automatically switch ON/OFF the load. This project is required for load shedding time management which is used when the electricity demand exceeds the supply and there comes a need for manually switching ON/OFF the electrical devices in time. Hence this system eliminates the manual operation by automatically switching the load ON/OFF. A matrix keypad is interfaced with the microcontroller from where the specified time is input to the microcontroller when this input time equals to the real time, based on the commands the microcontroller initiates that particular relay to switch ON/OFF the load. The time is displayed on a seven segment display.

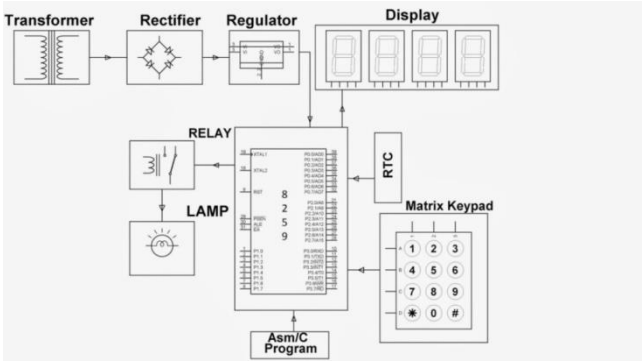


Fig 48: Block diagram of the System

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

BLOCK DIAGRAM EXPLANATION:

The various blocks in the circuit are:

1. Transformer
2. Regulators
3. LCD display
4. Microcontrollers
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 pin out. 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, a *switching 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 masks 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.

RELAY OUTPUT

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 checks 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.

WORKING:

The AC power supply from mains first gets converted into and unregulated DC and then into a constant regulated DC with the help of this circuit. The circuit is made up of transformer, bridge rectifier made up from diodes, linear voltage regulator 7805 and capacitors. If you observe, the working of the circuit can be divided into two parts. In the first part, the AC Mains is converted into unregulated DC and in the second part, this unregulated DC is converted into regulated 5V DC. So, let us start discussing the working with this in mind. Initially, a 230V to 12V Step down transformer is taken and its primary is connected to mains supply. The secondary of the transformer is connected to Bridge rectifier (either a dedicated IC or a combination of 4 1N4007 Diodes can be used). A 1A fuse is placed between the transformer and the bridge rectifier. This will limit the current drawn by the circuit to 1A. The rectified DC from the bridge rectifier is smoothened out with the help of 1000µF Capacitor. So, the output across the 1000µF Capacitor is unregulated 12V DC. This is given as an input to the 7805 Voltage Regulator IC. 7805 IC then converts this to a regulated 5V DC and the output can be obtained at its output terminals.

ADVANTAGES:

- 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

- Manpower dependencies are less.
- Power can be saved.
- Low cost.
- Easy to use.
- Accuracy in time
- Effective distribution of power.
- We can set the time in advance.

FUTURE SCOPE:

This project can be advanced in which the distribution point monitored by one central location. The relays are used to cut off supply of concerned geographical region through circuit breaker. In this system user can send commands to concerned DP to read the remote electrical parameters. This system can repeatedly send the real time electrical parameter data like active power, reactive power, voltage, current, frequency etc., periodically in the form of SMS to the user. It can be designed to send SMS alerts when relay trips. In this power system microcontroller are being used to effectively communicate with the sensors. The microcontroller has internal memory to hold the assembly code. .This internal memory is used to dump some set of assembly instructions into the controller. The operation of the micro-controller is completely dependent on these assembly instructions. The proposed system will overcome manual efforts for controlling the load shedding time break in a systematic way by sending SMS. Central unit can cut off power supply of specific zone by just sending an SMS to the concerned Distribution Point. These relay gets activated whenever the electrical parameters overdo the predefined values. The proposed system is designed to Load Monitoring.

APPLICATION:

1. Power distribution companies to shade load automatically, reduce down time for critical load, reduce spinning reserve requirement etc.
2. Implemented in factories to manage the on off time of different generator sets. Owner homes to switch on and off different generator set.

CONCLUSION:

According to our observations real time clocks (RTC) work more accurate than other time-keeping alternatives, it allows the main system to perform important tasks, and they do not consume much power. Functionality of Electronic devices can even increase by using real-time clocks (RTC). Certain electronic devices can rely on real time clocks when comparing the times of previous functions. If the functions have taken place within a selected period of time, device functions can be reduced drastically. Hence real time clocks interfaced with AT89S52 microcontrollers could be used extensively in load shedding time management system by utility departments.

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

HARDWARE AND SOFTWARE:

Hardware the Components used is 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 2 with the specification as follows:

SoC: Broadcom BCM2837
CPU: 4× ARM Cortex-A53, 1.2GHz
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

Fig 49: Raspberry Pi 3b

- **PIR Sensor (SB0061)**

It is a module used to detect the motion of the object. The Sensor specifications are 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

  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.

Fig 50: Pi Camera Module

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.

IMPLEMENTATION AND RESULTS:

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 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.

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.

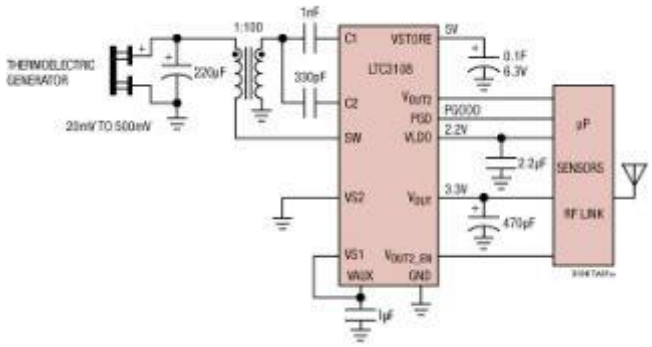


Fig 51: Circuit of Project

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.

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.

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. 13-1 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.
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 20 kHz to 200 kHz. 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 VOUT. 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 VOUT. 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

.

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. SETTINGS FOR OUTPUT VOLTAGE		
VS2	VS1	V_{OUT}
GND	GND	2.35
GND	VAUX	3.3
VAUX	GND	4.1
VAUX	VAUX	5

Table 12: Settings for Output Voltage

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 VOUT), 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.

5.2.4 Moisture Monitoring System:

Over-watering and under-watering both are harmful for plants. Roots need air as well as water. If the soil is constantly saturated, air cannot reach the roots and they suffocate. Also, excess water weakens the plant and makes it susceptible to various diseases, particularly fungal attacks. Under-watering, on the other hand, is equally harmful. Plants not receiving enough water droop from the top down and leaf edges turn brown. A moisture monitor can make things better.

A moisture monitor provides a solution to the above problem by monitoring the moisture level of the soil and producing an audio-visual alert when the moisture goes below a preset level, indicating that the plant needs to be watered. Fig shows the proposed layout of the device.

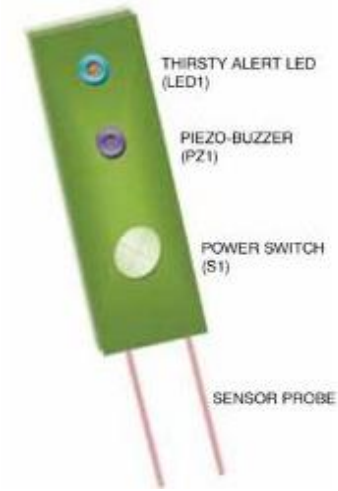


Fig 52: Moisture Sensor

Moisture monitors circuit and working

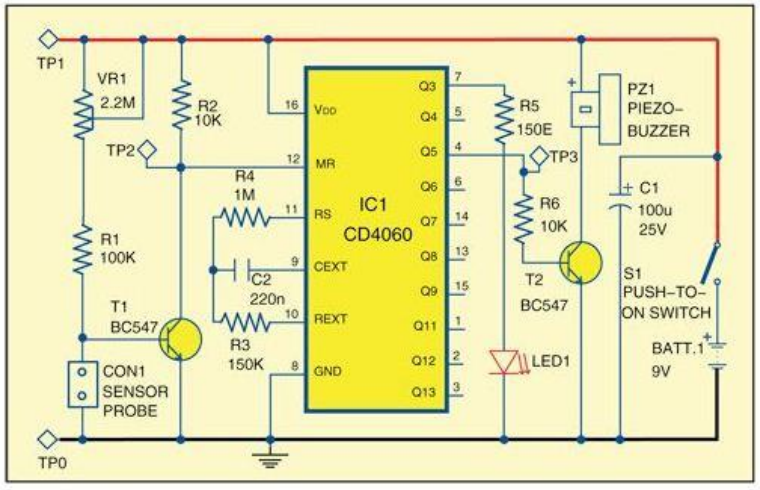


Fig 53: Circuit of Project

Test Points

Test point	Details
TP0	0 V, GND
TP1	9 V when switch S1 is on
TP2	High (8 V approx.) when soil is wet and low when soil is dry
TP3	Pulsetrain when soil is dry

Table 13: Test Points

The core of the circuit is inexpensive and built around popular 14-stage ripple-carry binary counter CD4060 (IC1) and a few commonly available components. Not all the outputs of the binary counter are available externally. The frequency at pin 7 (Q3) of IC1 is actually divided by 24=16 compared to initial astable frequency. Similarly, Q4 will have half the frequency of Q3. Components R3, R4 and C2 set the clock oscillator frequency to control the flash rate of LED1 and the beeping rate of PZ1. Pulses are enabled when reset pin (pin 12) is low and disabled, or inhibited, when reset pin is high.

Parts List

Working of the circuit is simple and straightforward. The base of transistor T1 is connected to a 'gimmick' potential divider comprising sensitivity control preset VR1 (2.2-mega-ohm), fixed resistor R1 and the moisture sensor probe. In standby state (soil in wet condition), IC1 is disabled because its reset pin 12 is directly tied to +9 V through resistor R2. However, when the soil is dry, transistor T1 is forward biased by VR1 and R1. This enables IC1 to oscillate. As a result, LED1 starts blinking and piezo buzzer PZ1 sounds to indicate that the plant needs water.

Moisture monitor requires a 9V supply. A PP3-size battery is recommended for compactness.

PARTS LIST

Semiconductors:	
IC1	- CD4060 oscillator-cum-divider
T1, T2	- BC547 npn transistor
LED1	- 5mm red LED
Resistors (all ¼-watt, ±5% carbon):	
R1	- 100-kilo-ohm
R2, R6	- 10-kilo-ohm
R3	- 150-kilo-ohm
R4	- 1-mega-ohm
R5	- 150-ohm
VR1	- 2.2-mega-ohm preset
Capacitors:	
C1	- 100µF, 25V electrolytic
C2	- 220nF ceramic disk
Miscellaneous:	
CON1	- 2-pin connector
BATT.1	- 9V battery/PP3 type
S1	- Push-to-on switch
PZ1	- Piezo-buzzer

Table 14: Parts List

Construction and testing

An actual-size, single-side PCB for flora caretaker is shown in Fig. 3 and its component layout in Fig. 4. After construction, enclose the whole circuit in a suitable crystalline tube or box. The moisture sensor probe can be constructed using two small metal rods (steel or copper) mounted vertically with a small gap (about 10 mm) in between them. These two metal rods must be supported by a small insulated (wooden or plastic) board. You can place one flora caretaker in each plant pot for constant monitoring of soil moisture.

5.2.5 Home Automation Using IoT:

The process of controlling or operating various equipment, machinery, industrial processes, and other applications using various control systems and also with less or no human intervention is termed as automation. There are various types of automation based on the application they can be categorized as home automation, industrial automation, autonomous automation, building automation, etc.

Home Automation

Home automation is the process of controlling home appliances automatically using various control system techniques. The electrical and electronic appliances in the home such as fan, lights, outdoor lights, fire alarm, kitchen timer, etc., can be controlled using various control techniques.

Wireless Home Automation using IOT (Internet of Things)

There are various techniques to control home appliances such as IOT based home automation over the cloud, home automation under Wi-Fi through android apps from any Smartphone, Arduino based home automation, home automation by android application based remote control, home automation using digital control, RF based home automation system and touch screen based home automation.

Required Components & Materials

The essential components and materials for home automation using IOT project can be listed as a Wi-Fi module, Opto-coupler, TRIAC, resistors, capacitors, diode, regulator, loads (home appliances). There are various ecommerce websites that are providing facility to purchase all the required components online such as a project kit consisting of individual components essential to design a particular project.

Required Blocks for Home Automation Project

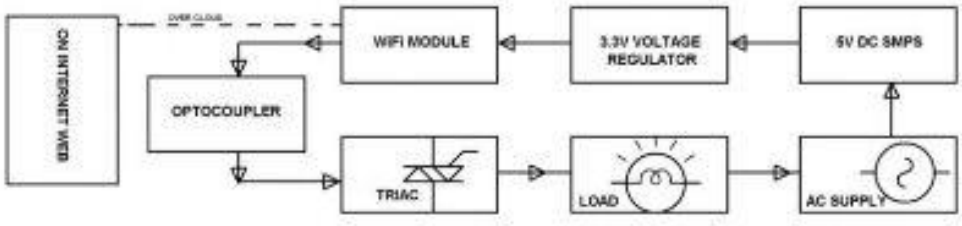


Fig 54: Block Diagram of System

The home automation using IOT project consists of various blocks such as power supply, Optocoupler, Wi-Fi module, TRIAC, voltage regulator, SMPS (Switch Mode Power Supply) and load.

Designing DIY Blocks of Home Automation System

There various modules and blocks used for designing home automation using IOT project such as Wi-Fi module, voltage regulator, Optocoupler, TRIAC and so on.

Wi-Fi Module

Wi-Fi (Wireless Fidelity) is a wireless networking technology used for exchanging the information between two or more devices without using cables or wires. There are various Wi-Fi technologies like Wi-Fi 802.11a, 802.11b, 802.11g and 802.11n. Here, in this project Wi-Fi module is used to receive commands from the internet and activate loads through TRIAC & Optocoupler by executing a program written within the Wi-Fi module. Hence, no microcontroller is used in this project to drive loads.

Voltage Regulator

Voltage regulator is an electronic device used for regulating voltage in a power system. There are various types of voltage regulators such as variable voltage & fixed voltage regulators which are again subdivided into several types like electro-mechanical, automatic voltage, linear, hybrid regulators, etc. Here, in this project 3.3V voltage regulator is used to provide required power supply to a Wi-Fi module from 5V SMPS power supply.

Fig 55: Voltage Regulator

Opto-Coupler

The package of light emitting device and light sensitive device without any electrical connection is called as an Optocoupler or Optoisolator. There will be a beam of light used as a connection between these light emitting & light sensitive devices. The light emitting device is an LED and light sensitive device in this project is a TRIAC. Thus, Optocoupler and TRIAC are used to drive loads based on the signal received from the Wi-Fi module.

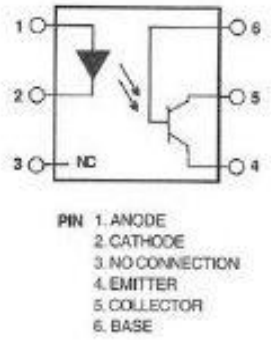


Fig 56: Opto-Coupler

Connecting the Home Automation Circuit

The load can be controlled and monitored using a web page with user configurable front end. The user can send commands through the allotted IP and these commands are fed to Wi-Fi module. The Wi-Fi module is configured to access internet using any nearby wireless modem. The commands received by a Wi-Fi module are executed by a program within a Wi-Fi module. The Wi-Fi module is interfaced to TRIAC & Optocoupler through the loads are turned ON & OFF based on commands. The load status (ON or OFF) will be displayed on the web page.

5.2.6 PC Based Electrical Load Control:

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.

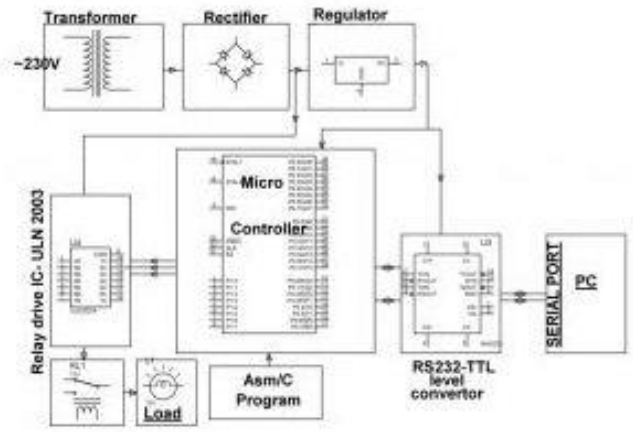


Fig 57: Circuit of Project

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 object code.

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.

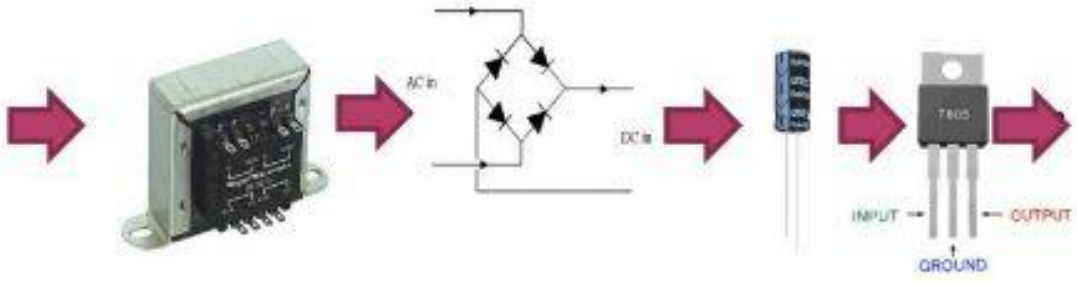


Fig 58: Power Supply configuration

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

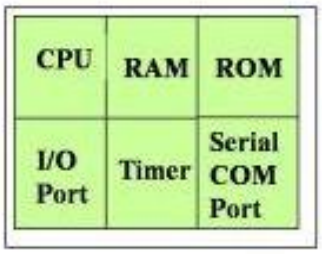


Fig 59: Microcontroller I/O

MAX 232

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.

The 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

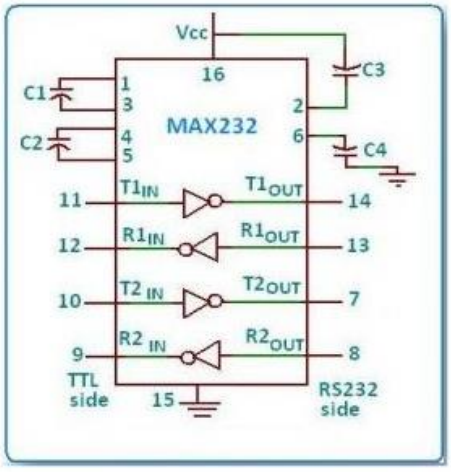


Fig 60: MAX 232 Microcontrollers

Db9 Connector

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

Fig 61: Db9 Connector

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.

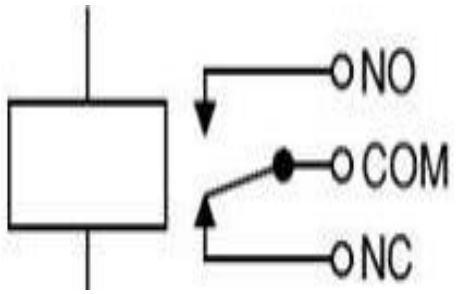


Fig 62: Relay

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.

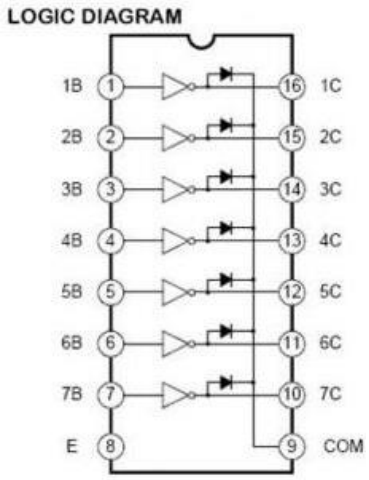


Fig 63: ULN2003 Relay Driver

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

5.2.7 Electrical Parameter Measurement:

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.

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 i.e. 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.
• **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 AC 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 $2\pi f$ with units in radians per second, rad/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.

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	Siemens	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 V_L **= -L(di/dt)**
Power	Watts	W	Unit of Power **P = V × I** or $I^2 \times R$
Impedance	Ohm	Z	Unit of AC Resistance $Z^2 = R^2 + X^2$
Frequency	Hertz	Hz	Unit of Frequency ***f* = 1 ÷ T**

Table 15: Electrical Parameters & Units

CHAPTER 6: Swachh Bharat Abhiyan (Clean India)

6.1 Strategic Technology options for Swatchh Bharat Abhiyan (SBA) (Clean India) with Photograph.

❖ **Swatchh Bharat Abhiyan**

- On October 2nd 2014, Prime Minister Narendra Modi officially launched the Swachh Bharat Abhiyan (SBA) at Raj path, New Delhi, by taking up the broom to clean a road.
- The SBA was launched with eight core objectives. The principal objective was to ensure a healthy life for Indian citizens and to improve India's semblance globally.
- SBA has specific goals aimed for the rural as well as urban areas.
- Gramin SBA, i.e., for the rural areas has a target of 11 crore household latrines to be installed in villages by 2019. The central agency for this work is the Drinking Water and Sanitary Ministry.
- The Urban SBA has a target to build 1 crore household toilets, 2.5 lakh community toilets, 2.6 lakh public toilets and solid waste management. Ministries are to build 50,000 toilets in schools by August 2015.The central agency for this work is the Urban Development and Housing Ministry.
- SBA has to achieve its ultimate goal by 2019, the 150th birth anniversary of Mahatma Gandhi, to ensure a clean and green India (every city and village). The intention and expected results of SBA undoubtedly are remarkable however, apt implementation remains as a significant challenge.

❖ **Strategic**

- The focus of the Strategy is to move towards a 'Swachh Bharat' by providing flexibility to State Governments, as Sanitation is a state subject, to decide on their implementation policy and mechanisms, taking into account State specific requirements.
  It is suggested that Implementation Framework of each State be prepared with a road map of activities covering the 3 important phases necessary for the
- Programmer:
- Planning Phase
- Implementation Phase
- Sustainability Phase
- Each of these phases will have activities that need to be specifically catered for with concrete Plans of Action, which shall need specific preparation and planning.

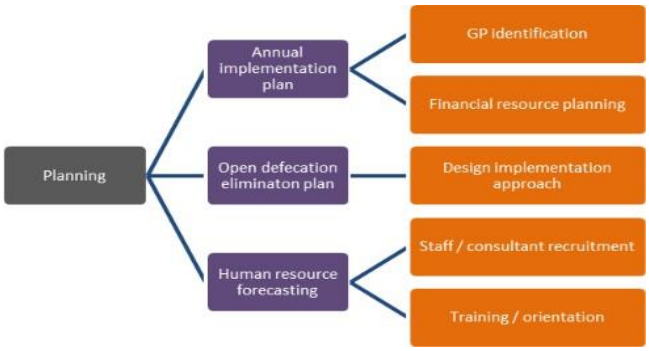


Fig 64: Strategic Model of SBA

6.2 Guidelines for the process of the implementation of SBA

- Implementation of SBM (G) is proposed with 'District 'as the base unit, with the goal of creating ODF GPs.
- A project proposal shall be prepared by a District, and scrutinized and consolidated by the State Government into a State Plan.
- Funds are to be made available for these preliminary IEC works including for triggering behavior change. This will endeavor to reach every household in every community and shall disseminate information regarding the need for safe sanitation, and the ill effects of open defecation getting the population oriented towards satisfying their felt-needs.
- The proliferation of educational facilities in the rural areas provides the opportunity to utilize an approach that should essentially include an element that involves school and college children as potential agents of change in homes.
- The built-in flexibility in the menu of options is to give the poor and the disadvantaged families' opportunity for subsequent up gradation of their toilets depending upon their requirements and financial position.
- The provision of Incentives for individual household latrine units to the rural households is available to States which wish to provide the same this may also be used to maximize coverage so as to attain community outcomes.
- The Scheme shall aim to saturate coverage in the first instance the States/ Districts/ GPs in all major river basins of India e.g. Sutlej , Ravi, Beas, Ganga, Yamuna, Godavari, Narmada, Tapti, Kaveri, Brahmaputra. This will ensure the outcomes required for pollution free rivers, in addition to ODF communities.
- A robust Monitoring arrangement has to be put in place to monitor open defecation status of a village, the implementation of Solid and Liquid Waste Management projects as well as the construction and us of Household, Schools, Aaganwadi toilets and Community Sanitary Complexes. The monitoring has inter-alia also to use a robust community led system, like Social Audit.
- To accelerate coverage in Gram Panchayat selected under the Sansad Adarsh Gram Yojana, these GPs may be selected on priority for coverage under the SBM.

CHAPTER 7: Village Condition due to Covid-19

With respect to COVID 19 pandemic, Ministry of Panchayati Raj, Government of India in close collaboration with State Governments has taken various initiatives. Close consultation and guidance of the State as well as District authorities is being maintained to ensure that lock down conditions are not violated and norms of social distancing are scrupulously followed to contain the spread of the disease. India has overtaken Brazil and become the second-worst affected country in the world by the corona virus pandemic, with more than 4 million cases. COVID-19 had mostly remained in India's cities, but the disease is now spreading to rural India – an area with over 850 million people and far worse healthcare. The reason for this shift appears to be migrant workers who have been returning to their villages since lockdown was eased at the end of June. The medical response to stop the spread and treat those infected has been inadequate, according to media reports. With one trained doctor for every 1,497 people, against the World Health Organization recommended one per 1,000, and public health expenditure for 2018 at just 1.3% of GDP, India faces an uphill struggle in dealing with the Pandemic. While two-thirds of India's population lives in rural areas, there are almost four times as many health workers per person in cities. Most rural communities rely on untrained health workers. Over two-thirds of these rural health providers have no formal medical training, but remain the only option of medical support for most of the rural population.

7.1 Taken steps in Kalakachha village related to existing situation with photograph:

During interaction with the Sarpanch, we got to know that quarantine place and home quarantine facility were implemented during the lockdown. According to Sarpanch and villagers; in the Kalakachha village the sanitization process was done during the lockdown period when first case of covid 19 came in the village.

Fig 65: Effects of COVID-19

The novel corona virus disease (COVID-19) pandemic has left the urban poor in India poorer, hungrier and with less nutrition than their rural counterparts, a recent report has claimed.

Passage to the city had usually helped the urban poor in the country beat hunger, it added.

A large section of rural residents could cushion the blow of pandemic-driven economic disruption due to food grain via the public distribution system (PDS). The urban poor's access to such ration, however, was minimal, according to the report compiled by *Hunger Watch.*

Hunger Watch is a loose collection of social groups and movements. It came together for a periodic study of the actual status of hunger, food access and livelihood security among various disadvantaged populations in the wake of the country-wide lockdown in March 2020.

This is the first report of the collective, based on interviews with 3,994 households across 11 states. The data was collected in October 2020 and compared with pre-lockdown levels on the same parameters.

The report, released May 6, 2021, showed that on average, urban respondents reported a 15 percentage point worse condition than their rural counterparts across all important parameters.

Incomes reduced by half or a quarter for more than half the urban respondents while it was a little over one-third for rural respondents. The consumption of grains and pulses were at least 12 percentage points lower for urban respondents.

Similarly, a decline in nutritional quality and quantity was more among the urban respondents as was the need to borrow money for buying food.

Some 54 per cent urban respondents had to borrow money for food. This was 16 per cent lower for rural respondents. Some 45 per cent rural respondents had to skip a meal in October 2020; nearly two-thirds of the urban respondents had to do so in the same month.

The social security schemes also had a relatively better coverage among the rural poor as rural areas had better access to PDS rations. A larger proportion of households in urban areas did not have access to ration cards.

"This calls for special attention on social protection measures including schemes for provision of subsidized food and employment guarantee in urban areas," the report said.

It added that given the massive shock experienced by the urban poor, it was hoped that there would be an announcement of an urban employment programmed in the Union Budget. But that did not happen.

Stalked by hunger

Overall, levels of hunger and food insecurity remained high, with little hope of the situation improving without measures specifically aimed at providing employment opportunities as well as food support.

Roughly two-thirds of nearly 4,000 persons interviewed by *Hunger Watch* reported that the quantity of food they consumed in October 2020 had either "decreased somewhat" or "decreased a lot" compared to before the lockdown.

Things were much worse for socially vulnerable groups such as households headed by single women, households with people having disabilities, transgender people and old persons without caregivers.

For instance, 58 per cent of the older people without caregivers had to go to sleep at night sometimes without a meal. This was the case with 56 per cent of households headed by single women and 44 per cent of households with disabled persons.

The net of hunger became more widespread as more people had to start skipping some meal in a day. Even among those who never had to skip meals before the lockdown, about one in seven had to skip meals "often" or "sometimes."

The survey found that 27 per cent of the respondents had to go to bed without eating "sometimes" and about one in twenty had to go to bed without eating "often" in October, 2020.

The numbers are similar for those who had to skip meals in the same month. Some 56 per cent of the respondents "never" had to skip meals before. There is a 10 percentage point increase in the number of people who had to skip some meal in the month preceding the survey period.

This, even when India had a record food grain production at 296.65 million tons in the 2019-20 crop year (July-June), beating the target of 291.1 million tones and four per cent higher than the last year.

Despite this, the additional support provided for poor and informal sector workers introduced as part of the Pradhan Mantri Garib Kalyan Yojana as well as the Atmanirbhar Bharat package, ended in October 2020.

It was only recently announced again for two months in the wake of lockdown-like restrictions in several states, but that too only for ration card holders.

The figures in the Hunger Watch report are alarming, especially when seen in conjunction with the recent rounds of NFHS (National Family Health Survey) data.

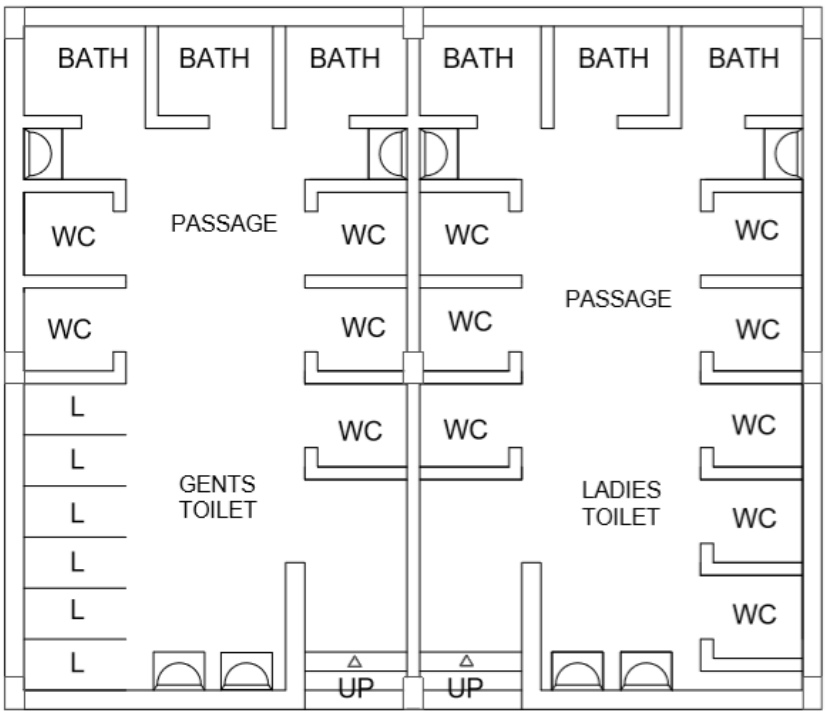
The NFHS data has shown either a worsening or stagnation in malnutrition outcomes such as prevalence of stunting and wasting among children and high levels of anemia among women and children.

CHAPTER 8: Sustainable Design Planning Proposal (Prototype Design)-I (Scenario / Existing Situation / Proposed Design in AutoCAD / Recapitulation Sheet / Measurement Sheet / Abstract Sheet / Sustainability of Proposal / Any other software)

8.1 Design Proposals

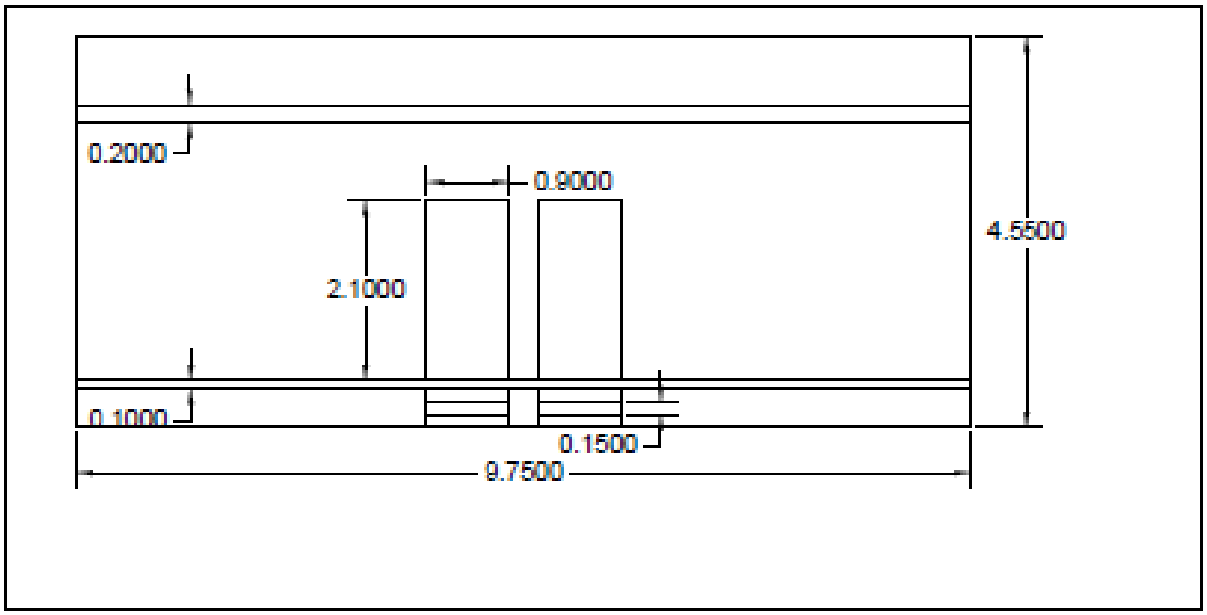
8.1.1 DESIGN OF PUBLLIC TOILET

PLAN

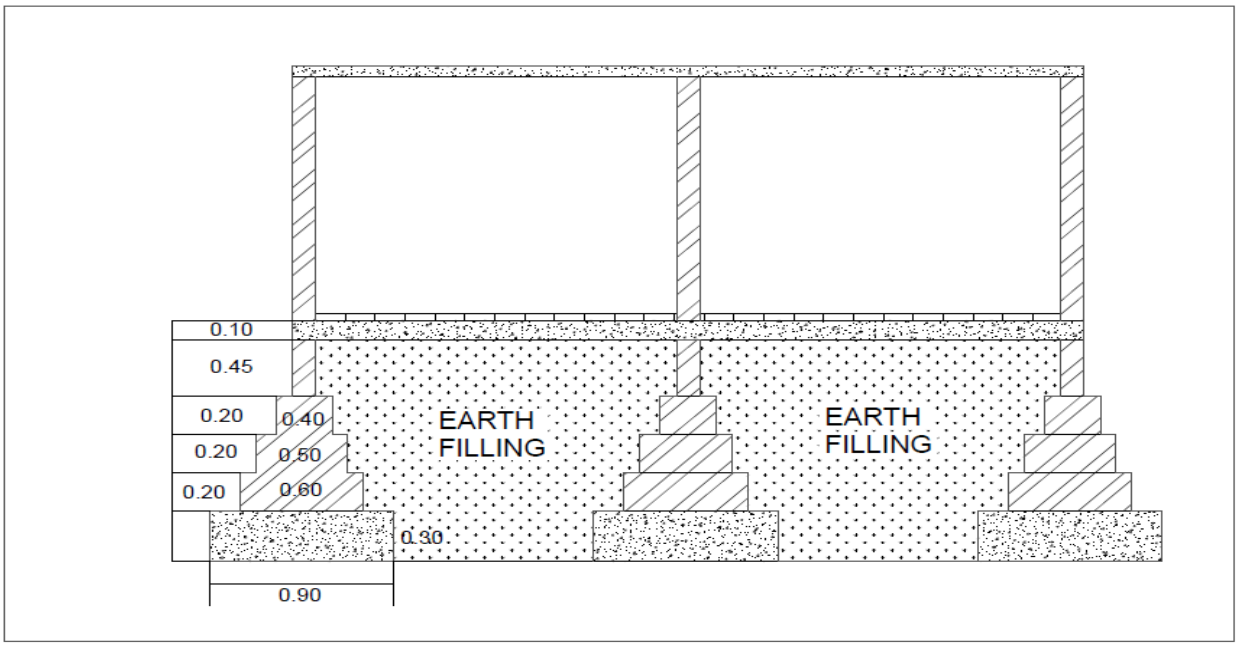


SR. NO.	OBJECT	LENGTH	WIDTH
1	BATH	3'3"	4'
2	WC	3'3"	4'
3	LETRINE	4'	2'
4	WASH	2'	1'6"

ELEVATION



SECTION



MEASUREMENT SHEET

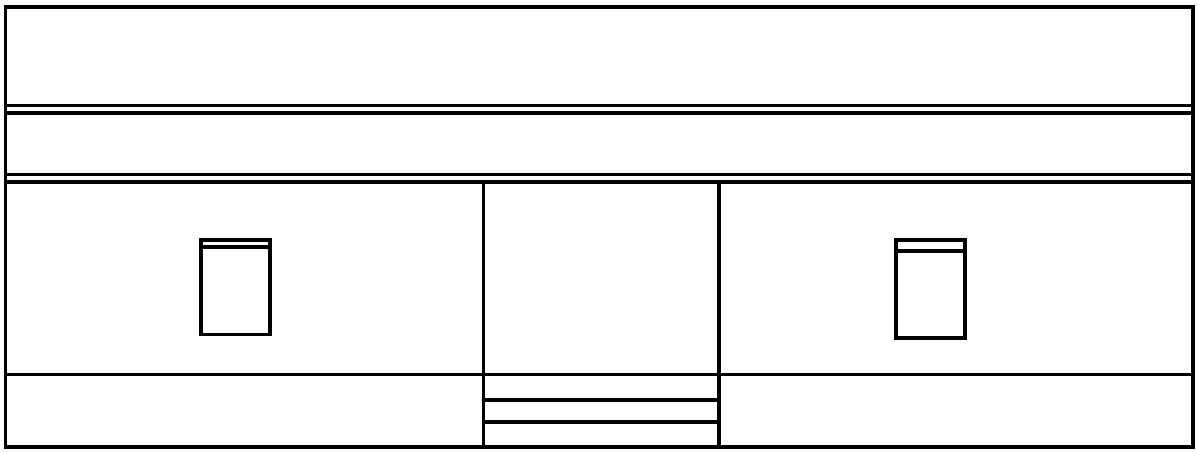
Sr. No	Description	No	L	B	H	Quantity	Total quantity
1	Excavation	1	63.66	0.9	1.1	63.023	**63.023**
2	B.B.C.C.	1	63.66	0.9	0.2	11.45	**11.45**
3	Brick Masonry up to plinth						
	First step	1	65.46	0.5	0.3	9.81	
	Second step	1	65.91	0.4	0.3	7.9	
	Third step	1	66.36	0.3	0.85	16.72	**34.43**
4	Earth filling in plinth	1	9.15	7.8	0.55	39.25	**39.25**
5	P.C.C. in plinth	1	63.66	0.3	0.1	1.90	**1.90**
6	Brick work in super structure	1	63.66	0.2	3	40.086	
	Deduction of door					-2.42	
	Deduction of lintel					-0.646	**37.02**
7	R.C.C. lintel					0.645	**0.645**
8	R.C.C. slab	1	9.75	8.41	0.2	16.40	**16.40**
9	Parapet wall	1	63.66	0.3	0.8	15.27	**15.27**
10	Plaster work						
	Inside	1				155.85	
	Outside	1				101.7	**257.55**
11	Flooring work	1	9.15	7.8		71.37	
	Deduction for door	26	0.9	0.3		-7.02	**64.35**

ABSTRACT SHEET

Item No	Item Description	Quantity	Per	Rate	Amount
1	Excavation for foundation	63.023	Cubic meter	170	10713.91
2	P.C.C. in foundation	11.45	Cubic meter	4000	45800
3	Brickwork up to plinth	34.43	Cubic meter	7000	248010
4	Earth filling in plinth	39.25	Cubic meter	95	3728.75
5	P.C.C. in plinth	1.90	Cubic meter	4000	7600
6	Brickwork in superstructure	37.02	Cubic meter	7000	259140
7	R.C.C. Lintel	0.645	Cubic meter	9000	5805
8	R.C.C. Slab	16.40	Cubic meter	9000	147600
9	Parapet wall	15.27	Cubic meter	7000	106890
10	Plaster work	257.55	Cubic meter	1200	309060
11	Flooring work	64.35	Cubic meter	750	4826.25
				TOTAL	**1149173.91**

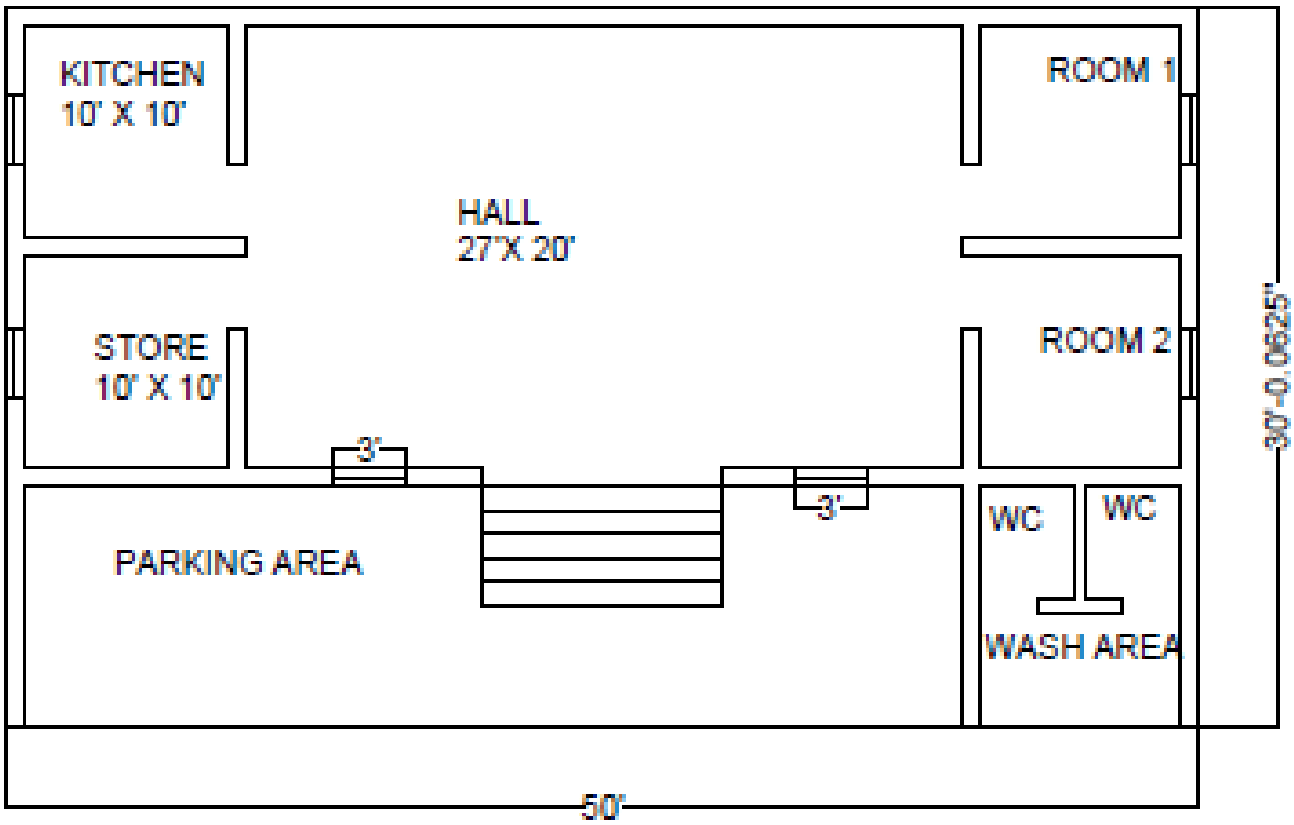
8.1.2 DESIGN OF COMMUNITY HALL

ELEVATION



ELEVATION

PLAN



MEASUREMENT SHEET

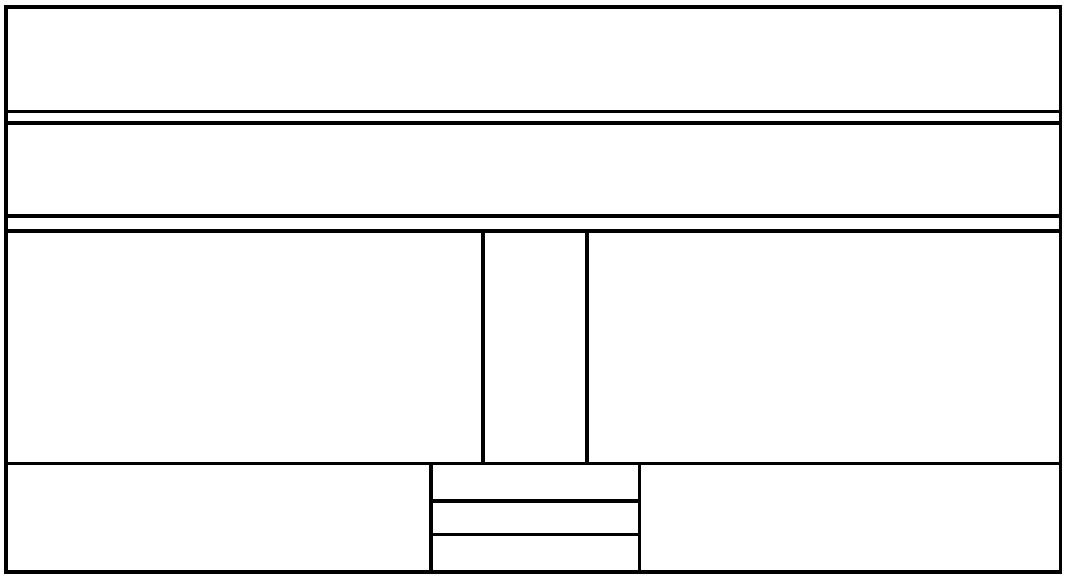
Total length						
L=8.30x4=33.23 m						
L=3.076x3=9.23 m						
L=2.46x1=2.46 m						
Total centre line length=44.92 m						
Total number of junction=4						
Sr No.	Item description	no	length	width	height	Quantity
1	Excavation in foundation					
	Net C.L length	1	43.12	0.9	1.5	58.12
	=44.92-0.5x0.9x4					
	=43.12 m					
2	Plain cement concrete in foundation 1:3:6	1	43.12	0.9	0.3	11.6424
3	Brickwork in foundation up to plinth					
	Step 1					
	L =44.92-0.5x0.5x4					
	=43.72	1	43.72	0.6	0.2	5.2464
	Step 2					
	L 44.92-0.5x0.5x4					
	=44.92	1	43.92	0.5	0.2	4.39
	Step 3					
	L 44.92-0.5x0.4x4					
	=44.12 m	1	44.12	0.4	0.2	3.52
	Step 4					
	L =44.92-0.5x0.3x4					
	=44.32 m	1	44.32	0.3	1.2	15.95
	H=(1.5-0.3-3x0.2)+0.6					
	=1.2 m					
					Total quantity	29.5

ABSTRACT SHEET

No.	Item description	quantity	rate	per	Amount Rs.
1	Excavation in foundation	58.13 m3	85	Cubic meter	4940.2
2	B.B.C.C. in foundation	11.64	3200	Cubic meter	37148
3	Brickwork up to plinth	29.5	3200	Cubic meter	94400
4	brickwork in super structure	39.88	3500	Cubic meter	139580
5	Brick work for parapet wall	17.04	3500	Cubic meter	59640
6	R.C.C. slab	13.43	8800	Cubic meter	1181840
7	Plaster work	257.45	150	Cubic meter	38618
				Rs.	492600
				Add 5% lump sum	24629
				TOTAL	**519228.2**

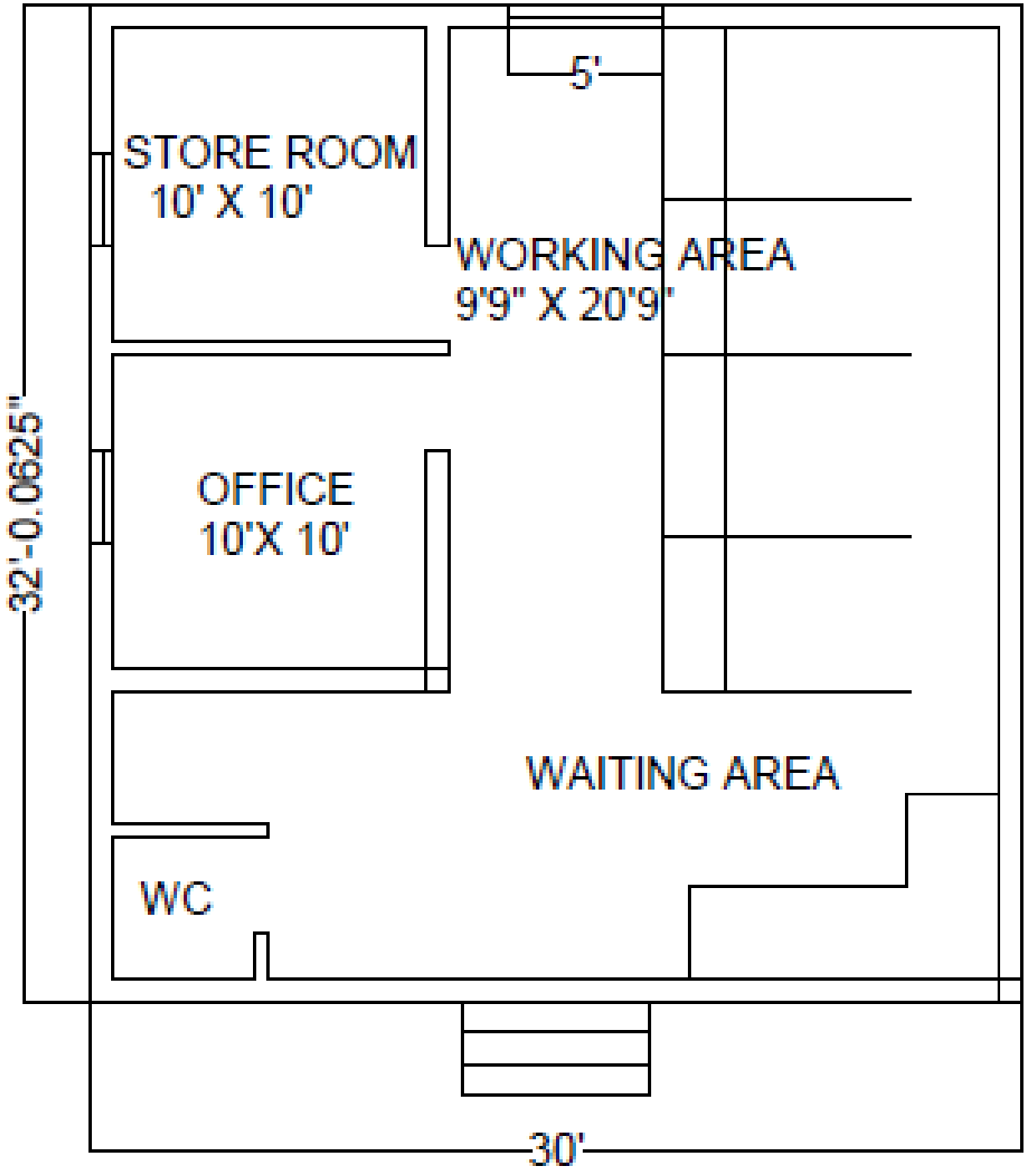
8.1.3 DESIGN OF POST OFFICE

ELEVATION



ELEVATION

PLAN


5'
STORE ROOM
10' X 10'
WORKING AREA
9'9" X 20'9"
32'-0.0625"
OFFICE
10'X 10'
WAITING AREA
WC
30'

MEASUREMENT SHEET

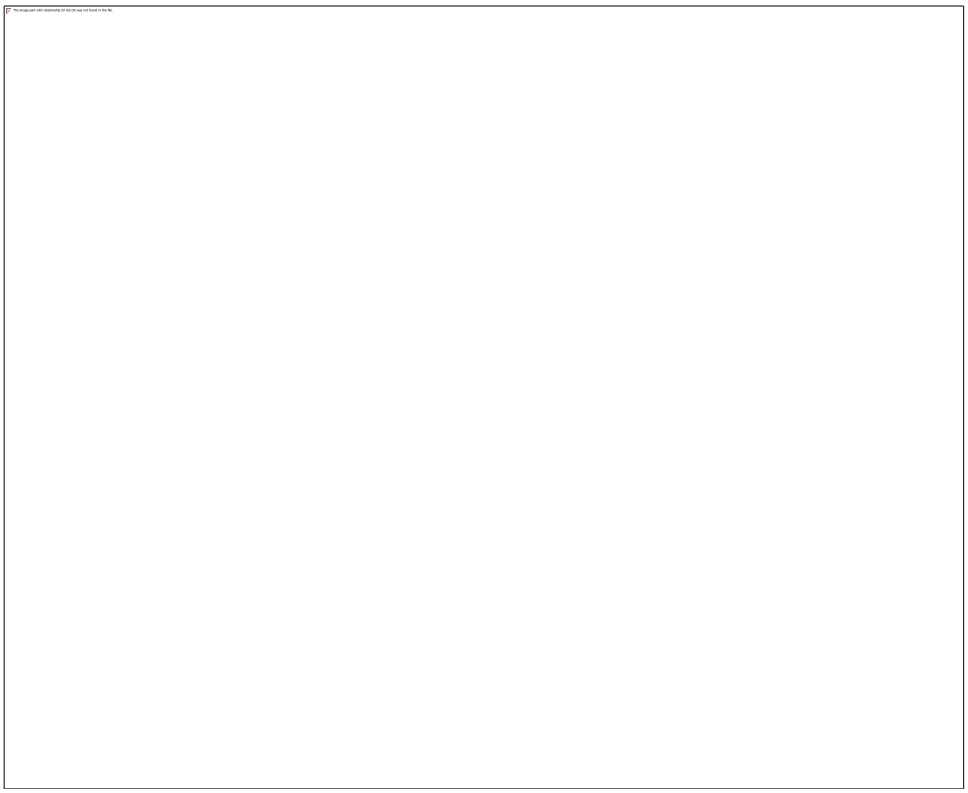
Total C.L. length						
L=9.14x2=18.28 m						
L=10x2=20 m						
L=1.60x4=6.4 m						
L=3.04x2=6.08 m						
L=1x1=1 m						
Total C.L. length = 57.16 m						
Total no. of junction = 8						
Sr. No	Item description	No	length	width	height	Quantity
1	Excavation in foundation	1	53.56	0.9	1.5	72.30
	Net CL. Length					
	=57.16-0.5x009x8					
	=53.56 m					
2	Plain cement concrete in foundation in 1:3:6	1	53.56			
3	Brickwork in foundation	1	54.76	0.6	0.2	6.57
	Step 1					
	L=57.16-0.5x0.6x8					
	=54.76 m					
	Step 2	1	55.16	0.5	0.2	5.51
	L=57.16-0.5x0.5x8					
	=55.16 m					
	Step 3	1	58.74	0.4	0.2	4.70
	L=57.16-0.5x0.3x8					
	=58.74 m					
	Step 4	1	55.56	0.3	1.2	20.14
	L=57.16-0.5x0.3x8					
	=55.56 m					
	H=(1.5-0.3-3x0.2)+0.6					
	=1.2 m					
					Total quantity	36.92
4	Brickwork in superstructure C.M.(1:6)					
	L=57.16-0.5X0.3X8					
	=55.56 m	1	55.56	0.3	3	5036
5	RC.C. Slab	1	19.80	19.2	0.12	45.60

ABSTRACT SHEET

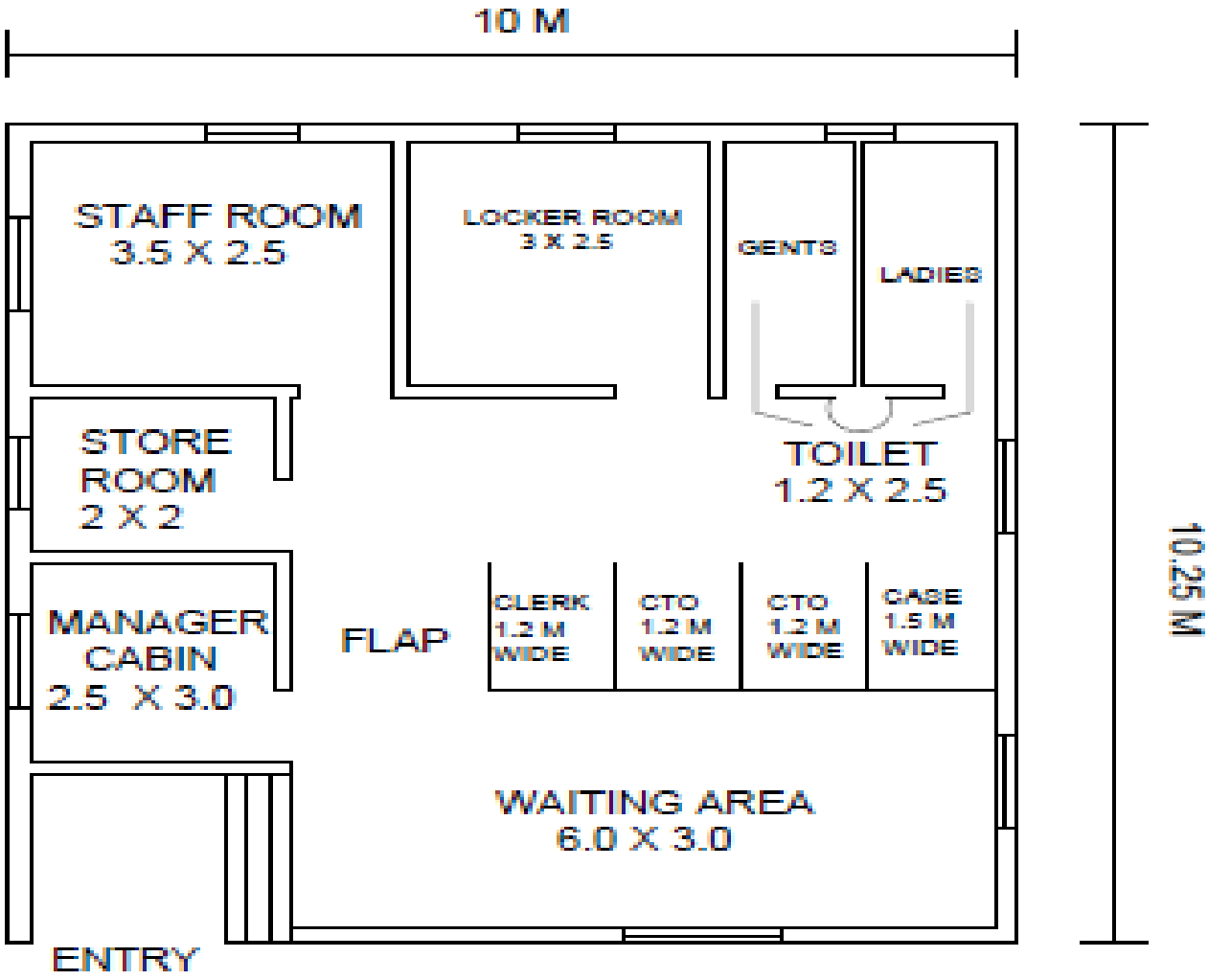
No.	Item description	Quantity	Rate	Per	Amount Rs.
1	Excavation in foundation	72.30	85	Cubic meter	6145
2	B.B.C.C in foundation	14.46	3200	Cubic meter	46272
3	Brickwork up to plinth	36.92	3200	Cubic meter	118144
4	Brickwork in superstructure	50.36	3500	Cubic meter	178360
5	Brickwork for parapet wall	10.477	3500	Cubic meter	36672
6	R.C.C. Slab	45.60	8800	Cubic meter	401280
7	Plaster work	46.76	150	Cubic meter	7015
				Rs.	793888
				Add 5 % lump sum	39694
				TOTAL	**833582**

8.1.4 DESIGN OF BANK

ELEVATION



PLAN


10 M
STAFF ROOM
3.5 X 2.5
LOCKER ROOM
3 X 2.5
GENTS
LADIES
TOILET
1.2 X 2.5
STORE
ROOM
2 X 2
MANAGER
CABIN
2.5 X 3.0
FLAP
CLERK
1.2 M
WIDE
CTO
1.2 M
WIDE
CTO
1.2 M
WIDE
CASE
1.5 M
WIDE
WAITING AREA
6.0 X 3.0
ENTRY
10.25 M

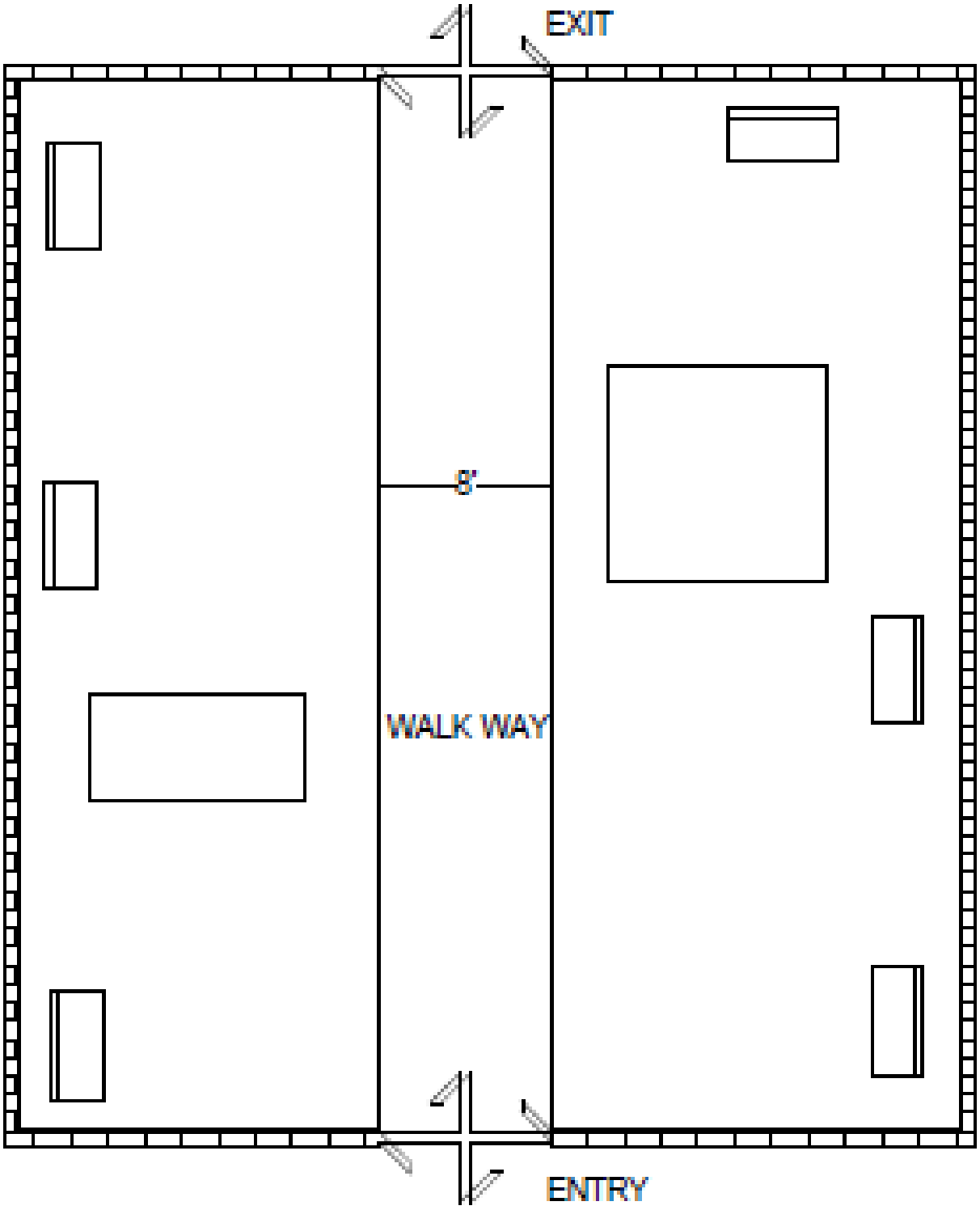
MEASUREMENT SHEET

Sr No.	Item description	no	length	width	height	Quantity
1	Excavation in foundation					
	Net C.L length	1	54.4	0.9	1.5	58.12
	=54.4 m					
2	Plain cement concrete in foundation 1:3:6	1	54.4	0.9	0.3	11.6424
3	Brickwork in foundation up to plinth					
	Step 1	1	55.6	0.6	0.3	10.008
	Step 2	1	56.8	0.3	0.2	3.408
	Step 3	1	57	0.228	0.8	10.40
	Step 4	1	57.8	0.3	1.2	20.80
					Total	44.616
4	Brickwork in superstructure C.M.(1:6)					
	External wall	1	57	0.228	3	38.98
	Deduction door & window					
	D1	1	1.2	0.228	2.1	0.57
	D2	5	1.0	0.228	2.1	2.394
	D3	2	0.8	0.228	2.1	0.766
	W1	3	0.8	0.228	1.2	0.656
	W2	3	0.6	0.228	1.2	0.49
	V	4	0.6	0.228	0.6	0.32
						5.196
5	RCC work					
	Slab	2	10.25	10	0.12	24.6
	Lintel					0.675
					Total	25.275 m3
6	2 cm thick marble flooring					
	Rooms	2	3.5	2.5		17.5
	Toilet	2	2.5	1.2		6
	Passage	1	7.5	10		75
	Total					98.5 m2

ABSTRACT SHEET

No.	Item description	Quantity	Rate	Per	Amount Rs.
1	Excavation in foundation	12.8412	85	Cubic meter	1091.502
2	B.B.C.C in foundation	9.512	3200	Cubic meter	30438.4
3	Brickwork up to plinth	20.130	3200	Cubic meter	64416
4	Brickwork in superstructure	9.640	3500	Cubic meter	33740
5	R.C.C. Slab	0.929	8800	Cubic meter	8175.2
6	Plaster work	45.876	150	Cubic meter	45.876
				Rs.	137906.9
				Add 5 % lump sum	6895.34
				TOTAL	**144802.24**

8.1.6 DESIGN OF A PUBLIC GARGEN



PUBLIC GARDEN

8.1.7 DESIGN OF A SOLAR POWER PLANT

1. Basic Project Details

Utilizing designing a Power plant on the N/A land of the village; our motive is to develop infrastructure, increase productivity and liability of the Village.

Project Details	
Design Name	Kalakachha 72 kW
Project Address	Lat: 21.054255 Lon: 72.954690
Prepared By	Aishan Mistry

Table 16: Basic Details of Solar Power Plant

System Matrices	
Module DC Name Plate	72 Kw
Inverter AC Name Plate	66 kW Load Ratio:1.09
Annual Production	118.6 MWh
Performance Ratio	74.1%
kWh/kWp	1,646.6
Weather Datasheet	TMY, 10km Grid, metronome (metronome)
Simulation Version	1f9edce3ce-66326158e8-b7b9cc5b96-a4e98e67ce

Table 17: System Matrices

2. Detailed Layout of the Design

1. **Row Spacing** is the edge-to-edge spacing between rows (in the N/S direction). This spacing can be set manually, or automatically calculated through the use of three different linked metrics:

a. Span / Rise define the ratio of the distance between rows over the height at the back of the module bank.

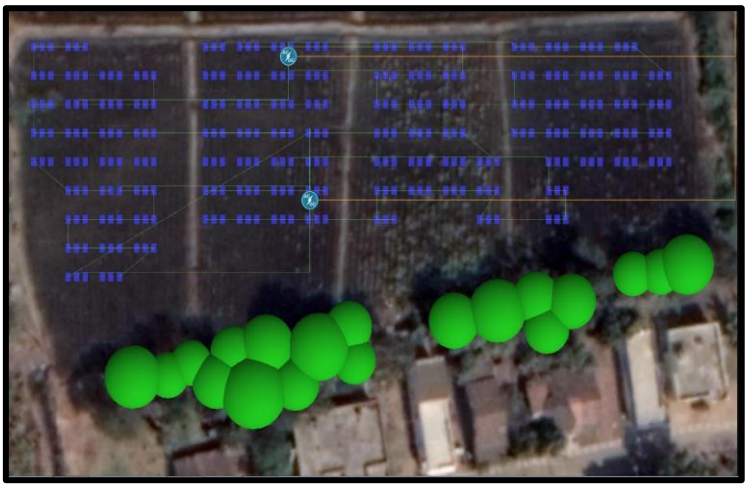


Fig 66: Design Top View

b. Ground Coverage Ratio (GCR) is the ratio of module area divided by the surface area covered by the modules

c. Time of Day specifies a day and time range the modules will not shade one another, based on sun angles at the project location

2. **Module Spacing** is the distance between modules on every side of each module and is generally used to define the spacing needed for module clips or similar items

3. **Frame Spacing** is the edge-to-edge spacing between frames (in the E/W direction).
   a. Frame Spacing now controls the distance between modules in the North/South direction, separating blocks of modules in the same row
   b. Peak Spacing controls the gap at the peak of the dome, where the modules meet to form the high point of their connection

3. Shading Heat Map

Sources of shading loss

There are three best practices for modeling shading

1. **Row-to-row shading**: For fixed-tilt arrays (i.e. where the modules are tilted up along a flat surface), it is possible that the modules shade each other, especially if the row spacing is narrow or if the tilt is high. These shading losses are calculated automatically (and there is no other way for the user to modify the losses, other than reducing tilt or increasing spacing).

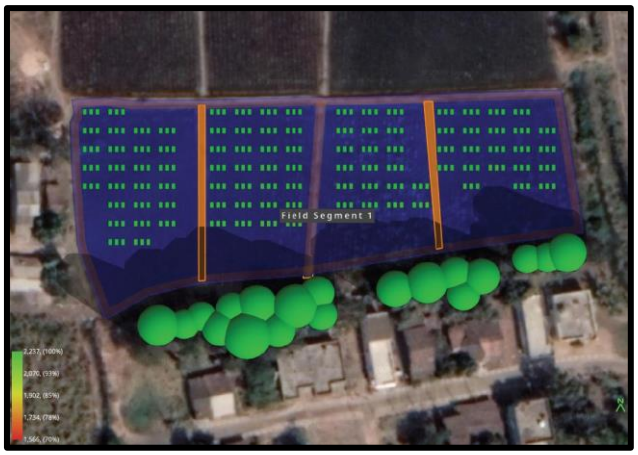


Fig 67: Shading Heat Map

2. **Keepout Obstruction Shading**: If a Keepout with a height is defined in the Designer, then the shadows from that Keepout will be calculated and applied on each module in the array, for each hour of the year. Shading losses are automatically applied in the simulation based on the height (and proximity) of the Keepout relative to the modules.

3. **Horizon file**: Shade can be applied using a Horizon File. Horizon files are a collection of azimuth/elevation points that define the horizon around the array. These are attached to a Condition Set under the "Shading" section.

Shading Report:

Description	Tilt	Azimuth	Modules	Nameplate	Shaded Irradiance	AC Energy	TOF[2] (1)	Solar Access (2)	Avg TSRF[2] (3)
Field Segment 1	26.5°	180.0°	288	72.0 kWp	2,169.6kWh/m^2	118.6 MWh[1]	99.3%	97.7%	97.0%

Table 18: Shading Report

1. **Tilt and Orientation Factor (TOF)**: compares the available irradiance for the actual tilt and orientation of the array to the ideal tilt and orientation for that area. It is expressed as a percentage, so in the image above the first array receives 96% of the irradiance that an optimally oriented array would receive.
2. **Solar Access %** refers to the percentage of irradiance left after accounting for shade. Mathematically: Shaded Irradiance / POA Irradiance = Solar Access.
3. **Total Solar Resource Factor (TSRF)**: compares the actual irradiance available accounting for both shade and TOF against an ideal orientation with zero shade losses. Simply put: TOF x Solar Access % = TSRF

4. Single line diagram

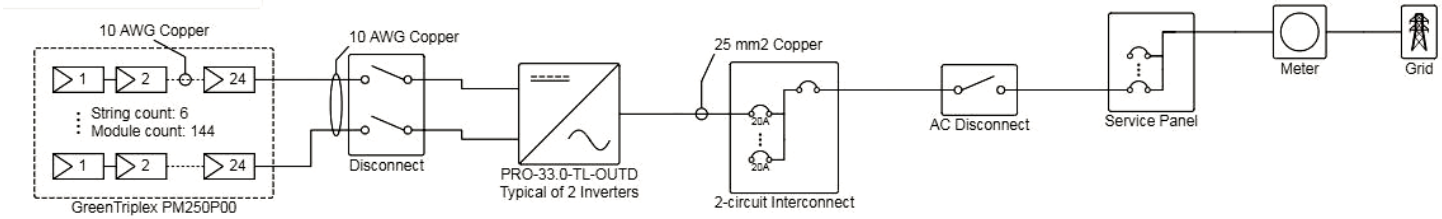


Fig 68: Single Line Diagram

Module Specification	
288x BenQ Green Triplex PM250P00	
STC Rating	**250 W**
Vmp	**30.1 V**
Imp	**8.26 A**
Voc	**37.8 V**
Isc	**8.75 A**

Table 19: Module Specification

Inverter Specification	
2x ABBPRO-33.0-TL-OUTD	
Max AC Power Rating	**33 Kw**
Max Input Voltage	**1,100 V**
Min AC Power Rating	**0 W**
Min Input Voltage	**580 V**

Table 20: Inverter Specification

Wire Schedule		
Tier	Wire	Length
AC Branch	**2x 25** mm^2	**2620 m**
String	**12x 10 AWG**	

Table 21: Wire Schedule

5. Monthly Production:

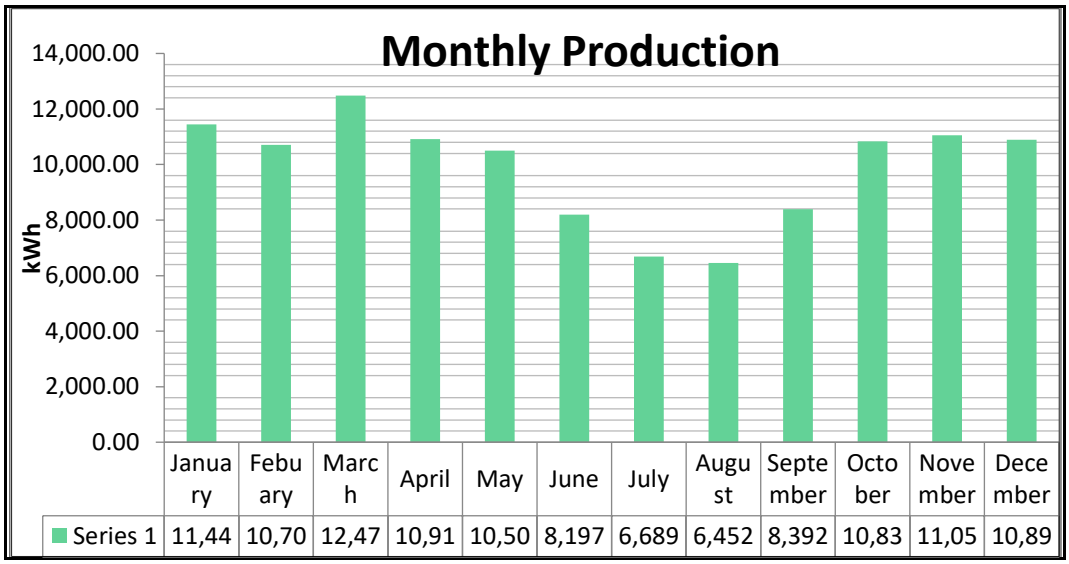


Fig 69: Monthly Production Report

Month	GHI (kWh/m2)	POA (kWh/m2)	Shaded (kWh/m2)	Nameplate (kWh)	Grid (kWh)
January	157.7	213	207.5	14,273.90	11,447.60
February	162.2	200.3	196.4	13,470.80	10,707.40
March	215.7	237.2	233.6	15,999.70	12,479.10
April	212.3	207.1	202.9	13,840.40	10,915.10
May	219.1	196.8	192	13,044.40	10,501.80
June	171.7	152.1	147.6	9,986.40	8,197.30
July	134.9	123.7	119.7	8,299.40	6,689.10
August	124.6	119	115.1	7,801.40	6,452.70
September	150.5	156.1	152.1	10,369.10	8,392.50
October	174.1	203.9	200.1	13,709.30	10,830.60
November	156.8	207.4	204	13,999.20	11,050.20
December	146.6	204.7	198.7	13,648.20	10,894.70

Table 22: Monthly Production Report

6. Annual Production Report

Before looking over the Annual Report, these are each element of the Report decoded below.

Annual Global Horizontal Irradiance	The total irradiance will fall on a flat plane at the location of the array. This is aggregated directly from the weather file.
POA Irradiance	The total irradiance in the plane of the modules, accounting for tilt and azimuth angles. This is averaged across all modules in the array.
Shaded Irradiance	The total irradiance accounting for all shading (from the horizon, row-to-row, and obstruction)
Irradiance after Reflection	The total irradiance after accounting for reflection off the surface of the module (i.e. IAM reflection).
Irradiance after Soiling	Irradiance after module soiling is accounted for. Note that soiling assumptions are made in the Condition Set.

Total Collector Irradiance	The total annual irradiance is available to the modules in the array. This is averaged across all modules.
Nameplate	The maximum potential power of the array, defined as the total collector irradiance multiplied by the system nameplate power.
Output at Irradiance Levels	The total energy output by the modules, after accounting for low-light effects and module IV curve distortions. More details on Output at Irradiance available here.
Output at Cell Temperature	The total output of the modules, factoring in the temperature effects on the IV curves. This is the sum of the modules at their maximum power points.
Output After Mismatch	The total energy output of the modules, factoring in all system constraints (e.g. series & parallel mismatch, voltage drop, etc.).
Optimizer Output	If DC optimizers are present, this shows the total output of the optimizers, factoring in their efficiency curves and principles of operation.
Optimal DC Output	The total energy available energy of the DC system, accounting for all wire resistive losses.
Constrained DC Output	The total DC energy after accounting for inverter voltage and power limits. More details about clipping and Constrained DC Output available here
Inverter Output	The total AC energy output from the inverters, taking into account inverter performance losses.
Energy to Grid	The total AC energy output after accounting for AC wire losses to the point of interconnection

	Description	Output	%Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	2,026.2	
	POA Irradiance	2,221.4	9.6%
	Shaded Irradiance	2,169.6	-2.3%
	Irradiance after Reflection	2,112.5	-2.6%
	Irradiance after Soiling	2,070.3	-2.0%
	Total Collector Irradiance	**2,070.4**	**0.0%**
Energy (kWh)	Nameplate	148,235.8	
	Output at Irradiance Levels	147,806.7	-0.3%
	Output at Cell Temperature Derate	131,267.0	-11.2%
	Output After Mismatch	127,675.1	-2.7%
	Optimal DC Output	127,105.5	-0.4%
	Constrained DC Output	127,090.0	0.0%
	Inverter Output	122,983.0	-3.2%
	Energy to Grid	**118,558.0**	**-3.6%**
Temperature Metrics			
Avg. Operating Ambient Temperature		29.0 °C	
Avg. Operating Cell Temperature		41.8 °C	

Table 23: Annual Production Report

7. System Losses

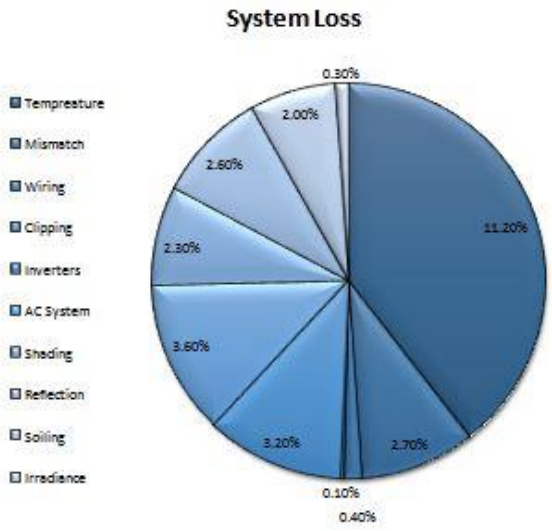


Fig 70: System Losses

8. Detailed Condition set

Description	Condition Set											
Weather Datasheet	TMY, 10km Grid, meteonorm (meteonorm)											
Solar Angle Location	Project Latitude-Longitude											
Transportation Model	Perez Model											
Temperature Model	Sandia Model											
Temperature Model Parameters	**Rack Type**			**a**			**b**			**Temperature Delta**		
	Fixed Tilt			-3.56			-0.075			3°C		
	Flush Mount			-2.81			-0.0455			0°C		
	East-West			-3.56			-0.075			3°C		
	Carport			-3.56			-0.075			3°C		
Soiling (%)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
	2	2	2	2	2	2	2	2	2	2	2	2
Irradiation Variance	5%											
Cell Temperature Spread	4° C											
Module Binning Range	-2.5% to 2.5%											
AC System Derate	0.50%											
Module Characterizations	**Device**			**Uploaded By**			**Characterization**					
	Green Triplex PM250P00 (Ben Q)			Folsom Labs			Spec Sheet Characterization, PAN					
Component Characterizations	**Device**			**Uploaded By**			**Characterization**					
	PRO-33.0-TL-OUTD (ABB)			Folsom Labs			Spec Sheet Efficiency					

Table 24: Detailed Condition Set

9. Wiring and Component Details

Components:

Component	Name	Count
Module	BenQ, GreenTriplex PM250P00 (250W)	288 (72.0 kW)
Inverter	PRO-33.0-TL-OUTD (ABB)	2 (66.0 kW)
AC Home Runs	$25mm^2$ (Copper)	2 (2,619.7 m)
Strings	12 SWG (Copper)	12 (711.0 m)

Table 25: Components Details

Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	12	21-27	Along with Racking

Table 26: Wiring Zones

Field Segments

Racking	Orientation	Tilt	Azimuth	Inter Row Spacing	Frame Size	Frames	Modules	Power
Fixed Tilt	Portrait (Vertical)	26.5°	180°	3m	1x3	97	288	72.0 kW

Table 27: Field Segments

10. Cost

Component	Name	Rating	Cost of 1N in Rs.	Total No. of Component	Total Cost In Rs.
Solar Module	BenQ, GreenTriplex PM250P00 (250W)	250W	15,411	288	44,38,368
Inverter	PRO-33.0-TL-OUTD (ABB)	33kW	2,30,000	2	4,60,000
AC Home Runs	$25mm^2$ Copper	3 core	90.1 /m	2619.7 m	2,35,773
Strings	12 SWG	1 core	275/m	711 m	1,95,525
Grand Total :					**53,29,666**

Table 28: Cost of Solar Power Plant

8.1.8 DESIGN OF AN OFF-GRID ROOFTOP SYSTEM

1. Basic Project Details

Project Details	
Design Name	Kalakachha 7.5 kW
Project Address	Lat: 21.054255 Lon: 72.954690
Prepared By	Aishan Mistry

Table 29: Basic Details of Rooftop Solar System

System Matrices	
Module DC Name Plate	7.5 kW
Inverter AC Name Plate	6.3 kW Load Ratio:1.1
Annual Production	13.6 MWh
Performance Ratio	75.1%
kWh/kWp	1,842.32
Weather Datasheet	EPW (metronome)

Table 30: System Matrices

2. Detailed layout of the Design

This 3D design is made using various software; Cutia, Google Sketch-up, and Skelion plugin of Solar. While the results are generated from third party Software; PVWatts open source tools & PVsyst.

Design Top View

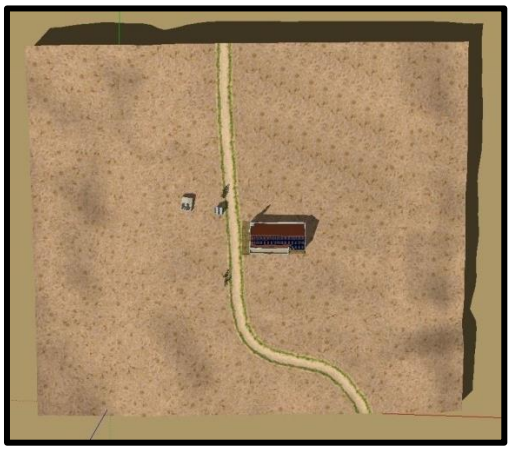


Fig 71: Top View of Design

Home Front View

Fig 72: Front View of Home

Home Iso View

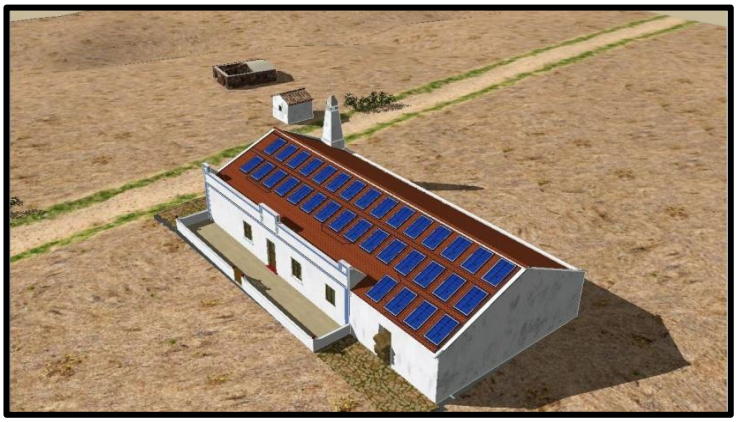


Fig 73: Isometric View of Design

3. Monthly Production

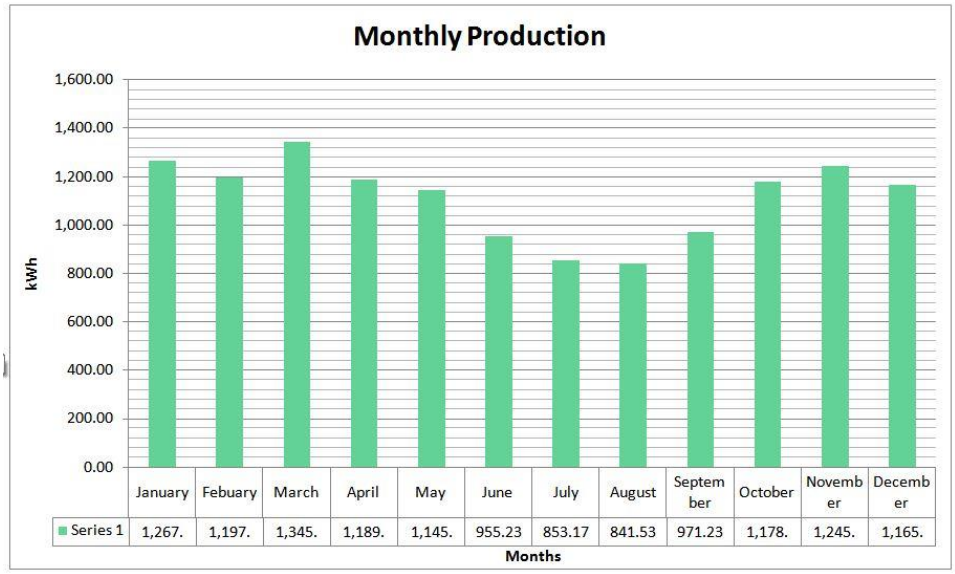


Fig 74: Monthly Production Report

4. System Losses

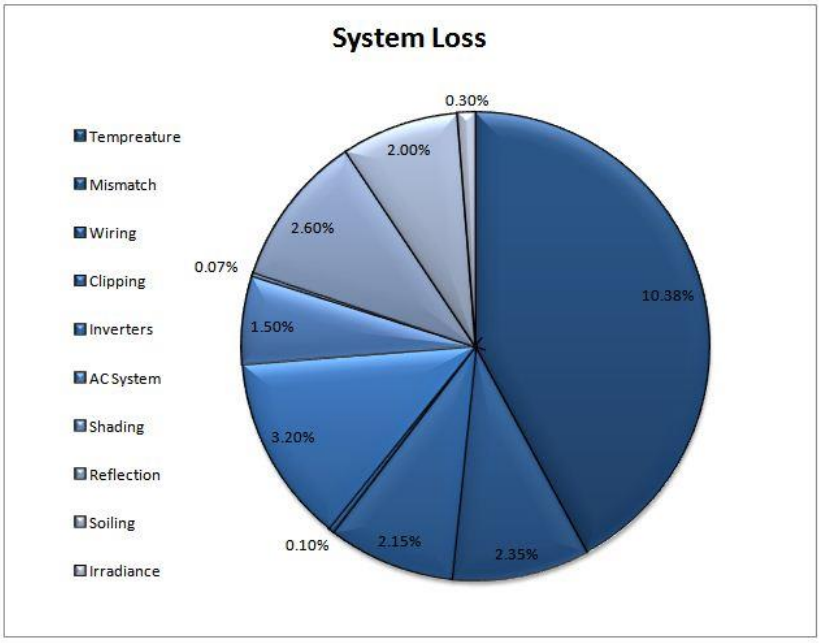


Fig 75: System Losses

Estimated system losses										
Group	**Temperature**	**Mismatch**	**Wiring**	**Clipping**	**Inverters**	**AC System**	**Shading**	**Reflection**	**Soiling**	**Irradiance**
1	10.38%	2.35%	2.15%	0.10%	3.20%	1.50%	0.07%	2.60%	2.00%	0.30%

Table 31: Estimated Loss of System

Monthly Shading Losses (%)												
Group	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
1	0.20	0.09	0.00	0.00	0.00	0.00	0.03	0.01	0.00	0.15	0.17	0.17

Table 32: Monthly Shading Losses

5. Component Details

a. Solar Panels

Fig 76: Solar Panel

Particular	Description
Model	WS-220/24V
Maximum Power, Pm	220W
Open Circuit Voltage, Voc	43.70V
Short Circuit Current, Isc	6.71A
The voltage at Maximum Power, Vmp	35.25V
Current at Maximum Power, Imp	6.25A
Maximum System Voltage	600/1000V
Module Efficiency	16.34%
Rated Voltage (dc)	35.25V
Rated Current (dc)	6.25A
Warranty	7 years

Table 33: Specification of Solar Panel

b. Inverter

Fig 77: Inverter

Particular	Description
Brand Name	Luminous
Model	PCU-NXT-9.5kVA
VA Rating	9.5kVA
Output Waveform	Sine Wave
Max. Power Voltage Vmp	150-240 V
Battery Bank Voltage	120 V
Input Voltage Range	190-300 V
No. of 12V Batteries in Series	10
Max. Supported Panel Power	7500 W
Efficiency	96%
Warranty	2 Years

Table 34: Specification of Inverter

c. Battery

Fig 78: Battery

Particular	Description
Brand	Luminous
Model	LPTT-12150H
Rating	150 AH
Volt	12 Volt
Type	Lead Acid TT
AH Efficiency	90%
WH Efficiency	80%
Warranty	5 Years

Table 35: Specification of Battery

6. Results

a. General

Groups global Results						
Solar panels	**Nº Panels**	**Panel Power (Wp)**	**DC rating (kWp)**	**Energy (kWh)**	**Yield (kWh/kWp)**	**Shading Loss (%)**
Waaree:WS-220	34	220.00	7.48	13780.56	1842.32	0.07

Table 36: Group Global Results

Results for solar modules in each group (grouped by same tilt, azimuth, and panel model)										
Group	**Model**	**NºP.**	**Panel Power (Wp)**	**DC rating (kWp)**	**Azimuth**	**Tilt**	**Energy (kWh)**	**Yield (kWh/kWp)**	**$\sum H_m$ (kWh/m²/year)**	**Shading Loss (%)**
1	Waaree:WS-220	34	220.00	7.48	-4.05	23.33	13780.56	1842.32	2428.69	0.07

Table 37: Solar Individual Group Results

Provided data					
Group	**Database**	**Module Type**	**Array Type**	**DC-AC ratio**	**Inverter Efficiency**
1	EPW	Standard	Fixed - Open Rack	1.1	96%

Table 38: Provided Data

b. Energy

Energy per Day(kWh/day)												
Group	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
1	27.15	30.47	39.46	41.83	43.39	42.24	40.32	40.35	41.99	39.74	34.38	31.35

Table 39: Energy Generation per Day

Energy per Month (kWh/month)												
Group	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
1	1267.65	1192.17	1345.36	1189.02	1145.16	955.23	853.17	841.53	971.23	11178.82	1245.33	1165.80

Table 40: Energy Generation per Month

Yearly average Energy		
Group	**Edy (kWh/day)**	**Emy (kWh/month)**
1	37.75	1148.38

Table 41: Yearly Average Energy Generation

c. Average Solar Insolation

Average Solar Insolation per Day (kWh/m^2/day)												
Group	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
1	4.35	4.90	6.73	7.27	7.80	7.90	7.72	7.52	7.70	7.03	5.87	5.08

Table 42: Average Solar Insolation per Day

Average Solar Insolation per Month (kWh/m^2/month)												
Group	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
1	134.81	137.18	208.67	218.02	241.65	237.00	239.34	233.08	230.88	217.80	176.07	157.34

Table 43: Average Solar Insolation per Month

Yearly Average Solar Insolation		
Group	**Hdy (kWh/m^2/day)**	**Hmy (kWh/m^2/month)**
1	6.65	202.39

Table 44: Yearly Average Solar Insolation

7. Cost

Component	Name	Rating	Cost of 1N In Rs	Total No. of Component	Total Cost In Rs.
Solar Panel	Waaree WS-220/24V	220W	11,115	34	3,77,910
Inverter	Luminous PCU-NXT-9.5kVA	7.5kW/9.5kVA	90,000	1	90,000
Battery	Luminous LPPT-12150H	150 AH/12V	11,000	10	1,11,000
Mounting Structure	Standard Galvanized Iron	------	3/per Watt	-------	22,500
DC Wire	$25mm^2$ Copper	3 Core	90/m	120 m	10,800
Grand Total					**6,12,210**
20% Subsidy					**1,22,442**
Final Amount to Pay					**4,89,768**

Table 45: Cost of Rooftop Solar System

8. Graphs

a. Solar paths/Horizon

- Sun path, sometimes also called day arc, refers to the daily and seasonal arc-like path that the Sun appears to follow across the sky as the Earth rotates and orbits the Sun. The Sun's path affects the length of daytime experienced and the amount of daylight received along a certain latitude during a season.
- When a solar array has an elevated horizon, for example from a nearby mountain range, it will reduce the sunlight reaching the array and it can be modeled as a Horizon profile.
- Horizon profiles are an excellent source of information for verifying real-life conditions surrounding the array.

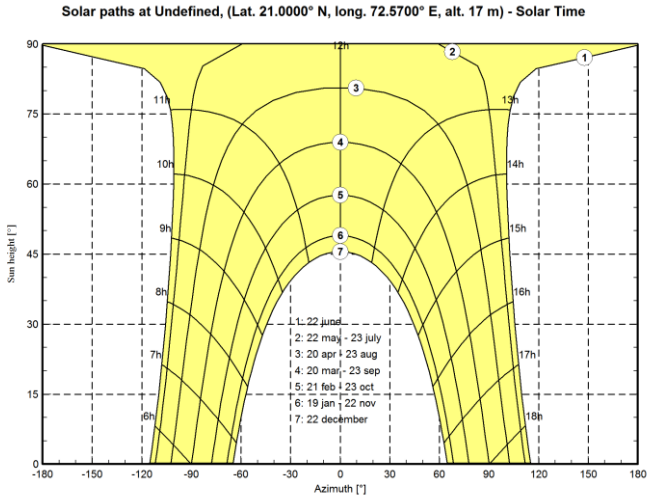


Fig 79: Solar Horizon on a Plane

- They are ideal for modeling far shading originated from features such as mountain ranges that are sufficiently far from the array. However, Horizon profiles are less precise than keep outs for close or near shading, for example from objects such as trees and buildings located close by to the array

b. Azimuth

- The solar azimuth angle is the azimuth angle of the Sun's position. This horizontal coordinate defines the Sun's relative direction along the local horizon, whereas the solar zenith angle defines the Sun's apparent altitude
- **Solar azimuth** angle (A): angular displacement from south of the projection of beam radiation on the horizontal plane. A = 0 equals south, A < 0 is east, and A > 0 is west

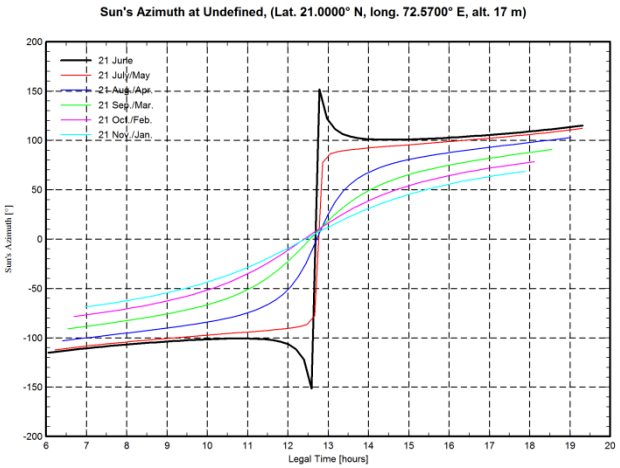


Fig 80: Sun's Azimuth

c. Clear Day Irradiation

- Solar irradiation refers to the amount of solar radiation received from the Sun per unit area which is expressed in (kW/ m²).
- Clear Day Irradiation is the amount of solar radiation received on a clear sunny day per unit area by a surface that is always held perpendicular (or normal) to the rays that come in a straight line from the direction of the sun at its current position in the sky.

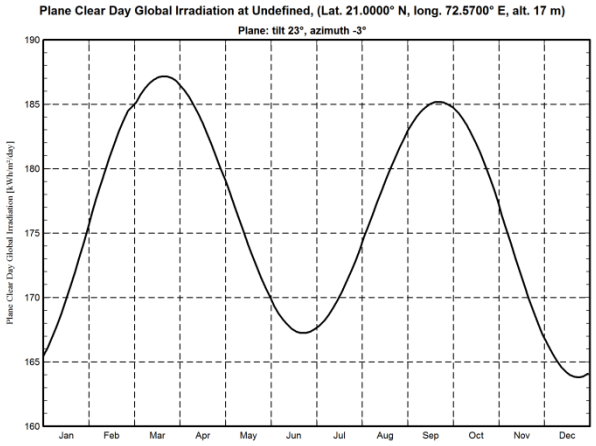


Fig 81: Clear Day Irradiation

d. Sun Incidence Angle

- The solar incidence angle, θ, is the angle between the sun's rays and the normal on a surface. for example, a surface directly facing the sun has an angle of incidence of zero, and a surface parallel to the sun (such as a sunrise striking a horizontal rooftop) has an angle of incidence of 90°

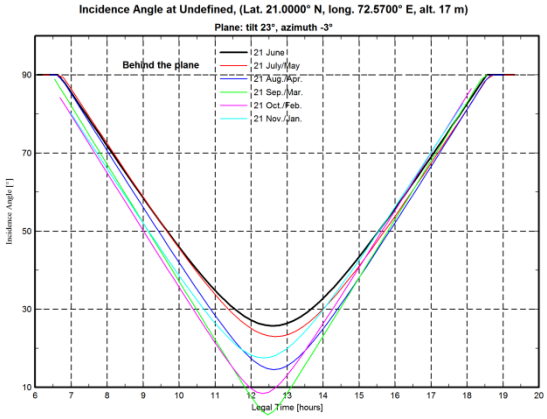


Fig 82: Sun Incidence Angle

e. Sun Height on the Plane/Sun Altitude

- Solar altitude refers to the angle of the sun relative to the Earth's horizon. The solar altitude varies based on the time of day, the time of year, and the latitude on Earth. Regions close to the equator have a higher solar altitude than regions near the Earth's poles.

- Solar altitude is the angle of the sun relative to the Earth's horizon and is measured in degrees. The altitude is zero at sunrise and sunset and can reach a maximum of 90 degrees (directly overhead) at noon at latitudes near the equator.

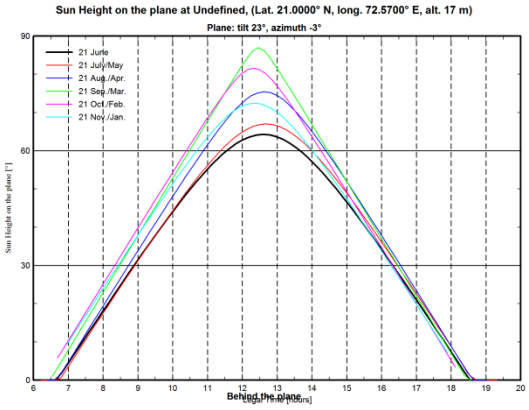


Fig 83: Sun Height on the Plane

f. Length of the Day

- The day does not get shorter, but daylight gets shorter. That's because of the earth's rotation. When the earth rotates in a certain way, the daylight gets longer and shorter.
- The length of the day changes from season to season due to the Earth's axial tilt.

- The Earth's axis of rotation is inclined at 23.5Degree to the plane of the ecliptic. This causes the seasons.
- Length of the Day increasing at the slightly slower pace of about 2 minutes and 7 seconds per day.

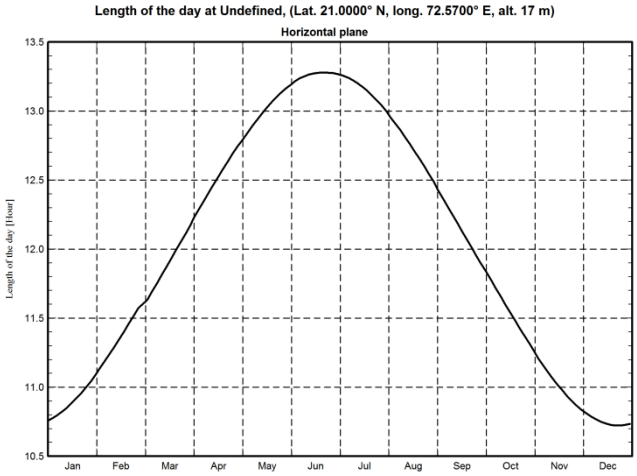


Fig 84: Length of the Day

g. Sunrise/Sunset Time

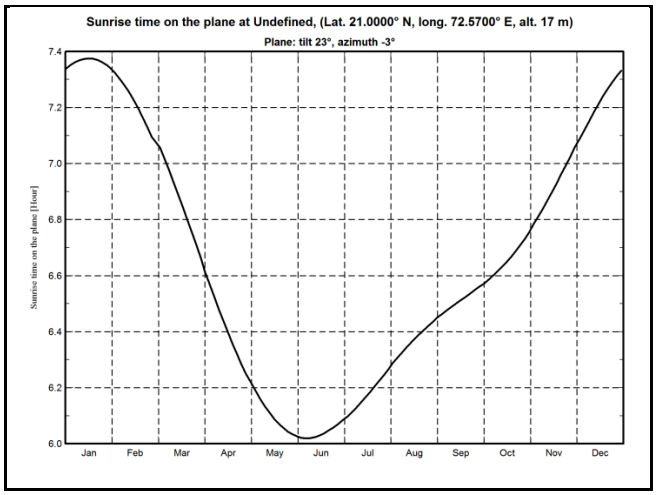


Fig 85: Sunrise Time

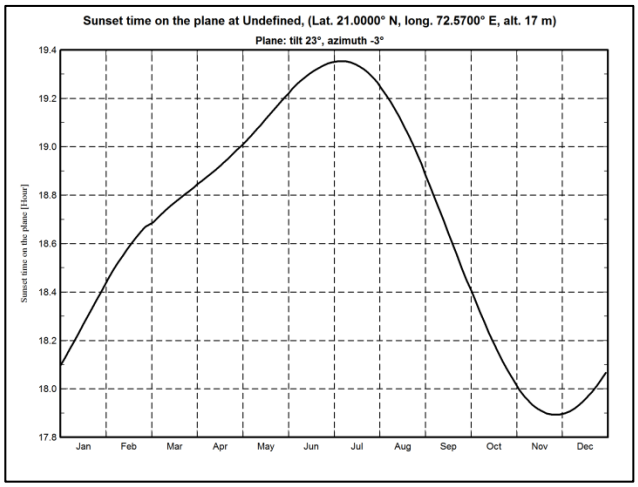
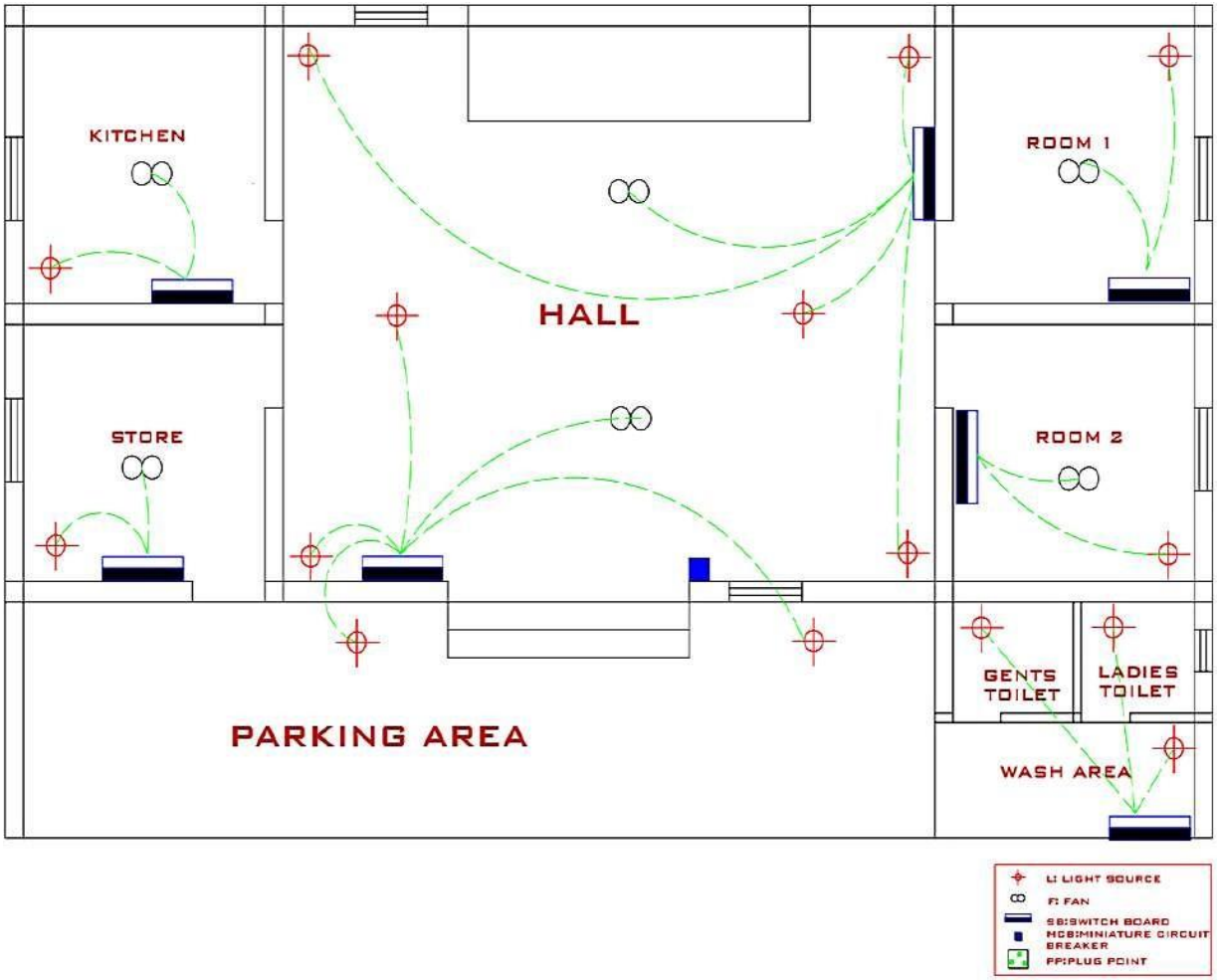


Fig 86: Sunset Time

8.1.9 ELECTRICAL DESIGN OF COMMUNITY HALL



- **Load Calculation Of Community Hall**

Sr. No	Type And Location Of Point	No. Of Points	Watt/Point	Total Wattage
1	Light Points	15	30	450
	(2+2+2+2+2+2+2+1)			
2	Fan Points	6	60	360
	(3+3)			
3	5 Amp. Socket Outlet			
	(2+2+2+2+2+2+2+1)	13	100	1300
	Total	34		2110

Table 46: Load Calculation of Community hall

- **Estimate Of Community Hall (Electrical)**

Sr. No.	Materials with Specification	Quantity Reqd.	Unit	Rate		Total Cost (Rs.)
				Rs	**Per**	
1	MCB	1		400	Each	400
2	240 V, 16 A, 2 Way MCB Type Board	1		370	Each	370
3	Board 12- module	2		345	Each	690
	Board 4- module	1		168	Each	336
	Board 2-module	4		121	Each	484
4	PVC Conduit Pipe 25 MM Diameter	60	meter	30	meter	1800
5	1/1.80mm, 650v Grade Single core aluminum PVC cable	0.5	meter	10	meter	5
6	1/1 40mm, 650 V grade Single Core Aluminum PVC Cable	150	meter	10	meter	1150
7	Single Way 5A Anchor Switch, 240 V	34		20	Each	680
8	PVC Type Two Plate Ceiling Rose	21		20	Each	420
9	PVC type pedant holder	15		40	Each	600
10	flexible Wire 23/0 193 mm	50	meter	10	meter	500
11	Earthing wire 14 SWG GI Wire	0.4	meter	35	meter	14
12	Nut, Bolt with Earthing Thimble	30		15	Each	450
13	51mm screw	30		100	200no	300
14	6 A, 3 Pin Socket	14		40	Each	560
15	Cement, Soil Varnish					300
16	Fan Regulator	6		300	Each	1800
17	Fan	6		1200	Each	7200
18	Lamp	15		200	Each	3000
19	Labor Charge	29 Point		150	Each	4350
					Total	25409
	5 % miscellaneous charge					1270
					RS. Total	26680

Table 47: Estimation of Community Hall wiring

8.2 Recommendations of the Design

- From the collect data and observation, the information of new proposal as follows.
- **Community hall:** In the village there is no Community hall available, and then we proposed of PHC design.
- **Post office:** In the village post office physical condition are bad and it is rented then we proposed post office design.
- **Public Toilet:** In Kalakachha village there is no public toilet available, So for better sanitization we decided to proposed this design
- **Design of Solar Power:** We recommended village people about solar power so they don't have to wait for electricity, so we proposed a design of solar power plant and rooftop system.

8.3 Suggestions/ Benefits to Villagers

- In the village as if Post office physical condition is best so all village people will easily getmuch better facilities.
- In the village Community Hall building is not available, so village people get to use it in other area.
- In the village solar system will help farmer to not rely on electricity which havepower cut and only for 8hrs and it can work for 24 hrs and saved their money

CHAPTER 9: Proposing designs for Future Development of the Village for the PART-II Design

- The study is aimed to know the basic scenario of the village through techno-economic survey and gap analysis form.
- Our design proposal shows that we are interested to provide economic services and facilities to the villagers.
- We aim to work according to the new upcoming town planning scheme in Kalakachha village.
- We would like to bring each possible facility like easy transportation, economic electricity (using renewable energy), adequate water supply, Public infrastructures, medical facility, Higher education Facility.
- Our very next plan is to propose our design to the Talati officer and get approval to execute our design.
- Also, we would like to make villagers know how these designs ay help them.
- Reconstruction of System Design after Collecting Data from relative Sub-station of Village.
- Design of Cost Effective Street Lights
- SOCIAL INFRASTRUCTURE: Building Public Latrine block
- TRANSPORT FACILITIES: Making New Roads
- SOCIO-CULTURAL FACILITIES: Beautification of Pond with other Amenities

CHAPTER 10: Conclusion of the Entire Village Activities of the Project

Vishwakarma Yojana is a Gujarat government project allotted to GTU in which we the students of GTU who were involved in this project were allocated with a village in our district for Urbanization. We have done Surveys of Kalakachha and did the SWOT analysis, which helped us to know our strengths, weaknesses, opportunities & threats. From this, we analyzed the problems and requirements of our allocated village and started finding the solution. From various thinking, research, and group discussions we designed a solar rooftop system and Solar Power Plant for the Village that will help to reliable Power Source for the Village, and at the end of the project, we will Take Reading from the Feeder of the Village and will solve the Real-time Problems for generation, distribution of power as well as looking on to the Amenities and Socio-Cultural benefits for the Villagers.

As per the problem observed in rural areas, preventive and renewable measures are suggested. Implementation of improvement will reduce the problem in the area and improve the standard of living of village people. This can be resulted in improving the social and economic effect of rural areas on the economy of the country and it may result in more efficient use of infrastructure.

Here, for Kalakachha village we identify the problem from Gap analysis, and from that, we suggest some building planning and design and Solar Power plant in the village also give a proposal of Solar rooftop system.

In Kalakachha Village Requirement building like public toilet, community hall , Garden etc is not existing . By this design we provide basic amenities to the village.

We visited smart village in Abrama and know about problem of our allocated village.

By visiting the village we can implement the latest technology for the occupation of the village.

By Designing these amenities will be helpful to the people to the latest environment and bit faster than previous. 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.

These will help to the villagers by providing health facilities as they are healthy day by day.

The Students who want to work towards preservation of rural soul of country can do many things for our own good and environment. By implanting given design proposals, we can say that all the missing amenities are provided will stop the migration of rural people towards the urban area. This can cause reduce the load on urban areas as well as pollution in both sector can be minimized gradually.

CHAPTER 11: References referred for this Project

- http://www.dictionary.com/browse/village
- http://censusindia.gov.in/
- http://www.solarmitra.com/
- http://bio-gas-plant.blogspot.in/
- http://e4ev.org/about-us/what-are-smart-villages/https://india.gov.in/my-government/schemes
- https://www.wisions.net/projects
- https://en.wikipedia.org/wiki/Renewable_energy_in_India
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- https://www.helioscope.com/
- www.bis.org.in
- www.censusindia.gov.in
- www.smallcities.gov.in
- www.onefivenine.com
- https://cea.nic.in/
- https://npp.gov.in/

- Apparatus and method of generating energy from renewable energy sources
  https://patents.google.com/patent/US20180287461A1/en?q=rural+power+grid&country=US&language=ENGLISH

- Solar energy conversion
  https://patents.google.com/patent/AU2009279510B2/en?q=rooftop+solar&oq=rooftop+solar&page=1

- Distributed energy storage and power quality control in photovoltaic arrays
  https://patentimages.storage.googleapis.com/88/8d/14/3f14d18ab8202d/US20150008864A2.pdf

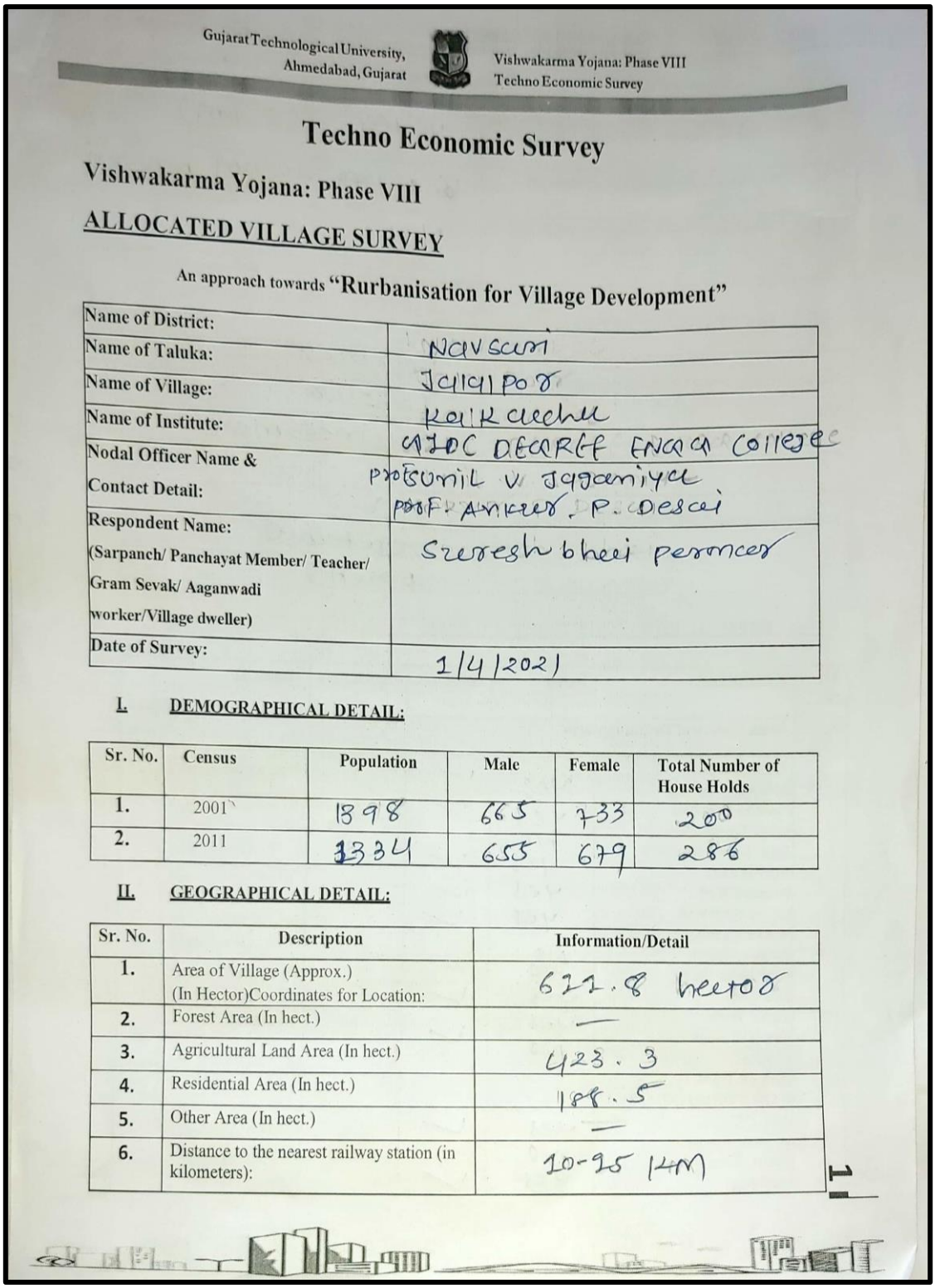
- Water harvesting and storage system
  https://patents.google.com/patent/US4527927?oq=rainwater+harvesting+in+villages

- Design and construction method for pre-fabricated high rise building attaching for environments and village community
  https://patents.google.com/patent/US20030101680?oq=built+environment+in+village

- Irrigation and fertilization system powered by solar energy
  https://patents.google.com/patent/WO2016174576A1/en?oq=smart+village+case+study

CHAPTER 12: Annexure Attachments

12.1 Survey Form of Ideal Village



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ALLOCATED VILLAGE SURVEY

An approach towards **"Rurbanisation for Village Development"**

Name of District:	NAVSARI
Name of Taluka:	JALALPOR
Name of Village:	KALIACHHA
Name of Institute:	AJOC DEGREE ENGG COLLEGE
Nodal Officer Name & Contact Detail:	PROF SUNIL V JAGANIYA PROF. ANKUR. P. DESAI
Respondent Name: (Sarpanch/ Panchayat Member/ Teacher/ Gram Sevak/ Aaganwadi worker/Village dweller)	Sureshbhai Parmar
Date of Survey:	1/4/2021

I. **DEMOGRAPHICAL DETAIL:**

Sr. No.	Census	Population	Male	Female	Total Number of House Holds
1.	2001	1898	665	733	200
2.	2011	1334	655	679	286

II. **GEOGRAPHICAL DETAIL:**

Sr. No.	Description	Information/Detail
1.	Area of Village (Approx.) (In Hector)Coordinates for Location:	621.8 hector
2.	Forest Area (In hect.)	—
3.	Agricultural Land Area (In hect.)	423.3
4.	Residential Area (In hect.)	188.5
5.	Other Area (In hect.)	—
6.	Distance to the nearest railway station (in kilometers):	10-15 KM

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7.	Name of Nearest Town with Distance:	Vesma (5 KM)
8.	Distance to the nearest bus station (in kilometers):	20 KM Navsari
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.	Farmers
	2.	Labours
	3.	Businessmen

Major crops grown in the village:	1.	Sugar
	2.	Vegetable
	3.	Fruits

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	No			
	Tube Well Or Bore Well	Yes	✓		
2.	**DUG WELL**				
	Protected Well	Yes	✓		
	Un Protected Well	Yes	✓		
3.	**WATER FROM SPRING**				
	Protected Spring	No			
	Unprotected Spring	No			
	Rainwater	Yes	✓		
	Tanker Truck	Yes	✓		
	Cart With Small Tank	No			
4.	**SURFACE WATER (RIVER/DAM/ LAKE/POND/STREAM/CANAL/**				
	Irrigation Channel	Yes	✓		
	Bottled Water	No			
	Hand Pump	Yes	✓		

2.

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	Other(Specify)Lake/ Pond	Yes	✓		pond

Suggestions if any:

B.	Water Tank Facility				
	Overhead Tank	Capacity:	✓		50,000 lit
	Underground Sump	Capacity:			

Suggestions if any:

C.	The Type of Drainage Facility				
	A. UNDERGROUND DRAINAGE 1	Yes	✓		open with outlet

Suggestions if any:

D.	Road Network :All Weather/ Kutchha (Gravel)/ Black Topped pucca/ WBM				
	Village approach road		✓		pucca
	Main road		✓		pucca
	Internal streets		✓		kutcha
	Nearest NH/SH/MDR/ODR Dist. in kms.	NH-48			5 KM

Suggestions if any:

E.	Transport Facility				
	Railway Station (Y/N) (If No than Nearest Rly Station---Kms)	NO		✓	Maroli 15 KM
	Bus station (Y/N) Condition: (If No than Nearest Bus Station---Kms)	NO		✓	
	Local Transportation (Auto/ Jeep/Chhakda/ Private Vehicles/ Other)	Yes	✓		private

Suggestions if any:

F.	Electricity Distribution				
	(Y/N) Govt./ Private (Less than 6 hrs./ More Than 6 hrs)	Yes	✓		Government >6hrs

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	Power supply for Domestic Use	Yes	✓		24 hr
	Power supply for Agricultural Use	Yes	✓		6 hr
	Power supply for Commercial Use	Yes	✓		8 hr
	Road/ Street Lights	NO		✓	
	Electrification in Government Buildings/ Schools/ Hospitals	Yes	✓		
	Renewable Energy Source Facilities (Y/ N)	NO		✓	
	LED Facilities	Yes	✓		Private Sector ✓

Suggestions if any:

G.	**Sanitation Facility**				
	Public Latrine Blocks If available than Nos.	NO		✓	
	Location Condition				
	Community Toilet (With bath/ without bath facilities)	NO		✓	
	Solid & liquid waste Disposal system available	NO		✓	
	Any facility for Waste collection from road	Yes			From Vehicel

Suggestions if any:

H.	**Main Source of Irrigation Facility:**				
	TANK/POND STREAM/RIVER CANAL WELL TUBE WELL. OTHER (SPECIFY)	Pond Council well private tubewell	✓		

Suggestions if any:

I.	**Housing Condition:**				
	Kutchha/Pucca (Approx. ratio)	0.25	✓		Kutchha is more

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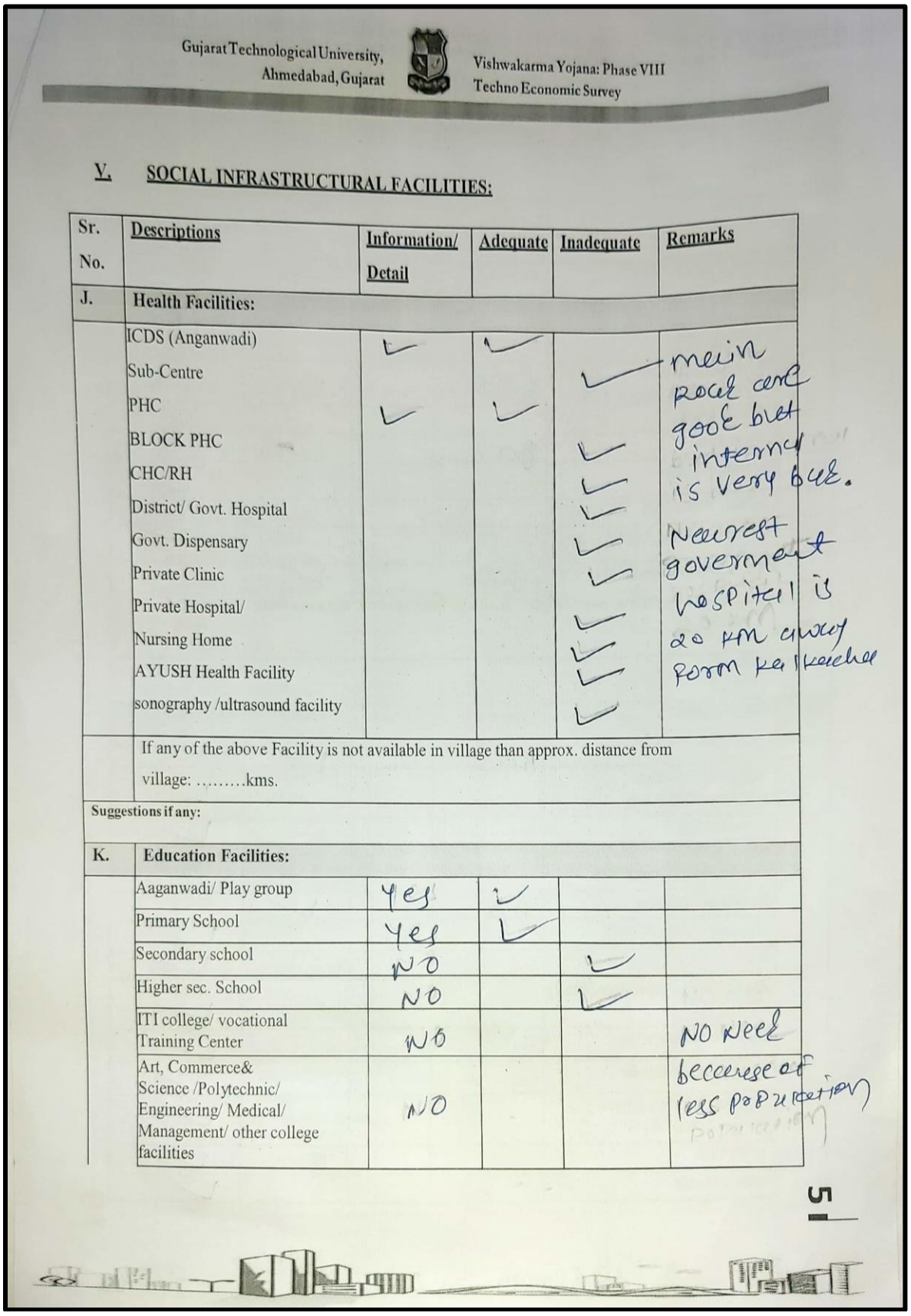

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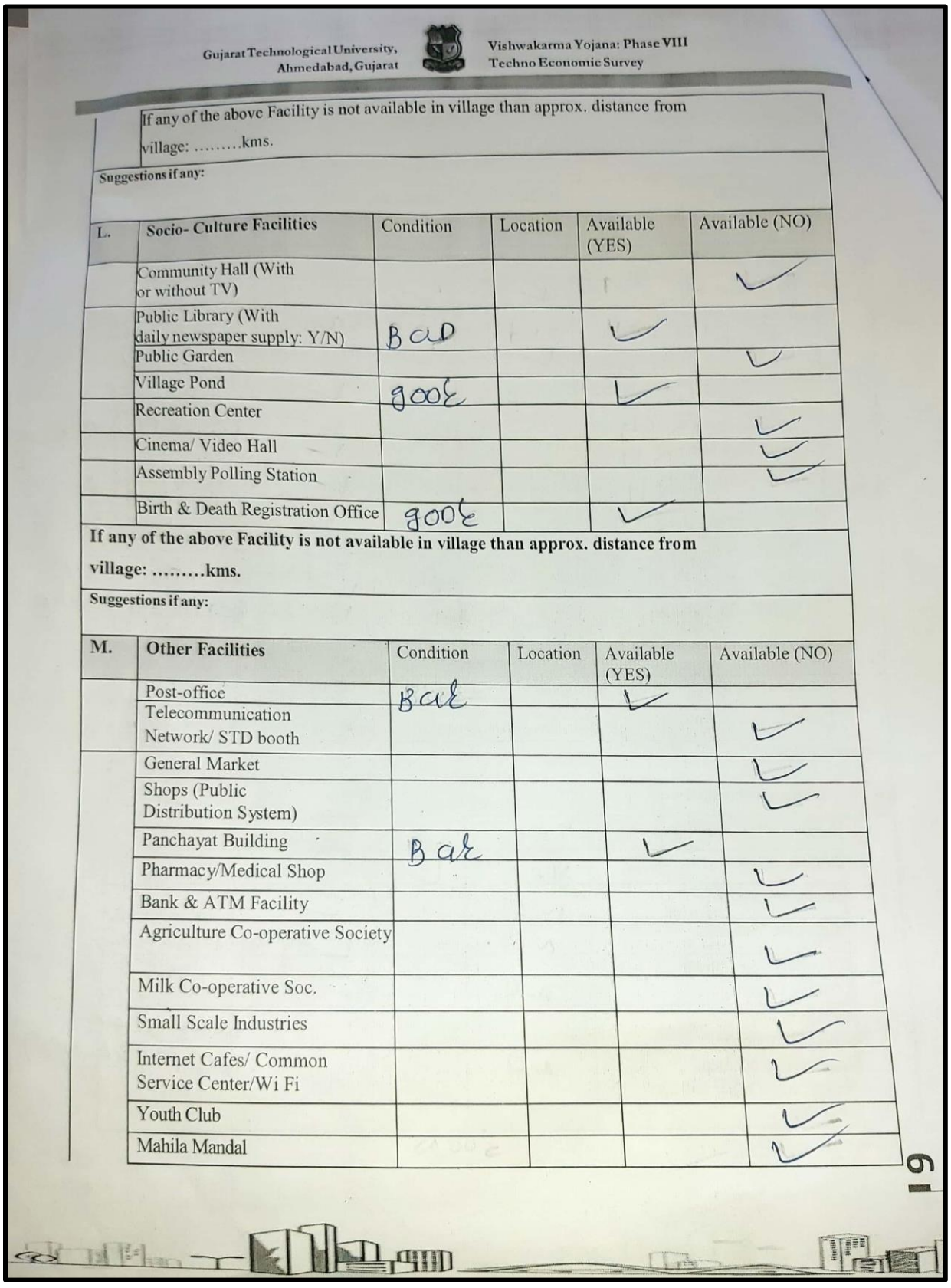
V. SOCIAL INFRASTRUCTURAL FACILITIES:

Sr. No.	Descriptions	Information/ Detail	Adequate	Inadequate	Remarks
J.	**Health Facilities:**				
	ICDS (Anganwadi)	✓	✓		
	Sub-Centre			✓	main road are good but internal is very bad.
	PHC	✓	✓		
	BLOCK PHC			✓	
	CHC/RH			✓	
	District/ Govt. Hospital			✓	
	Govt. Dispensary			✓	Nearest goverment hospital is 20 KM away Paran Ka Kachha
	Private Clinic			✓	
	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	Yes	✓		
	Primary School	Yes	✓		
	Secondary school	NO		✓	
	Higher sec. School	NO		✓	
	ITI college/ vocational Training Center	NO			NO Need
	Art, Commerce& Science /Polytechnic/ Engineering/ Medical/ Management/ other college facilities	NO			beccerse of less Population

5



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If any of the above Facility is not available in village than approx. distance from village: .....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)	Bad		✓	
	Public Garden				✓
	Village Pond	good		✓	
	Recreation Center				✓
	Cinema/ Video Hall				✓
	Assembly Polling Station				✓
	Birth & Death Registration Office	good		✓	

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	Bad		✓	
	Telecommunication Network/ STD booth				✓
	General Market				✓
	Shops (Public Distribution System)				✓
	Panchayat Building	Bad		✓	
	Pharmacy/Medical Shop				✓
	Bank & ATM Facility				✓
	Agriculture Co-operative Society				✓
	Milk Co-operative Soc.				✓
	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	900		✓ ✓ ✓	
	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	NO		✓	
2.	Bio-Gas Plant Solar Street Lights Rain Water Harvesting System	Yes NO NO	✓	 ✓ ✓	
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	SOFT COPY	✓		
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			

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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	School breilding Ramchandet Breilding	
2.	Additional Information/ Requirement		
3.	During the last six months how many times CLEANING ..... FOGGING..... Drive was undertaken in the village?	cleaning daily but Fogging in 1 week	free to covid-19

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
ગ્રામ પંચાયત કાળકાછ
તા. જલાલપોર, જી. નવસારી

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12. 3 Survey form of Allocated Village

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Techno Economic Survey

Techno Economic Survey

For

Vishwakarma Yojana: Phase VIII

IDEAL VILLAGE SURVEY

An approach towards Rurbanisation for Village Development

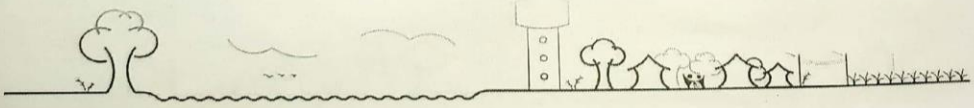
Name of Village:	Abrama
Name of Taluka:	Jalalpor
Name of District:	Navsari
Name of Institute:	VIDC DEGREE ENGG. College
Nodal Officer Name & Contact Detail:	Prof. Sumit V. Jaganiya Prof. Ankur P Desai
Respondent Name: (Sarpanch/ Panchayat Member/ Teacher/ Gram Sevak/ Aaganwadi worker/Village dweller)	Sailesh bhai N. Patel
Date of Survey:	1/4/2021

1. **Demographical Detail:**

Sr. No.	Census	Population	Male	Female	Total House Holds
i)	2001	6252	3132	3120	1426
ii)	2011	6462	3243	3219	1492

2. **Geographical Detail:**

Sr. No.	Description	Information/Detail
i)	Area of Village (Approx.) (In Hector) Coordinates for Location:	1632 Hector
	Forest Area (In hect.)	—
	Agricultural Land Area (In hect.)	1200 Approx
	Residential Area (In hect.)	200
	Other Area (In hect.)	—
	Water bodies	250 Nearer
	Nearest Town with Distance:	Vyara - 3 KM



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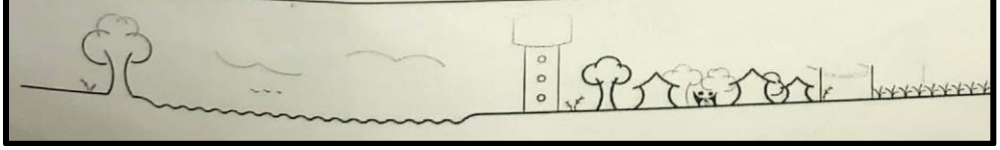
Vishwakarma Yojana: Phase VIII
Techno Economic Survey

3. Occupational Details:

Name of Three Major Occupation groups in Village	1. farmers 2. self - business 3. industrial laborer

4. Physical Infrastructure Facilities:

Sr. No.	Descriptions	Detail	Adequate	Inadequate	Remarks
A.	**Main Source of Drinking water**				
	• Tap Water (Treated/ Untreated) • RO Water • Well (Covered/ Uncovered) • Hand pumps • Tube well/ Borehole • River/ Canal/ Spring/ Lake/ Pond		✓ ✓ ✓ ✓ ✓	 ✓ 	 3 4 ccemcl
Suggestions if any:					
B.	**Water Tank Facility**				
	Overhead Tank	Capacity:	✓		5000 lit
	Underground Sump	Capacity:			
Suggestions if any:					
C.	**Drainage Facility**				
	Available (Yes/ No)	Yes	✓		60+
Suggestions if any:					
D.	**Type of Drainage**				
	Closed/ Open	open		✓	
	If Open than Pucca / Kutchcha	pucca			
	Whether drain water is discharged directly in to Water bodies/ Sewer plants	water bodies		✓	
Suggestions if any:					



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Vishwakarma Yojana: Phase VIII
Techno Economic Survey

E.	Road Network :All Weather/ Kutchha (Gravel)/ Black Topped pucca/ WBM				
	Village approach road		✓		Pucca
	Main road		✓		Pucca
	Internal streets		✓		Kutchha
	Nearest NH/SH/MDR/ODR Dist. in kms.	NH-48	✓		
Suggestions if any:					
F.	**Transport Facility**				
	Railway Station (Y/N) (If No than Nearest Rly Station---Kms)	Yes		✓	Vedchel 3 km
	Bus station (Y/N) Condition: (If No than Nearest Bus Station---Kms)	Yes	✓		Navsari 16 km
	Local Transportation (Auto/ Jeep/Chhakda/ Private Vehicles/ Other)	Yes	✓		Auto
Suggestions if any:					
G.	**Electricity Distribution**				
	(Y/N) Govt./ Private (Less than 6 hrs./ More Than 6 hrs)	Yes	✓		DGVCL 24 hr
	Power supply for Domestic Use	Yes	✓		24 hr
	Power supply for Agricultural Use	Yes	✓		8 hr
	Power supply for Commercial Use	Yes	✓		24 hr
	Road/ Street Lights	Yes	✓		Florescent

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Techno Economic Survey

	Electrification in Government Buildings/ Schools/ Hospitals		✓		
	Renewable Energy Source Facilities (Y/ N)		✓		Solar panel
	LED Facilities		✓		
Suggestions if any:					
H.	**Sanitation Facility**				
	Public Latrine Blocks If available than Nos.	Yes	✓		
	Location Condition	good	✓		
	Community Toilet (With bath/ without bath facilities)	1	✓		with bath
	Solid & liquid waste Disposal system available	Yes	✓		
	Any facility for Waste collection from road	NO	✓		
Suggestions if any:					
I.	**Irrigation Facility:**				
	Main Source of Irrigation (Stream/River/ Canal/ Well/ Tube well/ Other)		✓		tube well
Suggestions if any:					
J.	**Housing Condition:**				
	Kutchha/Pucca (Approx. ratio)	80-1	✓		

5. **Social Infrastructural Facilities:**

Sr. No.	Descriptions	Information/ Detail	Adequate	Inadequate	Remarks

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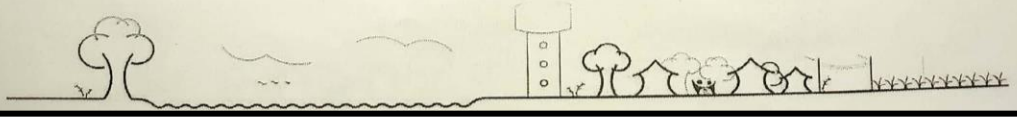
Vishwakarma Yojana: Phase VIII
Techno Economic Survey

K.	Health Facilities:				
	Sub center/ PHC/ CHC /Government Hospital/ Child welfare & Maternity Homes (If Yes than specify No. of Beds) Condition:		✓		
	Private Clinic/Private Hospital/ Nursing Home		✓		
	If any of the above Facility is not available in village than approx. distance from village: .....kms.				
Suggestions if any:					

L.	Education Facilities:				
	Aaganwadi/ Play group		✓		2
	Primary School		✓		1
	Secondary school		✓		1
	Higher sec. School		✓		1
	ITI college/ vocational Training Center			✓	
	Art, Commerce& Science /Polytechnic/ Engineering/ Medical/ Management/ other college facilities		✓		1 engineering
	If any of the above Facility is not available in village than approx. distance from village: .....kms.				
Suggestions if any:					

M.	Socio- Culture Facilities				
	Community Hall (With or without TV) Location:		✓		without TV



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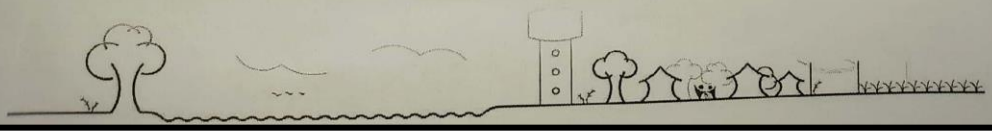
Techno Economic Survey

	Condition:	good			
	Public Library (With daily newspaper supply: Y/N) Location: Condition:	NO		✓	
	Public Garden Location: Condition:	NO		✓	
	Village Pond Location: Condition:	yes good	✓		
	Recreation Center Location: Condition:	NO		✓	
	Cinema/ Video Hall Location: Condition:	NO		✓	
	Assembly Polling Station Location: Condition:	NO		✓	
	Birth & Death Registration Office Location: Condition:	yes good	✓		

If any of the above Facility is not available in village than approx. distance from village: ……kms.

Suggestions if any:

N.	Other Facilities				
	Post-office	yes	✓		
	Telecommunication Network/ STD booth	yes	✓		



	General Market		✓		
	Shops (Public Distribution System)		✓		
	Panchayat Building		✓		
	Pharmacy/Medical Shop		✓		
	Bank & ATM Facility		✓		
	Agriculture Co-operative Society			✓	
	Milk Co-operative Soc.		✓		
	Small Scale Industries		✓		
	Internet Cafes/ Common Service Center/Wi Fi		✓		
	Other Facility				
Suggestions if any:					

6. **Sustainable /Green Infrastructure Facilities:**

Sr. No.	Descriptions	Information/ Details	Adequate	Inadequate	Remarks
O.	Adoption of Non-Conventional Energy Sources/ Renewable Energy Sources				
P.	Bio-Gas Plant Solar Street Lights Rain Water Harvesting System	yes NO yes	✓ ✓	✓	
Q.	Any Other				

7. Data Collection From Village

Village Base Map Available: Hard Copy/Soft Copy	SOFT COPY

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Vishwakarma Yojana: Phase VI
Techno Economic Survey

Recent Projects going on for Development of Village	—
Any NGO working for village development	—

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)	School Building, Panchayat Building	
2.	Additional Information/ Requirement		

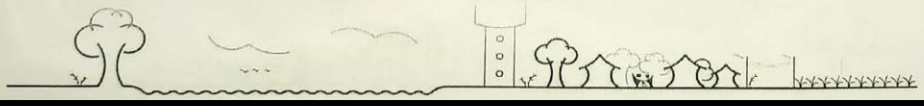
9. Smart Village Proposal Design

Sr. No.	Descriptions	Information/ Detail	Remarks
1.	NO DESIGN PROPOSAL		

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

S.N. Patel
સરપંચ
ગ્રામ પંચાયત અબ્રામાં,
તા. જલાલપોર, જી. નવસારી.



12.4 GAP Analysis

Village Facilities	Planning Commission/UDPFI Norms	Village Name:	KALAKACHHA		
		Population: 1334			
		Existing	Required as per Norms	Smart Village / Cities / Heritage Future Projection Design	Gap
Social Infrastructure Facilities					
1) Education					
Aaganwadi	Each or Per 2500 population	2	1		1
Primary School	Each Per 2500 population	1	1		0
Secondary School	Per 7,500 population	0	0		0
Higher Secondary School	Per 15,000 Population	0	0		0
College	Per 125,000 Population	0	0		0
Tech. Training Institute	Per 100000 Population	0	0		0
Agriculture Research Centre	Per 100000 Population	0	0		0
Skill Development Center	Per 100000 Population	0	0		0
2) Health Facility					
Govt/Panchayat Dispensary or Sub PHC or Health Centre	Each Village	1	1		0
Primary Health & Child Health Center	Per 20,000 population	0	0		0
Child Welfare and Maternity Home	Per 10,000 population	0	0		0
Multispecialty Hospital	Per 100000 Population	0	0		0

Physical Infrastructure Facilities					
3) Transportation		Adequate			
Pucca Village Approach Road	Each village – 1	Adequate	1		1
Bus/Auto Stand provision	All Villages connected by PT (ST Bus or Auto)-1	Adequate	1		1
Drinking Water (Minimum 70 lpcd)		Adequate			
Over Head Tank	1/3 of Total Demand	3	0		0
U/G Sump	2/3 of Total Demand	0	0		0
Drainage Network - Open		Adequate	Inadequate		0
Drainage Network - Cover		Yes	No		0
Waste Management System		Adequate	Inadequate		0

Socio- Cultural Infrastructure Facilities					
Community Hall	Per 10000 Population	0	0		0
community hall and Public Library	Per 15000 Population	0	0		0
Cremation Ground	Per 20,000 population	0	0		0
Post Office	Per 10,000 population	1	0		1
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		-1
Police post	Per 40,000Population	0	0		0

Electrical Design					
Electricity Network		Adequate			
street light	Poles 30 meters apart	Adequate	Inadequate		Adequate

12.5 Summary Details of All the Villages Designs in Table form as Part-I and Part-II:

Sr. No.	Village Name	Discipline	Part-I	Part-II
1	**Kalakachha**	**Civil**	Community Hall	Opening gate of village
			Public Toilet	Super market
			Post Office	Cyber café
			Bank	Electric shop
			Public garden	Library
		Electrical	Solar Power Plant	Street light
			Solar Rooftop System	Solar panel cleaning machine
			Wiring of Gram Panchayat Building	Speed breaker generation
2	**Bhutsad**	**Civil**	Public Toilet	ATM
			Community hall	Supermarket
			Medical Store	Library
			Cybercafé	Chabutaro
			Post Office	Rain water Harvesting
			Garden	Bank
		Electrical	Submersible Pump	Automatic Solar Street lights
			Control Panel	Power factor improvement in agriculture load
			Solar water pump simulation	Automatic hand sanitizer dispenser

12.7 Summary of Good Photographs in Table Format (village visits, Ideal, Smart Village

1. Ideal/Smart Village Photos

Fig 87: Ideal/Smart Village Photos

2. Allocated Village Photos



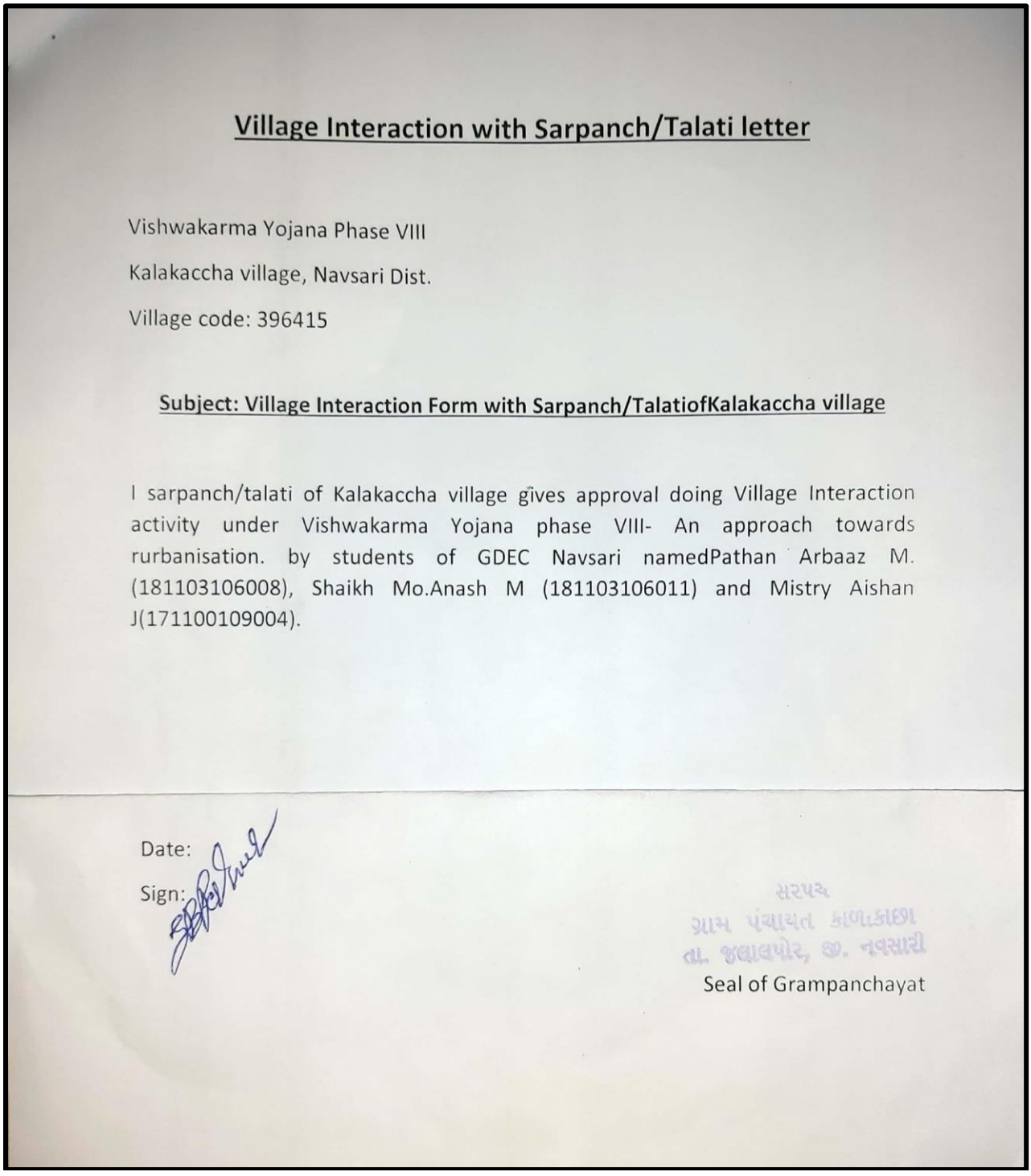






Fig 88: Allocated Villages photos

12.8 Village Interaction with Sarpanch Report with the photograph



Village Interaction with Sarpanch/Talati letter

Vishwakarma Yojana Phase VIII

Kalakaccha village, Navsari Dist.

Village code: 396415

Subject: Village Interaction Form with Sarpanch/TalatiofKalakaccha village

I sarpanch/talati of Kalakaccha village gives approval doing Village Interaction activity under Vishwakarma Yojana phase VIII- An approach towards rurbanisation. by students of GDEC Navsari namedPathan Arbaaz M. (181103106008), Shaikh Mo.Anash M (181103106011) and Mistry Aishan J(171100109004).

Date:

Sign:

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તા. જલાલપોર, જી. નવસારી

Seal of Grampanchayat

12.9 Sarpanch Letter giving information about the village development

Approval Letter For Proposed Design Approval

Vishwakarma Yojana Phase VIII

Kalakaccha village, Navsari Dist.

Village code: 396415

Subject: Approval of design proposal for Kalakaccha village

I sarpanch/talati of Kalakaccha village gives approval for following design proposal given under Vishwakarma Yojana phase VIII- An approach towards rurbanisation by students of GDEC Navsari namedPathan Arbaaz M. (181103106008), Shaikh Mo.Anash M (181103106011) and Mistry Aishan J(171100109004).

- Approved main design proposals as of part 1:
  1) Community hall
  2) Public Toilet
  3) Public garden
  4) Atm machin
  5) Post office

Date:

Sign:

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ગ્રામ પંચાયત કાળકાછા
તા. જલાલપોર, જી. નવસારી

Seal of Grampanchayat

Approval Letter for Swachhta&Covid Awareness Activity Approval

Vishwakarma Yojana Phase VIII

Kalakaccha village, Navsari Dist.

Village code: 396415

Subject: Approval of doing awareness activity for swachhta and covid for Kalakaccha village

I sarpanch/talati of Kalakaccha village gives approval of doing swachhta and covid awareness activity under Vishwakarma Yojana phase VIII- An approach towards rurbanisation by students of GDEC Navsari namedPathan Arbaaz M. (181103106008), Shaikh Mo.Anash M (181103106011) and Mistry Aishan J(171100109004).

Date:

Sign:

સરપચ
ગ્રામ પંચાયત કણકાછા
તા. જલાલપોર, જી. નવસારી

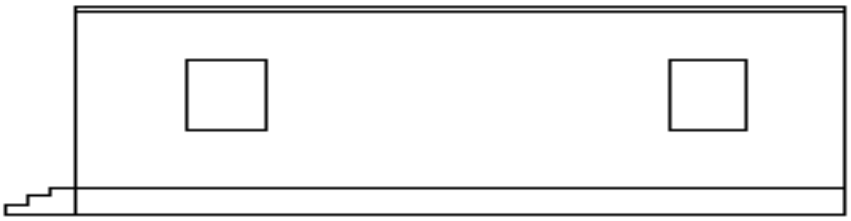
Seal of Grampanchayat

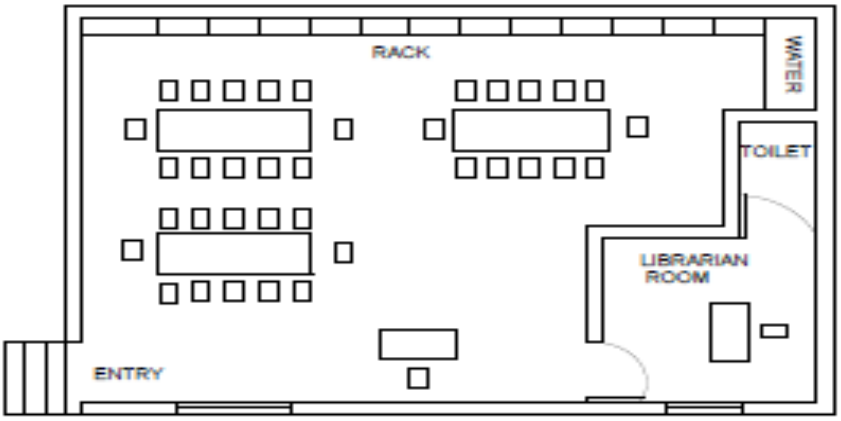
CHAPTER 13: From the Chapter- 9 future designs of the aspects (Feasibility,Construction, Operation and maintenance of various design options in Rural Areas along with cost with AutoCAD designs / planning with any software

13.1 Design Proposals

13.1.1 DESIGN OF LIBRARY

ELEVATION





PLAN

MEASUREMENT SHEET

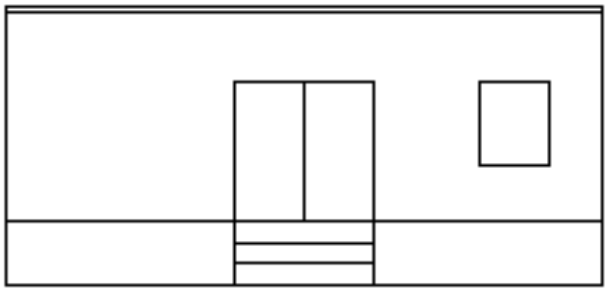
Sr. No.	Description of work	No	Length	Width	Height	Quantity
1	Excavation in foundation	1	30.75	0.9	0.9	24.19
2	P.C.C. in foundation	1	30.75	0.9	0.3	8.3
3	Brickwork up to plinth	1	31.05	0.3	0.45	4.19
4	Brickwork in superstructure	1	31.05	0.3	0.45	4.19
5	Earth filling in plinth	1	9	6	0.45	24.3
6	PCC in plinth	1	31.05	0.3	0.1	0.93
7	RCC lintel	1				0.39
8	RCC slab	1	9.6	6.6	0.2	12.67
9	Plaster work	1				107.51
10	Flooring	1	9	6		54

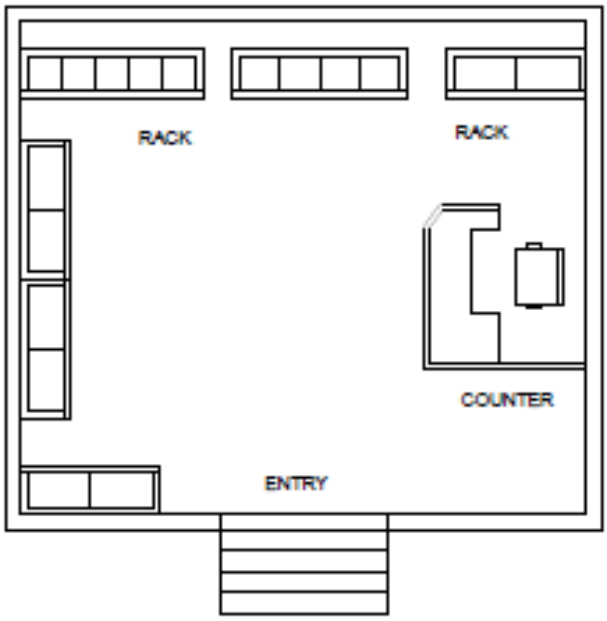
ABSTRACT SHEET

Item no	Description	Quality	Per	Rate	Amount
1	Excavation in foundation	24.91	Cubic meter	162	4035.42
2	P.C.C. in foundation	8.3	Cubic meter	4000	33200
3	Brickwork up to plinth	4.19	Cubic meter	7100	29749
4	Brickwork in superstructure	4.19	Cubic meter	7100	29749
5	Earth filling in plinth	24.3	Cubic meter	80	1944
6	PCC in plinth	0.93	Cubic meter	4000	3720
7	RCC lintel	0.39	Cubic meter	9000	351
8	RCC slab	12.67	Cubic meter	9000	114030
9	Plaster work	107.51	Cubic meter	1100	118261
10	Flooring	54	Cubic meter	700	37800
				Total	372839.42

13.1.2 DESIGN OF SUPER MARKET

ELEVATION





PLAN

MEASUREMENT SHEET

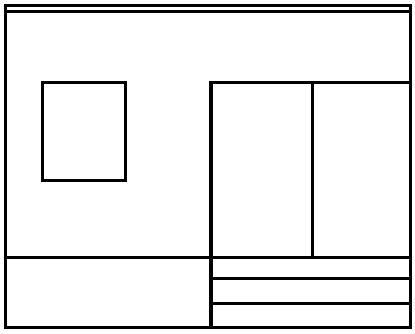
Sr. No.	Description of work	No	Length	Width	Height	Quantity
1	Excavation in foundation	1	25.2	0.9	0.9	20.41
2	P.C.C. in foundation	1	25.2	0.9	0.3	6.8
3	Brickwork up to plinth	1	25.2	0.3	0.45	3.4
4	Brickwork in superstructure	1	25.2	0.3	3	22.68
5	Earth filling in plinth	1	5	7	0.45	15.75
6	PCC in plinth	1	25.2	0.3	0.1	7.56
7	RCC lintel	1				0.096
8	RCC slab	1	5.3	7.3	0.2	7.74
9	Plaster work	1				230.76
10	Flooring	1	5	7		35

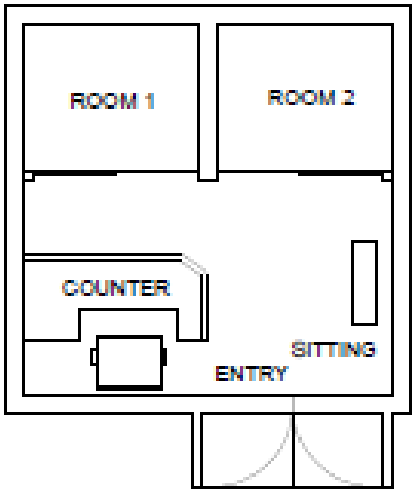
ABSTRACT SHEET

Item no	Description	Quality	Per	Rate	Amount
1	Excavation in foundation	20.41	Cubic meter	162	3306.42
2	P.C.C. in foundation	6.8	Cubic meter	4000	27200
3	Brickwork up to plinth	3.4	Cubic meter	7100	24140
4	Brickwork in superstructure	22.68	Cubic meter	7100	161028
5	Earth filling in plinth	15.75	Cubic meter	80	1260
6	PCC in plinth	7.56	Cubic meter	4000	30240
7	RCC lintel	0.096	Cubic meter	9000	864
8	RCC slab	7.74	Cubic meter	9000	69660
9	Plaster work	230.76	Cubic meter	1100	253836
10	Flooring	35	Cubic meter	700	24500
				Total	596034.42

13.1.3 DESIGN OF CYBER CAFÉ

ELEVATION





PLAN

MEASUREMENT SHEET

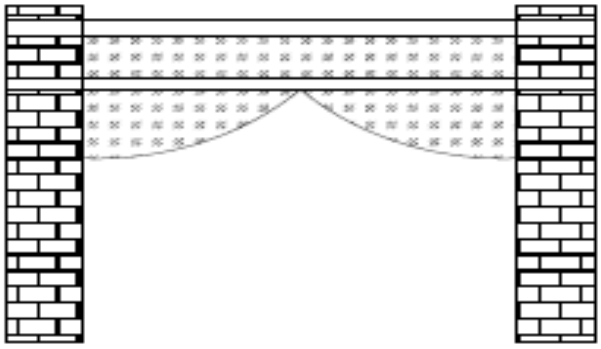
Sr. No.	Description of work	No	Length	Width	Height	Quantity
1	Excavation in foundation	1	19.2	0.9	0.9	15.56
2	P.C.C. in foundation	1	19.2	0.9	0.3	5.184
3	Brickwork up to plinth	1	20.4	0.3	0.45	2.754
4	Brickwork in superstructure	1	20.4	0.3	3	18.36
5	Earth filling in plinth	1	7	7	0.45	22.05
6	PCC in plinth	1	20.4	0.3	0.1	0.612
7	RCC lintel	1				0.096
8	RCC slab	1	6.4	7.3	0.2	9.344
9	Plaster work	1				125
10	Flooring	1	7	7		49

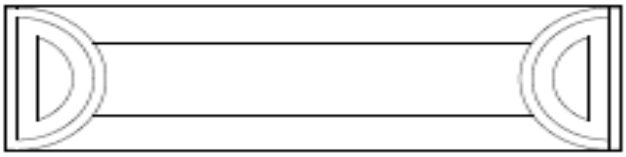
ABSTRACT SHEET

Item no	Description	Quality	Per	Rate	Amount
1	Excavation in foundation	15.56	Cubic meter	162	252072
2	P.C.C. in foundation	5.184	Cubic meter	4000	20736
3	Brickwork up to plinth	2.754	Cubic meter	7100	19553.4
4	Brickwork in superstructure	18.36	Cubic meter	7100	130356
5	Earth filling in plinth	22.05	Cubic meter	80	1764
6	PCC in plinth	0.612	Cubic meter	4000	2448
7	RCC lintel	0.096	Cubic meter	9000	864
8	RCC slab	9.344	Cubic meter	9000	84096
9	Plaster work	125	Cubic meter	1100	137500
10	Flooring	49	Cubic meter	700	34300
				Total	683689.4

13.1.4 DESIGN OF ENTRANCE GATE OF KALAKACHHA

ELEVATION





PLAN

MEASUREMENT SHEET

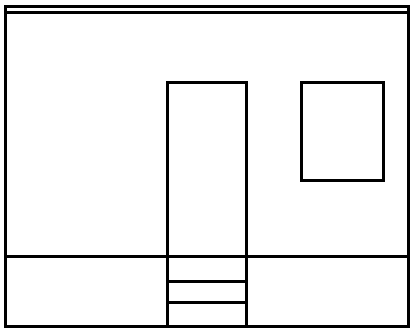
Sr. No	Description	No	Length	Width	Height	Quantity
1	Excavation	2	2	2	1.5	13.5
2	Masonry work 1(6”)	1	1.524	0.1524	1.83	1.04
3	Masonry work 2 (9”)	2	7.12	2.083	4.877	8.66
4	Roof 1	1	7.2	2.08	0.1524	2.28
5	Roof 2	1	7.2	2.08	0.1524	2.28

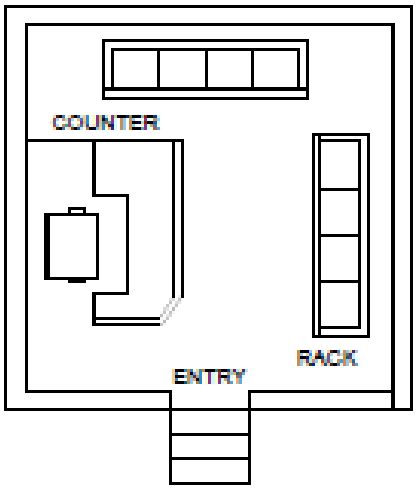
ABSTRACT SHEET

Sr. No	Description	Quantity	Rate	Per	Amount
1	Excavation	13.5	162	Cubic meter	2187
2	Masonry work 1(6”)	1.04	7100	Cubic meter	7384
3	Masonry work 2 (9”)	8.66	7100	Cubic meter	61486
4	Roof 1	2.28	3500	Cubic meter	7980
5	Roof 2	2.28	3500	Cubic meter	7980
				TOTAL	87017

13.1.5 DESIGN OF ELECTRICAL SHOP

ELEVATION





PLAN

MEASUREMENT SHEET

Sr. No.	Description of work	No	Length	Width	Height	Quantity
1	Excavation in foundation	1	19.2	0.9	0.9	15.56
2	P.C.C. in foundation	1	19.2	0.9	0.3	5.184
3	Brickwork up to plinth	1	20.4	0.3	0.45	2.754
4	Brickwork in superstructure	1	20.4	0.3	3	18.36
5	Earth filling in plinth	1	7	7	0.45	22.05
6	PCC in plinth	1	20.4	0.3	0.1	0.612
7	RCC lintel	1				0.096
8	RCC slab	1	6.4	7.3	0.2	9.344
9	Plaster work	1				125
10	Flooring	1	7	7		49

ABSTRACT SHEET

Item no	Description	Quality	Per	Rate	Amount
1	Excavation in foundation	15.56	Cubic meter	162	252072
2	P.C.C. in foundation	5.184	Cubic meter	4000	20736
3	Brickwork up to plinth	2.754	Cubic meter	7100	19553.4
4	Brickwork in superstructure	18.36	Cubic meter	7100	130356
5	Earth filling in plinth	22.05	Cubic meter	80	1764
6	PCC in plinth	0.612	Cubic meter	4000	2448
7	RCC lintel	0.096	Cubic meter	9000	864
8	RCC slab	9.344	Cubic meter	9000	84096
9	Plaster work	125	Cubic meter	1100	137500
10	Flooring	49	Cubic meter	700	34300
				Total	683689.4

13.1.7 DESIGN OF COST & ENERGY EFFICIENT STREET LIGHTING SYSTEMS

The factors that are playing a vital role in the Road Lighting are following.

1. **Type of Road**
   - Road Classification

2. **Street Light Pole**
   - Street Light Pole Arrangements
   - Placement of Pole

3. **Lighting Fixture**
   - Lighting Fixture Mounting Height
   - Lighting Fixture Classification
   - Lighting Fixture Distributor

4. **Lighting Factors**
   - Maintenance Factor
   - Coefficient of Utilization

5. **Lighting Uniformity**
   - Lighting Uniformity
   - Surrounding Ratio

6. **Lighting Pollution**
   - Glare
   - Sky Glow
   - Trespass

7. **Selection of Luminas**
   - Types of Lighting Source
   - CRI
   - Fixture Position

1. Type of Road:

Type of Road	Density of Traffic	Type	Example
A	Heavy and high speed motorized traffic	Road with fixed separators, No crossings for very long distance	National highways or state highways or called interstate highways, express ways or motor ways
B	Slightly lower density and lower speed traffic termed	Road which is made for vehicular traffic with adjoining streets for slow traffic and pedestrians as we find in metros	Trunk road or major road in a city
C	Heavy and moderate speed traffic	Important urban roads or rural roads. they do not interfere with the local traffic within the town	Ring roads
D	Slow traffic, pedestrians	Linking to shopping areas and invariably the pedestrians, approach road	Shopping street, trunk road
E	Limited speed. Slow or mixed traffic predominantly pedestrians,	____	Local streets, collectors road

Table 48: Type of Roads

Road Classes as per SP 72 (Part 8), IS 1944 (Part 1) and IS 1970	
Class A1	Important routes with rapid and dense traffic where safety, traffic speed, and driving comfort are the main considerations.
Class A2	Main Roads with considerable volume of mixed traffic, such as main city streets, arterial roads and thoroughfares.
Class B1	Secondary roads with considerable traffic such as main local traffic routes, shopping streets
Class B2	Secondary roads, with light traffic
Class C	Lighting for residential and unclassified roads not included in previous groups
Class D	Lighting for bridges and flyovers
Class E	Lighting for town and city centers
Class F	Lighting for roads with special requirement such as roads near air fields, railways and docks

Table 49: Road Classification

2. Street Light Pole:

(1) Street Light Arrangement

There are four basic types of street lighting layout arrangements used for streets or highways illumination.

a. One Side Pole Layout

- **Arrangement:** In One Side Pole Layout, all luminaries are located on one side of the road.
- **Road Width:** For narrower roads.
- **Pole Height:** The installation height of the lamp is equal to or less than the effective width of the road surface.
- **Advantages:** There are good indelibility and low manufacturing cost.
- **Disadvantages:** The brightness (luminance) of the road on the side where the lamp is not placed is lower than the on which side the light pole is placed.

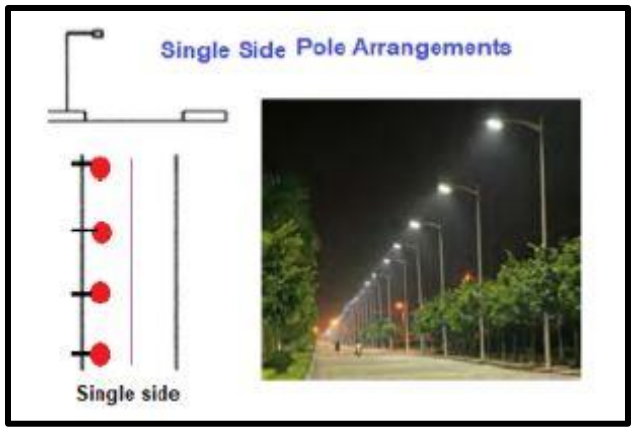


Fig 89: Single pole Arrangement

b. Both Side Staggered Pole Layout

- **Arrangement:** In the staggered arrangement, the luminaries are placed alternately on each side of the road in a "zigzag" or staggered fashion.
- **Road Width:** For Medium Size roads.
- **Pole Height:** The installation height of the lamp is equal or 1.5 time the effective width of the road.
- **Advantages:** This type of arrangement is better than single side arrangement.
- **Disadvantages:** Their longitudinal luminance uniformity is generally low and creates an alternating pattern of bright and dark patches. However, during weather they cover the whole road better than single side arrangements.

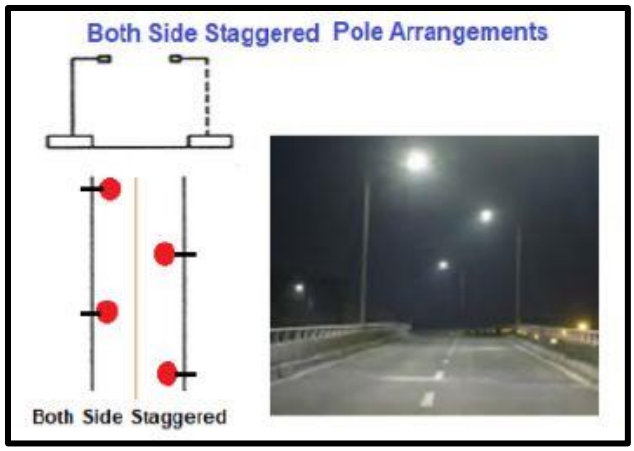


Fig 90: Both side staggered

c. Both Side Opposite Pole Layout

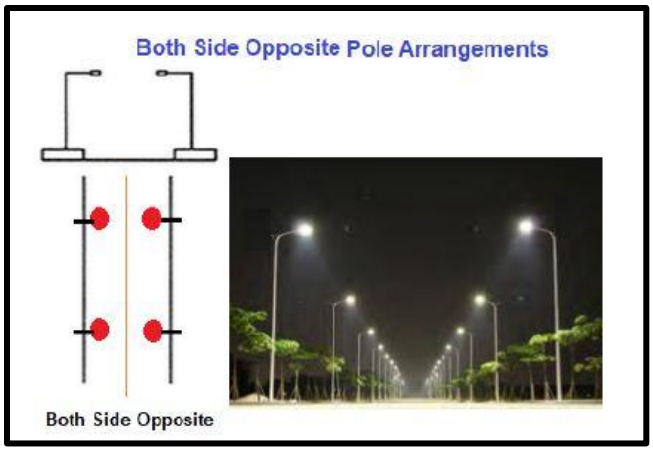


Fig 91:Both side opposite

- **Arrangement:** In Both Side Opposite Pole Layout, the luminaries located on both sides of the road opposite to one another.
- **Road Width:** For Medium Size roads.
- **Pole Height:** The installation height of the lamp will be 2 to 2.5 time the effective width of the road.
- **Advantages:** Opposite arrangements may provide slightly better lighting under wet conditions.
- **Disadvantages**: If the arrangement is used for a dual carriageway with a central reserve of at least one-third the carriageway with, or if the contraire serve includes other significant visual obstructions (such as trees or screens), it effectively becomes two single-sided arrangements and must be treated as such.

d. Twin Central Pole Layout

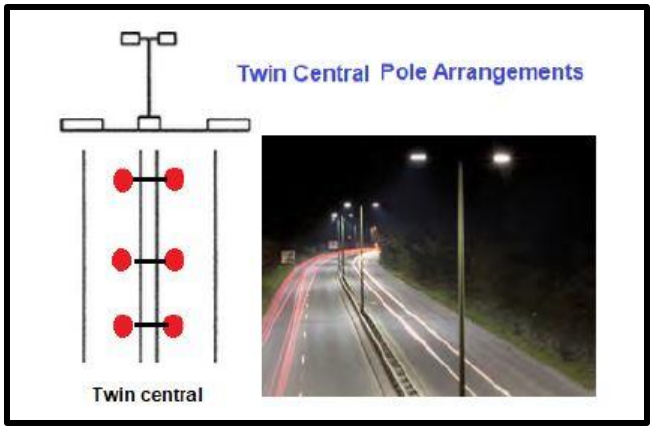


Fig 92: Twin Central

- **Arrangement:** In Twin central arrangement, the luminaries are mounted on a T-shaped in the middle of the center island of the road. The central reserve is not too wide; both luminaries can contribute to the luminance of the road surface on either lane.
- **Road Width:** Large Size roads.
- **Pole Height:** The installation height of the lamp is equal to the effective width of the road.
- **Advantages:** This arrangement generally more efficient than opposite arrangements. However, opposite arrangements may provide slightly better lighting under wet conditions.

(2) Proper Placement of a Pole:

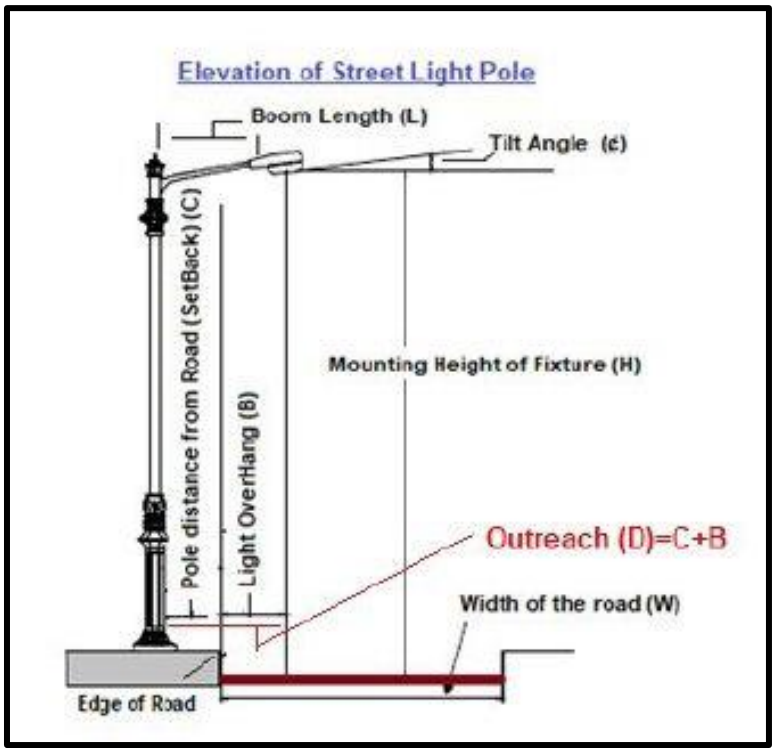


Fig 93: Elevation of Street light pole

i. Setback:

- Set back is the horizontal distance between the face of a light pole and the edge of traveled way.
- Placing luminaries too close to vertical surface results in hotspots at its base.
- A setback of 3 foot to 4 foot works well for many applications.
- Light from luminaries at extremely short setbacks grazes the surface and enhances its texture.
- Light from luminaries at Long setbacks (Luminaries too far from a vertical surface) cause shadows at low levels.
- Longer setbacks may be required for taller surfaces..
- As setback (or spacing) distance increases, Light levels and uniformity decrease.

Set Back (BS 5489)	
Design Speed	**Pole Set Back**
50 km/hr	0.8 meter
80 km/hr	1 meter
100 km/hr	1.5 meter
120 km/hr	2 meter

ii. Overhang:

- Overhang is the horizontal distance between the center of a luminaries mounted on a bracket (Nadir) and the adjacent edge of a carriage way or traveled way.
- In general, overhang should not exceed one fourth of the mounting height to avoid reduced visibility of curbs, obstacles, and footpaths.

iii. Outreach:

- Outreach is the horizontal distance between the center of the column and the center of the luminaries and is usually determined for architectural aesthetic considerations.

iv. Pole Boom(Arm) Length:

- The use of an arm places the light source closer to the traveled way while allowing the pole to be located further from the edge of the traveled way.
- Depending on the application, Pole arms may be single and/or double mast arms or davit arms at the top of the pole.
- There are several different arm lengths and styles of arms that are used.

v. Arm Types:

- Type A bracket an arm has a single member arm. It is used when the Arm length is less than 3.5 Meter.
- Type B bracket arm has a two member truss arm design. Type B arms are used when the Arm length is more than 3.5 Meter.

vi. Arm Lengths:

- The length of the bracket arm is dependent upon a street width, pole location in relation to the curb and the presence of median.
- Type A (Single member bracket) arms are available in 2 Meter and 2.5 Meter lengths.
- Type B (Twin member bracket) arms are available in 3.5 Meter, 4 Meter and 5 Meter Lengths.
- **Pole Height is 10 Meter:** On typical streets that are 12 Meter' wide from curb to curb, either a 2 Meter or 2.5 Meter arm is used. Depending on whether the pole is located behind the sidewalk or in the grass parkway between the sidewalk and the curb, the arm length may need to be increased to 4 Meter.
- **Pole Height is 13 Meter:** On an undivided street, generally Meter, 2.5 Meter or 4 Meter arms are used.
- **Pole Height is 13 Meter:** divided Street, typically have an 8 Meter wide center median to divide opposing lanes of traffic. On streets where the light poles are installed in a raised median, two 4 Meter arms oriented 180° apart are used.

vii. Boom Angle:

- When the angle of tilt is larger, a uniformity ratio is increasing. Otherwise discomfort glare is increasing because strong light comes into driver's eyes. So the angle of tilt shall be kept from 15° to 30°.

Tilt Angle		
Pole Height	**Arm Length**	**Arm Tile Angle**
6 meter	0.5 meter	5°,10°,15°
8 meter	1 meter	5°,10°,15°
10 meter	1.5 meter	5°,10°,15°
>= 12 meter	2 meter	5°,10°,15°

Table 50: Tilt Angle

viii. Pole Height:

- Light poles for conventional highway lighting applications support luminaries mounting heights ranging from approximately 30ft to 50 ft (9.1 m to 15.2 m).
- Light towers for high-mast lighting applications generally range from 80 ft to 160 ft (24.4 m to 48.8 m) and are designed in multiple sections.
- Weathering steel is a common material choice for light towers.
- Ornamental light Poles used for local streets generally range in height for 8 ft to 15 ft (2.4 m to 4.5 m).

Pole Height	Application
< 6 meter	Majority of side streets or alleys, Public gardens and parking Area to make people feel safe
8 meter	Urban traffic route , the multiplicity of road junctions
10 meter	Urban traffic routes
12 meter	Heavily used routes
18 meter	High mast lighting poles shall be installed at large-scale area such as airports, dockyards, large industrial areas, sports areas and road Intersections.

Table 51: Pole Height

ix. Pole Distance from Curb(Offset):

- The lighting poles should not be installed very close to the pavement edge, because the capacity of the roadway is decreased and the free movement of traffic is obstructed.

- For roads with raised curbs (as in urban roads) =Min. 0.3 meter and desirable 0.6 meter from the edge of raised curb.
- For roads without raised curbs (as in rural roads)=Min. 1.5 meter from the edge of the carriageway, subject to min. 5.0 meter from the center line of the carriageway.
- Height and overhang of mounting
- The glare on eyes from the mounted lights decreases with increases in the height of mounting. Usually, mounting height range from 6 to 10m.
- Overhangs on the lighting poles would keep the poles away from the pavement edges, but still allow the lamp to be held above the curb or towards the pavements.

x. Pole to Pole Spacing:

- Spacing is the distance, measured along the center line of the road, between successive luminaries in an installation.
- To preserve longitudinal uniformity, the space height ratio should generally be greater than 3.
- Placing luminaries too far apart creates scallops at the base of the surface.
- Spacing distances that are equal to 3 to 4 times the setback work well for many applications.
- Placing luminaries closer together eliminates scallops.
- Uniformity and light levels increase as spacing (or setback) distances decrease.
- Spacing of luminaries normally does not exceed five to six mounting heights.
- The span must not be more than 45 meters and for an average of 20-30 meters.

3. Lighting Fixture:

(1) Fixture's Mounting Height:

- Higher mounting heights used in conjunction with higher wattage luminaries enhances lighting uniformity and typically reduces the number of light poles needed to produce the same illumination level.
- In general, higher mounting heights tend to produce a more cost-effective design. For practical and aesthetic reasons, the mounting height should remain constant throughout the system.
- The manufacturer's photometric data is required to determine an appropriate mounting height.
- Typical mounting heights for highway lighting purposes range from 30 ft to 55 ft (9.1 meter to 16.8 meter).
- Mounting heights for light towers or High mast is typically 80 ft (24 m) or greater.
- The installation height is too low, the glare of the lamp increases.
- As the installation high increase, glare decreases, but the lighting utilization rate decreases.

(2) Fixtures Classification:

The Illuminating Engineering Society of North America (IESNA, IES or BIS1981) provides classifications for luminaries according to their glare control and high-angle brightness.

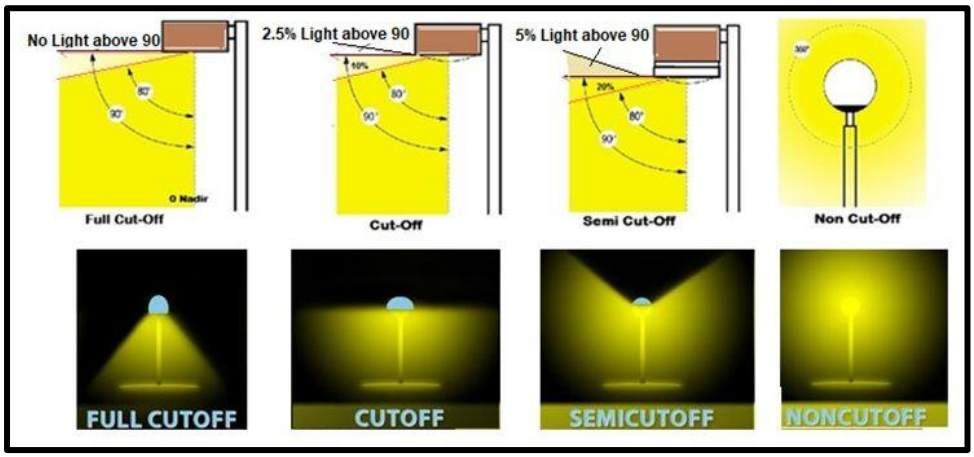


Fig 94: Fixtures Classifications

a) Full Cutoff (F):

- A luminary's light distribution is designated as full cutoff (F) when Zero intensity at or above horizontal (90° above nadir) and Less than 10% of lamp lumens at or above 80°.
- Full-cutoff fixtures reduce glare dramatically and eliminate direct up light by sending all their light toward the ground .This efficiency should translate into lower bulb wattages if the existing poles are used. However, some lighting engineers believe that to achieve the same illumination uniformity as their semi-cutoff counterparts, full-cutoff fixtures need to be mounted either on taller poles or closer together
- **Benefits:** Limits spill light on to adjacent property, reduces glare. No light is emitted directly from the luminaries into the sky. Reduce Lighting Pollution.
- **Limitations:** May reduce pole spacing to maintain uniformity and increase pole and luminaries quantities.
- **Application:** Use for roadway, parking, and other vehicular lighting applications. Minimizes glare and light pollution and light trespass.

b) Cutoff (C):

- A luminaries light distribution is designated as cutoff (C) when Less than 2.5% Intensity at or above horizontal (90° above nadir) and Less than 10% of lamp lumens at or above 80°.
- The direction of maximum intensity may vary but should be below 65º.
- **Benefits:** Small increase in high-angle light allows increased pole spacing. Cutoff system is the reduction of glare.
- **Limitations:** May allow some up light (Sky Light) from luminaries. Typically a small overall impact on sky glow.
- **Application:**
  i. Interchange lighting and rural intersections due to the ability to reduce glare.

ii. Use in applications where pedestrians are present. Provides more vertical luminance than Full Cutoff luminaries.
iii. Lamp rating should be less than 3200 lumens.
iv. The cutoff design is where the luminaries' light distribution is less than 25,000 lm at an angle of 90° above nadir (vertical axis) and100, 000 lm at a vertical angle of 80° above nadir.

c) Semi-Cutoff (S):

- A luminaries' light distribution is designated as Semi cutoff (S) when Less than 5% Intensity at or above horizontal (90° above nadir) and Less than 20% of lamp lumens at or above 80°.
- The direction of maximum intensity may vary but should be below 75º.
- **Benefits:** High-angle light accents taller vertical surfaces such as buildings. Most light is still directed downward.
- **Limitations:** Li□le control of light at property line. Potential for increased glare when using high wattage luminaries. Typically directs more light into the sky than cutoff.

- **Application:**
  i. Used for standard road lighting. Adequate glare control is obtained with reasonable spacing.
  ii. The principal advantage of the semi-cutoff system is a greater flexibility in sitting.
  iii. Use in pedestrian areas. If using in residential areas, provide with house side shields to minimize light trespass. Lamp rating should be less than 3200 lumens.
  iv. For the semi-cutoff design, the luminous flux numbers become 50,000 lm for 90° above nadir and 200,000 lm at a vertical angle of80° above nadir.
  v. Semi-cutoff fixtures create broad cones of light that permit wide spacing between poles. But such fixtures create harsh glare and send some light directly into the sky.

d) Non-Cutoff (N):

- A luminaries light distribution is designated as Non Cutoff (N) when Emit light into all directions.
- No limitations on light distribution at any angle.
- There is considerable output near the horizontal plane.
- **Benefits:**
- Uniform luminous surfaces such as internally illuminated signs or globes. Wattage should be limited. Suitable for sports lighting, facade, landscape or other applications where luminaries are tilted due to limitations in pole or fixture locations
- **Limitations:** Location and aiming are critical. Most likely of all categories to produce offensive brightness and sky glow.
- **Application:**
  i. Used in areas with a lot of background light. Non-cutoff luminaries shall not be used at lower mounting heights because of glare.
  ii. Use for decorative applications only. Lamp rating should be less than 3200 lumens.
  iii. "Full cut off" fixtures must be installed properly, so that the bottom of the fixture is level with the ground.

(3) Fixtures Distributions (Optical System):

The Illuminating Engineering Society classified series of Fixture distribution patterns as Types 1, 2, 3, 4, and 5.

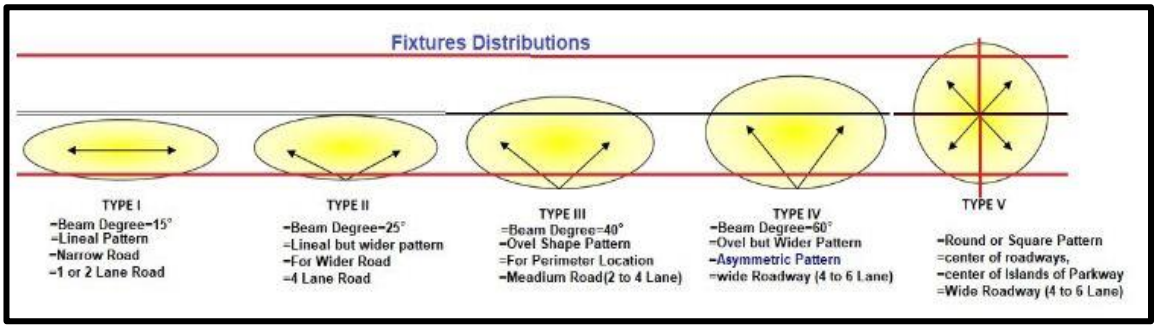


Fig 95: Fixture Distribution

a. Type 1 flow (Two-Way):

- The lateral distribution having a preferred lateral width of 15 degrees in the cone of maximum Lumen.
- **Illumination Pattern:** Narrow, symmetric luminance pattern.
- **Fixture Location:** This type is generally applicable to a luminary's location near the center of a roadway where the mounting height is approximately equal to the roadway width.
- **Type of Road:** The luminaries' is placed on the side of the street or edge of the area to be lighted. Most 1or 2 Lane Road

b. Type 2 flow (Two-Way):

- Light distributions have a preferred lateral width of 25 degrees.
- **Illumination Pattern:** Slightly wider luminance pattern than Type I.
- **Fixture Location:** They are generally applicable to luminaries located at or near the side of relatively narrow roadways, where the width of the roadway does not exceed 1.75 times the designed mounting height.
- **Type of Road:** The luminary is placed on the side of the street or edge of the area to be lighted. It produces a long, narrow, oval-shaped lighted area which is usually applicable to narrower streets.

c. Type 3 flow (Bat wing):

- Type III light distributions have a preferred lateral width of 40 degrees.
- **Illumination Pattern:** It produces an oval-shaped lighted
- **Fixture Location:** This distribution is intended for luminaries mounted at or near the side of medium width roadways, where the width of the roadway does not exceed 2.75 times the mounting height.
- **Type of Road:** The luminary is placed on the side of the street or edge of area to medium width streets.

d. Type 4 flow (Forward Throw):

- Type IV light distributions have a preferred lateral width of 60 degrees.
- **Illumination Pattern:** Widest luminance pattern.
- **Fixture Location:** This distribution is intended for side-of-road mounting and is generally used on wide roadways where the roadway width does not exceed 3.7 times the mounting height.
- **Type of Road:** very wide roadway (4 to 6 Lane)
- **Applications**: Type IV often use at perimeters where Spill Light is required and there is no place to add Pole.

e. Type 5 flow:

- Type V light distributions have a circular symmetry of candlepower that is essentially the same at all lateral angles.
- **Illumination Pattern:** It produces a circular, wider lighted area and is usually applicable to wide streets.
- **Fixture Location:** The luminaries are mounting at or near center of roadways, center islands of parkway, and intersections.
- **Type of Road:** very wide roadway (4 to 6 Lane)
- **Applications**: Type V often applies to high-mast lighting.

4. Lighting Factor

(1) Maintenance Factor/ Light Loss Factor (MF):

- The Maintenance Factor (Light loss factor) is the combination of factors used to denote the reduction of the illumination for as given area after a period of time compared to the initial illumination on the same area.
- The efficiency of the luminary is reduced over time. The designer must estimate this reduction to properly estimate the light available at the end of the lamp maintenance life.
- Luminary maintenance factors vary according to the intervals between cleaning, the amount of atmospheric pollution and the IP rating of the luminaries.
- However, it is proposed to consider maintenance factor of not less than 0.5 for LED Road lighting installations for IP66 rated luminaries.
- The maintenance factor may range from 0.50 to 0.90, with the typical range between 0.65 To 0.75
- These maintenance factor values shall be adopted for the purposes of producing the lighting simulation design.
- The maintenance factor is the product of the following factors.
- LLF = LLD + LDD + EF
- Mostly We consider Maintenance factor from 0.8 to 0.9

We have to choose Maintenance factor carefully by increasing maintenance factor 0.5 the spacing of pole increasing 2 meter to 2.5meter

Maintenance Factor	Max. Spacing of Pole (Meter)
0.95	43
0.9	40.5
0.85	38
0.8	36

Table 52: Maintenance Factor

i. Lamp Lumen Depreciation Factor (LLD):

- As the lamp progresses through its service life, the lumen output of the lamp decreases. This is an inherent characteristic of all lamps. The initial lamp lumen value is adjusted by a lumen depreciation factor to compensate for the anticipated lumen reduction.
- This assures that a minimum level of illumination will be available at the end of the assumed lamp life, even though lamp lumen depreciation has occurred. This information should be provided by the manufacturer. For design purposes, a LLD factor of 0.9 to 0.78 should be used.

ii. Luminaries' Dirt Depreciation Factor (LDD):

- Dirt on the exterior and interior of the luminaries and to some on the lamp reduces the amount of light reaching the roadway.
- Various degrees of dirt accumulation may be anticipated depending upon the area in which the luminaries are located. Industry, exhaust of vehicles, especially large diesel trucks, dust, etc, all combine to produce the dirt accumulation on the luminaries.
- Higher mounting heights, however, reduce the vehicle-related dirt accumulations.

iii. Equipment Factor (EF):

- Allows for variations inherent in the manufacture and operation of the equipment (i.e., luminaries, system voltage and voltage drop).
- It is generally assumed to be 95%.

(2) Coefficient of Utilization (CU):

- Coefficient of Utilization is the ratio of the luminous flux from a luminaries received on the surface of the roadway to the lumens emitted by the luminaries' lamps alone.
- Coefficient of Utilization should maximum.
- Coefficient of Utilization differs with each luminary's type, and depends upon mounting height, road width, and overhang.
- The coefficient of utilization (K) should be over 30% or the utilance above 40% for the road, highway, square or enclosure. Luminaries or floodlights should not by placed far from the area to be lit or, where appropriate, light projection beyond the useful zone should be minimized (K = average maintained luminance multiplied by the surface calculation and divided by the lumens installed).

Fig 95: Coefficient of Utilization

5. Lighting Uniformities

(1) Lighting Uniformity:

- Uniformity is a description of the smoothness of the lighting pattern or the degree of the intensity of bright and dark areas on the road.
- Uniformity is a measure of how evenly distributed the light on the road is, which can be expressed as Overall Uniformity (UO) and Longitudinal Uniformity (UL).
- The uniformity ratio shall not exceed 4:1 and preferably should not exceed 3:1 except on residential streets, where 6:1 may be acceptable.

i. Overall Uniformity (UO):

- In design, the overall uniformity (UO) is expressed as a ratio of the minimum to the average luminance on the road surface of the carriageway within the calculation area.
- **UO=Lmin / Lave**
- It is a measure of how evenly or uniformly illuminate on the road surface.
- A good overall uniformity ensures that all spots and objects on the road are sufficiently lit and visible to the motorist.
- The industry accepted value for UO is **less than 1.**

ii. Longitudinal Uniformity (UL):

Fig 96: Longitudinal Uniformity

- The longitudinal uniformity (UL) is expressed as the ratio of the minimum to maximum luminance along the center line of a lane within the calculation area.
- **UL=Lmin / Lmax.**
- Longitudinal uniformity is a measure to reduce bright and dark bands of light appearing on road lit surfaces. The effect can be somewhat hypnotic and present confusing luminance patterns.
- It is a measure to reduce the intensity of bright and dark banding on road lit surface.
- A good level of longitudinal uniformity ensures comfortable driving conditions by reducing the Pattern of high and low luminance level on road (i.e. Zebra Effect)
- It is applicable to long continuous roads.

(2) Surrounding Ratio:

- Road lighting should be illuminating not only the road, but also the adjacent areas so motorists can see objects in the periphery and anticipate potential road obstructions (e.g., a pedestrian about to step onto the road).
- The SR is the visibility of the road's periphery relative to that of the main road itself.
- As per industry standards, SR should be at least 50.
- Figure show how road lighting should illuminate both the main road and its periphery.

Fig 97: Surrounding ratio

6. Lighting Pollution

- Light pollution is an unwanted consequence of outdoor lighting and includes such effects as sky glow, light trespass, and glare.
- 30 to 50% of all light pollution is produced by roadway lighting that shines wasted light up and off target.

(1) Glare:

- Glare is the condition of vision in which there is discomfort or a reduction in the ability to see significant objects. Glare affects human vision and it is subdivided into four components, Disability Glare, Discomfort Glare, Direct Glare and Indirect Glare.

- **By origin**

  i Direct Glare
  ii Indirect (reflected) Glare

- **By effect on people**

  i Disability Glare
  ii Discomfort Glare

A. Disability glares:

- Disability glare is the glare that results in reduced visual performance and visibility.
- Since disability glare reduces the ability to perceive small contrasts.
- It can impair important visual tasks in traffic such as detecting critical objects, controlling headlights, and evaluating critical encounters, making glare a potential danger for road users.
- LED light sources can provide very high luminance levels which may cause glare. For this reason, LED lamps are commonly equipped with diffusers to reduce this luminance.
- Disability glare may vary for different individuals and it can be calculated objectively.
- In a particular illuminated environment, the human eye will be able to detect differences in luminance down to a certain threshold. This threshold can be compared for a situation in the same environment when a source of glare is added. By comparing these thresholds, the threshold increment can be derived.

B. Discomfort glare:

- Discomfort glare is the glare producing discomfort. It does not necessarily interfere with visual performance or visibility.
- As vertical light angles increase, discomforting glare also increases
- Discomfort glare, on the other hand, is a subjective phenomenon and there is no method for its Rating.
- Although the 9-point De Boer scale (ranging from “1” for “unbearable” to “9” for “unnoticeable”) is the most widely used in the field of auto motive and public lighting.

C. Direct Glare:

- Direct glare is caused by excessive light entering the eye from a bright light source. The potential for direct glare exists anytime one can see a light source. With direct glare, the eye has a harder time seeing contrast and details.
- A system designed solely on lighting levels, tends to aim more light at higher viewing angles, thus producing more potential for glare.

- Exposed bright light source, for example a dropped lens cobra head or floodlight causes of direct glare.

D. Indirect Glare:

- Indirect glare is caused by light that is reflected to the eye from surfaces that are in the field of view – often in the task area.
- Indirect Glare can be minimized with the type and layout of lighting equipment. Direct the light away from the observer with the use of low glare, fully shielded luminaries.
- As the uniformity ratio increases (poor uniformity), object details become harder to see.
- For roadway lighting, good uniformity shows evenly lighted pavement. However, to meet small target visibility criteria, a non uniform roadway surface may be beer.
- There should be a balance between uniform perception and detecting objects on the road. Also, emphasis is put on horizontal surface uniformity. In reality, vertical surfaces may require more lighting in order to improve guidance.

➢ HOW TO REDUCE GLARE?

- Glare and light trespass are more concern when installing floodlights.
- Use shielded Light should be use to reduce Glare.
- Higher mounting heights can more effective in controlling spill light, because floodlights with a more controlled light distribution (i.e., narrower beam) may be used, and the floodlights may be aimed in a more downward direction, making it easier to confine the light to the design area.
- Lower mounting heights increase the spill light beyond the property boundaries. To illuminate the space satisfactorily, it is often necessary to use floodlights with a broader beam and to aim the floodlights in directions closer to the horizontal than would occur when using higher mounting heights.
- Lower mounting heights make bright parts of the floodlights more visible from positions outside the property boundary, which can increase glare.

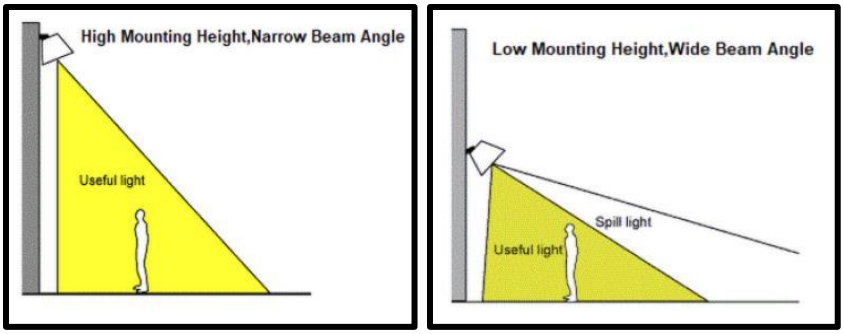


Fig 98: Light Glare

(2) Sky Glow:

- Sky Glow is brightening of the night sky caused by outdoor lighting.
- Light that is emitted directly upward by luminaries or reflected from the ground is scattered by dust and gas molecules in the atmosphere, producing a luminous background. It has the effect of reducing one's ability to view the stars in Night.

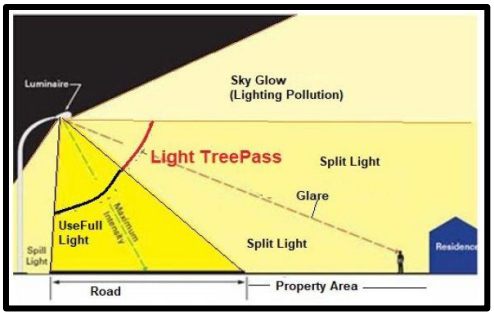


Fig 99: Sky glow

- **HOW TO REDUCE SKY GLOW?**

- While it is difficult to accurately model sky glow, at this point it is presumed that the most important factors are light output and lamp spectral characteristics, light distribution from the luminary, reflected light from the ground, and aerosol particle distribution in the atmosphere.
- If the quantity of light going into the sky is reduced, then sky glow is reduced. Thus, to reduce sky glow by
- By using full cutoff luminaries to minimize the amount of light emitted upward directly from the luminary.
- Reduce Lighting Level.
- Make practice to Turn off unneeded lights
- Limited Lighting hours in outdoor sales areas, parking areas, and signage
- Installing Low-Pressure Sodium light sources, which allow astronomers to filter the line spectra from telescopic images

(3) Light Trespass:

- Light trespass is condition when spill (Unwanted or Unneeded) light from a streetlight or floodlight enters a window and illuminates an indoor area.

- **HOW TO REDUCE LIGHT TRESSPASS?**

- Select luminaries, locations, and orientations to minimize spill light onto adjacent properties.
- Use well-shielded luminaries.
- Keep floodlight aiming angles low so that the entire beam falls within the intended lighted area.

7. Selection of Luminas

(1) Types of Lighting Source:

- Street Lights are mostly Low-pressure sodium (LPS), High-pressure sodium (HPS), Metal halide and Light emitting diodes (LED).
- LPS is very energy efficient but emits only a narrow spectrum of pumpkin-colored light that some find to be undesirable.
- LPS is an excellent choice for lighting near astronomical observatories and in some environmentally sensitive areas.
- HPS is commonly used for street lighting in many cities. Although it still emits an orange-colored light, its coloring is more “true to life” than that of LPS.
- Where it’s necessary to use white light, there are metal halide and LEDs.
- High-pressure sodium lamps should be used for expressways, main roads, secondary roads and branch roads.

- Low-power metal halide lamps should be used in mixed traffic roads for motor vehicles and pedestrians in residential areas.
- Metal halide lamps can be used for motor vehicle traffic, such as city centers and commercial centers, which require high color identification.
- Metal halide lamps, CFL lamps are used at Pedestrian streets in industrial areas, sidewalks in residential areas, and sidewalks on both sides of motorway traffic.
- LED streetlights are more durable, longer lasting, efficiency, dimmable capacity and cost effective than traditional lights.

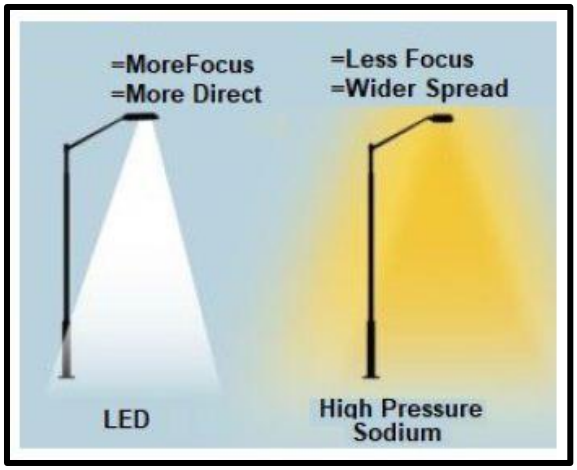


Fig 100: Type of Luminaire

- LED also enhances public safety by delivering superior visible light while providing the environmental advantage of using less energy

(2) Color Rendering Index (CRI):

- CRI Measures the ability of the artificial light to show or reproduce the colors of the road or objects on the road, relative to a natural light source.
- The natural light source (the sun) has CRI of 100. The higher
- **This index the beer the visibility will be. For all types of road CRI ≥ 70 is recommended.**
- **Efficacy**
- At the low end LED efficacy starts at 70 lumens per W (lm/W) and reaches as high as 150 lm/W.
- While the mean efficacy for outdoor area fixtures is slightly lower than common indoor fixtures such as roofers and linear lighting about 100 lm/W for area lights compared to about 110 lm/W for offers and linear fixtures this difference is not significant. It may be the result of outdoor area lights requiring more precise luminous intensity distributions and other factors unique to outdoor lighting.

(3) Fixture Position:

- When using sealed road lighting, the protection level of the light source cavity should not be lower than IP54.
- For roads and places with dangerous environmental pollution and heavy maintenance, the protection level of the light source cavity should not be lower than IP65.
- The degree of protection of the lamp electrical appliance cavity should not be lesser than IP43.
- Lamps with excellent corrosion resistance should be used in areas or places with high levels of corrosive gases such as acid and alkali in the air.

(1) Measures:

- Sufficient illumination.
- Good uniformity.
- No Glare.
- Low consumption.
- No Color Temperature abnormalities
- No Zebra effect
- Shielded lighting to ensure light is pointed downwards
- Completely uniform luminance.
- No requirement for over lighting to obtain sufficient average illumination.
- Absence of glare.

.

(2) Features and Benefits:

Effective Energy-efficient Street Lighting Systems (NYSERDA, 2002)	
Features	**Benefits**
Proper pole height & spacing	Provide uniform light distribution
Proper Luminary aesthetics	Blends in with the surroundings
Good maintenance	Reduce problems in lightning
High lamp efficiency	Minimize energy cost
Life of Luminary	Reduce lamp replacement cost
Good color rendering	Helps object appear more natural
Proper light distribution	Provide required light on roads
Cost effectiveness	Lowers operating cost
Minimizing light pollution & glare	Reduce energy use

Table 53: Effective Energy efficient Street light

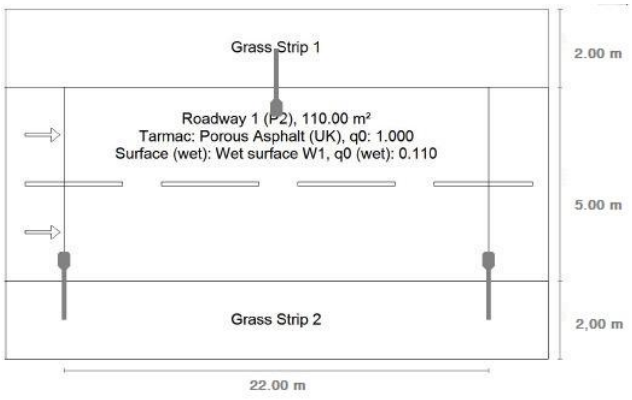
(3) Permissible Value for Street Light Designing

Descriptions	**Permissible Value**
Lumens per Watt	80 to 140
Voltage	230 V AC
Frequency	50 Hz
Power Factor	More than 0.94
THD	< 20%
Life Hours	10,000 hrs
Color Temperature	4000K to 5000K
CRI	More than 70
Beam Angle/ Beam Pattern	Type 2/3/4/5

Table 54: Permissible value for street light design

Proposed Design:

1. **Luminaire Details: Thorn R2L2 12L50-740**



Pole Data	
Pole Height (meter)	6.5
Top Dia (mm)	70
Bottom Dia (mm)	130
Thickness (mm)	30
Base Plate (mm)	225 x 225 x 16
Single Arm Bracket (mm)	1000
Material	GI

Table 55: Pole Data

Fig 101: Pole Arrangement

A small size LED road lighting lantern with 12 LEDs driven at 500mA with narrow road optic, LED driver Programmable. Class II electrical, IP66, IK08.

Housing: die-cast aluminum (EN AC-44300), powder coated textured light grey.
Enclosure: tempered flat glass.
Screws: stainless steel, Ecolubric treated.
Post top (Ø60/76mm, tilted 0°/5°/10°) or lateral (Ø34/42/49/60mm, tilted 0°/-5°/-10°/-15°) mounting. For lateral mounting to Ø34/42mm spigots an adaptor (59005840 R2L2 MA34/42 NPA) should be ordered separately.
Equipped with 50% power reduction circuit, effective 3 hours before and 5 hours after a calculated midnight. It can be deactivated at installation with an easily accessible internal switch.
Dimensions: 655 x 362 x 155 mm
Luminaire input power: 20 W
Luminaire luminous flux: 2826 lm
Luminaire efficacy: 141 lm/W
CRI: 75
Correlated Color Temperature: 4000 K
Weight: 4.89 kg
Life: 10,000 h

Fig 102: Luminaire

2. Street Profile:

Grass Strip 2: Width: 2.000 m
Roadway 1: Width: 5.000 m, Number of lanes: 2
Grass Strip 1: Width: 2.000 m

3. Luminaire Arrangement:

Luminaire: Thorn R2L2 S 12L50-740
Luminous flux (Luminaire): 2826 lm
Luminaire Wattage: 20.0 W
Arrangement: Double row, with offset
Pole Distance: 22.000 m
Height (1): 6.500 m
Overhang (2): 0.500 m
Boom Angle (3): 10.0 °
Boom Length (4): 1.087 m

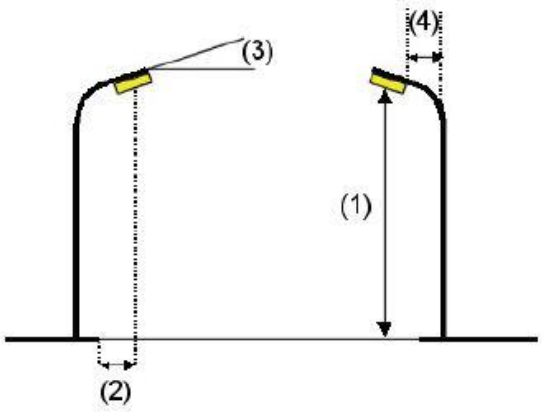


Fig 103: Luminaire Arrangement

4. Photometric Results:

Valuation Field Roadway 1
Length: 22.000 m, Width: 5.000 m
Grid: 3 x 3 Points
Street Elements: Roadway 1.
Selected Lighting Class: S2

	Eav [lx]	Emin [lx]	Emin (semi-cyl.) [lx]
Calculated values:	13.65	11.27	4.84
Required values according to class:	≥ 10.00	≥ 3.00	≥ 2.00
Fulfilled/Not fulfilled:	**Yes**	**Yes**	**Yes**

Table 56: Photometric Results

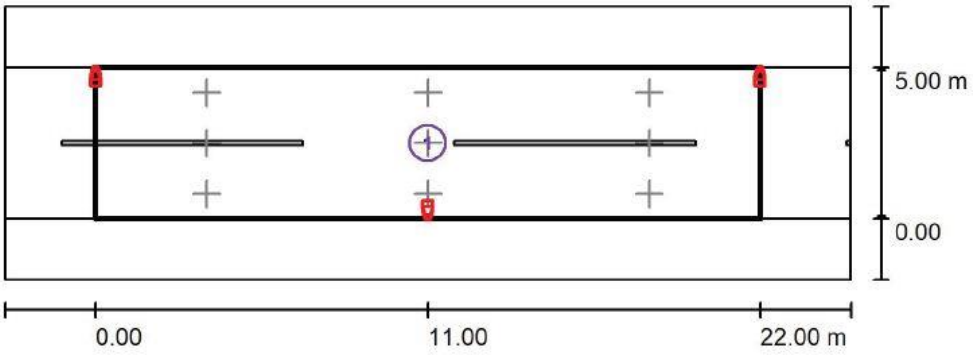


Fig 104: Photometric Results

5. Iso lines & Grayscale:

Eav [lx]	Emin [lx]	Emax [lx]	Ur (Emin/ Eav)	Emin / Emax
14	11	15	0.785	0.733

Table 57: Iso-lines

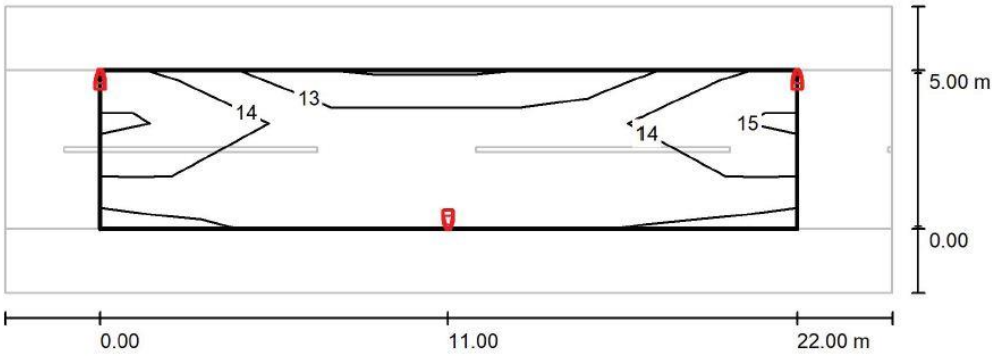


Fig 105: Iso lines

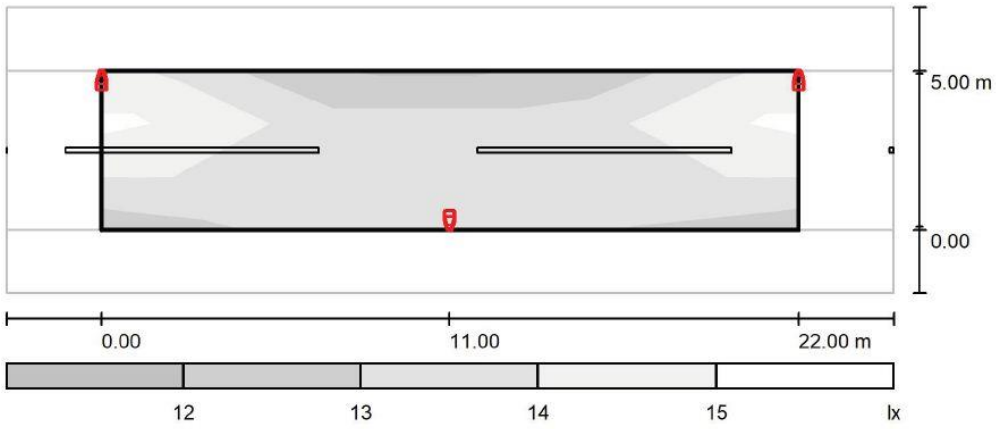


Fig 106: Grayscale

Required Calculations of Parameter for Designing:

1. Distance between each Street light pole:

- Road Details: The width of road is **5 m**.
- Pole Details: The height of Pole is **6.5 m**.
- Luminaire Details: Wattage of Luminaries is **20 W**.

Lamp Output (LL) is **2826 Lumen**
Required Lux Level (Eh) is **≥ 10 Lux (Not more than 15)**
Coefficient of Utilization Factor (Cu) is **0.83**
Lamp Lumen Depreciation Factor (LLD) is **0.43**
Lamp Dirt Depreciation Factor (LDD) is **0.85**
Equipment Factor (EF) is **0.60**
Space-Height Ratio (Distance between Pole / Road width) should be less than 5.

CALCULATION: Spacing between each Pole (D) = (LL*CU*LLF) / Eh*W
Note: Maintenance Factor/Light Loss Factor = LLD+LDD+EF

LLF = 0.43+0.85+0.60
= 1.89

Now Spacing between each Pole D = (2826*0.8*1.89) / 10*20
= 21.11 m
So, the Distance Between each Street light pole will be of **22 m.**

Checking the Space- Height Ratio: (22/5) = **4.2; which is Permissible.**

2. Required Power for Street light Area:

Required Illumination Level for Street Light (Eh) is **10 Lux/m^2**
Luminous Efficacy (En) is **141 lm/ W.**
Required Street Light Area to be illuminated (A) is **1 m^2**

CALCULATION: Required Power (W) = (Eh*A) /En

W = (10*1)/ 141
= **0.07 W/m^2**

3. Lux Level for Street Lighting:

The Average Lux Level of Street Light is measured by 9 point method. Make two equal quadrants between Two Street light poles. On the lane of light poles (one side pole to road), we have 3 points P1,P2 and P3, then P6 & P9 are points opposite pole 1 or Point P3 same is applicable for P4 and P7 for Pole 2.

CALCULATION: The Average lux (E_{av}) = [(P1+P3+P7+P9)/16] + [(P2+P6+P8+P4)/8] + [P5/4]

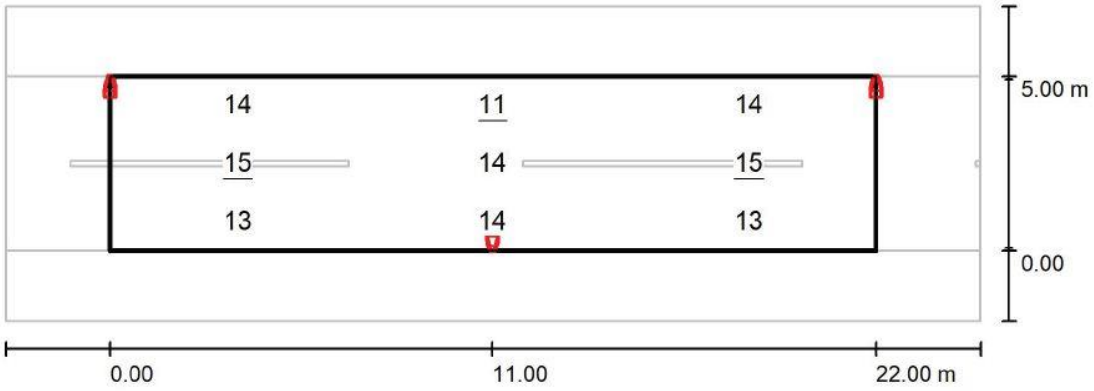


Fig 107:9 Point Lux method

E_{av} = [(13+13+14+14)/16] + [(14+15+11+15)/8] + [14/4]

= **14 Lux; which is Permissible**

4. Uniformity Ratio:

Once luminaries spacing has been decided it is necessary to check the uniformity of light distribution and compare this value to the selected lighting.

CALCULATION: Uniformity Ratio (UR) = Emin /Eav; = Emin/Emax

UR = 11/14 ; = 11/15
= **0.785** **= 0.733**

5. Installation Cost of Street Light (Calculation for 150 m Road):

CALCULATION: Installation Cost = Price of Street Light + Price of Pole + Price of Electrical Auxiliaries (Cables, MCBs, Lugs) + Labor Cost

Cost = 1900 + 4800 + 900 + 1500
= 9100 /- (For Single Unit)

Total No of Units to be installed = 13

Total Cost = 13 x 9100
= 1, 18,300/- INR

6. Energy Savings After Replacement:

CALCULATION: KWh (Savings) = (Wp (pr) x Hrs (pr)) -- (Wp (po) x Hrs (po)) ± Adjustments

Where: Wp (pr) = The power consumed when the old lighting fixture was used.
Hrs (pr) = The duration that the fixture was used in old setup.
Wp (po) = The power consumed when the new lighting fixture was used.
Hrs (po) = The duration that the fixture was used after new fixture was setup.

Old Fixture	Type	Wattage	CRI	Luminous Flux	Color Temperature	Luminous Efficacy	Lamp Life
Philips TL-D 36W/54-765 1SL/25	Fluorescent Tube light	36 W	70	2500 lm	6200 K	69.44 lm/W	10,000h

Table 58: Old Fixture Details

New Fixture	Type	Wattage	CRI	Luminous Flux	Color Temperature	Luminous Efficacy	Lamp Life
Thorn R2L2 S 12L50	LED	20 W	75	2826 lm	4000 K	141 lm/W	10,000 h

Table 59: New Fixtures Details

kWh Savings = (36 x 10,000) – (20 = x 10,000) ± 5
= 1, 60,000
= 160 ± 5 kWh

13.1.8 AUTOMATIC SOLAR PANEL CLEANING MACHINE

Introduction

The sun emits energy at an extremely large rate hence there is abundant availability of solar energy in the nature. If all solar energy could be converted into usable forms, it would be more enough to supply the world's energy demand. However, this is not possible because of conditions in the atmosphere such as effect of clouds, dust and temperature. Solar energy can be converted to more usable energy forms through solar panel. There is unprecedented interest in renewable energy, particularly solar energy, which provides electricity without giving rise to any carbon dioxide emission. Of the many alternatives, photovoltaic method of extracting power from solar energy have been considered has promising toward meeting the continuously increasing demand for energy. The efficiency of solar panel is limited due natural conditions so it is very much essential to take care of parameters like dust, humidity and temperature.

The develop design includes implementation of microcontroller based dust cleaning system. The main aim of the project is provide automatic dust cleaning mechanism for solar panel. Traditionally cleaning system was done manually. The manual cleaning has disadvantages like risk of staff accidents and damage of the panels, movement difficulties, poor maintenance etc. Automatic dust cleaning system of solar panels has taken to overcome the difficulties arise in the traditional cleaning and also produces an effective, non- abrasive cleaning and avoids the irregularities in the productivity due to the deposition of dust . The studies carried out to evaluate the efficiency of solar panel for dust collected on it for one day, one week and a month. The efficiency of solar panel also calculated after cleaning the surface for one day, one week and a month. Comparing both the efficiencies it is proved that solar panel efficiency increases considerably. Thus the developed design enhances the solar panel performance. Various source of energy like coal, gas, hydro, nuclear, renewable, diesel are going to be exhausted within few years.

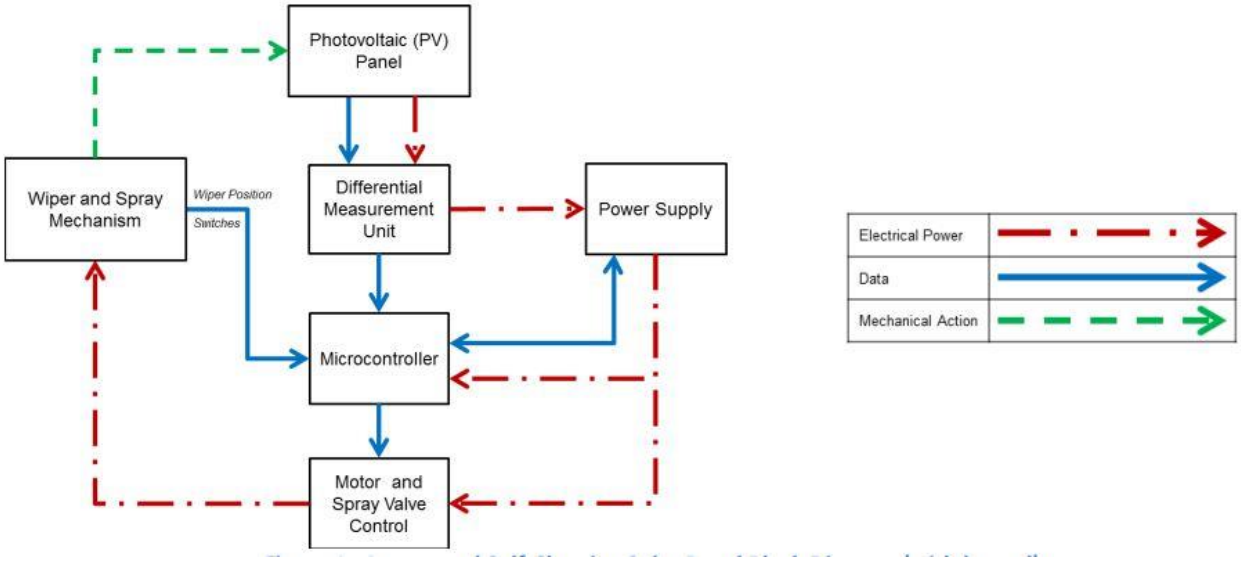


Fig 108: Block diagram of system

Working Principle:

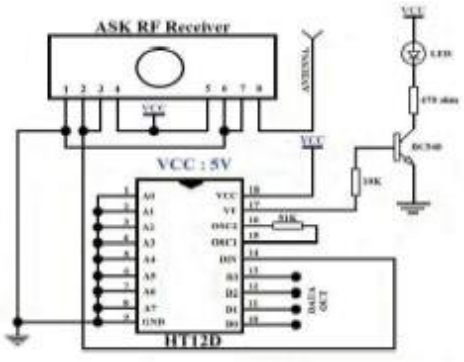


Fig 109: Circuit Diagram

Basically our project design is totally microcontroller based. It is a closed loop system, where we have provided feedback system for fault detection as well as system protection. When the system is switched ON ultimately the ARDUINO (i.e. microcontroller) starts functioning as per program uploaded in it.(The program for the system is to be pre-programmed and installed in the development board). The driving motor starts functioning in forward/reverse motoring mode as per the program. The rover continues its initial motoring action unless the NO (NORMALLY OPEN) contact of the contactor becomes NC (NORMALLY CLOSED). At this stage polarity of the motor will get reversed and reverse/forward motoring will start. The motoring action continues till the desired cycle is completed. But if there is any fault and the motoring action does not change in desired time interval then alarm system will come into action, parallel system gets shutdown.

So here we use the 433 Mhzics which is basically a 2 IC set. One is transmitter and other is receiver. And with that we have used HT12E/HT12D ICs which is basically an encoder decoder IC respectively. Along with that I have used the relay module to connect 4 loads to the circuit and so we have a receiver module and in other hand we have transmitter module.
So first I connect the decoder IC with transmitter to make the transmitter module which is known as remote control. It transmit the radio frequency signal to the receiver module
Then I have connected the encoder IC with receiver ic and make a receiver module which receive the signal given from the transmitter module
In receiver module there is a relay module which have 4 loads to connect, we can connect 4 loads to the receiver module and make them wirelessly remote controlled by a transmitter module

Cost Calculation:

Component	No. Of comp.	Cost
12v Geared DC motor	6×200	1200
Plastic Pipe	7 feet	150
Wires		100
433Mhz Receiver And Transmitter		200
IC – Nodemcu- Wi-Fi module		350
HT12E-HT12D (Encoder-decoder)		150
Relay module		500
Variable resistor		30
Cleaning brush		360
Sweeper		120
Wheels	6×10	60
Battery(12V,6A)		1500
Total Cost		**4800/-**

Table 60: Cost Calculation of System

13.1.9 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.

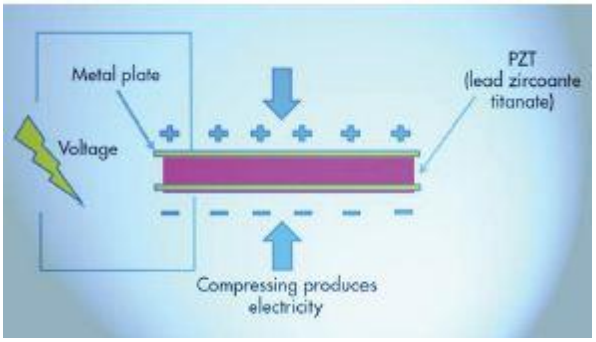


Fig 110: Piezoelectric Sensor

In our Village we can Construct Piezoelectric Speed Breakers at the main entrance of Village where the migration of vehicles and people are maximum and by applying the Kinetic Energy on Piezoelectric Sensor.

- Applying mechanical energy to a crystal is called a direct piezoelectric effect and works like this.
- A piezoelectric crystal is placed between two metal plates.
- Mechanical pressure is then applied to the material by the metal plates, which forces the electric charges within the crystal out of balance.
- The output current that is generated from the piezoelectric sensor may be less, which may increase the time taken for charging a battery. But it can be used for charging an electronic device battery for emergency purpose where there is no direct source of electricity.
- A vibrating piezoelectric device generates an ac voltage while electrochemical batteries require a dc voltage, hence the first stage needed in an energy harvesting circuit is an ac–dc rectifier connected to the output of the piezoelectric device.
- A piezoelectric transducer can generate voltages in the range of a few mill-Volts to tens of Volts, depending on their construction.
- Most of the commercially available piezoelectric transducers that are meant for hobby purposes generate voltages in the range of 10mV to 100mV.
- PZT is a crystalline material that contains lead, zirconium and titanium, and is the best piezoelectric material known.

Calculation for Piezoelectric Speed Breaker Installation:

For Constructing a Piezoelectric Speed Breaker We Need some Small Piezo Electric 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 a RCC 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.

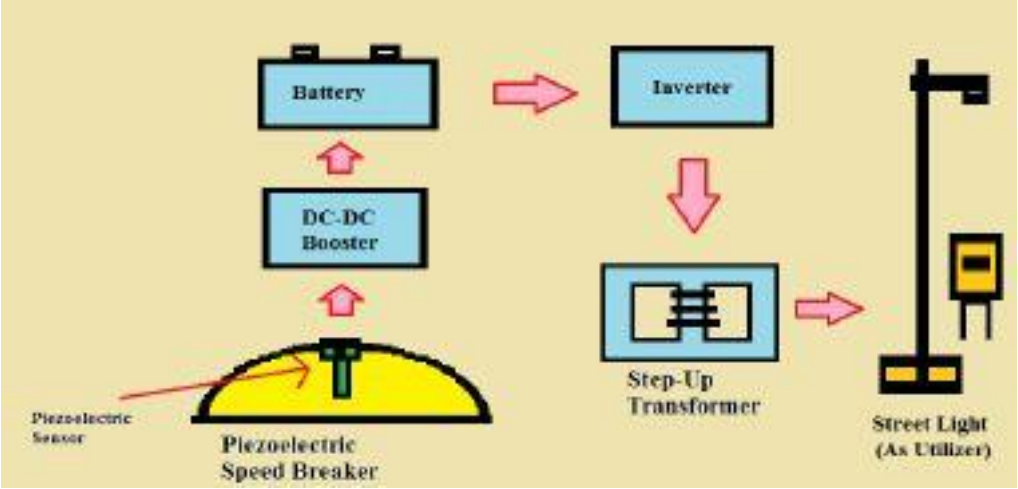


Fig 111: Arrangement of Components

Cost Calculation:

Sr. No.	Installations	Quantity	Cost/Qty	Total Cost
1	Piezoelectric Sensors	60	50	3000
2	Speed Breaker	9 mtrs	2000	18000
3	DC-DC Booster	1no.	1000	1000
4	Inverter	1no.	5000	5000
5	Battery	1 no.	10000	10000
6	Step-Up Transformer	1 no	1000	1000
Miscellaneous		-	-	1000
Total Cost Estimation				**39, 300**

Table 61: Cost Calculation of System

CHAPTER 14: Technical Options with Case Studies

14.1 Civil Case Studies

14.1.1 Advanced Earthquake Resistant

The science of structural and **Earthquake Engineering** helps enhance the seismic flexibility of civil structures and critical infrastructure through advanced engineering and management tools. While natural forces are extremely useful to mankind, natural disasters can wreak havoc with hurricanes, earthquakes, tsunamis posing threat to life and infrastructure worth billions of dollars

There are many known and practiced measures to protect against seismic threats. Let's take a look at some of the **earthquake resistant techniques** used by the engineers' world over to minimize the damage to structures due to earthquakes:

Floating Foundation:

The levitating or floating foundation separates the substructure of a building from its superstructure.

One way of doing this is by floating a building above its foundation on lead-rubber bearings that comprise a solid lead core covered in alternating layers of rubber and steel. The bearings are attached to the building and its foundation with the help of steel plates. So, when an earthquake occurs, the floating foundation can move without moving the structure above it.

Fig 112: Floating Foundations

In Japan this base isolation system works at a whole new level. Their design allows buildings to float mid-air. The system levitates, keeping the building on a cushion of air. The system has in-built sensors for detection of seismic activity and these sensors communicate with the air compressor that creates the layer of air between the building and its base.

Shock Absorption:

Similar to the shock absorbers used in vehicles, buildings also makes use of this technology. These earthquake resistant technologies help buildings slow down and reduce the magnitude of vibratory motions. Ideally shock absorbers should be placed at each level of the building – one end attached to the beam and the other end to the column. Each comprises a piston head that moves inside a cylinder full of silicone oil. During earthquakes, the horizontal motion of building will make the piston push against the oil, transforming mechanical energy from the quake to heat.

Rocking Core-Wall:

Modern high-rise buildings use this technique to improve seismic resistance at a low cost. To make this work, a reinforced concrete core is set through the heart of the structure, surrounded by

elevator banks. Many modern high-rise buildings use this technique to increase seismic resistance in an affordable way. It works most effectively when used together with base isolation.
For base isolation, elastomeric bearings are built with alternating layers of steel and natural rubber/neoprene. The bearing thus created has low horizontal stiffness and vertical rigidity. The combination is highly effective, cost-friendly and simple to implement.

Pendulum Power:

The pendulum power technique works by suspending a huge mass near the top of the structure. This mass is supported by steel cables and viscous fluid dampers are placed between the mass and the building that it protects. In case of any seismic activity, the pendulum moves in the opposite direction to balance the energy. Each of the pendulums is tuned to sync with the natural frequency of the structure and these systems are called tuned mass dampers. Their goal is to counter resonance and reduce the structure's dynamic response.

Symmetry, Diaphragms and Cross-Bracing:

Generally one common criterion for seismic designs is symmetry. Seismic risks of asymmetrical designs are higher. L-Shaped, T-Shaped and split-level structures may be more visually appealing but they are also prone to torsion. Thus engineers design symmetrical structures to keep the forces equally distributed through the structure and limit ornamental elements like cornices, cantilever projections etc.

An earthquake has a significant lateral force. Seismic designing counteracts these forces in both horizontal and vertical structural systems. Diaphragms are integral to horizontal structures – such as floors of a building or roof. Engineers design each diaphragm on its own deck and strengthen it horizontally so it can distribute sideways forces with vertical structure parts.

With vertical structures, engineers have several approaches. Braced frames are often used in building walls. Braced frames rely on trusses for resisting sideways motion. Cross-bracing is a technique that uses two diagonal members in an X-shape to build wall trusses and it is a popular technique to build **earthquake resistant structures**.

Finally

Seismic Engineering is a very complex and constantly evolving. Seismic structural assessment is a powerful tool in **Earthquake Engineering** that uses detailed modeling of the structure in conjunction with structural analysis to get a better understanding of the building's resistance. Retrofitting older structures with enhanced designs or materials is as important as rebuilding new structures from scratch. The ultimate goal of **Earthquake Civil Engineering** is to save lives so that the buildings don't collapse and allow inhabitants to escape in a timely manner.

14.1.2 Seismic retrofitting of building

Seismic retrofitting is the modification of existing structures to make them more resistant to seismic activity, ground motion, or soil failure due to earthquakes. With better understanding of seismic demand on structures and with our recent experiences with large earthquakes near urban centers, the need of seismic retrofitting is well acknowledged. Prior to the introduction of modern

seismic codes in the late 1960s for developed countries (US, Japan etc.) and late 1970s for many other parts of the world (Turkey, China etc.),[1] many structures were designed without adequate detailing and reinforcement for seismic protection. In view of the imminent problem, various research works has been carried out. State-of-the-art technical guidelines for seismic assessment, retrofit and rehabilitation have been published around the world – such as the ASCE-SEI 41[2] and the New Zealand Society for Earthquake Engineering (NZSEE)'s guidelines.[3] These codes must be regularly updated; the 1994 Northridge earthquake brought to light the brittleness of welded steel frames, for example.[4]

The retrofit techniques outlined here are also applicable for other natural hazards such as tropical cyclones, tornadoes, and severe winds from thunderstorms. Whilst current practice of seismic retrofitting is predominantly concerned with structural improvements to reduce the seismic hazard of using the structures, it is similarly essential to reduce the hazards and losses from non-structural elements. It is also important to keep in mind that there is no such thing as an earthquake-proof structure, although seismic performance can be greatly enhanced through proper initial design or subsequent modifications

Typical solution of retrofitting

This collapse mode is known as *soft story collapse*. In many buildings the ground level is designed for different uses than the upper levels. Low rise residential structures may be built over a parking garage which has large doors on one side. Hotels may have a tall ground floor to allow for a grand entrance or ballrooms. Office buildings may have retail stores on the ground floor with continuous display windows.

Traditional seismic design assumes that the lower stories of a building are stronger than the upper stories; where this is not the case—if the lower story is less strong than the upper structure—the structure will not respond to earthquakes in the expected fashion. Using modern design methods, it is possible to take a weak lower story into account. Several failures of this type in one large apartment complex caused most of the fatalities in the 1994 Northridge earthquake.

Fig 113: Retrofitting Solution

Typically, where this type of problem is found, the weak story is reinforced to make it stronger than the floors above by adding shear walls or moment frames. Moment frames consisting of inverted **U** bents are useful in preserving lower story garage access, while a lower cost solution may be to use shear walls or trusses in several locations, which partially reduce the usefulness for automobile parking but still allow the space to be used for other storage.

Beam-column joint connections

Beam-column joint connections are a common structural weakness in dealing with seismic retrofitting. Prior to the introduction of modern seismic codes in early 1970s, beam-column joints were typically non-engineered or designed. Laboratory tastings have confirmed the seismic vulnerability of these poorly detailed and under-designed connections. Failure of beam-column joint connections can typically lead to catastrophic collapse of a frame-building, as often observed in recent earthquakes

For reinforced concrete beam-column joints – various retrofit solutions have been proposed and tested in the past 20 years. Philosophically, the various seismic retrofit strategies discussed above can be implemented for reinforced concrete joints. Concrete or steel jacketing has been a popular retrofit technique until the advent of composite materials such as Carbon fiber-reinforced polymer (FRP). Composite materials such as carbon FRP and Aramaic FRP have been extensively tested for use in seismic retrofit with some success. One novel technique includes the use of selective weakening of the beam and added external post-tensioning to the joint[28] in order to achieve flexural hinging in the beam, which is more desirable in terms of seismic design.

Widespread weld failures at beam-column joints of low-to-medium rise steel buildings during the Northridge 1994 earthquake for example, have shown the structural deviancies of these 'modern-designed' post-1970s welded moment-resisting connections. A subsequent SAC research project [4] has documented, tested and proposed several retrofit solutions for these welded steel moment-resisting connections. Various retrofit solutions have been developed for these welded joints – such as a) weld strengthening and b) addition of steel haunch or 'dog-bone' shape flange.

Following the Northridge earthquake, a number of steel moments -frame buildings were found to have experienced brittle fractures of beam to column connections. Discovery of these unanticipated brittle fractures of framing connections was alarming to engineers and the building industry. Starting in the 1960s, engineers began to regard welded steel moment-frame buildings as being among the most ductile systems contained in the building code. Many engineers believed that steel moment-frame buildings were essentially invulnerable to earthquake induced damage and thought that should damage occur, it would be limited to ductile yielding of members and connections. Observation of damage sustained by buildings in the 1994 Northridge earthquake indicated that contrary to the intended behavior, in many cases, brittle fractures initiated within the connections at very low levels of plastic demand. In September, 1994, The SAC joint Venture, AISC, AISI, and NIST jointly convened an international workshop in Los Angeles to coordinate the efforts of various participants and to lay the foundation for systematic investigation and resolution of the problem. In September 1995 the SAC Joint Venture entered into a contractual agreement with FEMA to conduct Phase II of the SAC Steel project. Under Phase II, SAC continued its extensive problem-focused study of the performance of moment resisting steel frames and connections of various configurations, with the ultimate goal of developing seismic design criteria for steel construction. As a result of these studies it is now known that the typical moment-resisting connection detail employed in steel moment frame construction prior to the 1994 Northridge earthquake had a number of features that rendered it inherently susceptible to brittle fracture.

Shear failure within floor diaphragm

Floors in wooden buildings are usually constructed upon relatively deep spans of wood, called joists, covered with a diagonal wood planking or plywood to form a subfloor upon which the finish floor surface is laid. In many structures these are all aligned in the same direction. To prevent the beams from tipping over onto their side, blocking is used at each end, and for additional stiffness, blocking or diagonal wood or metal bracing may be placed between beams at one or more points in their spans. At the outer edge it is typical to use a single depth of blocking and a perimeter beam overall.

If the blocking or nailing is inadequate, each beam can be laid flat by the shear forces applied to the building. In this position they lack most of their original strength and the structure may further collapse. As part of a retrofit the blocking may be doubled, especially at the outer edges of the building. It may be appropriate to add additional nails between the sill plate of the perimeter wall erected upon the floor diaphragm, although this will require exposing the sill plate by removing interior plaster or exterior siding. As the sill plate may be quite old and dry and substantial nails must be used, it may be necessary to pre-drill a hole for the nail in the old wood to avoid splitting. When the wall is opened for this purpose it may also be appropriate to tie vertical wall elements into the foundation using specialty connectors and bolts glued with epoxy cement into holes drilled in the foundation.

Fig 114: Shear Failure

Sliding off foundation and "cripple wall" failure

Single or two-story wood-frame domestic structures built on a perimeter or slab foundation are relatively safe in an earthquake, but in many structures built before 1950 the sill plate that sits between the concrete foundation and the floor diaphragm (perimeter foundation) or stud wall (slab foundation) may not be sufficiently bolted in. Additionally, older attachments (without substantial corrosion-proofing) may have corroded to a point of weakness. A sideways shock can slide the building entirely off of the foundations or slab.

Fig 115: Crible Wall

Often such buildings, especially if constructed on a moderate slope, are erected on a platform connected to a perimeter foundation through low stud-walls called "cripple wall" or *pin-up*. This low wall structure itself may fail in shear or in its connections to itself at the corners, leading to the building moving diagonally and collapsing the low walls. The likelihood of failure of the pin-up can be reduced by ensuring that the corners are well reinforced in shear and that the shear panels are well connected to each other through the corner posts. This requires structural grade sheet plywood, often treated for rot resistance. This grade of plywood is made without interior unfilled knots and with more, thinner layers than common plywood. New buildings designed to resist earthquakes will typically use OSB (oriented strand board), sometimes with metal joins between panels, and with well attached stucco covering to enhance its performance. In many modern tract homes, especially those built upon expansive (clay) soil the building is constructed upon a single and relatively thick monolithic slab, kept in one piece by high tensile rods that are stressed after the slab has set. This post stressing places the concrete under compression – a condition under which it is extremely strong in bending and so will not crack under adverse soil conditions.

Reinforced concrete column burst

Jacketed and grouted column on left, unmodified on right

Reinforced concrete columns typically contain large diameter vertical rebar (reinforcing bars) arranged in a ring, surrounded by lighter-gauge hoops of rebar. Upon analysis of failures due to earthquakes, it has been realized that the weakness was not in the vertical bars, but rather in inadequate strength and quantity of hoops. Once the integrity of the hoops is breached, the vertical rebar can flex outward, stressing the central column of concrete. The concrete then simply crumbles into small pieces, now unconstrained by the surrounding rebar. In new construction a greater amount of hoop-like structures are used.

One simple retrofit is to surround the column with a jacket of steel plates formed and welded into a single cylinder. The space between the jacket and the column is then filled with concrete, a process called grouting. Where soil or structure conditions require such additional modification, additional pilings may be driven near the column base and concrete pads linking the pilings to the pylon are fabricated at or below ground level. In the example shown not all columns needed to be modified to gain sufficient seismic resistance for the conditions expected.

Reinforced concrete wall burst

Concrete walls are often used at the transition between elevated road fill and overpass structures. The wall is used both to retain the soil and so enable the use of a shorter span and also to transfer the weight of the span directly downward to footings in undisturbed soil. If these walls are inadequate they may crumble under the stress of an earthquake's induced ground motion.

One form of retrofit is to drill numerous holes into the surface of the wall, and secure short L-shaped sections of rebar to the surface of each hole with epoxy adhesive. Additional vertical and horizontal rebar is then secured to the new elements, a form is erected, and an additional layer of concrete is poured. This modification may be combined with additional footings in excavated trenches and additional support ledgers and tie-backs to retain the span on the bounding walls.

Residential retrofitting

Side-to-side forces cause most earthquake damage. Bolting of the mudsill to the foundation and application of plywood to cripple walls are a few basic retrofit techniques which homeowners may apply to wood-framed residential structures to mitigate the effects of seismic activity. The City of San Leandro created guidelines for these procedures, as outlined in the following pamphlet. Public awareness and initiative are critical to the retrofit and preservation of existing building stock, and such efforts as those of the Association of Bay Area Governments are instrumental in providing informational resources to seismically active communities.

Wood frame structure

Most houses in North America are wood-framed structures. Wood is one of the best materials for earthquake-resistant construction since it is lightweight and more flexible than masonry. It is easy to work with and less expensive than steel, masonry, or concrete. In older homes the most significant weaknesses are the connection from the wood-framed walls to the foundation and the relatively weak "cripple-walls." (Cripple walls are the short wood walls that extend from the top of the foundation to the lowest floor level in houses that have raised floors.) Adding connections from the base of the wood-framed structure to the foundation is almost always an important part of a seismic retrofit. Bracing the cripple-walls to resist side-to-side forces is essential in houses with

cripple walls; bracing is usually done with plywood. Oriented strand board (OSB) does not perform as consistently as plywood, and is not the favored choice of retrofit designers or installers.

Retrofit methods in older wood-frame structures may consist of the following, and other methods not described here.

- The lowest plate rails of walls (usually called "mudsills" or "foundation sills" in North America) are bolted to a continuous foundation, or secured with rigid metal connectors bolted to the foundation so as to resist side-to-side forces.
- *Cripple walls* are braced with plywood.
- Selected vertical elements (typically the posts at the ends of plywood wall bracing panels) are connected to the foundation. These connections are intended to prevent the braced walls from rocking up and down when subjected to back-and-forth forces at the top of the braced walls, not to resist the wall or house "jumping" off the foundation (which almost never occurs).
- In two-story buildings using "platform framing" (sometimes called "western" style construction, where walls are progressively erected upon the lower story's upper diaphragm, unlike "eastern" or *balloon framing*), the upper walls are connected to the lower walls with tension elements. In some cases, connections may be extended vertically to include retention of certain roof elements. This sort of strengthening is usually very costly with respect to the strength gained.
- Vertical posts are secured to the beams or other members they support. This is particularly important where loss of support would lead to collapse of a segment of a building. Connections from posts to beams cannot resist appreciable side-to-side forces; it is much more important to strengthen around the perimeter of a building (bracing the cripple-walls and supplementing foundation-to-wood-framing connections) than it is to reinforce post-to-beam connections.

Reinforced and unreinforced masonry

In many parts of developing countries such as Pakistan, Iran and China, unreinforced or in some cases reinforced masonry is the predominantly form of structures for rural residential and dwelling. Masonry was also a common construction form in the early part of the 20th century, which implies that a substantial number of these at-risk masonry structures would have significant heritage value. Masonry walls that are not reinforced are especially hazardous. Such structures may be more appropriate for replacement than retrofit, but if the walls are the principal load bearing elements in structures of modest size they may be appropriately reinforced. It is especially important that floor and ceiling beams be securely attached to the walls. Additional vertical supports in the form of steel or reinforced concrete may be added.

14.1.3 New Construction Materials for Modern Projects

Durable Concrete

Concrete Design and Construction Practices today are strength driven. Concrete grades up to M80 are now being used for high-rise buildings in India. However, due to escalation in the repair and replacement costs, more attention is now being paid to durability issues. There are compelling reasons why the concrete construction practice during the next decades should be driven by durability in addition to strength.

A large number of flyovers and some elevated roads extending up to 20km in length are being realized in different parts of the country and involve huge outlay of public money. However, the concrete durability is suspect. Many of the structures built during the period from 1970 have suffered premature deterioration. Concrete bridge decks built during the period now require extensive repairs and renovations, costing more than the original cost of the project. Multi-storied buildings in urban areas require major repairs every 20 years, involving grunting, concreting etc.

High Performance Concrete

In the United States, in response to widespread cracking of concrete bridge decks, the construction process moved towards the use of High Performance Concrete (HPC) mixes. Four types of HPC were developed[1]:

- Very High Early Strength Concrete – 17.5 mPa in 6 hours
- High Early Strength Concrete – 42.5 mPa in 24 hours
- A Very High Strength – 86 mPa in 28 days
- High Early Strength with Fiber Reinforcement
- High Performance Concrete was introduced in India initially for the reconstruction of the pre-stressed concrete dome of the Kaiga Atomic Power Project, followed for parts of the Reactors at Tarapur and Rajasthan. Subsequently, a number of bridges and flyovers have introduced HPC up to M75 grade in different parts of India.

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.

Fig 116: Construction Technique

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, met kaolin, 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, 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 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 tone 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 Nasik 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 cementations 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

. Fig 117: Furnace Slag

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.

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 cementations material ratio (w/cm)

Cement Silos

The use of batching plants for producing concrete is gaining increasing acceptance. As large volumes of cement are used in a batching plant, the cement is generally stored in vertical steel silos. When cement is received in bulkers from the factory, the same is directly pneumatically pumped into the silos which have capacities ranging from 50 to 500 tone depending upon the project requirements. If only bagged cement is available, they are emptied into the silos, usually with the help of screw conveyors. For modern applications, more than one silo will be required depending on the types of cement and mineral admixture used in the concrete mix.

Fig 118:Construction Technique

In a recently commissioned batching plant complex in the Middle East, each of the two plants feature nine cement silos for Portland cement, slag cement, micro silica, fly ash and SRC cement.

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Durability Enhancing Products

A full line of products are available to prevent or repair corrosion damage. A typical corrosion inhibiting admixture prevents deleterious expansion and cracking caused by the formation of rust during over-induced corrosion. There are also penetrating sealants to protect new and repaired concrete from the corrosive effects of chloride. The silane and siloxane based reacting sealers soak into the surface, creating a barrier against water or chlorides.

A number of concrete waterproofing admixtures eliminate the need for conventional external waterproofing membranes and saves time, money and hassle at the construction site. It transforms concrete into a water-resistant barrier by becoming an integral part of the concrete matrix.

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.

Reinforcement

The revised BIS Code 1786 provides for four grades of reinforcement characterized by the yield strength – Fe 415, Fe 500, Fe 550 and Fe 600. Each of the first three grades is also available with superior ductile properties and a nomenclature is Fe 415D, Fe500D and Fe550D. Primarily the ductile grades specify a higher elongation value. Use of higher grades reduces the tonnage of steel in compression members e.g. columns substantially, results in decongested reinforcement and facilitates easy placement and vibration of concrete. Fe 415 and Fe 500 are easily available in the market. Fe 550 is now being offered by some prime producers–Tata Steel, Sail etc. After the revision of the Code, Fe 550 is also offered in selected diameters.

Concrete vibrator

Concrete Vibrator- Consolidation of concrete should proceed immediately after placing the concrete to make impermeable/dense enough to gain desired strength. The concrete mass should be consolidated or compacted till the cream of concrete starts appearing on the surface. This may be done by hand or by mechanical device. Mechanical compaction is done by use of vibrators. Compaction of concrete by vibration is considered essential for all important work specially in situations where reinforcement are congested or the member is required to have exposed concrete surface finish. Type of vibrator: 1. Plate Vibrator: Plate vibrators are used to compact concrete to avoid blowholes on concrete slabs.

14.1.4 Engineering Aspects of Soil mechanics - Environmental Impact Assessment

Introduction of soil

The term "**soil**" can have different meanings, depending upon the field in which it is considered.

To a geologist, it is the material in the relative thin zone of the Earth's surface within which roots occur, and which are formed as the products of past surface processes. The rest of the crust is grouped under the term "rock".

To a penologist, it is the substance existing on the surface, which supports plant life.

To an engineer, it is a material that can be:

- **built on:** foundations of buildings, bridges
- **built in:** basements, culverts, tunnels
- **built with:** embankments, roads, dams
- **supported:** retaining walls

Soil Mechanics is a discipline of Civil Engineering involving the study of soil, its behavior and application as an engineering material.

Soil Mechanics is the application of laws of mechanics and hydraulics to engineering problems dealing with sediments and other unconsolidated accumulations of solid particles, which are produced by the mechanical and chemical disintegration of rocks, regardless of whether or not they contain an admixture of organic constituents.

Soil consists of a multiphase aggregation of solid particles, water, and air. This fundamental composition gives rise to unique engineering properties, and the description of its mechanical behavior requires some of the most classic principles of engineering mechanics. Engineers are concerned with soil's mechanical properties: permeability, stiffness, and strength. These depend primarily on the nature of the soil grains, the current stress, the water content and unit weight

Formation of soil

In the Earth's surface, rocks extend up to as much as 20 km depth. The major rock types are categorized as igneous, sedimentary, and metamorphic.

- **Igneous rocks:** formed from crystalline bodies of cooled magma.
- **Sedimentary rocks:** formed from layers of cemented sediments.
- **Metamorphic rocks:** formed by the alteration of existing rocks due to heat from igneous intrusions or pressure due to crustal movement.

Soils are formed from materials that have resulted from the disintegration of rocks by various processes of physical and chemical weathering. The nature and structure of a given soil depends on the processes and conditions that formed it:

- **Breakdown** of parent rock: weathering, decomposition, erosion.
- **Transportation** to site of final deposition: gravity, flowing water, ice, wind.
- **Environment** of final deposition: flood plain, river terrace, glacial moraine, lacustrine or marine.
- **Subsequent conditions** of loading and drainage: little or no surcharge, heavy surcharge due to ice or overlying deposits, change from saline to freshwater, leaching, contamination.

All soils originate, directly or indirectly, from different rock types.

Soil type

Soils as they are found in different regions can be classified into two broad categories:

(1) Residual soils
(2) Transported soils

Residual soils are found at the same location where they have been formed. Generally, the depth of residual soils varies from 5 to 20 m.

Chemical weathering rate is greater in warm, humid regions than in cold, dry regions causing a faster breakdown of rocks. Accumulation of residual soils takes place as the rate of rock

decomposition exceeds the rate of erosion or transportation of the weathered material. In humid regions, the presence of surface vegetation reduces the possibility of soil transportation.

As leaching action due to percolating surface water decreases with depth, there is a corresponding decrease in the degree of chemical weathering from the ground surface downwards. This results in a gradual reduction of residual soil formation with depth, until unaltered rock is found.

Residual soils comprise of a wide range of particle sizes, shapes and composition.

Indian standard soil classification

The range of particle sizes encountered in soils is very large: from boulders with dimension of over 300 mm down to clay particles that are less than 0.002 mm. Some clays contain particles less than 0.001 mm in size which behave as colloids, i.e. do not settle in water.

In the **Indian Standard Soil Classification System (ISSCS),** soils are classified into groups according to size, and the groups are further divided into coarse, medium and fine sub-groups.

The grain-size range is used as the basis for grouping soil particles into boulder, cobble, gravel, sand, silt or clay.

Very coarse soils	**Boulder size**		**> 300 mm**
	Cobble size		**80 - 300 mm**
Coarse soils	**Gravel size (G)**	**Coarse**	**20 - 80 mm**
		Fine	**4.75 - 20 mm**
	Sand size (S)	**Coarse**	**2 - 4.75 mm**
		Medium	**0.425 - 2 mm**
		Fine	**0.075 - 0.425 mm**
Fine soils	**Silt size (M)**		**0.002 - 0.075 mm**
	Clay size (C)		**< 0.002 mm**

Table 62: Indian Standard Soil Classification System

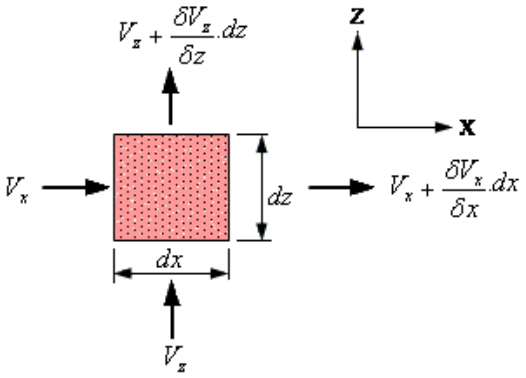
Terzaghi's theory

The total stress increases when additional vertical load is first applied. Instantaneously, the pore water pressure increases by exactly the same amount. Subsequently there will be flow from regions of higher excess pore pressure to regions of lower excess pore pressure causing dissipation. The effective stress will change and the soil will consolidate with time. This is shown schematically.

On the assumption that the excess pore water drains only along vertical lines, an analytical procedure can be developed for computing the rate of consolidation.

Consider a saturated soil element of sides ***dx, dy*** **and** ***dz.***

The initial volume of soil element = ***dx.dy.dz***

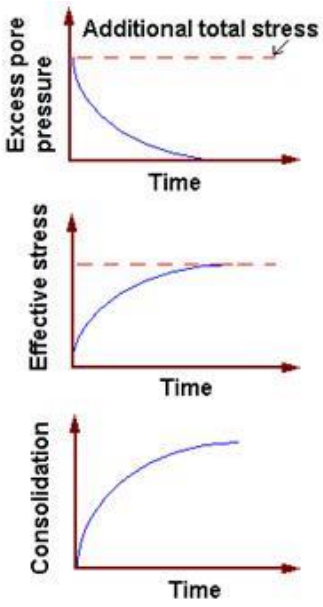


If **n** is the porosity, the volume of water in the element = ***n.dx.dy.dz***

The continuity equation for one-dimensional flow in the vertical direction is

$$\frac{\delta V_z}{\delta z} dx.dy.dz = -\frac{\delta}{\delta t}(n.dx.dy.dz)$$

Only the **excess head (h)** causes consolidation, and it is related to the **excess pore water pressure (u)** by
h = u/g_w.



The Darcy equation can be written as

$$V_z = -k_z \frac{\delta h}{\delta z} = -\frac{k_z}{\gamma_w}\frac{\delta u}{\delta z}$$

The Darcy eqn. can be substituted in the continuity eqn. and the porosity **n** can be expressed in terms of void ratio **e**, to obtain the flow equation as

$$\frac{k_z}{\gamma_w}\frac{\delta^2 u}{\delta z^2} dx.dy.dz = \frac{\delta}{\delta t}\left(\frac{e}{1+e} dx.dy.dz\right)$$

The soil element can be represented schematically as

If $\mathbf{e_0}$ is the initial void ratio of the consolidating layer, the initial volume of solids in the element is **(*dx dy dz*) / (1 + e_0),** which remains constant. The change in water volume can be represented by small changes **De** in the current void ratio **e.**

The flow eqn. can then be written as

$$\frac{k_z}{\gamma_w}\frac{\delta^2 u}{\delta z^2} dx.dy.dz = \frac{dx.dy.dz}{1+e_0}.\frac{\delta e}{\delta t}$$

or

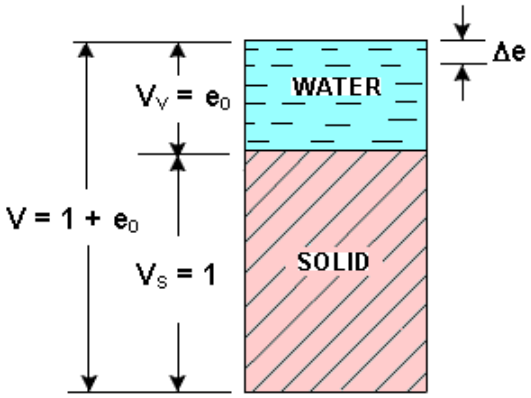
$$\frac{k_z}{\gamma_w}\frac{\delta^2 u}{\delta z^2} = \frac{1}{1+e_0}.\frac{\delta e}{\delta t}$$

This is the hydrodynamic equation of one-dimensional consolidation.

If $\mathbf{a_v}$ = coefficient of compressibility, the change in void ratio can be expressed as

De = $\mathbf{a_v}$ **(-Ds')** = $\mathbf{a_v}$**.(Du)** since any increase in effective stress equals the decrease in excess pore water pressure. Thus,

$$\frac{\delta e}{\delta t} = a_v . \frac{\delta u}{\delta t}$$



The flow eqn. can then be expressed as

$$\frac{k_z}{\gamma_w}\frac{\delta^2 u}{\delta z^2} = \frac{a_v}{1+e_0}.\frac{\delta u}{\delta t}$$

or

$$\frac{k_z}{a_v}.\frac{(1+e_0)}{\gamma_w}.\frac{\delta^2 u}{\delta z^2} = \frac{\delta u}{\delta t}$$

By introducing a parameter called the coefficient of consolidation, $c_v = \frac{k_z(1+e_0)}{a_v.\gamma_w} = \frac{k_z}{m_v.\gamma_w}$ the flow eqn. then becomes

$$c_v.\frac{\delta^2 u}{\delta z^2} = \frac{\delta u}{\delta t}$$

This is **Terzaghi's one-dimensional consolidation equation.** A solution of this for a set of boundary conditions will describe how the excess pore water pressure **u** dissipates with time **t** and location **z.** When all the **u** has dissipated completely throughout the depth of the compressible soil layer, consolidation is complete and the transient flow situation ceases to exist.

Compaction of soil

Compaction is the application of mechanical energy to a soil so as to rearrange its particles and reduce the void ratio.

It is applied to improve the properties of an existing soil or in the process of placing fill such as in the construction of embankments, road bases, runways, earth dams, and reinforced earth walls. Compaction is also used to prepare a level surface during construction of buildings. There is usually no change in the water content and in the size of the individual soil particles.

The objectives of compaction are:

- To increase soil shear strength and therefore its bearing capacity.
- To reduce subsequent settlement under working loads.
- To reduce soil permeability making it more difficult for water to flow through.

Laboratory Compaction

The variation in compaction with water content and compactive effort is first determined in the laboratory. There are several tests with standard procedures such as:

- Indian Standard Light Compaction Test (similar to Standard Proctor Test)
- Indian Standard Heavy Compaction Test (similar to Modified Proctor Test)

Indian Standard Light Compaction Test

Soil is compacted into a 1000 cm^3 mould in 3 equal layers, each layer receiving 25 blows of a 2.6 kg rammer dropped from a height of 310 mm above the soil. The compaction is repeated at various moisture contents.

Indian Standard Heavy Compaction Test

It was found that the Light Compaction Test (Standard Test) could not reproduce the densities measured in the field under heavier loading conditions, and this led to the development of the Heavy Compaction Test (Modified Test). The equipment and procedure are essentially the same as that used for the Standard Test except that the soil is compacted in 5 layers, each layer also receiving 25 blows. The same mould is also used. To provide the increased compactive effort, a heavier rammer of 4.9 kg and a greater drop height of 450 mm are used.

14.1.5 Water Supply-Sewerage system-Waste Water- Sustainable development techniques

Water is the most precious element / commodity available on the earth which is the main life support system of the environment. The water sources are identified and then they are used for various purposes and at various locations. Thus, water supply and distribution facilities are critical infrastructure for the environment. These facilities include wells or water supply intake structures, transmission mains, distribution mains and individual service lines. Regarding water supply source, water determination may not only bring forth technical issues, but political issues may arise as well. Ownership of water sources can be controversial, whether the source is ground water or surface water.

Fig 119: Waste Water Treatment

The use of water except for drinking purpose generates the wastewater which when discharged for the domestic use generates sewage. The sewage collection is carried out through sewer collection system. The sewage cannot be directly let loose in to the environment as there are all possibilities of polluting the surface water or the ground water. Even for irrigation also, the sewage requires treatment. The sewer collection and conveyance needs the treatment before its disposal. The treated sewage can be reused for cooling purpose, irrigation purpose or even for recycling in to the toilets and other applications depending on the specific use excluding drinking and bathing. The sewerage is the sewage collection network starting from individual discharge points to centrally collection point, conveyance mains, treatment systems and safe disposal in to the environment.

Many factors must be considered during planning, design and construction of these systems. For new areas, the population density, the available water supply source and its quantity and the topography is taken in to account. In developed areas where there is an existing underground utility including existing water and sewer, telephone, gas, electric, and cable, it is especially important to consider the impact of new water and sewer mains on these systems. Relocating existing utilities is very expensive, so care must be taken to avoid conflicts as much as possible. Excellent communication and coordination with owners of these utilities and governing agencies during planning, design and construction stage is crucial to the success of this infrastructure project.

In all instances, cost effectiveness is equally as important as technical excellence. Projects must be financially feasible before they can be constructed. Chokhavatia Associates have experience in all facets of Water Supply and Sewerage engineering, including:

1. Feasibility Studies and Master Planning
2.Preliminary and final design plans and Specifications
3.Project management
4. Construction Administration and Inspection.

The range of CA's Water Supply and Sewerage collection projects is comprehensive, and includes water intake structures, water and sewer systems for multi-storied buildings, hospitals, and design of complete distribution and collection systems to serve several entire townships. In addition, CA has provided comprehensive schemes for the collection, conveyance, treatment and disposal of effluent for two industrial areas in Ahmadabad, Gujarat, India.

Sustainable development techniques

The World in 2050 (TWI2050) initiative last week launched the report *'Transformations to Achieve the Sustainable Development Goals'* at the United Nations High Level Political Forum in New York. This report sets out six key transformations that will enable the world to meet the United Nations Sustainable Development Goals (SDGs).

Three years on from the adoption of the 2030 Agenda (which sets out the 17 SDGs that aim to ensure a more sustainable future for everyone), we still have a long way to go to achieving these Goals. The TWI2050 report argues that the global transformation is still possible, but requires strong political commitment and immediate and ambitious action.

Six key transformations

The report presents six key transformations needed to achieve the SDGs in a manageable way, based on the major drivers of societal change, including human capacity, consumption and production, decarburization, and the digital revolution. These are:

1. Sustainable development is a societal rather than an environmental challenge. Substantial advances in **human capacity** are needed through improvements of education and healthcare – resulting, among others, in higher income and better environmental decisions.
2. Responsible **consumption and production** cut across several of the other transitions, allowing us to do more with fewer resources – we need to adopt a circular economy approach and reduce demand.
3. It is possible to **decarbonize** the energy system around 2050 while providing clean and affordable energy for all – including through energy efficiency, more renewable and electrification.
4. Achieving access to nutritional **food and clean water** for all, while protecting the **biosphere** and the oceans, requires more efficient and sustainable food systems – for example by increasing agricultural productivity and reducing meat consumption.
5. **Smart cities:** Transforming our settlement patterns will benefit the world population and the environment– such as through 'smart' infrastructure, decent housing and high connectivity.
6. **Digital revolution:** Science, technology, and innovation need to support sustainable development. Much depends on the way the world will put the Information Technology revolution to use – continuing present trends or inverting them by asserting societal control over them

14.2 Electrical Case Studies

14.2.1 Design of Power Electronics converter

Sustainable energy is the main driving force for all renewable energy sources applications. Due their nature, energy supply from renewable energy sources is fluctuating depending on the availability of the energy source. Availability of the energy sources is mostly unpredictable (e.g. wind energy, solar energy, etc.) therefore, it is essential to have other energy sources that are more predictable to guarantee energy availability during periods of low energy supply from renewable sources. During period of energy surplus it is advantageous to store energy and make it available during the periods of low energy production and high energy demand. An efficient and high density way of storing energy is to produce fuel to accumulate the energy surplus.

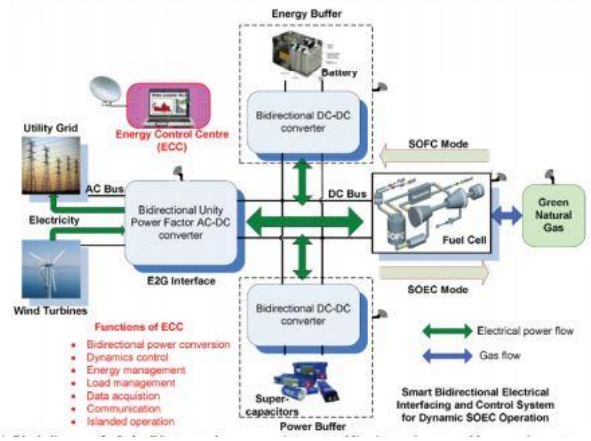


Fig 120: Converter Block diagram

According to the characteristics of the distributed generation systems based on the fuel cells, interface converters are necessary to boost the low variable voltage from the fuel cells and other auxiliary power sources (APS) such as batteries and super-capacitors, in order to provide the high quality, regulated dc voltage to the cascaded inverter for grid-connecting purposes. Hence, a large number of alternative converter topologies and implementations for low voltage high power applications have been proposed

1. DC-DC Converters

Basically, DC-DC converters can be divided into two categories depending on using the galvanic insulation or not: non-isolated converter or isolated converter. As to the non-isolated converters, normally, boost-type converters are favorable to fuel cell application. These topologies are simple, but they require a bulky input inductor to limit the current ripple in the components, especially with high voltage gains are required. To minimize the input inductor size and the current ripple, as well as to reduce the switch current stress, the converter can be designed with multiple legs interleaving each other by means of the input coupling inductors, and high efficiency can be obtained. For isolated DC-DC converters, in, the low voltage high power isolated converters have been overviewed and compared very well. The high efficiency full-bridge boost type fuel cell converter without any auxiliary snubbed circuit is designed in. Moreover, a novel parallel method is proposed in to increase the power level to 10 kW. Summarily, as with typical designs, tradeoffs exist in choosing the optimum DC-DC converter, so the designers must establish the exact requirements of the fuel cell system in question to determine the most advantageous design. As for the interfacing circuits of APS, generally, bidirectional DC-DC converters are needed. Theoretically, all the isolated unidirectional DC-DC converters overviewed in and can achieve bidirectional power delivering ability, through changing the diode-rectifiers to synchronized rectifiers which are based on gate-controlled semiconductors, such as MOSFETs or IGBTs.

2. Hybrid DC-DC Conversion Systems

The block diagrams of the widely utilized DC-DC hybrid systems with FCs and APS are summarized in Fig. 2 (a) and (e). In Fig. 2 (a) and (b), the DC bus is fixed by the fuel cell or by the APS. In this case, the main advantage is related with the fact that the current flows through APSs only during the transients, enlarging the lifetime of the APS. The critical disadvantage is that the usual dc bus conditions impose that the DC voltage cannot vary strongly. In Fig. 2 (c), only one power converter is used. The main characteristic of this direct connection is that both elements, the fuel cell and the APS, share the same voltage value. This will reduce the weight and will increase the reliability of the system.

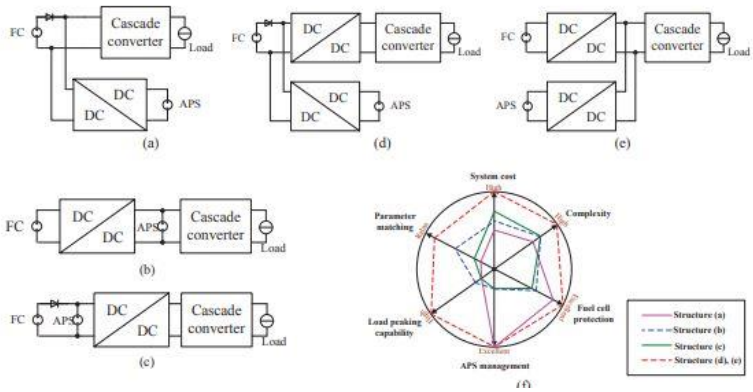


Fig 121: Types of Converters

But it is difficult to control the fuel cell current flexibly. Fig. 2 (d) and (e) show the block diagrams of the two voltage source power conversion system with two individual DC-DC converters, and hereby the two input power sources are decoupled completely. While, obviously, the cost and complexity of the whole system are increase. Hence, in terms of system cost, complexity, fuel cell protection, super-capacitor management, load peaking capability and parameter matching, the different structures analyzed above are compared in the spider plot as shown in Fig. 2 (f). In order to simplify the hybrid power conversion system and reduce the system cost, the multiple-input DC-DC converters can be used. The input voltage sources or current sources (voltage source cascaded with large inductance) can be connected either in series or in parallel for the DC-DC converters to transfer the desired power to the load. Furthermore, some parts of the DC-DC converter (such as filter or rectifier) can be shared by different input sources, so it has the potential to achieve higher power density.

3. DC-AC Inverters

The DC/AC converter technology is mature and uses mainly the hard-switching voltage source inverter (VSI), with single-phase, dual-phase or three-phase output, controlled by means of sinusoidal pulse-width-modulation (SPWM) or space vector PWM (SVPWM). Multilevel voltage-source inverters provide a cost effective solution in the medium voltage energy management market. Nowadays, there exist three commercial topologies of multilevel voltage-source inverters: neutral point clamped (NPC), cascaded H-bridge (CHB), and flying capacitors (FCs). Among the high-power converters, the NPC inverter introduced 25 years ago is the most widely used in all types of industrial applications, such as wind power generation, UPS and so on, in the medium and high voltage range.

14.2.2 Electronic Soft Starter for 1/3 Phase Induction Motor for Agriculture

Now let us have a brief recall of the need for having a starter for any motor.

An Induction motor can self start owing to the interaction between the rotating magnetic field flux and the rotor winding flux, causing a high rotor current as torque is increased. As a result, the stator draws high current and by the time the motor reaches to full speed, a large amount of current (greater than the rated current) is drawn and this can cause heating up of the motor, eventually damaging it. To prevent this, motor starters are needed.

Motor starting can be in 3 ways

- Applying full load voltage at intervals of time: Direct on Line Starting
- Applying reduced voltage gradually: Star Delta Starter and Soft starter
- Applying part winding starting: Autotransformer starter

Defining Soft Starting

Now let us shift our particular attention to soft starting.

In technical terms, a soft starter is any device that reduces the torque applied to the electric motor. It generally consists of solid-state devices like thyristors to control the application of supply voltage to the motor. The starter works on the fact that the torque is proportional to the square of the starting current, which in turn is proportional to the applied voltage. Thus the torque and the current can be adjusted by reducing the voltage at the time of starting the motor.

There can be two types of control using soft starter:

- **Open Control**: A start voltage is applied with time, irrespective of the current drawn or the speed of the motor. For each phase, two SCRs are connected back to back and the SCRs are conducted initially at a delay of 180 degrees during the respective half-wave cycles (for which each SCR conducts). This delay is reduced gradually with time until the applied voltage ramps up to the full supply voltage. This is also known as Time Voltage Ramp System. This method is not relevant as it doesn't control the motor acceleration.

- **Closed-Loop Control**: Any of the motor output characteristics like the current drawn or the speed is monitored and the starting voltage is modified accordingly to get the required response. The current in each phase is monitored and if it exceeds a certain set point, the time voltage ramp is halted. Thus the basic principle of the soft starter is by controlling the conduction angle of the SCRs the application of supply voltage can be controlled.

Components of a basic soft starter

- Power switches like SCRs which need to be phase controlled such that they are applied for each part of the cycle. For a 3 phase motor, two SCRs are connected back to back for each phase. The switching devices need to be rated at least three times more than the line voltage.
- Control Logic using PID controllers or Microcontrollers or any other logic to control the application of gate voltage to the SCR, i.e. to control the firing angle of SCRs to make the SCR conduct at the required part of the supply voltage cycle.

Working Example of Electronic Soft Start System for 3 phase induction motor

The system consists of the following components.

- Two back to back SCRs for each phase, i.e. 6 SCRs in total.
- Control Logic circuitry in the form of two comparators- LM324 and LM339 to produce the level and the ramp voltage and an Optoisolator to control the application of gate voltage to each SCR in each phase.

A power supply circuitry to provide the required dc supply voltage.

The level voltage is generated using the comparator LM324 whose inverting terminal is fed using a fixed voltage source and the non inverting terminal is fed through a capacitor connected to the collector of an NPN transistor. The charging and discharging of the capacitor cause the output of the comparator to change accordingly and the voltage level to change from high to low. This output level voltage is applied to the non inverting terminal of another comparator LM339 whose inverting terminal is fed using a ramp voltage. This ramp voltage is produced using another comparator LM339 which compares the pulsating DC voltage applied at its inverting terminal to the pure DC voltage at its non inverting terminal and generates a zero voltage reference signal which is converted to a ramp signal by the charging and discharging of an electrolyte capacitor.

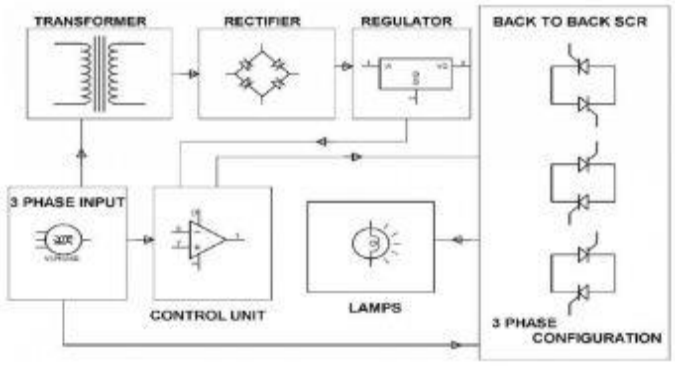


Fig 122: Circuit Diagram

The 3rd comparator LM339 produces a High pulse width signal for every high-level voltage, which decreases gradually as the level voltage reduces. This signal is inverted and applied to the Optoisolator, which provides gate pulses to the SCRs. As voltage level falls, the pulse width of the Optoisolator increases and more the pulse width, lesser is the delay and gradually the SCR is triggered without any delay. Thus by controlling the duration between the pulses or delay between applications of pulses, the firing angle of SCR is controlled and the application of supply current is controlled, thus controlling the motor output torque.

The whole process is an open-loop control system where the time of application of gate triggering pulses to each SCR is controlled based on how earlier the ramp voltage decreases from the level voltage.

Advantages of Soft Start

Now that we have learned about how an electronic soft start system works, let us recollect a few reasons why it is preferred over other methods.

- Improved Efficiency: The efficiency of the soft starter system using solid-state switches is more owing to the low on-state voltage.
- Controlled startup: The starting current can be controlled smoothly by easily altering the starting voltage and this ensures smooth starting of the motor without any jerks.
- Controlled acceleration: Motor acceleration is controlled smoothly.
- Low Cost and size: This is ensured with the use of solid-state switches.

14.2.3 Advanced Wireless Power Transfer System

Introduction:

Fig 123: WPT

The Transfer of electrical power in reliable and efficient way is always challenging for the designers and engineers. Presently all electrical power from the generating stations to the distribution station is transferred by the uses of wires and underground cables. One of the major issues in these types of systems is the losses due to resistance of the material. Generally the percentage of loss of power during the transmission and distribution is 26%. In modern technology the use of portable device has increased such as mobile robots and electric vehicle. Mobility is the main concern of this equipment i.e. they are not connected to the main source of power. All these problems are the main motivation for researchers. Nikola Tesla was the first who introduce the concept of wireless power transfer. But this technology from the time of Tesla is underdeveloped due to lack of funding and technology .But research from past few years has always going on and recent development has been observed in the field . Wireless power transfer can be achieved by several methods (discussed later). Here we discussed few methods such as induction coupling, resonating coupling, LASER technology for electrical power transfer.

Literature Review

- After the immense research in electromagnetic field by many pioneers and development of electromagnetic induction law by Michael Faraday which gives the basis of wireless power transfer.
- In 1891 Nikola Tesla was the first pioneer who started working on wireless power transfer system in his “experimental station” at Colorado, by using Tesla coils.

- Tesla wants to develop a wireless power system that is capable of transmitting power over long distances. He proposed many such systems.
- Nikola Tesla successfully lighted a small incandescent lamp by means of a resonant circuit grounded on one end. The lamp is lighted by the current induced in the coil. Wardenclyffe tower was also designed by Tesla for Trans-Atlantic wireless telephone and also for demonstrating wireless electrical power transmission.
- In 2008 the wireless power consortium was established to connect all manufactures its Qi inductive power standard enable wireless power charging and powering of portable devices of capacity up to 5W with separation distance 4cm.
- In recent years the research on microwave and LASER wireless power transmission system such as solar power satellite has increased.
- Energy harvesting also called power harvesting which is the conversion of ambient energy from environment to electric power which mainly used to power mini watts wireless electronic devices .The ambient energy is produce from stray electric or magnetic field or radio waves.

Wireless Power Transfer Methods

1. Inductive Coupling: This type of WPT is simply based on inductive coupling between two coils. This is a type of near field technique measuring with appliance near the source. It is generally based on the principle of mutual induction, where two coils are placed vicinity to each other and there is no physical connection between these two coils. The simplest example is transformer where the transfer of energy takes place due to electromagnetic coupling. Each of these coils connected without wires and it has been an important and popular technology to transfer power without wires because of its simplicity and reliability. Based on this technology there are various application device has been already made including electric brush and charging pad for cell phones or laptop. But these kinds of method also have some limitation i.e. the range can be very less up to few cm and separation distance is very less than the coil diameter

2. Magnetic Resonance Coupling: This is also one of the important methods for transferring power based on near field technique. It generally overcomes the disadvantage of up to some extent which arises in no resonant inductive coupling. This type of coupling used the concept of resonance. At resonance we know that natural frequency and excitation frequency are same. This leads to the maximum amplitude that means a maximum amount of energy is transferred between two coils. Here the receiver and transmitter coils are tuned to be at same resonant frequency .This allow us to transfer significant amount of power by increasing distance between coils. These type of system are used for building mid range power transfer. Mid range can be specified by distance up to 10 times the diameter of the transmitting coil. Magnetic resonance coupling have several advantage such as efficiency increases with decrease in the radiation and power loss and range can be increase up to some meter and it is directional. The mainly disadvantage is that selection of resonance frequency which tunes with the natural frequency and it cannot be used for long range application.

3. Microwave: This is one of the types of far-field technique of WPT which have range up to KM, with power transfer up to MW. This method uses microwave frequency ranging from 1GHZ to 1000GHZ generated from the microwave generator. First the microwave is generated by microwave generator which passes through the coax-waveguide adapter to the waveguide circulator .Then a tuner and directional coupler are used to separate wave according to their propagation direction.

Then they are transmitted through antenna. At the receiver terminal, a receiver antenna receives which pass through h a low pass filter to finally produce DC power. Based on microwave WPT system the present application is solar power satellite. Advantages of microwave WPT are that it is used for several KM range with transferring high amount of power. Disadvantages are generally that the radiation effect to human beings from the microwave electromagnetic radiation.

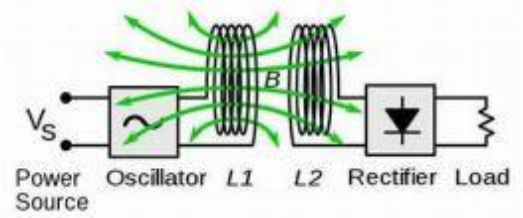


Fig 124: Microwave WPT

4. Laser: This is also one of the types of far- field technique, where the power is transmitted through LASER beams. For power transmission firstly the electrical energy is converted to high LASER beams and at receiving side, these LASER beams are converted to electricity by using photo voltaic cells. This type of WPT has several disadvantage i.e. why it is not used for electrical power transmission because LASER beams can easily harms human being if they cut LASER beam path. Therefore these are generally used for military weapon development and space research.

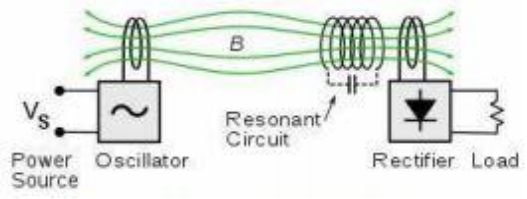


Fig 125: Laser WPT

Comparison between WPT Methods:

WPT methods	Inductive coupling	Inductive coupling	Microwave WPT	LASER
Separation distance	Few mm	Few meter	Up to 100KM	Few meter but with high intensity
Power	Few watts	Few Kilo Watts	Up to 100 MW	Up to 100 MW
Efficiency	Low	High	High	Low

Table 62: Comparison between WPT methods

Advantages:

- It gives the human comfort as there is no chording or wiring problem, so mobility is easier.
- There is no problem of power failure and extensive heating.
- Cost of overall system decreases due to no uses of wires.
- Overall efficiency increases due to decrease in the power loss.
- It offers no corrosion as there is no exposure to the atmosphere which is Eco-friendly.

- It offers ranges of power levels and separation distance between coils.

Disadvantages:

- WPT methods use the electromagnetic radiation for power transfer and the main effect of electromagnetic wave is its biological impact which harms human beings and animal.
- Biological impact of inductive coupling and resonance coupling is far less than compared to microwave power transmission technique
- There is also a limitation of separation distance and power capacity.
- Interference of microwave with other communication system.
- Initial cost is very high for implementing WPT system.

Applications:

- **Electrical Vehicles:** With using this technology, it enables the reliable and efficient power transmission to electrical vehicles without using of wires. WPT also marketed the electrical vehicles which attract the consumers to buy it and decrease the load on diesel and petrol vehicles.

- **Solar Power Satellite:** The most important application of WPT system is solar power satellite that uses the microwave for energy transferring. Satellites are generally equipped with solar power transmitter and receiver antenna. Solar panel converted the generated electricity into high power microwave beams and directed towards the ground station receiver antenna.

14.2.4 Industrial Temperature Controller

Introduction:

Temperature: This is the degree of hotness or coldness of a body or an environment.

Control System: A control system is a device or set of devices that manage, command, direct or regulate the behavior of other devices or systems. Thus 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 consists of a small programmable digital logic controller device, wired to a heating and/or cooling system. About the size of a typical wall-mounted thermostat, a temperature control system contains a small circuit board and a memory chip(s). After setting the temperature control system to a desired temperature, known as a set point, the system will utilize the heater and/or air conditioning unit (as needed) as effectors, to maintain that setting for the duration programmed.

Temperature is one of the main parameter to control in most of the manufacturing industries like chemical, food processing, pharmaceutical etc. In these kinds of industries, some product need the required temperature to be maintained at highest priority the product will fail. So the temperature

controller is most widely used in almost all the industries. The goal of this project is to design an ambient temperature measurement and control circuit. The motivation for the project is the fact that temperature measurement has become an integral part of any control system operating in a temperature sensitive environment and the various learning outcomes associated during the implementation of the project. In this project ON-OFF type controller has been implemented. Here the set value for temperature can be externally set by user. The actual temperature is sensed by the thermocouple temperature sensor. It is displayed on common cathode seven-segment LEDs with the set value. If it exceeds the set value the heater is turned off. After then when temperature falls below the specified limit again heater is turned on.

Methodology: The circuit presents the design, construction, development and control of automatic switching electric heater. The idea is based on the problem occurs in human's life nowadays by improving the existing technology. The Peripheral Interface Controller (PIC) based automatic temperature control system is applied to upgrade the functionality to embed automation feature. The electric heater will automatically switch on according to the temperature falls below the specified limit. The system monitors the temperature from the thermocouple temperature sensor, where it will control the electric heater according to the setting values in the programming. The system indicates the temperature from the PIC 16F887A, and it will display it on the common cathode LED display.

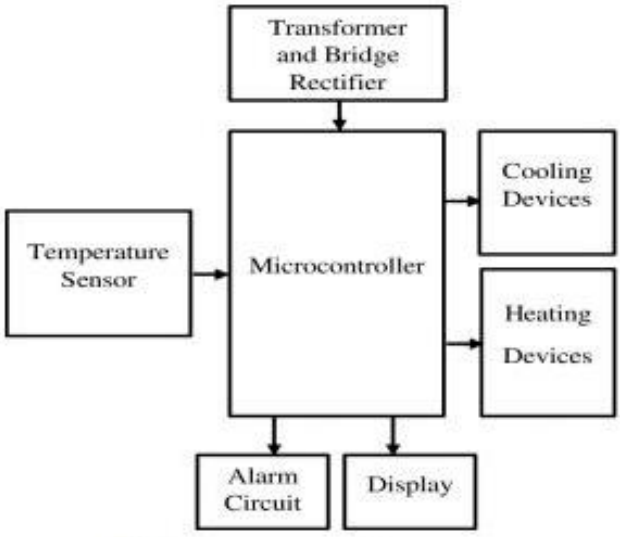


Fig 126: Block diagram of system

If the electric heater temperature goes beyond the preset temperature, then the electric heater will switch off and if temperature goes below to present value then electric heater will switch on. In this way, the electric heater's temperature can be maintained preset temperature value. It also provides a security characteristic, where it detects on extremely high temperature.

Concept: To increase the production of an industry, smooth control of temperature is the key function.5 Different industry has its own individual temperature requirement for specific role. Conventionally, industrial temperature measurement instrument thermometer is used to measure the temperature. After observing temperature reading, operator controls temperature manually. Sometimes controlling is not appropriate because of time consuming human operated control of cooling device and heating device. As a result, efficiency of temperature control fails and production is hampered in industries. Besides that, thermostat is used to select temperature which is not efficient because of erosion of metal and losing to strength of metal for successive using. Consequently, analog system loses its own linearity function since it is mechanically designed temperature control device. The temperature can be controlled more efficiently using interface between temperature sensors LM35 which produce linear voltage signal with rising temperature and microcontroller which takes response fraction of millisecond to response. Microcontroller takes signal from temperature sensor and compare with pre-set value of temperature then take

decision when heating device or cooling device would be turned on and the duration of maintained temperature in system.

The pseudo code for control the overall heating and cooling system can be written as:

When asking temperature > real-time temperature

Heating element = 1 for (asking temperature + 1 Degree Celsius)

Cooling element = 0 for 1 minute

When asking temperature < real time temperature

Cooling element = 1 for (real-time temperature – 1 Degree Celsius)

Heating element = 0 for 1 minute

A buzzer is turned on when unexpected or large temperature is found in the system can be cause to damage industry.

14.2.5 Accident Alerts in Modern Traffic Signal Control System - Camera Surveillance System

Introduction

The rapid development of economic construction and people's living standard continues to improve. As well as road traffic accident take place frequently this caused huge losses of life and property to the country and people. Traffic has become an important event in the national interest. It will be serious consequences if people cannot send weft to the outside for help when traffic occur. Poor emergency incident is a major cause for the high number of traffic fatalities and the death rate in our country. A number of technological and sociological improvements have helped reduce traffic fatalities during the past decade, e.g., each 1% increase in seatbelt usage is estimated to save 136 lives ,Moreover, each minute that an injured crash victim does not receive emergency medical care can make a large difference in their survival rate, i.e. Analysis shows that reducing accident response time by 1 min correlates to a six percent difference in the number of lives saved. An effective approach for reducing traffic fatalities, therefore, is to reduce the time between when an accident occurs and when first responders, such as medical personnel, are dispatched to the scene of the accident. Accident detection system use sensors embedded in a car to determine when an accident has occurred. These systems immediately dispatch emergency medical personnel to serious accidents. Eliminating the time between accident occurrence and first responder dispatch reduces fatalities by 6%. In this paper we discussed to the technologies which use in proposed system, GPS and GSM cooperate with VANET. In addition we studied in the related work research papers steps are being taken as to how to minimize the loss of life and property despite poor emergency facilities. The authors have also aimed at giving an overview of implementing safety services in vehicular systems of today and future development. We gave brief analysis to these research papers taking in consideration the Strengths and weaknesses. Then we proposed the

system which based on vibration sensors and processing capabilities can be used to overcome the challenges of detecting traffic accidents and deliver the emergency message at short time.

GPS and GSM based system

Mostly vehicle tracking systems are based on GPS and GSM. Short Messaging Service (SMS) is a feature available on all mobile phones which allows a small amount of text to be sent between one user and another. GPS consists of a network of 24 satellites in six different 12-hour orbital paths spaced so that at least five are in view from every point on the globe. Today, GPS has a wide range of other applications including tracking package delivery, mobile commerce, emergency response, exploration, surveying, law enforcement, recreation, wildlife tracking, search and rescue, roadside assistance, stolen vehicle recovery, satellite data processing, and resource management.

Vehicle Tracking System

A vehicle tracking system combines the installation of an electronic device in a vehicle, or fleet of vehicles, with aim designed computer software at least at one operational base to enable the owner or a third party to track a vehicle's location, collecting data in the process from the field and send it to the base of operation. Modern vehicle tracking systems commonly use GPS technology for locating the vehicle. Vehicle Information can be viewed on electronic maps via the Internet or specialized software. Vehicle tracking systems are also salable in consumer vehicles as a theft protection and retrieval device. Police can simply follow the signal emitted by the tracking system and locate the stolen vehicle. When used as a security system, a Vehicle Tracking System may serve as either an extension to or instead of a traditional Car alarm. Some vehicle tracking systems make it possible to control vehicle remotely, including block doors or engine in case of emergency. The existence of vehicle tracking device then can be used to less the insurance cost.

GSM Overview

The GSM system was designed as a second generation (2G) cellular phone technology. One of the basic aims was to provide a system that would enable greater capacity to be achieved than the previous first generation analogue systems. GSM achieved this by using a digital TDMA (time division multiple access approach). By adopting this technique more users could be accommodated within the available bandwidth. In addition to this, ciphering of the digitally encoded speech was adopted to retain privacy. Using the earlier analogue cellular technologies it was possible for anyone with a scanner receiver to listen to calls and a number of famous personalities had been "eavesdropped" with embarrassing consequences.

GPS Overview

The GPS project was started in 1973 to overcome the limitations of previous navigation systems, integrating ideas from several predecessors, including a number of classified engineering design studies from the 1960s. GPS was created and realized by the U.S. Department of Defense (USDOD) and was originally run with 24 satellites. It became fully operational in 1994 [1]. The emergency services, for instance, can use GPS not only to find their way to an incident quicker than ever before but also to pinpoint the location of accidents and allow follow-up staff to find the

scene quickly. This is particularly useful for search and rescue teams at sea and in extreme weather conditions on land where time can be a matter of life or death.

VANTE Overview

VANET belongs to wireless communication networks area, and it is the emerging field of MANETs in which vehicles act as the mobile nodes within the network. The basic aim of VANET is to increase safety of road users and comfort of passengers. VANET is the wireless network in which communication takes place through wireless links mounted on each node (vehicle) . Each node within VANET act as both, the candidate and router of the network as the nodes communicates through other intermediate node that lies within their own communication range. VANET are self-organizing network.

It does not depend on any fixed network infrastructure. Although some fixed nodes act as the roadside units to facilitate the vehicular networks for serving geographical data or a gateway to internet. Higher node mobility, speed and quick pattern movement are the main characteristics of VANET. This also causes rapid changes in network topology.

VANET is a particular type of MANET, in which vehicles act as nodes. Unlike MANET, vehicles move on predefined roads, vehicles velocity depends on the speed signs and in addition these vehicles also have to follow traffic signs and traffic signals.

There are many challenges in VANET that are needed to be solved in order to provide reliable services. Stable & reliable routing in VANET is one of the major issues. Hence more research is needed to be conducted in order to make VANET more applicable. As vehicles have dynamic behavior, high speed and mobility that make routing even more challenging.

Proposed work

Due to the GSM network problems which may happen in any location over the roads lead us to suggest use a redundant technology (VANET) to ensure and guarantee deliver the emergency message. Vehicle Ad hoc Network is a Network which contains mobile nodes that topology constantly changing. The mobile nodes can move quickly from one place to another place. Most current VANET routing protocols select paths according to minimum hop count.

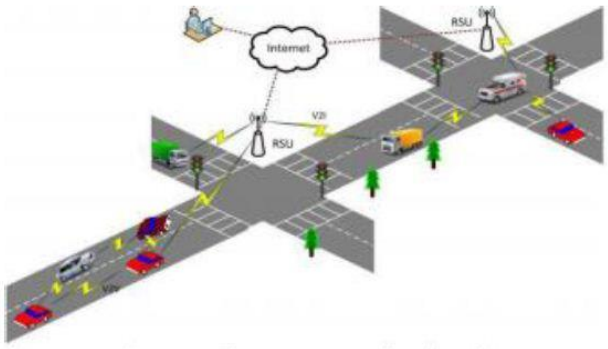


Fig 127: System overview

Minimum hop paths have poor performance because they tend to contain wireless links between far nodes. These long wireless links can be slow or loss, leading to poor throughput. Cause to mobility the link between far nodes is broken speedily. Proposed work can be considered by

achieve method of routing which select path between the source and destination which are more stable than other paths through intermediate nodes.

More stability paths can be select through a method which measures signal strength between nodes and select the average values. If received signal strength closest to the average values then it is accepted for further processing otherwise it is discarded.
The benefit of this scheme is by selecting average routes to the destination, we can optimize the lifetime of the network and to meet the goal of the Accident detection system to send emergency message in short time and guarantee arrives to rescue services center.

In general, Accident detection system with VANET provide redundancy to send message to RSC ,also the expected result of the proposed algorithm will improve the network performance by avoiding broadcasting storm and decrease delivery time to the emergency message. The new algorithm will support the link stability by select the nodes have average lifetime taking in consideration the traffic flow when accidents happen.

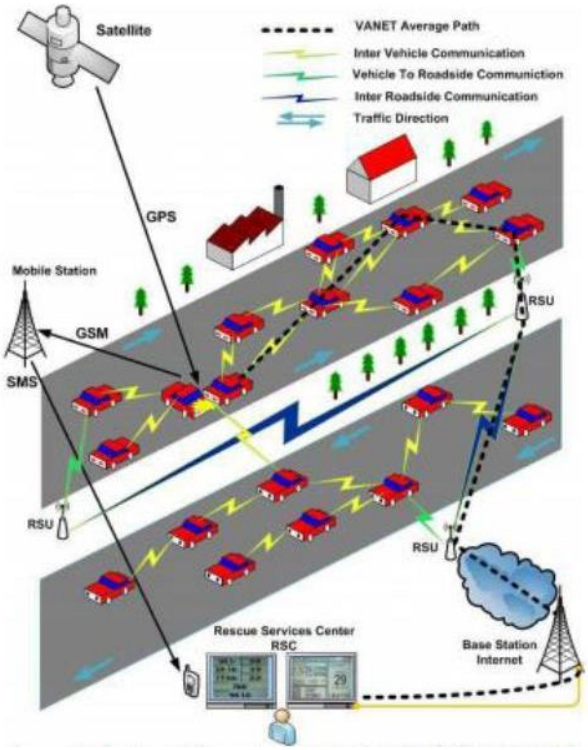


Fig 128: System Implementation

CHAPTER: 15 Five Most important and crucial items that need to be Addressed from the techno-economy survey or Ideal Village Survey or Smart Village Survey of the village for the visible change in the respective allotted village for the VY project and make the villagers happier and more comfortable for the Enhancement of the village

Most of the designs proposed by us are necessary for the development of village. Among all 12 designs we proposed the most important that should be implement are:

1.) Public Toilet

The public toilet system has many advantages main like benefits.

- It will save lives.
- It will improve women's safety and literacy.
- It will boost the economy.
- It will help eradicate manual scavenging.

2.) CYBER CAFE

- 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. Home internet comes with contract, and even if you do not use the internet at home, there is still a monthly bill.
- 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. A user would not need to buy PC parts, as for gamers that need to shell out huge sums of money to build fast and good desktop units for gaming.

3.) Co-Operative bank.

- To provide finance facilities to farmers
- To provide banking facilities to villagers
- For the economic development of village
- To guide villagers about new monetary policies and governmental schemes.

4.) Single Solar Street light Pole Installation Design.

- One time Investment reduces the operating cost.
- No Energy Charges, as it will use renewable Energy Source.
- Lighten up roads of village.

CHAPTER 16: Survey by interviewing 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	employment
2	What are the chances of employment in village?	Yes	Agriculture
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?	NO	—
6	Is women health awareness Program organized in village?	NO	—
7	Are women having opportunity to work and income?	NO	—
8	Child girl education is appreciated in village?	NO	—
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?	NO	—
12	Is water scarcity in village? How many days per year?		
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.	NO	—
18	Is village improvement is observed in comparative scenario from past to present?	Yes	population
19	Is any unavoidable difficulty village people are facing? Any natural calamity is there?	Yes	mobail network
20	Life Living standard of girls and women is appreciated and uplifted in village?	NO	—

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

21-6-21

CHAPTER 17: Irrigation / Agriculture activities and Agro Industry alternate techniques and Solution

Irrigation and agriculture activates in Kalakachha village:

The total area is 1511.80 Acres, the Non-Agricultural area is 811acres and the total irrigated area is 700 acres. Paddy, Vegetables, and Banana are agricultural commodities that grow in this village. 8 hours of agricultural power supply in summer and 8 hours of agricultural power supply in winter are available in this village. The total irrigated area in this village is 700 acres from canals 30 hectares and from Lakes or tanks, 20 hectares are the Sources of irrigation. There is also lake at the entrance of the village.

Fig 129: Agricultural Activities

Agro Industry:

Agro-based industry would mean any activity involved in cultivation, under controlled conditions of agricultural and horticultural crops, including floriculture and cultivation of vegetables and postharvest operation on all fruits and vegetables. The development of agro-industries has assumed crucial importance in the economic planning and progress of the country.

Agro Industries are the enterprises, activities. and institutions that deliver material inputs to the farming sector and transform, distribute and otherwise add value to agricultural and food products targeting an identified market demand. Benefits of agro-industries include providing.

Fig 130: Modern Agriculture

Benefits of Agro-Processing

- Enhanced agricultural productivity and increased farm household incomes.
- Year-round availability of affordable safe and nutritious food.
- Job creation for rural and urban youth.
- Production of fortified foods for vulnerable groups in society.
- Establishment of indigenous food standards.
- Large quantities of agricultural "waste" produced in one location which can be transformed into useful products such as animal feed.
- Reduce importation of similar or foreign foods and conserve foreign exchange.
- Export to sub-Saharan countries with inadequate resources for agriculture.

Type of Agro Industries I India

- Textile Industry.
- Sugar Industry.
- Vegetable Oil Industry.
- Tea Industry.
- Coffee Industry.
- Leather Goods Industry.

Alternative Techniques and Solution:

With the reducing agricultural land area, water availability and fertility of the soil, along with increasing demands of aquatic fishes & seafood, the need for opting alternative and sustainable methods of farming are becoming a must. There are many such techniques already being adopted in various parts of the world. Out of these techniques, Aquaculture and Hydroponics are popular techniques.

What is Aquaculture?

Aquaculture is the controlled process of cultivating aquatic organisms, especially for human consumption. It's a similar concept to agriculture, but with fish instead of plants or livestock. Aquaculture is also referred to as fish farming. The seafood that you find at your local grocery store is likely labeled as farmed fish. Aquaculture can happen all over the world, and it does: in coastal ocean waters, freshwater ponds and rivers, and even on land in tanks.

Chapter: 18 Social Activities – Any Activities Planned by Students

1. Swatchhta Abhiyan:

When we go to the village some parts of the village from the entrance of the gate to school of the village is clean and in these parts all houses are Pucca. After that when we go to the end of the village where kutcha house there is no cleanliness because of cow and buffalo. We told the people of the village that they should clean the road day by day. We also told that because of the dirt and wastage the people should affect their health. .

2. Covid19 Awareness:

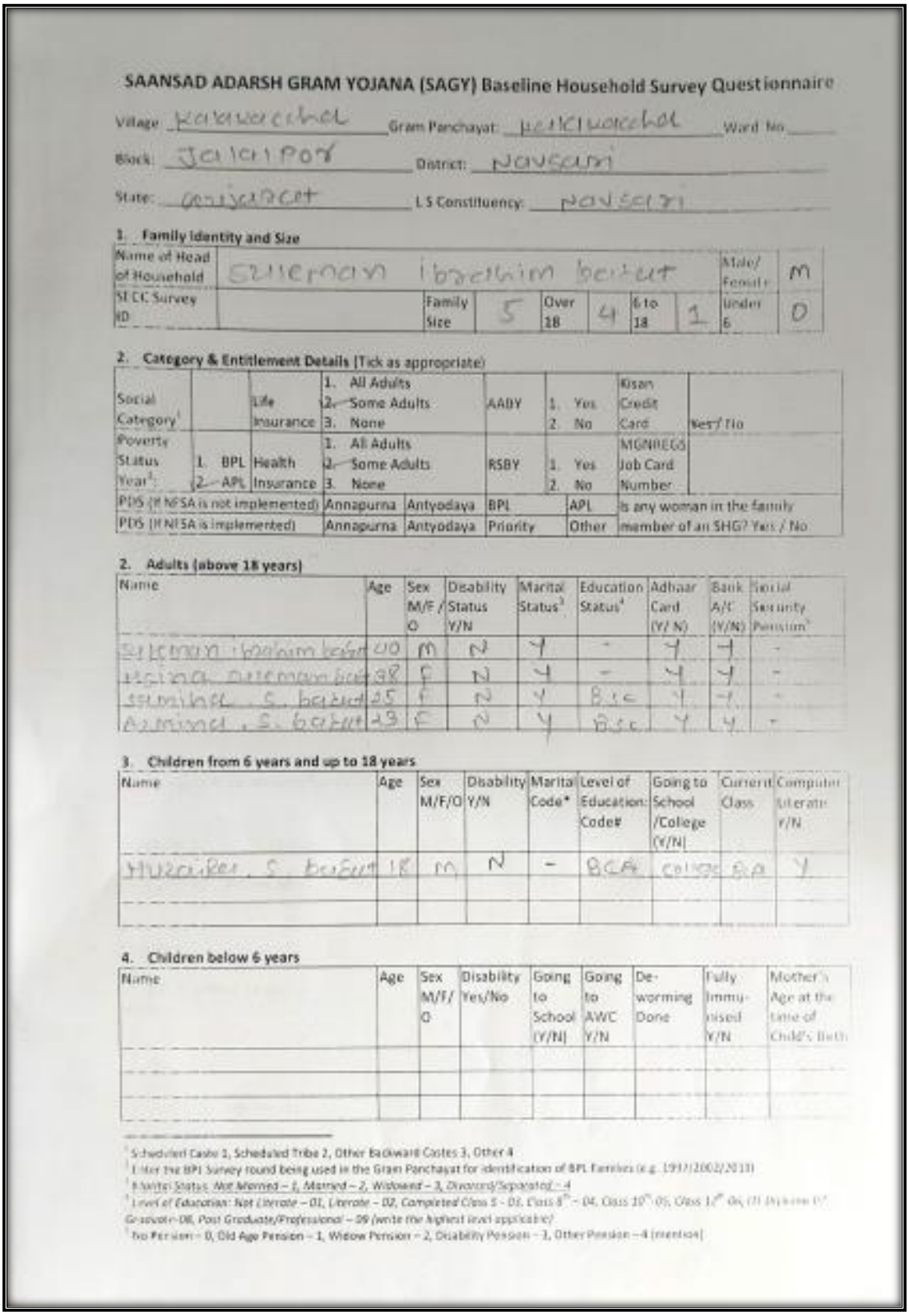
We go to the village and see some people sitting together without mask. We go there and tell them about covid19 awareness. We also told that they should wear mask perfectly and regular when they are go from house. Does hand sanitize when they go public area and then when they go to house wash hand with soap We also told that the third wave of covid19 is still on the way and stay children at home without any work. We tell them to vaccinate for safety for their health. Also told to away from crowded area and if you are in touch with covid patient before than quarantine yourself for 7 days min in an alone room.

.

3. Khelo India

We go to the village and told the people of the village and tell the parents and children about khelo India and also tell what impotence about khelo India is. We told them about outdoor sports and mind games like chess to play. Thus they become sharp and stay fit. We met the Sarpanch and tell about these.

CHAPTER 19: Kalakachha Village SAGY Questionnaire



SAANSAD ADARSH GRAM YOJANA (SAGY) Baseline Household Survey Questionnaire

Village: Kalakachha Gram Panchayat: Kalakachha Ward No:

Block: Jalalpor District: Navsari

State: Gujarat L S Constituency: Navsari

1. Family Identity and Size

Name of Head of Household	Suleman Ibrahim Bedat							Male/ Female	M
SECC Survey ID		Family Size	5	Over 18	4	6 to 18	1	Under 6	0

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]
Suleman Ibrahim Bedat	40	M	N	Y	-	Y	Y	-
Hajira Suleman Bedat	38	F	N	Y	-	Y	Y	-
Sumaiya S. Bedat	25	F	N	Y	B.Sc	Y	Y	-
Azmina S. Bedat	23	F	N	Y	B.Sc	Y	Y	-

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
Muzaiker S. Bedat	18	M	N	-	BCA	College	B.A	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 - 05, Class 8th – 08, Class 10th 10, Class 12th 12, (If Diploma 01 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	
Community Water Tap	Yes / No	
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:
Cooking: LPG/Biogas/Kerosene/Wood/Electricity
Mention if Any Other:
If cooking in Chullah: Normal/ Smokeless

12. Landholding (Acres)

1. Total	1511.50	2. Cultivable Area	1511.50
3. Irrigated Area	700.0	4. Uncultivable Area	811

13. Principal Occupations in the Household

Livelihood	Tick if applicable
Farming on own Land	4
Sharecropping /Farming Leased Land	12
Animal Husbandry	2
Pisciculture	2
Fishing	2
Skilled Wage Worker	1
Unskilled Wage Worker	1
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
Sugar		

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

Football and cricket

19. Do children play musical instrument (mention)

Schedule Filled By:

Principal Respondent:

Date of Survey:

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: Kalakachchal

b. Block: Jalalpor

c. District: Navsari

d. State: Gujarat

e. Lok Sabha Constituency: Navsari

f. Number of Wards in the Gram Panchayat: ____

g. Number of Villages in the Gram Panchayat: None

h. Names of Villages: Kalakachchal

Demographic Information

Number of Households 286 Total Population 1384 Male 655 Female 679

SC HHs 7 4 2-1 ST HHs 56-254 OBC HHs 25-1 Other HHs 10 83-1

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	N	16 KM
b.	Nearest Primary Health Centre (PHC)	Y	
c.	Nearest Community Health Centre (CHC)	N	16 KM
d.	Nearest Post Office	Y	
e.	Nearest Bank Branch (Any)	N	6 KM
f.	Nearest Bank with CBS Facility	N	6 KM
g.	Nearest ATM	N	6 KM
h.	Nearest Primary School	N	2 KM
i.	Nearest Middle School	N	2 KM
j.	Nearest Secondary School	N	2 KM
k.	Nearest Higher Secondary School / +2 College	N	18 KM
l.	Nearest Graduate College	N	20 KM
m	Nearest ITI / Polytechnic Centre	N	12 KM
n	Kisan Seva Kendra	N	10 KM

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	15 KM
p	Nearest Agro Service Centre	N	15 KM
p	MSP based Government Procurement Centre	N	15 KM
q	Milk Cooperative /Collection Centre	N	10 KM
r	Veterinary Care Centre	N	12 KM
s	Ayurveda Centre	N	15 KM
t	E - Seva Kendra	N	15 KM
u	Bus Stop	N	5 KM
v	Railway Station	N	15 KM
w	Library	N	8 KM
x	Common Service Centre	N	-

IV. Sports Facilities in the Gram Panchayat

a. Number of Play Grounds in the GP: Total 2 Public 2 Private -

b. Mini Stadium : no 0 Yes(Y) /No (N) *(Playground with equipment and sitting arrangement)*

V. Education, ICDS

a. Number of Angan Wadi Centres: 1

b. Number of villages without Angan Wadi Centres _____

Names of such villages: _____

c. Schools (Number)

Primary Private: - Primary Govt.: 1

Middle Private: - Middle Govt.: -

Secondary Private: - Secondary Govt.: -

Higher Secondary Private: - Higher Secondary Govt: -

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)			✓				
b.	Kerosene			✓				
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 / Not Covered	–	Kalakachha
b.	Hand Pump Coverage in Villages:	Covered / Not Covered	Kalakachha	–
c.	Coverage under Covered Drains:	Covered / Not Covered	–	Kalakachha
d.	Coverage under Open Drains:	Covered Bad condition / Not Covered	Kalakachha	–
e.	Villages with Household Electricity Connection (Numbers)	Connected good / Not Connected	Kalakachha	–

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	
b.	Irrigated Land		e.	Forests/ Plantations		h.	Wells/Bore Wells	
c	Un-irrigated Land		f.	Other Common Land		i	Tanks /Ponds	

Kalakachha.

[1] Mention the number of Villages Covered and Not Covered

3

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)	104.
b)	Number of Households receiving pension (old age, widow, disability)	
c)	Number of eligible Households who are not receiving pension	
d)	Number of Households eligible for Ration Card	704.
e)	Number of eligible HHs having ration cards	
f)	Number of households covered under RSBY (Rashtriya Swasthya Bima Yojana)	
g)	Number of HHs covered under AABY (Aam Aadmi Bima Yojana)	
h)	Number of active Job Card holders under MGNREGA	
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	154.
l)	Number of landless households	454
m)	Number of IAY beneficiaries	
n)	Number of FRA[2] beneficiaries	
o)	umber of Community Sanitary Complexes	
p)	Number of Households headed by single women	54.
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	34.
u)	Number of SHG Federations	
v)	Number of Youth Clubs	
w)	Number of Bharat Nirman Volunteers	

Name and Signature of Surveyor and Respondent'

Surveyor	PRI Respondent (Preferably Gram Panchayat Chairperson)	Official Respondent (Preferably seniormost Government official in the Gram Panchayat)	Date of Survey
A. A. Thakur			21-6-21

[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: [illegible]

b. Ward Number: 396415

c. Gram Panchayat: [illegible]

d. Block: Jalalpor

e. District: Navsari

f. State: Gujarat

g. Lok Sabha Constituency: [illegible]

h. Number of Habitations / Hamlets in the Gram Panchayat: _____

i. Names of Habitations / Hamlets:

Demographic Information

Number of Households 286 Total Population 1334 Male 655 Female 679

SC HHs 2.42 % ST HHs 56.75 % OBC HHs 25 % Other HHs 10.83 %

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	N	7 KM
c	Nearest Secondary School	N	9 KM
d	Krsan Seva Kendra	N	10 KM
e	Milk Cooperative /Collection Centre	N	10 KM
f.	Health Sub Centre	Y	6 KM
h.	Bank	N	6 KM
i.	ATM	N	6 KM
j.	Bus Stop	N	5 KM
k.	Railway Station	N	15 KM

[1] While filling this the surveyor must collect the information from the Ward Members 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
i	Library	N	10 KM
iii	Common Service Centre	N	10 KM
iv	Veterinary Care Centre	N	10 KM

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: ALL

iii. Drinking Water Facilities

a Piped Water Supply Coverage to Habitations: 3 (1-All 2-None 3-Some)

If 3 mention the name of the habitations not covered:

b Hand Pump Coverage in Habitations: 3 (1-All 2-None 3-Some)

If 3 mention the name of the habitations not covered:

iv. Coverage of Habitations under Waste Management System

a. Coverage under Covered Drains: 2 (1-All 2-None 3-Some)

If 3 mention the name of the habitations not covered:

b Coverage under Open Drains: 1 (1-All 2-None 3-Some)

If 3 mention the name of the habitations not covered:

c Coverage under Doorstep Waste Collection: (1-All 2-None 3-Some)

If 3 mention the name of the habitations not covered: 3

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: 2

vi. Sports Facilities in the Village

a.Number of Play Grounds in the Village (minimum size 200 square meters): NO

b Mini Stadium : NO Yes(Y) /No (N)

vii. Education, ICDS

a. Number of Anganwadi Centres: 1

c. Schools (Number)

Primary Private: - Primary Govt.: 1

Middle Private: - Middle Govt.: -

Secondary Private: - Secondary Govt.: -

Higher Secondary Private: - Higher Secondary Govt: -

2

SAANSAD ADARSH GRAM YOJANA (SAGY) Village Details Survey Questionnaire

	Land Category	Area in Acres		Land Category	Area in Acres		Irrigation Structure	
a	Cultivable Land	1571.00	d.	Pasture / Grazing Land		g	Check Dam	-
b	Irrigated Land	948.00	e	Forests/ Plantations		h	Wells/Bore Wells	2
c	Unirrigated Land	611	f.	Other Common Land		i	Tanks/ Ponds	65

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	57
5	Number of landless households	63
6	Number of IAY beneficiaries	-
7	Number of FRA beneficiaries	-
8	umber 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'

Surveyor	PRI Respondent (Preferably a ward member from a ward that is fully or partially covered under the Village)	Official Respondent (Preferably a Government official in the Gram Panchayat)	Date of Survey
A.A. Shaikh			21-6-21

3

CHAPTER 20: TDO-DDO-Collector email sending soft copy attachment in Report

Development scenario of Kalakachha village, Navsari.

Respect Sir/Madam

We are the students of GIDC Degree Engineering College, Abrama, Navsari affiliate to Gujarat Technological University. It has been assigned to Vishwakarma Yojana-VY in which students survey various villages and design various amenities to deliver it making them ideal for living better life cycle as par needs as well as village problem statements.

As a part of Vishwakarma Yojana's guidelines, we have been asked to inform all the respected officers about our project in which we will shortly notify about this village profile of issues for Development and our design work for them. This is all about project information give in this table.

Village: Kalakachha		**Population:1334**
Key issues	**Remark**	**Design given**
Water scarcity	There are 3 water storage tank for the purposed of household. It is not enough because water tank are 12 year old, it need to renovation. Canal is use but only irrigation purposed.	• Lack modification • Rain water harvesting system
Internal road network	During the rainy season it gets muddy. Moreover, the safety of integrated village is at risk due to no availability of street network.	• Road maintain • CC road
Solid waste management	Open waste disposal can be seen everywhere in the village.	• Waste used as fertilizer in farming.
Toilet	Nearly 50% have household toilet, under SBA toilet was needed.	• Public toilet
Health care	Good habitants have to travel 5 km for batter health care. Provide enough staff and renovation of building.	• PHC
Recreational area	Currently only village have one mosque and temple as recreational place.	• Public garden
Community place	Grampanchayat faces problem to conducting gramshabha. Moreover, the village does not have any place for	• Community hall

	local function.	
Identification	Village comes within the premises of other village but it was seen that village direction holding were not proper which can causes difficulty in finding the village.	• Entrance gate

Sr. No	Design name	Periods [Month]	Amount Expenditure (Rs)	Benefit
1	Public garden	5	22,56,620	Recreational area
2	Public toilet	3	11,49,173	Sanitation
3	Post office	4	8,33,582	Recreational area
4	Co-operative bank	6	14,48,000	Economic
5	Community hall	5	5,19,228	To organized events
6	Library	4	3,72,840	Education purpose
7	Super market	3	5,96,034	Supply foods
8	Cyber cafe	3	6,83,689	Pay and used internet
9	Entrance gate	5	87,017	Aesthetics
10	Electrical shop	4	6,83,690	Electricity supply
11	Street light	4	1,18,300	Recreational
12	Solar power system	2	53,29,666	Irrigation purpose

Please find hear with attached,

1. Detail project report of Kalakachha village

Best regards,
Anash Shaikh, Arbaaz Pathan and Aishan Mistry,
GIDC Degree Engineering College,
U.G.Civil and Electrical engineering,
Gujarat technological university

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CHAPTER 21: Comprehensive report for the entire village

- In Part-I VY direct the study of ideal village and after that to study the allocated village to difference the Situation.
- In Part-I Techno Economy Survey and Smart Village Survey Form had been filled by the Student for Gap-Analysis and Data Collection of the Village.
- In Part-II SAGY Questionnaire Form Filled By The Student for Data Collection of Household.
- In Part-I & II Student have done Following Designed After Data Collection:
    1. Public Toilet
    2. Community Hall
    3. Post office
    4. Public garden
    5. Bank
    6. Library
    7. Super market
    8. Cyber café
    9. Entrance gate
    10. Electrical shop

Special features of VY phase V

GTU VY section had already planned the work action plan for both part 1 and 2. The new format has been given to students in advance to enhance the knowledge and criteria.

- Orientation programs to understand the aim, objectives and scope of the Vishwakarma Yojana have been organized at GTU.
- In phase V students have directed to study and observe the ideal village than the VY section had allotted the different villages to team.
- Techno economic and smart village forms had been filled by the students for the data collection and the GAP analysis.
- In part-II, SAGY form is introduced to students for the planning the suitable proposed design in priorities.

- In part 1 & 2 students has to provide the following designs after data collections:
  1. Sustainable design (Civil/Electrical)
  2. Physical design (Civil)
  3. Social design (Civil)
  4. Socio-Cultural design (Civil)
  5. Smart Village Design (Civil/Electrical)

Conclusion

Migration from village to city/ common phenomenon in India the reason for migration is on a count of employment opportunity, educational facilities, health care system and other infrastructure facilities. Migration towards urban is not welcomed which may destroy the city too.

To arrest the village has to be developed in terms of infrastructure such as good schools, good primary center, community halls, employment facilities, good roads, electricity, clean and hygienic environment.

With this background government of Gujarat has introduce vishwakarmayojana from 2012 onwards. In this Yojana the Gujarat technological university engineering students have been assigned selected villages to plan the design the development of the village into rurban. Under these project students in a team prepare the design for the development in terms of physical, social and cultural

The problem observed in country side areas, preventive and renewable measures are suggested. Implementation of improvement will reduce the problem in the area and improve the standard of living of village people. This can be resulted in improving the social and economic effect of rural areas on the economy of the country and it may result in more efficient use of infrastructure.

Designing these amenities will be helpful to the people to the latest environment and grow bit faster than previous. 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.

Feedback from Nodal Officer

The Government of Gujarat has launched "Vishwakarma Yojana" (a scheme) with motto of Rurbanisation for the undeveloped villages. Keeping the rural soul with urban facility is the main objective of this Yojana. As we had worked for the phase IV & V with this project, we feel very proud and this project is very much helpful to the final year engineering students. The definition of Civil Engineering is satisfied with this project. In Project students get the experience in communication skill, technical aspects and find the problems to the villagers.

The frequently arranged technical workshop by the GTU helps the student to expose their knowledge and ideas. It is a great platform for the students to interact, learn and solving the problems of

We really thankful to whole GTU Vishwakarma Yojana team for successful implementation of such a noteworthy project. We wish to express our sincere thanks to our HOD, Principal & Staff members for their continuous support.

Sunil V. Jaganiya
Nodal Officer
GIDC Degree Engineering College