A Case Study of Solar Power Plant, NirjaraSolaireUrja Private Limited (NSUPL), Konapur

Project Submitted

To

Government Degree College, Medak

For The Partial Fulfillment for the Award of the Degree of

Bachelor of Science (B.Sc.) in physics

By

1. A. Ramakrishna 6028-19-441-001
2. B. Praveen Kumar 6028-19-441-003
3. K. Madhuri 6028-19-441-008
4. K. Anusha 6028-19-441-009
5. S. Shiva Kumar 6028-19-441-010

Under the Guidance of

Dr. N. Thirumal Reddy
Assistant Professor of physics

Government Degree College, Medak

Affiliated to Osmania University

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DECLARATION

We, the students hereby declares that the Project entitled "A Case Study of Solar Power Plant, NirjaraSolaireUrja Private Limited (NSUPL), Konapur" submitted to Government Degree College, Medak for the partial fulfillment of the requirements for the award of degree of Bachelor of Science is original in its content and has not been submitted before, either in parts or in full, to any University for award of any other degree or diploma from this or any other University

Date: 18-06-2022

Students

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CERTIFICATE

This is to certify that the Project entitled "A Case Study of Solar Power Plant, NirjaraSolaireUrja Private Limited (NSUPL), Konapur" submitted to Government Degree College, Medak for the partial fulfillment of the requirements for the award of degree of Bachelor of Science under the guidance of Dr.N .Thirumal Reddy, Asst Prof of Physics and is original in its content and has not been submitted before, either in parts or in full, to any University for award of any other degree or diploma from this or any other University.

Date: 18-06-2022

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Examiner

T. Reshma Devi

(T. Reshma Devi)

Acknowledgements

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Project Students

ABSTRACT

The large usage of the fossil fuels, like the oil, the gas and the coal, results in greenhouse effect and pollutes the atmosphere. Meanwhile, there is a huge conflict between the fossil fuels supply and the global energy demand leading to a hike oil price in the market. The energy shortage and the atmosphere pollution have been the major limitations for the human development. In order to meet the rising global energy demand from environmental friendly sources, various renewable energy sources are given attention. From all the renewable energy sources, solar energy is the most rapidly increasing renewable energy source because it is inexhaustible, freely available and clean source of energy. Solar energy is inexhaustible, freely available and clean source of energy generation.

In the present project work, we are aimed to understand the solar power plant situated in the nearby locality of our college, Government Degree College, Medal and visited NirjaraSolaireUrja Private Limited (NSUPL), Konapur. We understood the functioning of the solar power plant, advantages, disadvantages, cost per unit and what are the requirements to install for house.

Index

1. Introduction:

Energy is a requirement in our everyday life as a way of improving human development leading to economic growth and productivity. The world is fast becoming a global village due to the increasing daily requirement of energy by all population across the world while the earth in its form cannot change. The need for energy and its related services to satisfy human social and economic development, welfare and health is increasing. All societies call for the services of energy to meet basic human needs such as: health, lighting, cooking, space comfort, mobility and communication and serve as generative processes. Securing energy supply and curbing energy contribution to climate change are the two-over-riding challenges of energy sector on the road to a sustainable future. It is overwhelming to know in today's world that 1.4 billion people lack access to electricity, while 85% of them live in rural areas. As a result of this, the number of rural communities relying on the traditional use of biomass is projected to rise from 2.7 billion today to 2.8 billion in 2030.

Historically, the first recorded commercial mining of coal occurred in 1750, near Richmond, Virginia. Momentarily, coal became the most preferred fuel for steam engines due to its more energy carrying capacity than corresponding quantities of biomass-based (firewood and charcoal) fuels. It is noteworthy that coal was comparatively cheaper and a much cleaner fuel as well in the past centuries. The dominance of fossil fuel-based power generation (Coal, Oil and Gas) and an exponential increase in population for the past decades have led to a growing demand for energy resulting in global challenges associated with a rapid growth in carbon dioxide (CO_2) emissions. A significant climate change has become one of the greatest challenges of the twenty-first century. Its grave impacts may still be avoided if efforts are made to transform current energy systems. Renewable energy sources hold the key potential to displace greenhouse gas emissions from fossil fuel-based power generating and thereby mitigating climate change [1].

2. Energy Conservation & Transition in India:

The World is in a transition phase and energy is central to it. India has been responsible for almost 10% of the increase in global energy demand since 2000. India's energy demand in this period has almost doubled, pushing the country's share in global demand up to 5.7% in 2013 from 4.4% at the beginning of the century. The primary

energy demand in India has grown from about 441 Mtoe(Million tons of oil equivalent) in 2000 to about 775 Mtoe in 2013. This demand is expected to increase to about 1250 (estimated by International Energy Agency) to 1500 (estimated in the Integrated Energy Policy Report) million tons of oil equivalent in 2030. India's energy consumption has almost doubled since 2000 and the potential for further rapid growth is enormous. Yet the increase in domestic energy production is far below than India's consumption needs. By 2040 more than 40% of primary energy supply will be imported, up from 32% in 2013. It may also be noted that no country in the world has been able to achieve a Human Development Index of 0.9 or more without an annual energy supply of at least 4 toe per capita. Consequently, there is a large latent demand for energy services that needs to be fulfilled in order for people to have reasonable incomes and a decent quality of life.

Improving the energy efficiency meets the dual objectives of promoting sustainable development and of making the economy competitive. Recognizing the formidable challenges of meeting the energy needs and providing adequate and varied energy of desired quality in a sustainable manner and at reasonable costs, improving efficiency have become important components of energy policy. In addition, the environmental and health burdens arising out of the use of hydrocarbons may also force mankind towards energy efficiency and clean energy systems. Energy Conservation has also assumed enhanced importance with a view to conserve depleting energy resources.

Government of India has undertaken a two pronged approach to cater to the energy demand of its citizens while ensuring minimum growth in CO_2 emissions, so that the global emissions do not lead to an irreversible damage to the earth system. On one hand, in the generation side, the Government is promoting greater use of renewable in the energy mix mainly through solar and wind and at the same time shifting towards supercritical technologies for coal based power plants. On the other side, efforts are being made to efficiently use the energy in the demand side through various innovative policy measures under the overall ambit of Energy Conservation Act 2001.

Table 1: GENERATION CAPACITY OF POWER IN INDIA (FUELWISE) AS ON 31.03.2022 (Ref: https://powermin.gov.in/en/content/power-sector-glance-all-india)

CATAGORY	INSTALLED GENERATION CAPACITY (MW)	% of SHARE IN TOTAL
Fossil Fuel		
Coal	2,04,080	51.10%
Lignite	6,620	1.70%
Gas	24,900	6.30%
Diesel	510	0.10%
Total Fossil Fuel	2,36,109	59.10%
Non-Fossil Fuel		
RES (Incl. Hydro)	1,56,608	39.20%
Hydro	46,723	11.70%
Wind, Solar & Other RE	1,09,885	27.50%
Wind	40,358	10.10%
Solar	53,997	13.50%
BM Power/Cogen	10,206	2.60%
Waste to Energy	477	0.10%
Small Hydro Power	4,849	1.20%
Nuclear	6,780	1.70%
Total Non-Fossil Fuel	1,63,388	40.90%
Total Installed Capacity (Fossil Fuel & Non-Fossil Fuel)	3,99,497	100%

3. Energy Production:

Commercial electricity production started with the coupling of the dynamo to the hydraulic turbine. The mechanical production of electric power began the Second Industrial Revolution and made possible several inventions using electricity, with the major contributors being Thomas Alva Edison and Nikola Tesla. Previously the only way to produce electricity was by chemical reactions or using battery cells and the only practical use of electricity was for the telegraph.

Electricity generation at central power stations started in 1882, when a steam engine driving a dynamo at Pearl Street Station produced a DC current that powered public lighting on Pearl Street, New York. The new technology was quickly adopted by many

cities around the world, which adapted their gas-fuelled street lights to electric power. Soon after electric lights would be used in public buildings, in businesses and to power public transport such as trams and trains.

The first power plants used water power or coal. Today a variety of energy sources are used, such as coal, nuclear, natural gas, hydroelectric, wind, and oil as well as solar energy, tidal power, and geothermal sources.

4. Energy Distribution:

The earliest distribution of electricity came from companies operating independently of one another. A consumer would purchase electricity from a producer, and the producer would distribute it through their own power grid. As technology improved so did the productivity and efficiency of its generation. Inventions such as the steam turbine had a massive impact on the efficiency of electrical generation but also the economics of generation as well. This conversion of heat energy into mechanical work was similar to that of Steam engines, however at a significantly larger scale and far more productively. The improvements of these large-scale generation plants were critical to the process of centralized generation as they would become vital to the entire power system that we now use today.

Throughout the middle of the 20th century many utilities began merging their distribution networks due to economic and efficiency benefits. Along with the invention of long-distance power transmission, the coordination of power plants began to form. This system was then secured by regional system operators to ensure stability and reliability.

5. Renewable energy:

Electricity is mainly produced by Renewable and Non-Renewable resources. Renewable energy, often referred to as clean energy, comes from natural sources or processes that are constantly replenished. For example, sunlight and wind keep shining and blowing, even if their availability depends on time and weather.

Renewable energy is generated by sources that can be replenished within a relatively short period of time. Solar, wind, water, biomass, and geothermal are all renewable energy sources. Green energy, while similar to renewable energy, is a subset of sources that have the highest environmental benefits [2]. Clean energy sources emit low carbon, and include renewable energy sources along with nuclear power [3, 4]. Renewable energy sources have been used to generate heat and power for much of human history, and more relatively recently, electricity.

A renewable resource, also known as a flow resource, is a natural resource which will replenish to replace the portion depleted by usage and consumption, either through natural reproduction or other recurring processes in a finite amount of time in a human time scale and also it can be used repeatedly and does not run out because it is naturally replaced. Examples of renewable resources include solar, wind, hydro, geothermal, and biomass energy.

A renewable resource is a commodity of which there is an endless supply. Some resources, unlike the sun, wind, or water, are considered renewable even though some time or effort must go into their renewal. Most precious metals are renewable also. Although precious metals are not naturally replaced, they can be recycled because they are not destroyed during their extraction and use.

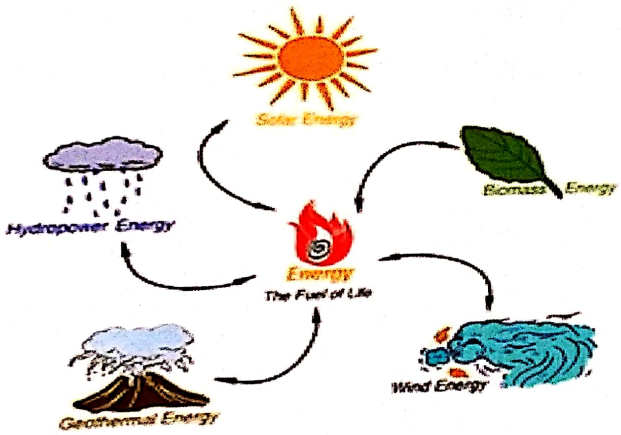

Fig. 1 : Renewable sources

Renewable resources have become a focal point of the environmental movement, both politically and economically. Energy obtained from renewable resources puts much less strain on the limited supply of fossil fuels, which are non-renewable resources. The problem with using renewable resources on a large scale is that they are costly and, in most cases, more research is needed for their use to be cost-effective.

There are many incentives designed to encourage the use of alternative energy. For example, energy taxes place a surcharge on fossil fuels so that the prices of renewable resources are more competitive and people will be more inclined to use renewable energy. Green funds, investment vehicles such as mutual funds, support eco-friendly and sustainable companies by investing in them and helping to promote environmental awareness

Non-renewable energy resources include coal, natural gas, oil, and nuclear energy. Once these resources are used up, they cannot be replaced, which is a major problem for humanity as we are currently dependent on them to supply most of our energy needs

There are four major types of non-renewable resources: oil, natural gas, coal, and nuclear energy. Oil, natural gas, and coal are collectively called fossil fuels. Fossil fuels were formed within the Earth from dead plants and animals over millions of years—hence the name "fossil" fuels. They are found in underground layers of rock and sediment. Pressure and heat worked together to transform the plant and animal remains into crude oil (also known as petroleum), coal, and natural gas.

The plants and animals that became fossil fuels lived in a time called Carboniferous Period, around 300 to 360 million years ago. The energy in the plant and animal remains originally came from the sun through the process of photosynthesis; solar energy is stored in plant tissues, which animals then consume, adding the energy to their own bodies, when fossil fuels are burned, this trapped energy is released.

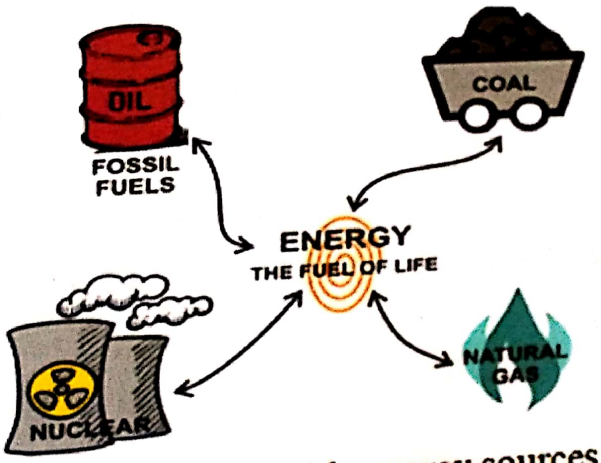

Fig.2 : Non - renewble energy sources

6. Major sources of renewable energy:

The major sources of renewable energy sources are:

- Solar (photovoltaic, solar thermal)
- Geothermal
- Hydro-power
- Wind
- Biogas (e.g., landfill gas/wastewater treatment digester gas)
- Biomass

- Low-impact hydroelectricity
- Emerging technologies - wave and tidal power

Solar energy: Energy from the Sun is referred to as solar energy. Solar energy could be used as either active solar or passive solar. Active solar is directly consumed in activities such as drying clothes and warming of air. Technology has provided a number of ways to utilize this abundant resource.

Geothermal energy: This refers to heat energy stored under the ground for millions of years through the earth formation. It utilizes a rich storage of unutilized thermal energy that exists under the earth's crust.

Hydro-power: This is a major renewable energy source used all over the world today to produce electricity.

Wind energy: In ancient times, wind energy was used to move ships by impacting on the sails.

Advantages of renewable energy:

Advantages or Environmental and economic benefits of using renewable energy include:

- Generating energy that produces no greenhouse gas emissions from fossil fuels and reduces some types of air pollution
- Diversifying energy supply and reducing dependence on imported fuels
- Creating economic development and jobs in manufacturing, installation, and more
- Less maintenance cost as most sources entail few or no moving parts, hence, less mechanical damages.
- They are economical and can cut costs spent on fossil fuel.
- They emit little or no waste in the environment.
- Renewable energy sources do not deplete. Therefore, these have a better prospect for the future.

7. Solar Energy:

A solar power plant is based on the conversion of sunlight into electricity, either directly using photovoltaics (PV), or indirectly using concentrated solar power (CSP). Concentrated solar power systems use lenses, mirrors, and tracking systems to focus a large area of sunlight into a small beam Electricity is the set of physical phenomena associated with the presence and motion of matter that has a property of electric charge.

Electricity is related to magnetism, both being part of the phenomenon of electromagnetism, as described by Maxwell's equations.

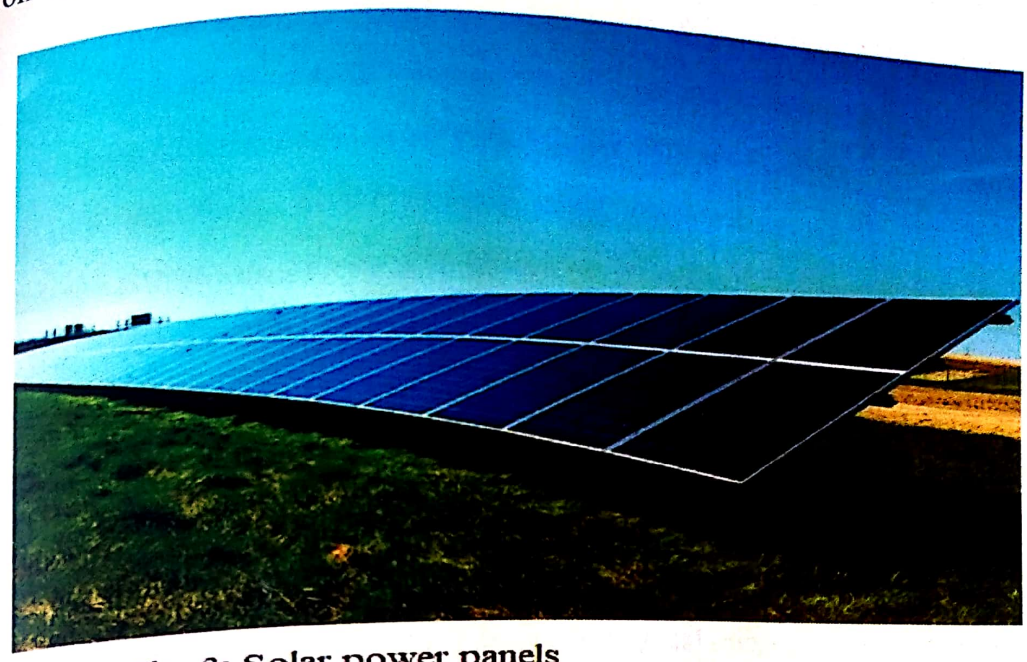

Fig. 3: Solar power panels

Solar energy is the energy obtained by capturing heat and light from the Sun. Energy from the Sun is referred to as solar energy. Technology has provided a number of ways to utilize this abundant resource. It is considered a green technology because it does not emit greenhouse gases. Solar energy is radiant light and heat from the Sun that is harnessed using a range of technologies such as solar power to generate electricity, solar thermal energy including solar water heating, and solar architecture

A solar power plant is based on the conversion of sunlight into electricity, either directly using photovoltaics (PV), or indirectly using concentrated solar power (CSP). Concentrated solar power systems use lenses, mirrors, and tracking systems to focus a large area of sunlight into a small beam.A solar power plant uses sunlight to get energy. As the sunlight is ample and renewable, one can use it to power up the home and business premises. If we install a solar power plant, we might need to spend upfront. However, it will minimize our energy consumption significantly.Solar power is a form of energy harnessed from the power and heat of the sun's rays. It is renewable, and therefore a "green" source of energy.

Facts about Solar Power:

- Every hour, the sun beats down with enough power to provide global energy for an entire year.
- It takes an average of eight minutes for energy to travel from the sun to the Earth.
- Scientists have used solar energy to power spaceships since 1958.

(Most solar panels used today have an average life expectancy of between 20-40 years.

We can use solar energy by converting it to electrical energy. So we must use a device called solar panels which can convert the light energy into electrical energy. Solar panel is a group of solar cells. Solar power is the conversion of renewable energy from sunlight into electricity, either directly using photovoltaics (PV), indirectly using concentrated solar power, or a combination.

Photovoltaic cells convert light into an electric current using the photovoltaic effect. Concentrated solar power systems use lenses or mirrors and solar tracking systems to focus a large area of sunlight to a hot spot, often to drive a steam turbine. Photovoltaic were initially solely used as a source of electricity for small and medium-sized applications, from the calculator powered by a single solar cell to remote homes powered by an off-grid rooftop PV system. Commercial concentrated solar power plants were first developed in the 1980s. Since then, as the cost of solar electricity has fallen, grid-connected solar PV systems have grown more or less exponentially. Millions of installations and giga watt - scale photovoltaic power stations have been and are being built. Solar PV has rapidly become a viable low-carbon technology, and as of 2020, provides the cheapest source of electricity in history.

As of 2021, solar generates 4% of the world's electricity, compared to 1% in 2015 when the Paris Agreement to limit climate change was signed. Along with onshore wind, the cheapest cost of electricity is utility-scale solar. The International Energy Agency said in 2021 that under its "Net Zero by 2050" scenario solar power would contribute about 20% of worldwide energy consumption, and solar would be the world's largest source of electricity.

8. Literature survey:

Though solar energy has found a dynamic and established role in today's clean energy economy, there's a long history behind photovoltaics (PV) that brought the concept of solar energy to fruition. With the way the cost of solar has plummeted in the past decade, it's easy to forget that going solar had a completely different meaning even just 15 years ago. Let's go back a few centuries to the origins of solar PV and explore the history of solar energy and silicon solar technology.

In theory, solar energy was used by humans as early as 7th century B.C. when history tells us that humans used sunlight to light fires with magnifying glass materials.

Later, in 3rd century B.C., the Greeks and Romans were known to harness solar power with mirrors to light torches for religious ceremonies. These mirrors became a normalized tool referred to as "burning mirrors." Chinese civilization documented the use of mirrors for the same purpose later in 20 A.D.

Another early use for solar energy that is still popular today was the concept of "sunrooms" in buildings. These sunrooms used massive windows to direct sunlight into one concentrated area. Some of the iconic Roman bathhouses, typically those situated on the south-facing side of buildings, were sunrooms. Later in the 1200s A.D., ancestors to the Pueblo Native Americans known as the Anasazi situated themselves in south-facing abodes on cliffs to capture the sun's warmth during cold winter months.

In the late 1700s and 1800s, researchers and scientists had success using sunlight to power ovens for long voyages. They also harnessed the power of the sun to produce solar-powered steamboats. Ultimately, it's clear that even thousands of years before the era of solar panels, the concept of manipulating the power of the sun was a common practice.

The development of solar panel technology was an iterative one that took a number of contributions from various scientists.Naturally, there is some debate around when exactly they were created and who should be credited for the invention. Some people credit the invention of the solar cell to French scientist **Edmond Becquerel**, who determined light could increase electricity generation when two metal electrodes were placed into a conducting solution. This breakthrough, defined as the "photovoltaic effect," was influential in later PV developments.

In 1873, Willoughby Smith discovered that selenium had photoconductive potential, leading to William Gray Adams' and Richard Evans Day's 1876 discovery that selenium creates electricity when exposed to sunlight.

A few years later in 1883, **Charles Frits** actually produced the first solar cells made from selenium wafers – the reason some historians credit Frits with the actual invention of solar cells

However, solar cells as we know them today are made with silicon, not selenium. Therefore, some consider the true invention of solar panels to be tied to Daryl Chapin, Calvin Fuller, and Gerald Pearson's creation of the silicon photovoltaic (PV) cell at Bell Labs in **1954**. Many argue that this event marks the true invention of PV technology because it was the first instance of a solar technology that could actually power an

electric device for several hours of a day. The first ever silicon solar cell could convert sunlight at four percent efficiency, less than a quarter of what modern cells are capable.

Solar panels in outer space – Some of the earliest uses of solar technology were actually in outer space where solar was used to power satellites. In 1958, the Vanguard I satellite used a tiny one-watt panel to power its radios. Later that year the Vanguard II, Explorer III and Sputnik-3 were all launched with PV technology on board. In 1964, NASA was responsible for launching the first Nimbus spacecraft, a satellite able to run entirely on a 470 watt solar array. In 1966, NASA launched the world's first Orbiting Astronomical Observatory, powered by a one-kilowatt array.

First solar residence – In 1973, the University of Delaware was responsible for constructing the first solar building, named "Solar One." The system ran on a hybrid supply of solar thermal and solar PV power.

It was also the first instance of building integrated photovoltaics (BIPV) – the array didn't use solar panels but instead had solar integrated into the rooftop, similar to the design for Tesla's new roof product.

Achievements in solar conversion efficiency – Between 1957 and 1960, Hoffman Electronics made a number of breakthroughs with photovoltaic efficiency, improving the efficiency record from 8% to 14%. The next major achievement was in 1985 when the University of South Wales achieved 20% efficiency for silicon cells. In 1999, the National Renewable Energy Laboratory collaborated with Spectrolabe Inc. to create a solar cell with 33.3% efficiency. The University of South Wales broke that record again in 2016 when researchers reached 34.5% efficiency.

Solar-powered airplanes – In 1981, Paul Mac Cready built Solar Challenger, the first aircraft to run on solar power, and flew it across the English Channel from France to the U.K. In 1998, the remote-controlled solar airplane "Pathfinder" set an altitude record after reaching 80,000 feet. NASA broke that record in 2001 when they reached 96,000 feet with their non-rocket aircraft. In 2016, Bertrand Piccard completed the first zero-emissions flight around the world with Solar Impulse 2, the world's largest and most powerful solar-powered airplane today.

Solar-powered presidencies – In 1979, President Jimmy Carter had solar panels installed on the White House during his term as president. However, in 1981, President Ronald Reagan ordered the White House solar panels to be removed. In 2010, President Barack Obama requested that solar panels and a solar water heater be installed on the White House. Both were installed during Obama's first term.

Cost of solar panels over the time:

Prices for solar panels have dropped substantially over the past few decades, leading to a surge in consumer demand that has produced more than one million U.S. installations as of early 2016. In 1956, solar panels cost roughly $300 per watt .By 1975, that figure had dropped to just over $100 a watt.

Today, a solar panel can cost as little as $0.50 a watt. Consider this since the year 1980, solar panel prices have dropped by at least 10 percent every single year. The plummeting cost of solar is largely responsible for the growing popularity of solar and the legitimacy of PV as a reliable energy source in today's world

Solar panels harness the sun's energy to generate usable electricity. At a high level, solar cells absorb incoming sunlight to generate an electric current through what's known as the "photovoltaic effect".This electrical current is captured by plates and wires and turned into a usable energy, current that is sent to our home and appliances.

9. Basis of the solar energy:

The photons that reach your solar cells and generate an electric current come from the sun. Solar energy is formed by the constant nuclear fusion reactions occurring deep within the sun. Nuclear fusion in the sun happens when protons (which are essentially the same as hydrogen atoms) collide and fuse under extreme temperature and pressure to create helium.This process emits a massive amount of energy (plus more protons), and in the core of the sun, this reaction is constantly happening, producing over 500 million tons of hydrogen atoms every second.

Our sun exists at a temperature around seven million degrees Fahrenheit, and is constantly emitting massive amounts of energy in the form of electromagnetic radiation (EMR). EMR exists in many forms, and the sun produces all types of EMR, carried to earth in the form of photons.

In a nutshell, a solar panel works by generating electricity when particles of sunlight, or **photons**, knock electrons free from atoms, setting them in motion. This flow of electrons is electricity, and solar panels are designed to capture this flow, turning it into a usable electric current. This process is called the **photovoltaic effect**, and is the foundational chemical and physical process behind the vast majority of solar technology.

10. Objectives:

- To study the power generation in the solar plant.
- To study how the solar power is economy compared to the other conventional methods.
- To study how the solar power generation is eco-friendly.
- To study the infrastructure required to establish a solar plant.
- To study the distribution of the power generated.
- To study the how to install solar panels for house hold purpose.
- To study what infrastructure required to establish solar panels for house hold purpose.
- To study how the solar power is better and cheap for domestic use.

11. Methodology:

In the present project work as its title indicates, we have opted the survey as the methodology and to visit the NirjaraSolaireUrja Private Limited (NSUPL), Konapur, Medak (Dist.). The primary data was collected from the various sources of internet. A questionnaire was prepared to collect the required data from the visit of the NirjaraSolaireUrja Private Limited (SUPL), Konapur, Medak (Dist.) and it is as follow:

1. What type of land is suitable to construct a solar power plant?
2. How much area required to construction of a MW (Mega Watt) capacity solar power plant?
3. Is there any particular direction is required to fix a solar panel?
4. When this solar plant is constructed?
5. Which company / management are maintaining this plant?
6. Is this solar power plant is private or government?
7. How many panels are there in this solar power plant?
8. How much current (units) will generate in a day and in mouth?
9. What is cost of production per unit?
10. What is price of sale per unit?
11. What are the precautions we should take when we are entering to solar power plant?
12. What is the life time of this solar power plant?
13. What are mostly used in making of solar panels?
14. What are the advantages and disadvantages of solar power plants?

15. Shall we use solar panels to houses?
16. How many panels are required for a house?
17. What is the cost of one solar panel?

Name of the Students 1. A Ramakrishna
2. B. Naveen kumar
3. K. Madhan
4. K. Anusha
5. S. Shivakumar

Date: 26/05/2022

Name & Address of the Solar Plant Visited:

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1. What type of land is suitable to construct a solar power plant?

Any dry land usually we use land which are not useful for cultivation.

2. How much area required to construction of a MW (Mega Watt) capacity solar power plant?

5-6 Acres

3. Is there any particular direction is required to fix a solar panel?

Yes, solar panel should be in S direction with horizontal

4. When this solar plant is constructed?

In 2016

5. Which company / management are maintaining this plant?

Nirjara Solise Urja Pvt Ltd (NSUPL)

6. Is this solar power plant is private or government?

private

7. How many panels are there in this solar power plant?

45,768

8. How much current (units) will generate in a day and in mouth?

minimum 60,000 units, maximum 72,000 units per a day

9 What is cost of production per unit?

only maintenance required

10 What is price of sale per unit?

6 rupees per unit

11 What are the precautions we should take when we are entering to solar power plant?

visitors should wear the shoes, helmet, glasses, Jacket.

12 What is the life time of this solar power plant?

The life time of a solar power plant is 25 years.

13 What are mostly used in making of solar panels?

Silicon, solar cells, metal frame, glass sheet, wire.

14 What are the advantages and disadvantages of solar power plants?

Advantages: renewals, Ecomic, low maintainance.
disadvantages: highcost, required lot of space, whether dependent, storage is expensive low energy conversion rate.

15 Shall we use solar panels to houses?

Yes.

16 How many panels are required for a house?

45,768 for monthly electricity consumption of 1000 kWh requires 26 to 36 solar panel each produce 320 W

17 What is the cost of one solar panel?

is. 17000

12. Overview of NSUPL at Konapur:

It is situated at a distance of 25 km from our college (Government Degree College, Medak) towards the route of Siddipet. It was established in the month of June 2016 with the expenditure of nearly 100 Cr. It is placed in nearly 70 acres and out of this 70 acres, only the solar panels occupied nearly 50 acres of area. The circumference of this solar power plant is 4 km. Initially this Solar Power Plant owned by a company,

SDI and later it was transferred to ENGI. This company holds the total three plants including this in Telangana state.

From this plant nearly 60,000 units minimum and 72000 units maximum power is producing in a day and each every unit of power producing from this plant has a sale agreement with the Government the rate Rs 6/-. For every month it has an income 1,30,00,000/- (One Crore Thirty Lakh rupees). This plant has a life timer 25 years. By this plant they are supplying power to nearlylocated four villages in RamayampetMandal of Medak district. This Solar Power Plant was divided into four zones. It has 4 Invertors and 4 Transformers. To maintain this Solar Plant one senior engineer, one junior engineer and a technician is required.

The Solar Plant can be divided into three main parts:

1. Solar panel
2. Inverter
3. Transformer

Solar Panels: In this plant there are 45768 number of solar panel and each solar panel is constituted by 60 cells. All the cells in the panel are connected in series combination. Each cell has four PN junction diodes. The cost of solar panel cost is nearly Rs17000/- and these are made in China. Each solar panel generates 37.7 volts / 9 amps power. Every solar panel has a life span of 25 years and every year the efficiency of production of power decreases by 1%. On the day of install, if the efficiency of production is 100%, after 10 year the production standard will be 80-90%.

Invertor: Invertor is second important segment in Solar Power Plant. There are three sections which are interconnected with the each other with the communication bar these sections are:

1. Direct current control,
2. IGBT,
3. Alternating current control box

Direct current control box was connected with the eight positive and negative terminals of 8 string monitoring boxes. IGBT convert direct current into AC power. Alternating current control box connected to a charge controllers to flow the current which was produced.

There is a communicating device such that it indicates the complete information regarding the inverter room. There is one cooler which prevents the Invertor from heat developed.

Transformer: A transformer in a solar power plant step up the voltage to deliver the utility grid. It supplies 330 kW voltages to 4 villages of the Ramayampet mandal.

13. How can we setup a rooftop solar system?

In a rooftop solar plant, solar panels are mounted on top of a residential or commercial building. India is in the middle of an unprecedented power crisis. A shortage of domestic coal has caused a precarious situation at power plants, leading to power cuts and outages. The country recently saw an energy deficit of 5% at the national level, with some states reporting even steeper deficits. The looming power crisis has renewed attention on alternative power sources.

One such technology is rooftop solar, despite being promising, has remained critically underutilised in India. There are several benefits of installing a rooftop solar plant, both for consumers as well as the government. For instance, they can help cut down electricity bills and they also align with the government's ambitious goal of going greener.

How does it work?

Solar technologies absorb the Sun's radiation and turn it into energy. When the sun shines onto a solar panel, the photovoltaic (PV) cells in the panel absorb the sunlight, helping in the creation of electric current. A rooftop solar plant refers to one where the solar panels are mounted on top of a residential or commercial building. Here are the pros and cons of installing a rooftop solar system.

Fig 4: Solar technologies absorb the Sun's radiation and turn it into energy.

Pros:

1. Cost savings: It is cheaper than the conventional electric supply and government subsidies also help bring the cost down.
2. Low maintenance charges: Most rooftop solar systems have a life expectancy of up to 25 years and require only basic maintenance such as regular cleaning and repairs.

3. No additional land is required as vacant rooftop space can be utilised for installing solar panels.
4. Reduction in carbon footprint: Solar is a clean and renewable source of energy that helps in cutting the emission of greenhouse gases.

Cons:

1. Solar panels are not suitable for every type of roof. For instance, it could be difficult to set them up on slate or cedar tiles used in old houses.
2. Since solar is a big financial investment, it may not be an ideal choice for young homeowners who could be moving in the coming years.

How much does it cost?

The cost of setting up a rooftop solar system varies with the quality and price of the modules and inverters used. On average, the installation of a 1 kW rooftop solar system could cost between Rs 45,000 and Rs 85,000. Batteries would cost extra if power is to be stored.

Similarly, the cost for a 5 kW system would fall between Rs 2,25,000 to Rs 3,25,000. Rooftop solar systems are considered lighter on pocket as their cost can usually be recovered in 5-6 years.

Are there any subsidies?

The central government offers financial support to consumers for installing rooftop solar systems. However, the subsidy is only available for residential properties and not for commercial/industrial establishments. Classification of subsidies is as below:

Up to 3 kW Capacity - 40%

4-10 kW Capacity - 20%

Above 10 kW - No subsidy

In the case of GHS/RWA consumers, there is a subsidy provision of 20% for a total capacity up to 500 kWp (limited to 10 kWp per house).

How to apply for a solar rooftop system?

Consumers can apply for a rooftop solar system through the online portal of their respective DISCOM: https://solarrooftop.gov.in/grid_others/discomPortalLink.

The government has also launched a toll-free helpline number to provide information about the scheme: 1800-180-3333

14. Conclusions:

The sun provides a very abundant energy that is available to all of us. This energy from the sun is not completely under used so far. If 4% of the desert areas in the world are covered with the solar panels, it would supply the enough electricity to the world. This resource is not just available to business and major energy companies; it is also available to everyone. Moreover this energy protects the environment clean without green-house gasses. If we install the solar panels on the roof top of the houses, we can save electricity bill. Solar panels can be used for the street lights to prevent the energy losses.

Solar energy has the capacity to provide all of the energy we will ever need. We have the ability to harvest this energy, but we must invest more money and further develop and perfect the technology at hand.

Therefore we believe that solar energy is the energy of the future and can solve all of our energy demands including eliminating the pollution caused by other forms of electricity generation.

Solar power generation is the most environment friendly form of energy generation and it depends on the radiation of sun. We learned that if we put solar panels to things that use electricity we would waste less electricity and we wouldn't contaminate the world.

Although setting up of solar energy powered system is costly during establishment even though it saves energy which helps sustainability of the environment. In long term, it reduces cost as well.

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WATER LEVEL INDICATOR WITH ALARM

Project Submitted

To

Government Degree College, Medak
For the partial fulfillment for the award of the degree of
Bachelor of Science (B.Sc.) in Physics

By

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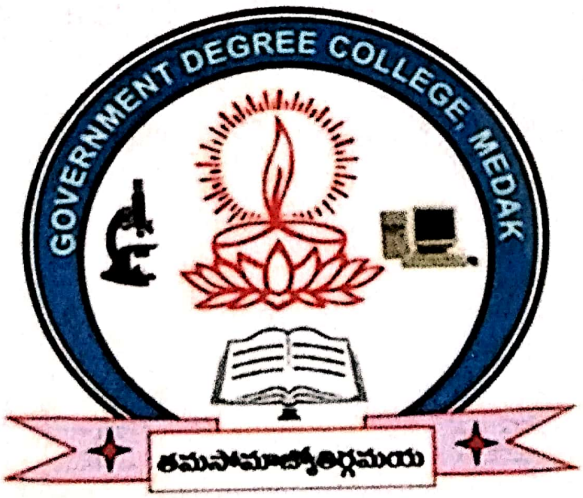

Government Degree College, Medak

Affiliated to Osmania University
Accredited with B grade by NAAC

June-2022

DECLARATION

We, the students hereby declare that the project entitled "Water Level Indicator With Alarm" submitted to Government Degree College, Medak for the partial fulfillment of the requirements for the award of degree of Bachelor of Science is original in its content and has not been submitted before, either in parts or in full, to any University for award of any other degree or diploma from this or any other University.

Date: 18-06-2022

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CERTIFICATE

This is to certify that the Project entitled **"Water Level Indicator With Alarm"** submitted to Government Degree College, Medak for the partial fulfilment of the requirements for the award of degree of Bachelor of Science under the guidance of C. Sudha Rani, Lecturer in Physics and is original in its content and has not been submitted before, either in parts or in full, to any University for award of any other degree or diploma from this or any other University.

Date: 18-06-2022

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Project Students

ABSTRACT

The electronic water level alarm gives the information about the level of the water level of the water tank if the water tank is full or the water tank is empty. Hence, any person can identify the level of water. By using the liquid level sensor we can measure the level of water in the water tank the drinking water crisis in India is reaching alarming proportions. It might very soon attain the nature of global crisis. Hence, it is of extreme importance to preserve water. In home based water tank, the one problem is very common to us that the control of water level of overhead tank, as a result the wastage of water is increasing day by day. But we all know water is very precious to us. This problem can be controlled by a simple electronic circuit consists with some cheap electronic components, that circuit is called 'Water Level Indicator'. The operation of water level controller works upon the fact that water conducts electricity. So water can be used to open or close a circuit. As the water level rises or falls, different circuits in the controller send different signals. These signals are used to switch ON or switch OFF the motor pump as per our requirements. Water Level Indicator is a simple low cost circuit. First we introduced this circuit from the web. There the circuit is made with various components like transistors, Resistors, Leds and etc. After we discussed that how to make the circuit without transistors and after we calculate that we got the result, beside we got help from our lecturer about this circuit. At last we got a simple circuit with transistor and it shows result. We use the transistors to make the circuit and easy installation to all. The other liquid control circuits, which we have seen those are very critical than this circuit.

INDEX

1. Introduction:

Water level indicator is a device which is used to measure the level of water or any other conductive liquid in container by following a very simple circuit. This device can be implemented along with including the water level. It will also give you an alarm when the tank becomes full.

This device works simply by closing the circuit with the conductivity of liquid. When the container is empty, the circuit will be open hence the resistor implemented will make the switch open and hence LED will go off. Similarly when liquid will comes up to the first installed probe it will close the circuit between base probe and first probe. So the Led will glow on indicating water level.

Nowadays all the households/owners are storing the water in overhead tanks by using the pumps. When the water is stored in the tank, no one can identify the water level and also no one can know when it will be full. Hence there is overflow of water in the tank then there is wastage of energy & water. To resolve this type of problems Four LED water level indicator with alarm is used, which helps in indicates the level of water in overhead tanks. The cost of this water level alarm circuit is low and it is useful for overhead water tanks, swimming pool boilers etc. They are also used in factories, chemical plants and electrical substations and also in other liquid storage system.

Water level indicator system gives you a clear view of current water level in your tank. Our LED based interface is simple and requres no extra training for the maintenance staff/watchmen. With brightly lit LEDs glowing automatically for water levels, the staff can turn the water pump ON and OFF on time. Once you have the water level indicator from Perfect Control Systems you will never waste a drop of precious water again.

2. Benefits of water level indicators:

- Easy to install
- Very little maintenance
- Compact design
- Automatic water level indicators ensure no overflows or running of dry pumps
- Saves money by using less water and electricity
- Can help avoid seepage of walls and roofs due to tanks overflowing
- Automatic save you can save manual labor time
- Consumes very little energy, perfect for continuous operation
- Shows incitation of water levels in any type of tank

3. Objectives:

The Main objectives of the study project are

1. Learn the working of a water indicator.
2. Understanding of the components use and working.
3. Performing labs in putting circuits together and troubleshooting.
4. To know the water level in overhead tank or water bodies.
5. To assess the functionality of IC4066, Diodes, Resistors

4. Methodology:

The circuit is designed to indicate three levels of water stored in the tank: low but not empty, half and full but not overflowing. When there is no water in the tank, all the LEDs are off as an indication that the tank is completely empty. When water level increases and touches the sensor, the Red LED will glow indicating that there is water within the tank. As the water level continues to rise and

reaches half the tank, Yellow LED will glow. When the water in the tank rises to full an alarm is made by the buzzer as an indication that the tank is full.

Using different electronic components an electronics circuit is constructed and installed in the overhead water tank on the college building. For this project the following apparatus arev required:

1. 6 V power Supply
2. LEDS
3. 180 K'Ω resistors
4. 330 'Ω resistors
5. 2.2 K'Ω resistors
6. Switch - IC DC 4066
7. BC 148 transistor
8. Breadboard
9. SPST ON/OFF Switch
10. Piezoelectric Buzzer
11. Connecting Wires.

Circuit Diagram:

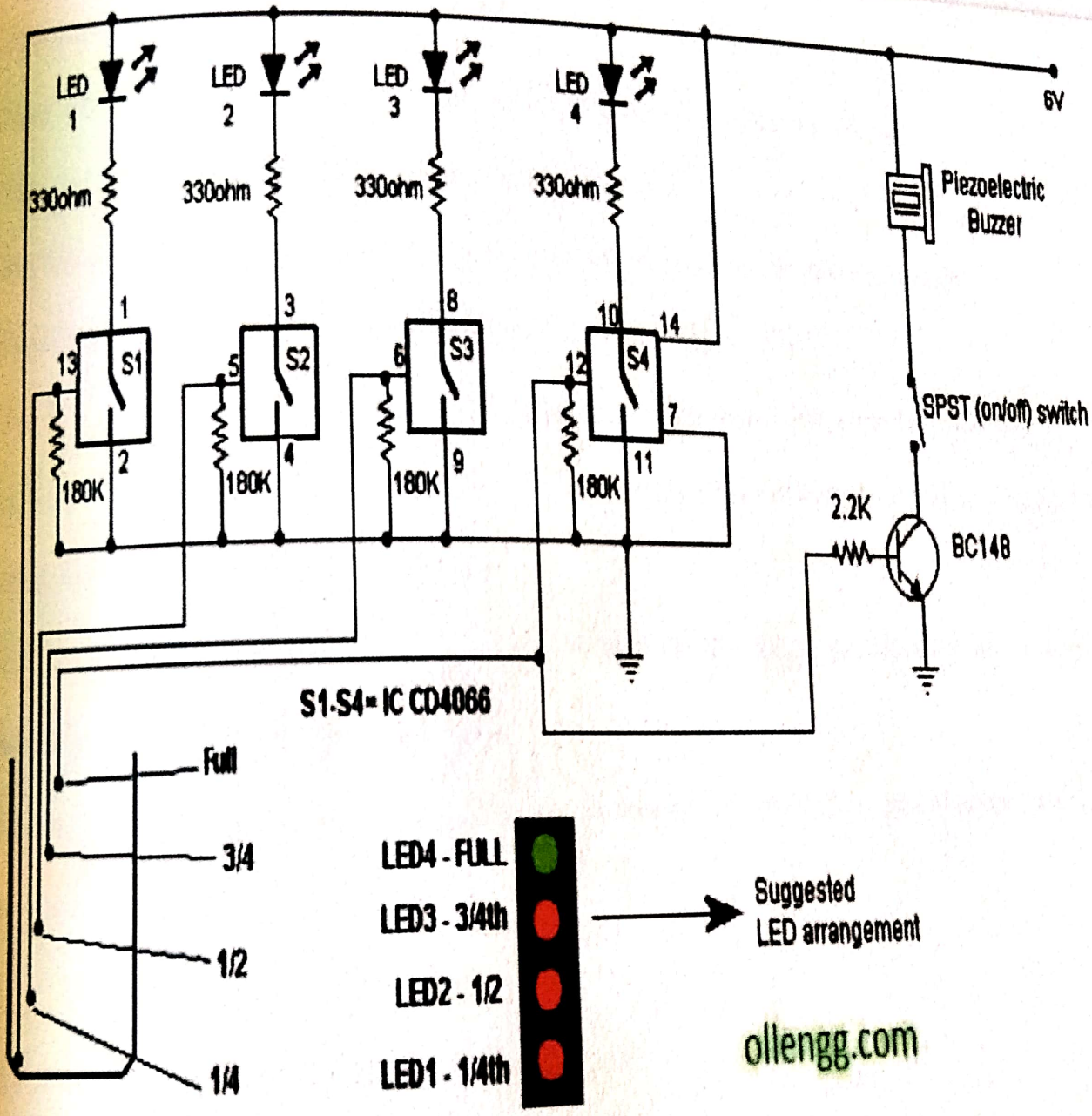


Fig. 1: Circuit diagram of Water Level Indicator

- This circuit is very useful for automatic controlling of water level while filling the container.
- As the water layer crosses the particular level which is predefined, the corresponding LED glows.
- Thus this circuit can be used as indication of knowing the current.
- The figure shows connection diagram of 40661IC.
- The Electrode connected in the output should be dropped in the container.
- The input of each electrode is connected to each switch of IC.
- There is one common electrode switch continuously emits 9v Volt DC power.
- As water is conductor of electricity, the respective electrode captures the power voltage while filling the container with water.
- This causes the control input of each switch to go high as water fills which in tens switches particular LED's to ground.
- As the water reaches it top most position in transistor, switches, the buzzer indicating that the container is full.

5. Description of components used in circuit:

Switch - IC CD 4066

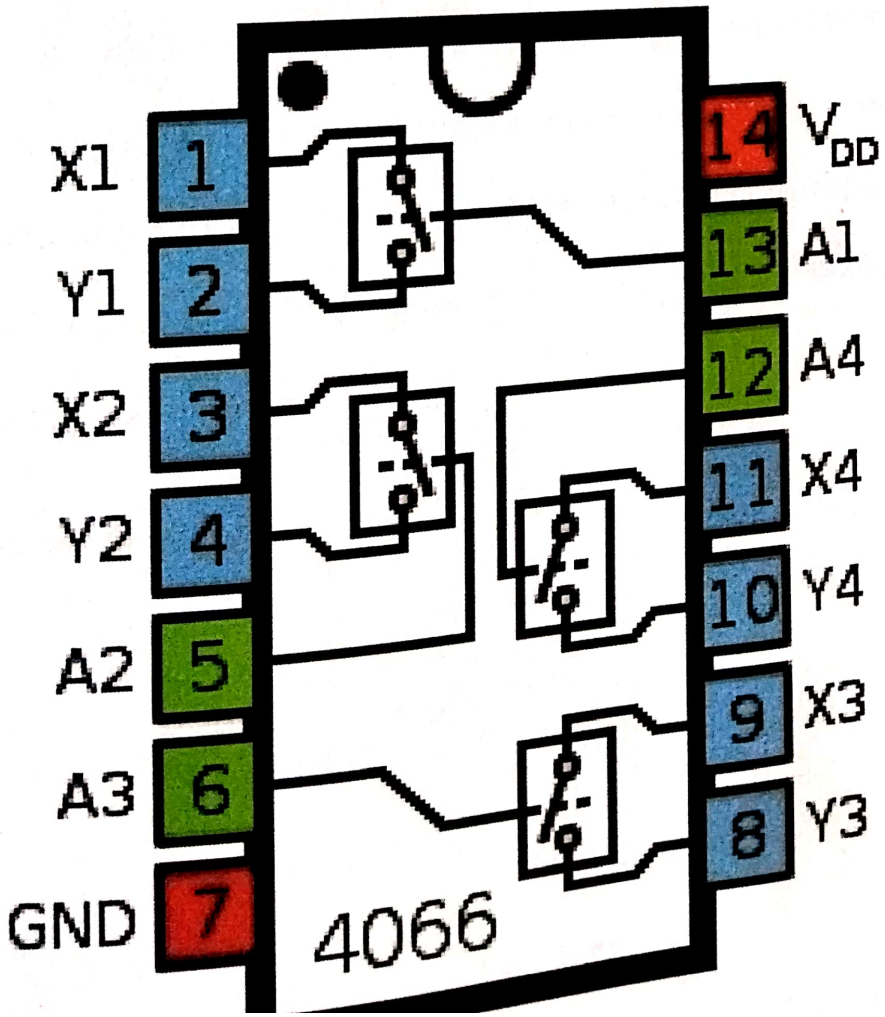
The CD4066 is a quad bilateral switch intended for the transmission or multiplexing of analogue or digital signals. The ON- state resistance is relatively constant over the full signal input range.

CD4066 device consists of 4 bilateral switches, each with independent controls. Both the P and n Devices in a given switch based on or off simultaneously by the control signal.

CD4066 is called as a bilateral switch because it can be operated forward or reverse either side of the switch can be used as the input. So current can flow in one direction and other direction depending on the side is input.

Logic Type	Analogue
Function Family	Bilateral switch
Description	Quad bilateral
Pins	14

Pin Diagram:

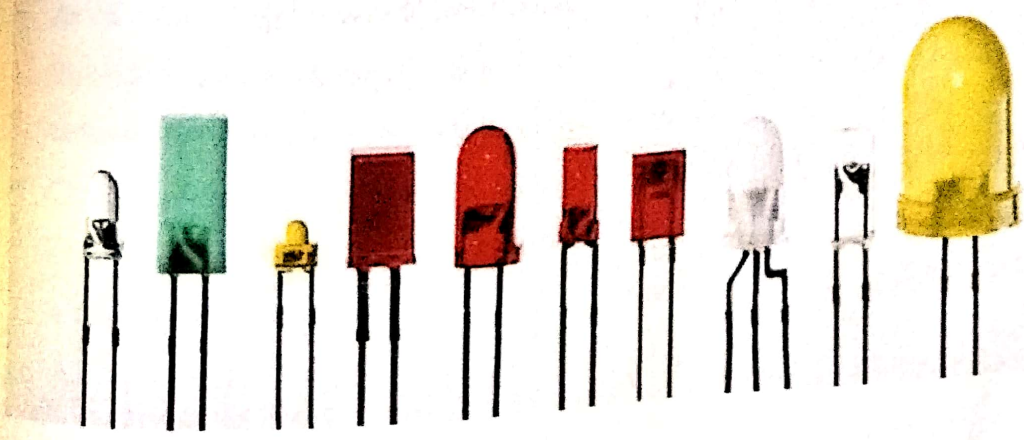


First to power the 4066, we connect vs. of power to Vdd, pin 14 & we connect the ground pin I.e., Pin 7 to ground this established sufficient power to the chip.

Switch:

- A switch is a device for changing the course (or flow) of circuit.
- The prototypical model is a mechanical device (For example Rail road Switch) which can be disconnected from one course and connected to another.
- The term "Switch" typically refers to electrical power or electronic telecommunication circuit.
- In applications where multiple switching options are required (e.g. a telephone Service), mechanical switches have long been replaced by electronic variants which can be intelligently controlled and automated.
- The Switch is referred as 'gate' when abstracted to mathematical form. In the philosophy of Logic, operational arguments are represented as logic gates.
- The use of electronic gates to function as a system of logical gates is the fundamental basis for the computer – i.e. a computer is a system of electronic switches which function as a logical gates.

Light Emitting Diode (LED):

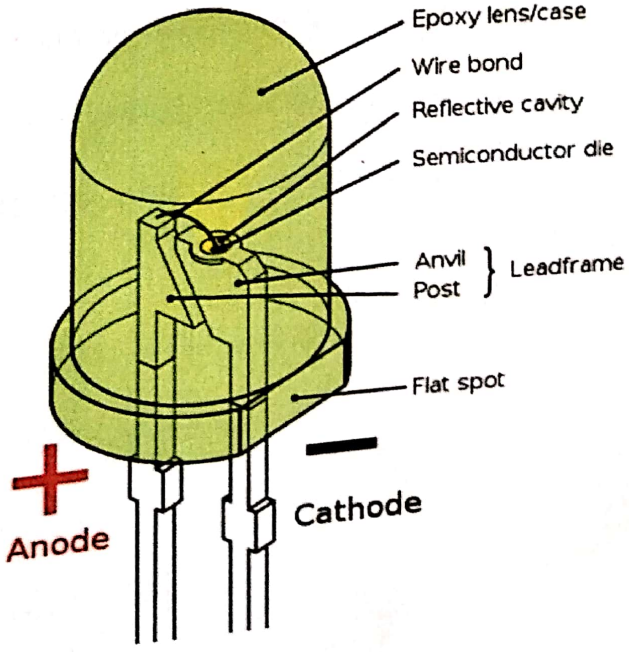


1. LEDs are available in red, Blue, Orange, Amber, yellow, Green and White. Blue and White LEDs are much more expensive than the other colours.
2. The colour of an LED is determined by the semi-conductor material, not by the colouring of the package(Plastic Body)
3. LEDs of all colours are available in uncoloured packages which may be defused (Milky) or clear (often described as water clear). The coloured packages are also available as defused or transparent.
4. A light Emitting Diode is a semi-conductor diode that emits in coherent narrow spectrum light. When electrically biased in the forward direction of p-n junction.
5. This effect is form of electroluminescence.

   An LED is usually a small area source, often with extra optics added to the chip that shapes it radiation pattern.
6. The Colour of emitted light depends on the composition and condition of the semiconducting material used, and can be infrared, visible or near ultraviolet. An LED can be used as a regular household light source.

Working of LED:

- Like a normal diode, an LED consists of a chip of semiconducting material impregnated or doped, with impurities to create a p-n junction.
- As in other diodes, current flows easily from the P side or anode to the n-side or cathode but not in the reverse direction.
- Charge carriers - electrons and holes – flow into the junction from electrodes with different voltages.



- When an electron meets a hole, it falls into a lower energy level and releases energy in the form photon.
- The wavelength of the light emitted, and therefore its colour, depends on the band gap energy of the materials forming the p-n junction.
- In silicon or germanium diodes, the electrons and holes recombined by a non-radioactive transition which produces no optical emission, because these are indirect band gap materials. The materials used for an LED have a direct band gap with energies corresponding to near infrared, visible or near ultra violet light.
- LED development begins with infrared and red devices, with gallium arsenide.
- Advances In materials science have made possible the production of devices with ever shorter wavelengths, producing light in variety of colours.
- LEDs are usually built on an n-type substrate, with an electrode attached to the p type layer deposited on its surface.
- P type sub straits, while less common, occur as well. Many Commercial LEDs, especially GaN/InGaN, are also use sapphire substrate.
- Substrate that are transparent to the emitted wavelength, and backed by a reflective layer, Increase the LED efficiency.
- The refractive index of the package materials should match the index of semiconductor, otherwise produced light gets partially reflected back in to the semiconductor, where it may be absorbed and turned into additional heat, thus lowering the efficiency.
- This type of reflection also occurs at the surface of the package. If the LEDs is coupled to a medium with different refractive index such as glass fibre or air.
- The reflective index of most: LED semiconductors are quieter high, so in almost all cases the LED is coupled into a much lower index medium.

- The large index difference makes the reflection quite substantial (per the Fresnel Coefficients), and this is usually one of the dominant causes of LED in an efficiency.
- Often more than half of the emitted light is reflected back at the LED package and package air interfaces.
- The reflection is most commonly reduced by using a dome shaped (half Sphere) package with the diode in the centre so that the outgoing light rays strike the surface perpendicularly, at which angle the reflection is minimized.
- An anti-reflection coating may be added as well.
- The Package may be cheap plastic, which may be coloured, but this is only for cosmetic reasons or to improve the contrast ratio.
- The colour of the packaging does not substantially affect the colour of the light emitted

P-n junction diode Explanation:

1. **P-Region-**
   - Holes are the majority charge carriers in the p- region and electrons are minority charge carriers.
   - Conductivity takes place due to holes from the p—region diffuses into the n region and combines with free electrons in the n region.
   - Holes are being released from the Anode terminal of the battery.

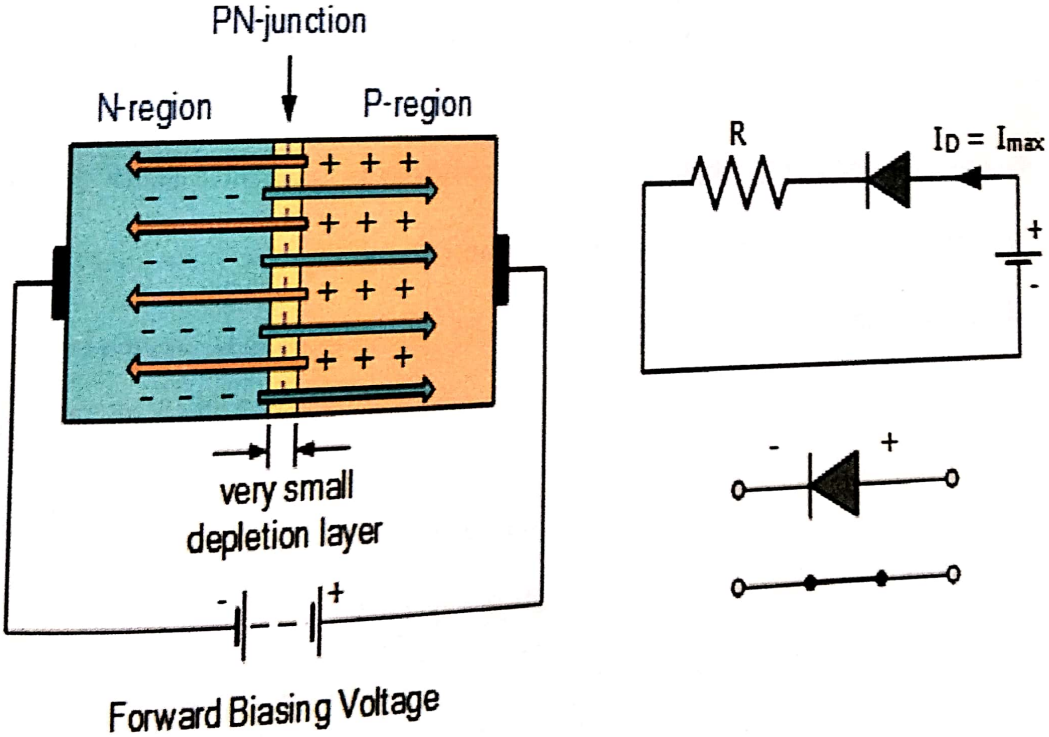
2. **n- Region-**

1. Electrons are the majority charge carriers in the n- region and holes are minority charge carriers.\
2. Conductivity takes place due to electrons from the n—region diffuse into the p region and combines with free holes in the p region.

3. Electrons are being released from the cathode terminal of the battery.

P-n Junction Forward Bias

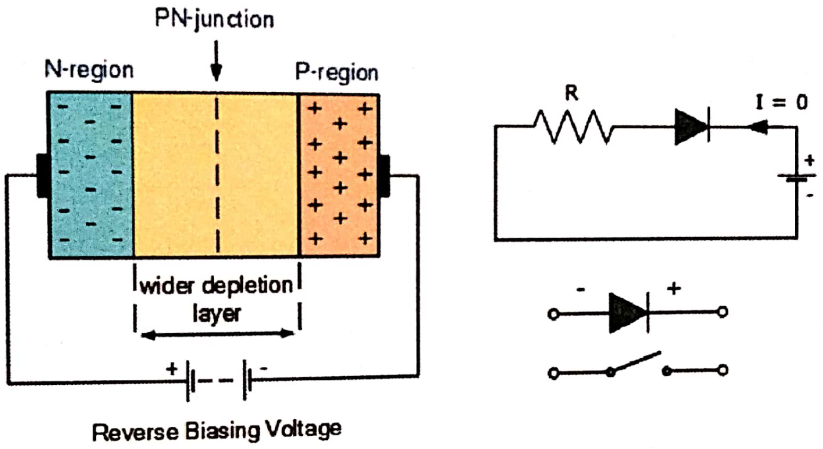
- Positive terminal of the battery is connected to p region and negative terminal is connected to n region.
- The holes in the p region are repelled from the positive terminal of the battery and drift towards the junction
- The holes in the n region are repelled from the negative terminal of the battery and drift towards the junction
- These electrons and holes recombine at the junction and cause moment of charge carriers in depletion region.
- Due to this recombination current is being generated which can be measured by mille ammeter.



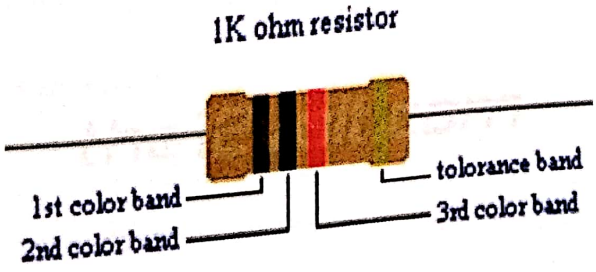
P- N junction Reverse bias:

- Positive terminal of the battery is connected to n region and negative terminal is connected to p region.

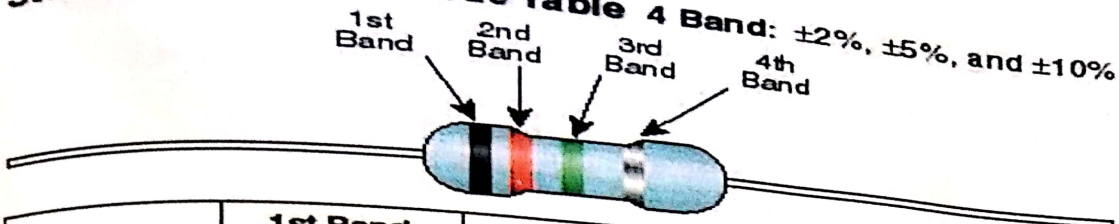
- The holes in the p region will be attracting by the negative terminal of the battery.
- The electrons in the n region are will be attract by the positive terminal of the battery.
- Majority carriers are drawn away from the junction and depletion region gets widen and the barrier potential increases.
- Conductivity takes place due to minority charge carriers. So less current is being generated in reverse bias condition.



Resistor: Resistors "Resist" the flow of electrical current. The higher the value of resistance (measured in ohms) the lower the current will be. Resistance is the property of a component which restricts the flow of electric current. Energy is used up as the voltage across the component drives the current.



Standard EIA Color Code Table 4 Band: ±2%, ±5%, and ±10%



Color	1st Band (1st figure)	2nd Band (2nd figure)	3rd Band (multiplier)	4th Band (tolerance)
Black	0	0	10^0	
Brown	1	1	10^1	
Red	2	2	10^2	±2%
Orange	3	3	10^3	
Yellow	4	4	10^4	
Green	5	5	10^5	
Blue	6	6	10^6	
Violet	7	7	10^7	
White	9	9	10^9	
Gold			10^{-1}	±5%
Silver			10^{-2}	±10%

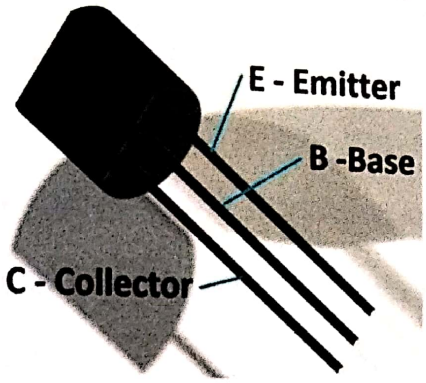
Transistor:

- A transistor is a semi-conductor device, commonly used as an amplifier or an electrically controlled switch.
- The transistor is the fundamental building block of the circuitry computers, cellular phones and all other modern electronics.
- Because of its fast response and accuracy, the transistor is used in wide variety of digital and analogue functions, including amplification, switching, Voltage regulation, signal modulation and oscillators.
- Transistor may be packaged individually or as part of an integrated circuit, some with over a billion transistors in a very small area.

Transistor has three regions:

1. Emitter- It Supplies charge carriers (Holes/Electrons) and is heavily doped region so that large number of charge carriers can be injected in to base.
2. Base – the middle section of transistor is called base this is lightly doped and very thin and allows most of the charge carriers injected in to it to flow into collector without getting neutralised.

3. Collector-The section at other end is called collector and is moderately doped. The doping of collector is intermediate between heavy doping of emitter and least doping of base



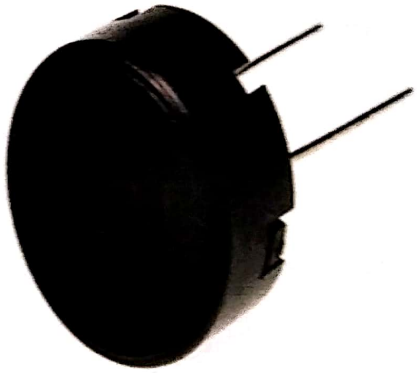
Importance:

- The transistor is considered by many to be the greatest invention of the twentieth century
- If the key active component in practically modern electronics.
- Its importance in today's society rests on its ability to be mass produced using a highly automated process (fabrication) that achieves varnishing low per transistor costs
- Although billions of individual (known as discrete) transistors are still used, the vast majority produced are in integrated circuits (Often abbreviated as IC and also microchips or simply chips) along with diodes, resistors, capacitors and other electronic components to produce complete electronic circuit.
- A logic gate consists of about twenty transistors whereas an advance microprocessor as of 2006 can use as many as 1.7 billion transistors (MOSFETs) [1].
- The transistors low cost, flexibility and reliability have made it a universal device for non-mechanical tasks, such as digital computing.

- Transistorized circuits have replaced electromechanical devices for the control of appliances and machinery as well. It is often easier and cheaper to use a standard microcontroller and write a computer program to carry out a control function.
- Because of the low cost of transistors and hence digital computers, there is a trend to digitalize information.
- With digital computers offering the ability to quickly find, sort and process digital information, more and more effort has been put into making information digital.
- As a result, much media data is delivered in digital form, finally being converted and presented in analogue form to the user.
- Areas influenced by the digital revolution include television, radio and newspapers.

Piezo Electric Buzzer:

- Piezoelectric ceramic buzzer element has a simple structure in which piezoelectric element is glued to vibration place.
- When alternating voltage is applied to piezoceramic element, the element expands or shrinks diametrically
- This characteristic is utilized to make a vibration plated bend to generate sounds.



6. Applications:

1. The water level indicator is used in Hotels, homes, apartments, commercial complex and in factories.
2. We can also measure the fuel level in motor vehicles.
3. [illegible] we can control the water level safely and easily.

7. Advantages:

1. The water level indicators are low cost in market.
2. Any person can identify the water level easily by hearing the beep sound.
3. By using this we can control the water level safely and easily.
4. By using it we can save the Power
5. We can save the money
6. It is an Automatic working device

8. Future Scope of this project:

The basic need of human being is water and it is one of the most important necessary for all living beings. But unfortunately a huge amount of water is being wasted by uncontrolled use and due to our negligence some other automated water level monitoring system is also offered so far but most of methods has some shortness in practice. We tried to overcome these problems and completed an efficient 4 LED Water level indicators with alarm. Main intension of this research work to establish a flexible, economical & Easy configurable system which can solve water losing problems. These could have a substandard benefit from this research work for efficient management of water.

9. References:

Required information is obtained from the following websites:

https://www. scribd.com

https://www.electronicsforyou.com

https://www.wikipedia.org

https://www.engineersgarrage.com

JIGNASA 2021-22

GOVT. DEGREE COLLEGE, MEDAK

(Affiliated to Osmania University)

Reaccredited with B grade by NAAC

DEPARTMENT OF PHYSICS

SYNOPSIS OF JIGNASA STUDENT STUDY PROJECT

ON

ECO ELECTRICITY WITH ALOVERA PLANT

SUPERVISOR NAME: Smt N. Aruna kumari

PREPARED BY : B.Sc (MPCS)-final year students

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ABSTRACT:

Electrical energy can be harvested from the living plants as a new potential renewable energy source. Characterization of the electrical signal is needed to enable an optimum energy harvesting setup condition. In the present paper, an investigation is conducted to analyze the characteristic of Aloe Barbadensis Miller (Aloe Vera) leaves in terms of electrical energy generation under specific experimental setups. The experimental results show that 870.55uW electrical power can be harvested from the Aloe Vera with 15 pairs of electrodes and this energy is capable to be stored in a capacitor. This energy has a high potential to be used to power up a low power consumption device.

INTRODUCTION:

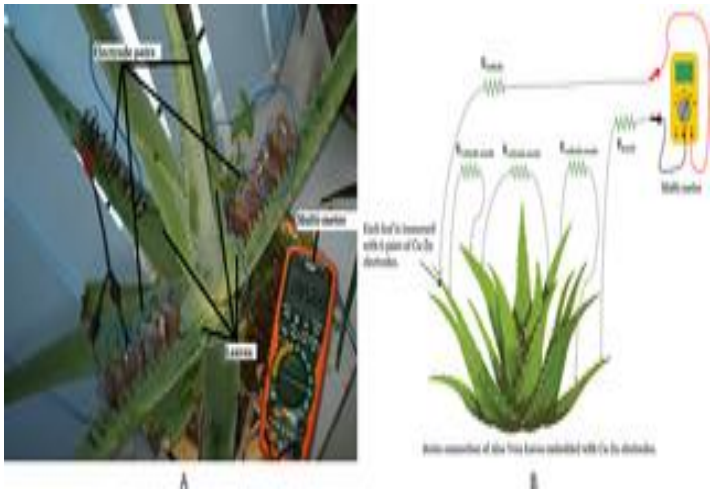
Advancement of technology in the 21st century has created a series of low power consumption and smaller size consumer electronics. This phenomenon had opened up the opportunity for the development of energy harvesting technique from low power energy sources. This research would like to introduce the usage of living plants as another new renewable energy source to harvest micro-energy. Photosynthesis is a process used by plants to synthesize carbohydrate molecules from carbon dioxide and water via the usage of light energy, normally from the sun. This process will cause the transport of electrons inside the plants, which creates a potential difference between the leaves and roots under exposure of light.

OBJECTIVES:

The objective of the present project is to investigate the characteristics of the Aloe Vera plant as a potential energy source and to determine its optimum setup to harvest a higher amount of energy from the plant.

APPARATUS USED:

1. Alovera plant
2. Copper plates
3. Zinc plates
4. Connecting wires
5. Multimeter
6. Timer
7. Graph sheets
8. Patch cords



CONCLUSION:

It is concluded that the Aloe Vera plant can generate electrical energy, which can be potentially useful to power up ultra-low power consumption devices. As compared to other living plants used in other researches to harvest energy, Aloe Vera has been observed to generate the highest magnitude of voltage and current. This energy can be stored in a capacitor. From the results of the experiments, it is observed that copper as the cathode electrode and zinc as the anode electrode is the best combination to generate maximum voltage and current

FUTURE SCOPE:

Hence, from this research, it is proven that electrical energy can be tapped from Aloe Vera leaves and it can be optimized to meet the desired voltage and current value via various experiment setups. This green energy, which can be stored in a capacitor, can be potentially used to power up ultra-low power devices such as remote sensors where energy is scarce in remote areas in future works.