

SOLAR PV – BATTERY BASED GARDEN LIGHTING SYSTEM

Submitted in partial fulfillment of the requirements for the award of

Bachelor of Engineering Degree in

Electrical and Electronics Engineering

by

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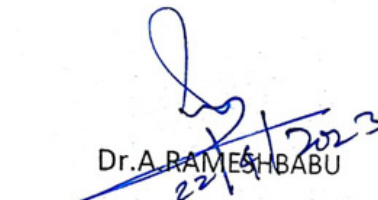


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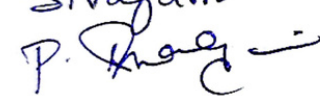
BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **KANAGA G** (Reg. No. 40140018) and **RENGANAYAGI P** (Reg. No. 40140028) who carried out the project entitled "**BATTERY DESIGNING USING PV PANEL**" under our supervision from February 2023 to April 2023.


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1. 

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SIGNATURE OF THE CANDIDATE

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CHAPTER NO	TITLE	PAGE.NO
	ABSTRACT	8
	LIST OF FIGURES	
1	INTRODUCTION	9
	1.1 GENERAL BACKGROUND	9
	1.2 LITERATURE SURVEY	10
	1.3 SCOPE OF THE PROJECT	11
	1.4 ADVANTAGES OF PROPOSED SYSTEM	11
	1.4.1 CLEAN, QUIET & EASY TO USE	
	1.4.2 SOLAR POWER MAXIMIZES BATTERY LIFE	
	1.4.3 LOW MAINTENANCE	12
	1.5 APPLICATIONS	
	1.5.1 RESIDENTIAL GARDENS	
	1.5.2 COMMERCIAL PROPERTIES	
	1.5.3 RURAL AREAS	
2	STAND ALONE PV SYSTEM DESCRIPTION	13
	2.1 BLOCK DIAGRAM	13
	2.2 EXISTING MODEL	14
	2.2.1 CHOOSE DC LIGHTING FIXTURE	15
	2.2.2 WIRE THE LIGHTING FIXTURE	
	2.2.3 USE A CHARGE CONTROLLER	

3	PROPOSED SYSTEM	
	3.1 DESCRIPTION OF PROPOSED SYSTEM	16
	3.1.1 DETERMINE THE POWER	16
	3.1.2 SELECT A PV PANEL	17
	3.1.3 CHOOSE A BATTERY	
	3.1.4 DESIGN THE CHARGING CIRCUIT	
	3.1.5 CONSIDER THE CONTROLLER	
	3.1.6 INSTALL THE SYSTEM	
	3.2 COMPONENTS	18
	3.2.1 PV PANEL	
	3.2.2 BATTERY	19
	3.2.3 CHARGE CONTROLLER	20
	3.2.4 LAMP LOAD	
4	RESULT	21
	4.1 HARDWARE RESULT	
5	CONCLUSIONS AND FUTURE SCOPE	22
	5.1 SUMMARY	
	5.2 FUTURE SCOPE	
	5.3 CONCLUSION	23
	REFERENCES	

FIGURE NO	TITLE	PAGE NO
1.1	PIE CHART OF SOURCES	10
2.1	BLOCK DIAGRAM OF PROPOSED MODEL	13
2.2	EXISTING BATTERY DESIGNING MODEL	14
3.1	PROJECT PROTOTYPE	16
3.2.1	PICTURE OF PV PANEL	18
3.2.2	PICTURE OF BATTERY	19
3.2.3	PICTURE OF CHARGE CONTROLLER	20
4.1	HARDWARE RESULT	21
5.2	OVERVIEW OF BATTERY DESIGNING USING PV PANEL	23

ABSTRACT

The garden lights will have a battery that will be charged through a solar panel in the day time and during the night time the energy from the battery will be used to power the lights and the cycle repeats. The use of solar-powered garden lights has become increasingly popular due to their energy efficiency and environmental benefits. Next the charge controller, which connect the PV panel and battery. The charge controller regulates the flow of electricity from the solar panel to the battery.

The electricity necessities of the world including India are elevated at disturbing rate and the power demand has been increasing. The fossil fuels (i.e., coal, petroleum and natural gas) and other conventional resources, presently used for generation of electrical energy. It is not sufficient or suitable to keep Generation with ever increasing demand of the electrical energy of the world. The generation of electrical power by cold based steam power plant and nuclear power plants causes pollution, which is likely to be more harmful in future due to large generating capacity on one side and it Became tough Because greater awareness of the people in this respect. This project give idea about non- conventional Energy sources and why we are going for that non-conventional energy sources. The proper uses of solar energy and its different application which are using at home defence sector, marines, remote area etc.

The charge controller ensures that the battery is not overcharged or discharged by controlling the amount of current flowing into the battery. It also prevents the battery from being damaged by overcharging, which can cause the battery to overheat and lose capacity in this paper.

CHAPTER 1

INTRODUCTION

1.1 GENERAL BACKGROUND

Fossil fuels (oil, coal and natural gas) have been throughout history, the backbone on which industrial activity has been developed and nowadays, they are the main energy resource of an industrialized society and also they have been the responsible of inequalities between countries with a limited access to this kind of resources, hindering their development.

Energy is the measure of the ability of a body or system to do work or produce a change and it is expressed usually in joules or kilowatt hours. No activity is possible without energy and its total amount in the universe is fixed: It cannot be created or destroyed but can only be changed from one type to another. According to its origin we can divide it in two groups: Renewable and non-renewable energy. Non-renewable energy is a limited resource. Fossil fuels, geothermal energy and nuclear energy are part of this group. Renewable energies are derived from natural processes that are replenished constantly. Self-consumption consists on consuming a part or the whole energy produced by an own energy power installation. When the total amount of energy is not needed in the system, the part of the energy that is not needed is sold to the grid. One of the most common ways of local energy production is solar systems.

The decrease of the solar photovoltaic (PV) panels price, as well as the increase on the number of the new regulations of PV-Systems and some subsidy schemes to promote the installation of panels has resulted in increased worldwide deployment of solar PV. The International Energy Agency's Photovoltaic Power System Programme's latest report [10] found that 75 GW of solar were installed globally in 2016, bringing the installed global photovoltaic capacity to at least 303 GW.

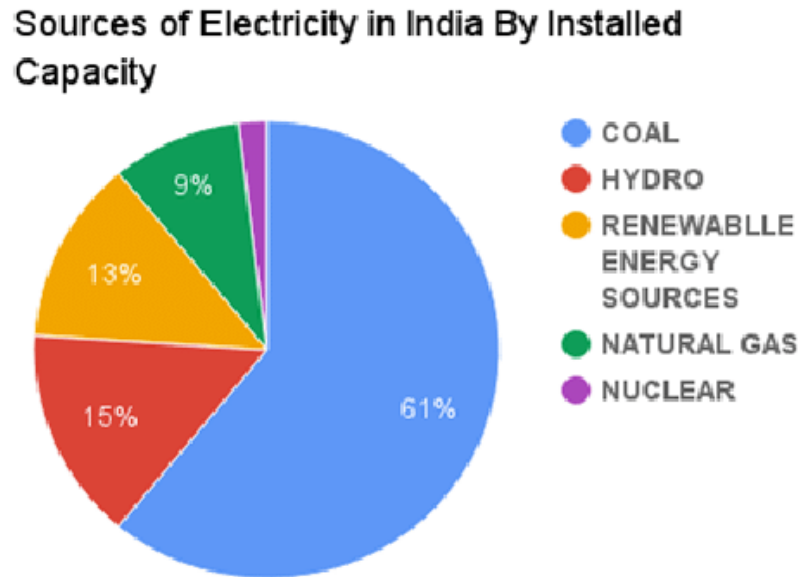


Figure 1.1 Pie Chart of sources

1.2 LITERATURE SURVEY

Testing of batteries used in stand-alone PV power supply systems :Test procedures and examples of test results, International Energy Agency Implementing Agreement on Photovoltaic Power Systems, October 2002

Energy analysis of batteries in photovoltaic systems. Part I & II: Energy return factors and overall battery efficiencies, Carl Johan Rydh, Bjorn A.

Lead-Acid Battery Guide for Stand-Alone Photovoltaic Systems, EIA INTERNATIONAL ENERGY AGENCY, December 1999

Batteries and Charge Control in Stand-Alone Photovoltaic Systems Fundamentals and Application , Sandia National Laboratories Photovoltaic Systems Applications Dept., Albuquerque January 15, 1997

<http://www.dcbattery.com>

<http://www.epsea.org->

http://www.fsec.ucf.edu/en/consumer/solar_electricity/basics/types_of_pv.htm-

http://www.iea-pvps.org/pv/sa_syst.htm

1.3 SCOPE OF THE PROJECT

The future scope of battery designing using PV (photovoltaic) panels is promising, as the world increasingly turns to renewable energy sources to combat climate change and reduce dependence on fossil fuels. PV panels generate electricity from sunlight, and the excess electricity can be stored in batteries for later use, making them an essential component of renewable energy systems. With advancements in technology and research, the efficiency of PV panels and batteries is continually improving, making them more accessible and affordable for the general population. In the future, we can expect to see more sophisticated battery designs that will enable higher energy density, longer lifetimes, and faster charging times. This will allow for greater energy storage capacities and more efficient use of renewable energy. As we move towards a more sustainable future, the integration of PV panel and batteries will play a crucial role in meeting the increasing demand for clean energy. The future of battery design using PV panels is bright ,and we can expect to see a more significant shift towards renewable energy in the years to come.

1.4 ADVANTAGES OF PROPOSED SYSTEM

1.4.1 Clean, Quiet, & Easy to use

Solar panels consume no fuel and give off no waste. There are no moving parts, which means no mechanical noise. Simply place the solar panel in the sun and you generate electricity!

1.4.2 Solar Power Maximizes Battery Life

Solar panels generate pure D.C. electricity when exposed to sunlight. This is exactly what your batteries want. By saturating your batteries with these electrons in a slow and steady manner on a daily basis, you prevent your batteries from repetitive deep discharges which will shorten the lifespan of lead-acid batteries. In fact, a properly designed solar battery charging system can easily double the useful life of your lead-acid batteries.

1.4.3 Low Maintenance

Since solar panels consume no fuel and have no moving parts to wear out, there are no air, oil, or fuel filters to change. Simply keep the surface of the panels clean.

1.5 APPLICATIONS

Solar PV-battery based garden lighting systems have become increasingly popular in recent years due to their numerous benefits. These systems can provide a cost-effective, reliable, and sustainable way to illuminate gardens, walkways, and other outdoor spaces, without the need for traditional grid-connected electricity.

Here are some potential applications of solar PV-battery based garden lighting systems:

1.5.1 Residential Gardens

Solar PV-battery based lighting systems can be installed in residential gardens, illuminating pathways, garden beds, and other features. These systems are perfect for those who want to enjoy their garden at night without worrying about high energy bills.

1.5.2 Commercial Properties

Businesses can also benefit from solar PV-battery based lighting systems in their outdoor spaces, such as parking lots, sidewalks, and courtyards. These systems can help reduce energy costs, enhance security, and create a more welcoming environment for customers and employees.

1.5.3 Rural Areas

Solar PV-battery based lighting systems can be particularly useful in rural areas where there is limited access to grid-connected electricity. These systems can help provide light in remote locations, making it easier and safer for people to move around at night.

CHAPTER 2

STAND ALONE PV SYSTEM DESCRIPTION

2.1 BLOCK DIAGRAM

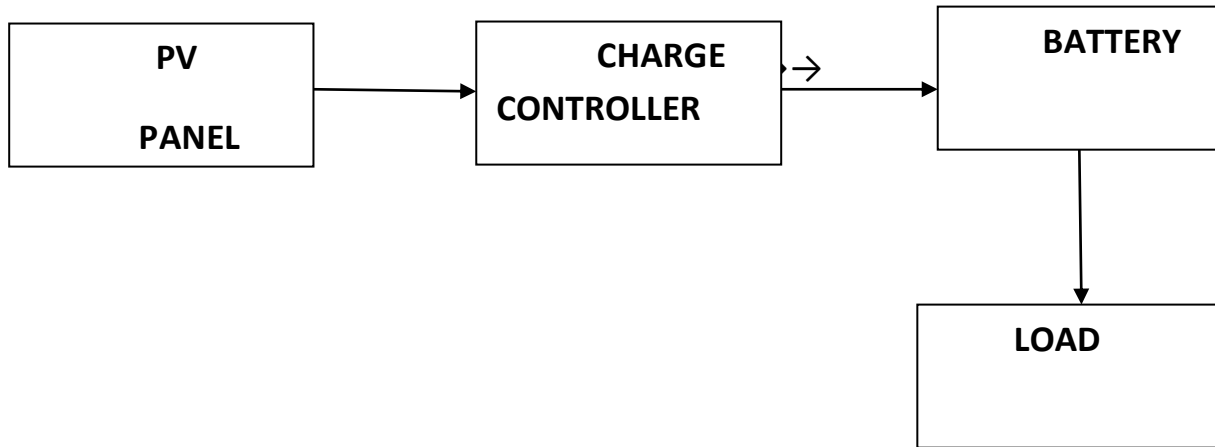


Figure 2.1 Block Diagram of Proposed model

Battery charging using a photovoltaic (PV) panel involves the conversion of solar energy into electrical energy and storing it in a battery. A PV panel works by absorbing photons from sunlight and converting them into direct current (DC) electricity. This DC electricity can then be used to charge a battery directly or through a charge controller that regulates the charging process. The charge controller regulates the charging process to ensure that the battery is not overcharged or undercharged. Overcharging can damage the battery and reduce its lifespan, while undercharging can limit the amount of energy that the battery can store. The charge controller monitors the battery voltage and adjusts the charging current accordingly. The amount of energy that can be stored in the battery depends on the capacity of the battery and the amount of sunlight that the PV panel receives. the more energy it can generate and the faster it can charge the battery. Overall, battery charging using a PV panel is an efficient and sustainable way to store and use solar energy. It can be used for a wide range of applications, including powering homes, businesses, and remote locations, and reducing reliance on fossil fuels.

2.2 EXISTING MODEL

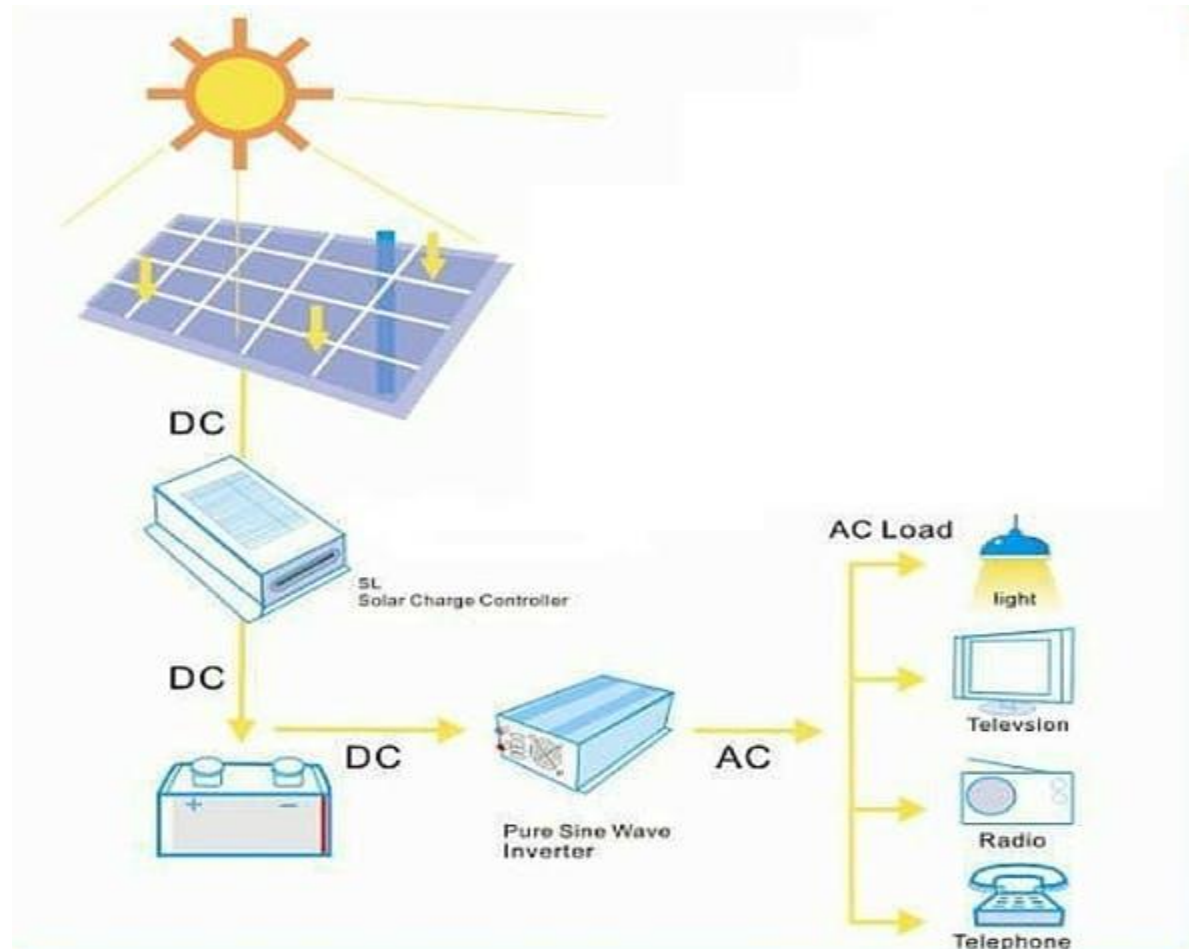


Figure 2.2 existing model

some steps to follow to set up a solar PV and battery-based lighting system without an inverter:

2.2.1 Choose DC lighting fixtures

We need to select lighting fixtures that are designed to run on DC power. DC lighting fixtures are available in a variety of styles and types, including LED lights, fluorescent lights, and halogen lights.

2.2.2 Wire the lighting fixtures

We will need to wire the DC lighting fixtures directly to the batteries in your solar PV system. This can be done using low-voltage wiring, which is designed for use with DC power.

2.2.3 Use a charge controller

A charge controller is a device that regulates the flow of electricity from the solar panels to the batteries. It ensures that the batteries are not overcharged or undercharged, which can damage the batteries. We will need to use a charge controller that is compatible with your solar PV system.

By following these steps, We can set up a solar PV and battery-based lighting system without using an inverter. This can be a good option if we want to save money on equipment costs or if we want to avoid the energy losses that can occur when using an inverter.

CHAPTER 3

PROPOSED SYSTEM

3.1 DESCRIPTION OF PROPOSED SYSTEM

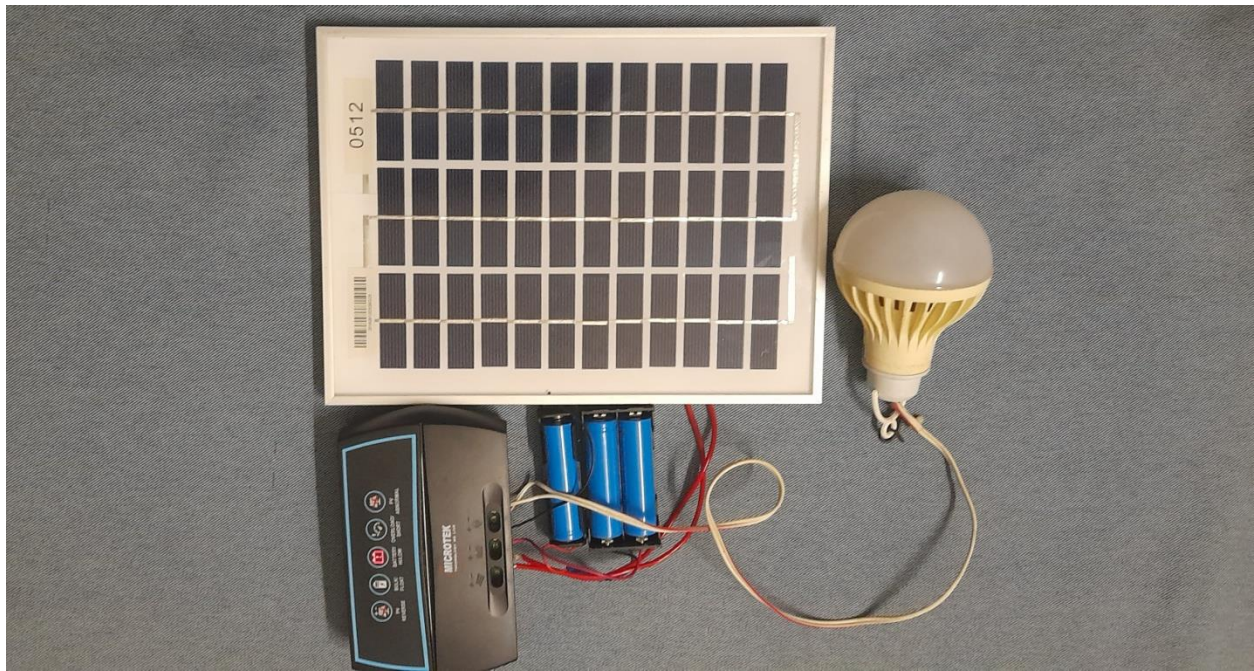


Figure 3.1 Project prototype

Designing a battery system for a garden light using a PV panel involves a few key considerations. Here are some steps you can follow:

3.1.1 Determine the power requirements

The first step is to determine how much power the garden light will require. This will depend on the type of light you plan to use, its wattage, and how long you want it to stay on each night. For example, if you plan to use a 10-watt LED light that will stay on for 8 hours each night, you will need a battery that can store at least 80 watt-hours of energy.

3.1.2 Select a PV panel

Once you have determined the power requirements, you can select a PV panel that can generate enough energy to charge the battery. Look for a panel that can generate at least as much power as the battery needs. For example, if you need to store 80 watt-hours of energy, you will need a panel that can generate at least 80 watt-hours of energy per day.

3.1.3 Choose a battery

Choose a battery that can store enough energy to power the garden light for the required amount of time. Lead-acid batteries are commonly used for this purpose, but lithium-ion batteries are also becoming more popular due to their higher energy density and longer lifespan. Make sure to choose a battery with a voltage that matches the output of the PV panel.

3.1.4 Design the charging circuit

The charging circuit will regulate the flow of energy from the PV panel to the battery. It should be designed to ensure that the battery is not overcharged or undercharged. A simple charging circuit can consist of a diode and a voltage regulator.

3.1.5 Consider the controller

A controller can be used to automate the charging process and to ensure that the battery is not overcharged or undercharged. It can also be used to turn the garden light on and off at the appropriate times. A simple controller can be made using a microcontroller and a few other components.

3.1.6 Install the system

Once the system is designed, it can be installed in the garden light. Make sure to position the PV panel in a location where it will receive plenty of sunlight during the day. The battery and charging circuit can be installed inside the garden light or in a separate enclosure. By following these steps, you can design a battery system for a garden light that uses a PV panel to generate energy.

3.2 COMPONENTS

3.2.1.PV PANEL

This is the key component of any solar photovoltaic system, which takes the sun's energy and converts it into the electrical current. The process of converting light (photons) to electricity (voltage) is called the solar photovoltaic (PV) effect. Photovoltaic solar cells convert sunlight directly into solar power (electricity). They use thin layers of semi-conducting material that is charged differently between the top and bottom layers. The semi-conducting material can be encased between a sheet of glass and or a polymer resin. When exposed to daylight, electrons in the semi-conducting material absorb the photons, causing them to become highly energised. These move between the top and bottom surfaces of the semi-conducting material. This movement of electrons generates a current known as a direct current (DC).

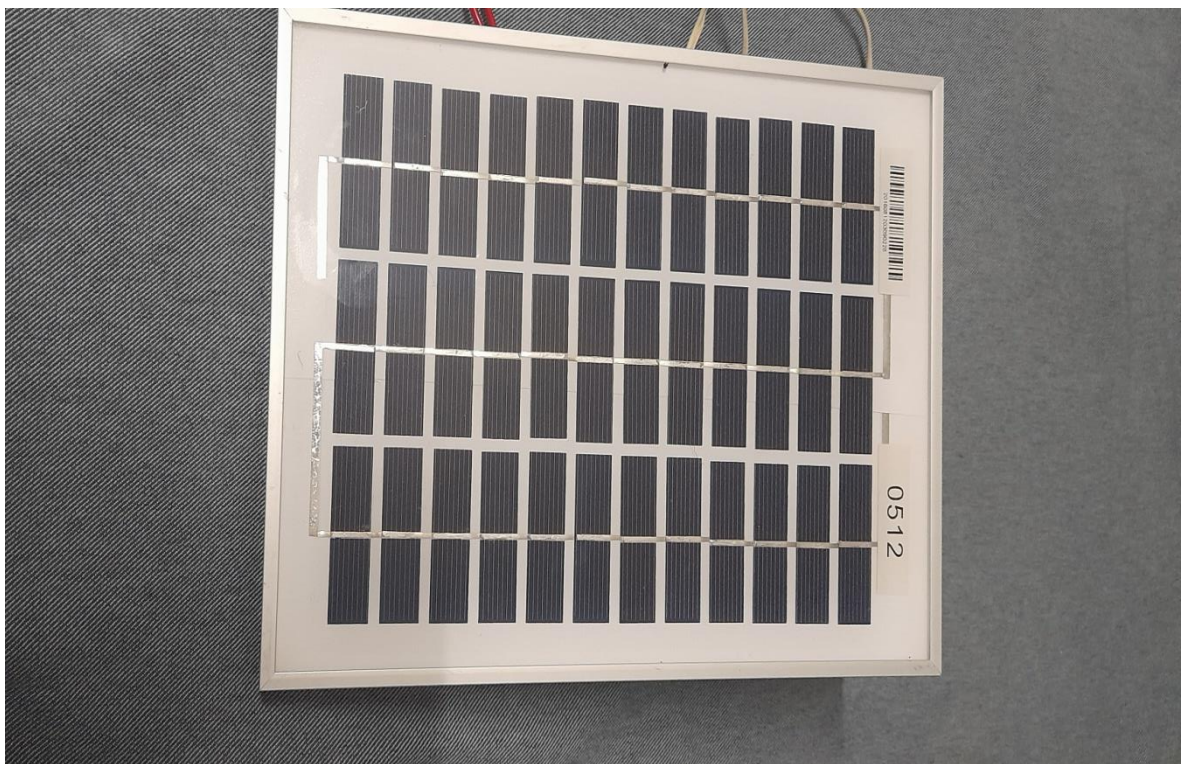


Figure 3.2.1 Picture of PV panel

3.2.2 BATTERY

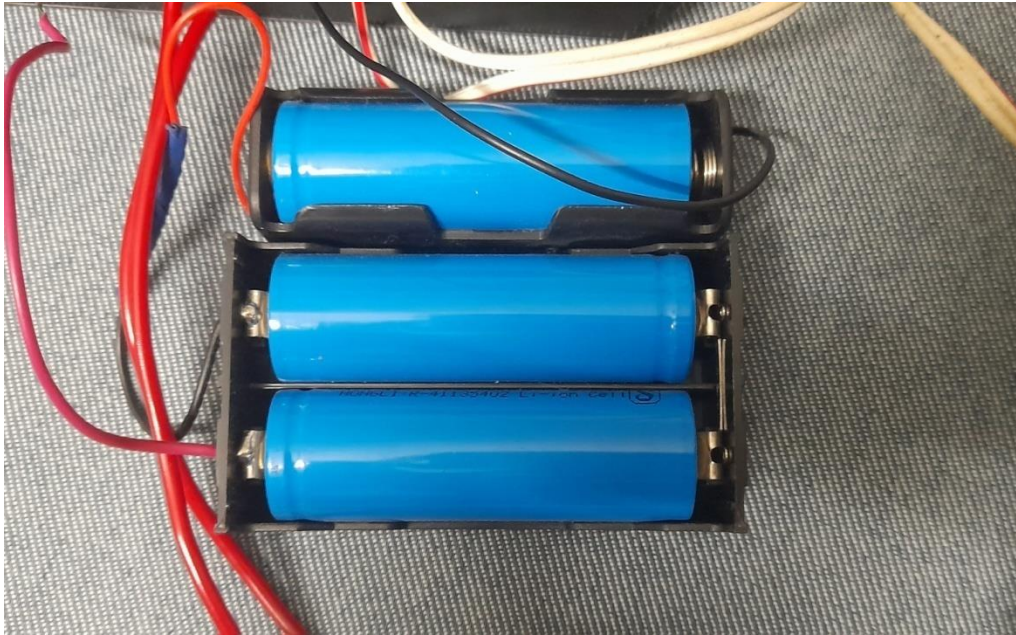


Figure 3.2.2 Picture of battery

The team has selected three deep cycle batteries to power the system. Each battery is a 12V and has a 20 Amp - hour Capacity. Batteries for PV system batteries generally have to discharge a smaller current for a longer period of time, such as at night or during a power outage, while being charged during the day. Deep cycle batteries are designed for the purpose of discharging to a lower capacity, between 50% and 80%.

Some of the portable equipment requires higher voltage battery packs. so in this case the voltage can increase by connecting these cell in series. The above figure shows a battery pack of three 3.7V Lithium-ion cells. These cells are connected in series now this 3S or 3 cell battery pack which produce 11.1 V in nominal mode. Similarly, six-cell lead acid string with 2 V/cell will generate 12 V and four alkaline with 1.5 V/cell will produce 6 V. According with the required voltage for your application, you can connect the number of cells in series. If one of the cell of the battery pack gets discharged or damaged then the battery pack shows the notification. This notification gets due to the protection board used in it. The below image illustrates a battery pack in which “cell 3” produces only 2.8V instead of the full nominal 3.7V.

3.2.3 CHARGE CONTROLLER



Figure 3.2.3 Picture of charge controller

The charge controller regulates the flow of electricity from the solar panel to the battery. The charge controller ensures that the battery is not overcharged or discharged by controlling the amount of current flowing into the battery. It also prevents the battery from being damaged by overcharging, which can cause the battery to overheat and lose capacity.

3.2.4 LAMP LOAD

Many electrical systems operate on 12V DC, and you are probably already familiar with several of these. Many batteries for vehicles including boats and RVs operate on 12V DC, which makes using a 12V LED system a no-brainer for these applications, as there is no need for any additional transformers or power supplies to convert the voltage - your LED lights can be plugged in directly. 12V is a very common voltage level primarily. This makes power supplies readily and cheaply available and can help reduce your purchase costs. 12V LED systems have a lower electric shock risk. When it comes to LED product safety, optical, shock and fire risk are often considered. Because 12V is a much lower voltage compared to line voltage (120/240V).

CHAPTER 4

4.1 HARDWARE RESULT



Figure 4.1 Hardware result

The system requires wiring to connect the various components. Overall, the hardware components of a solar PV-battery based lighting system are designed to work together to provide a reliable and sustainable source of lighting.

CHAPTER 5

CONCLUSION AND FUTURE SCOPE

5.1 SUMMARY

This System provides portable, reliable power anywhere it is needed... from off grid construction sites, to remote locations where power is not accessible or affordable, and without the associated with traditional fuel-driven generators. Flexible Panel Systems are designed for highly mobile applications where a small footprint & high power is required. Systems provide power platforms that are versatile, effective, and multi-faceted. Portability is a key feature of the System can be assembled or removed in minutes, allowing for rapid deployment in the field. The system can be deployed and operational for just an hour, or indefinitely. It is as temporary or permanent as necessary.

5.2 FUTURE SCOPE

In our Project ,for a time being we have completed up to single axis PV panel and dual axis will be carried out in future to increase the efficiency higher than the current state.

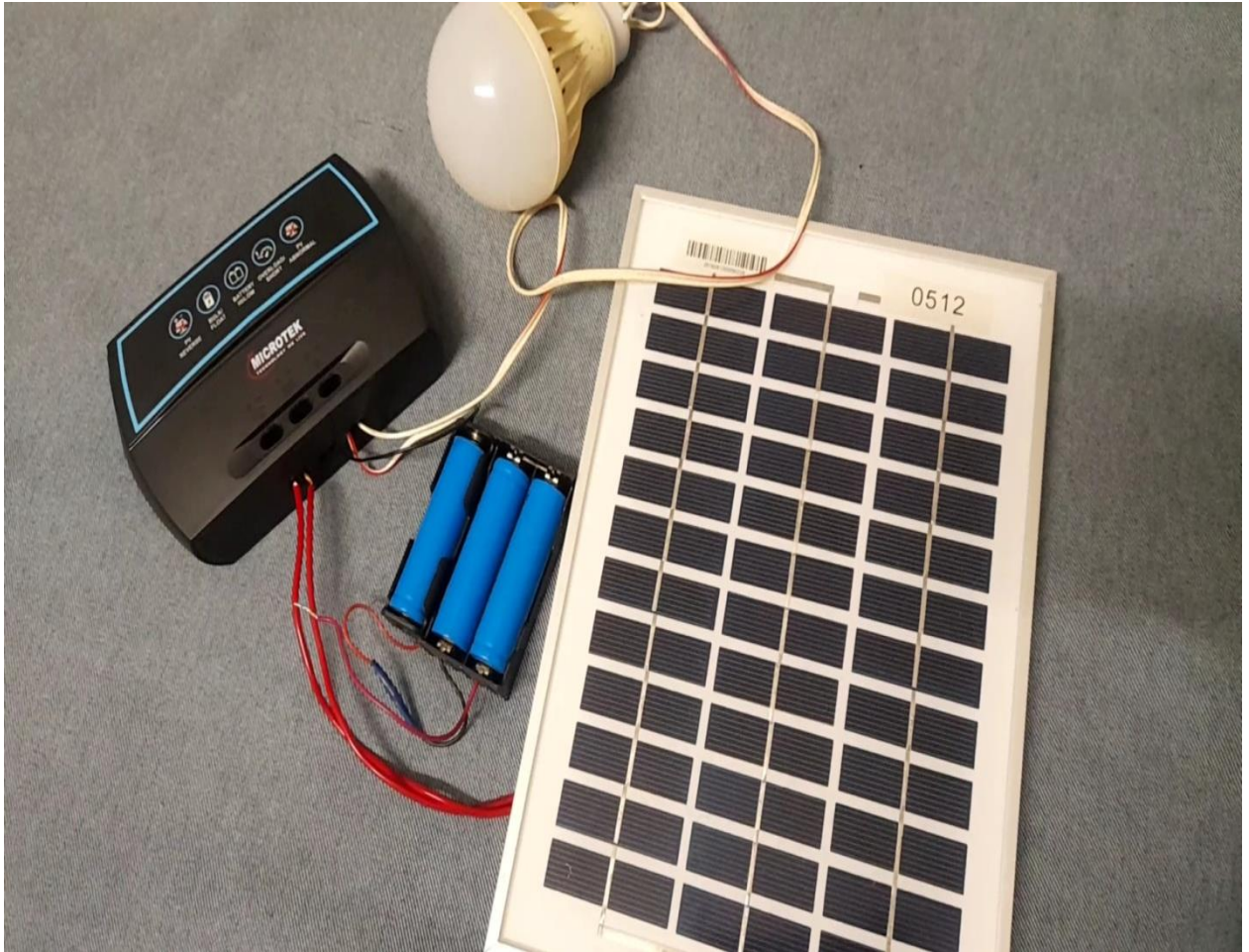


Figure5.2 overview of battery designing using pv panel

5.3 CONCLUSION

In this paper solar panel which is connect to the battery ,the batter supply line parallel of the solar battery charge . the load is connected to the battery through charge controller ,it is control the power supply which using through operate the solar battery charge is a flow of the best in the future life. This System provides portable, reliable power anywhere it is needed... from off-grid construction sites, to remote locations where power is not accessible or affordable, and without the associated with traditional fuel-driven generators.

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