

# Inverter For SOLAR TREE

Batch B16 Team members:

NAVEEN KUMAR M	211419105090
POOARASAN S	211419105102
SRINIVASAN S	211419105142
THIRUMAL M	211419105155

# ABSTRACT

- Solar energy is a renewable energy source that is derived from the sun's rays. It is a clean and sustainable alternative to traditional fossil fuels and has the potential to help mitigate climate change and reduce greenhouse gas emissions.
- One way to harness solar energy is through the use of solar panels or photovoltaic cells, which convert sunlight into electricity. Solar panels are typically installed on rooftops or on the ground, but there is also a growing trend towards integrating them into public spaces in the form of solar trees.

## INTRODUCTION TO INVERTER

We have made an inverter that's portable and gives you the perfect solution for when you need reliable and efficient power on-the-go. This inverter gives AC power and can drive loads up to 100 watts, which is sufficient enough to power up essential appliances.

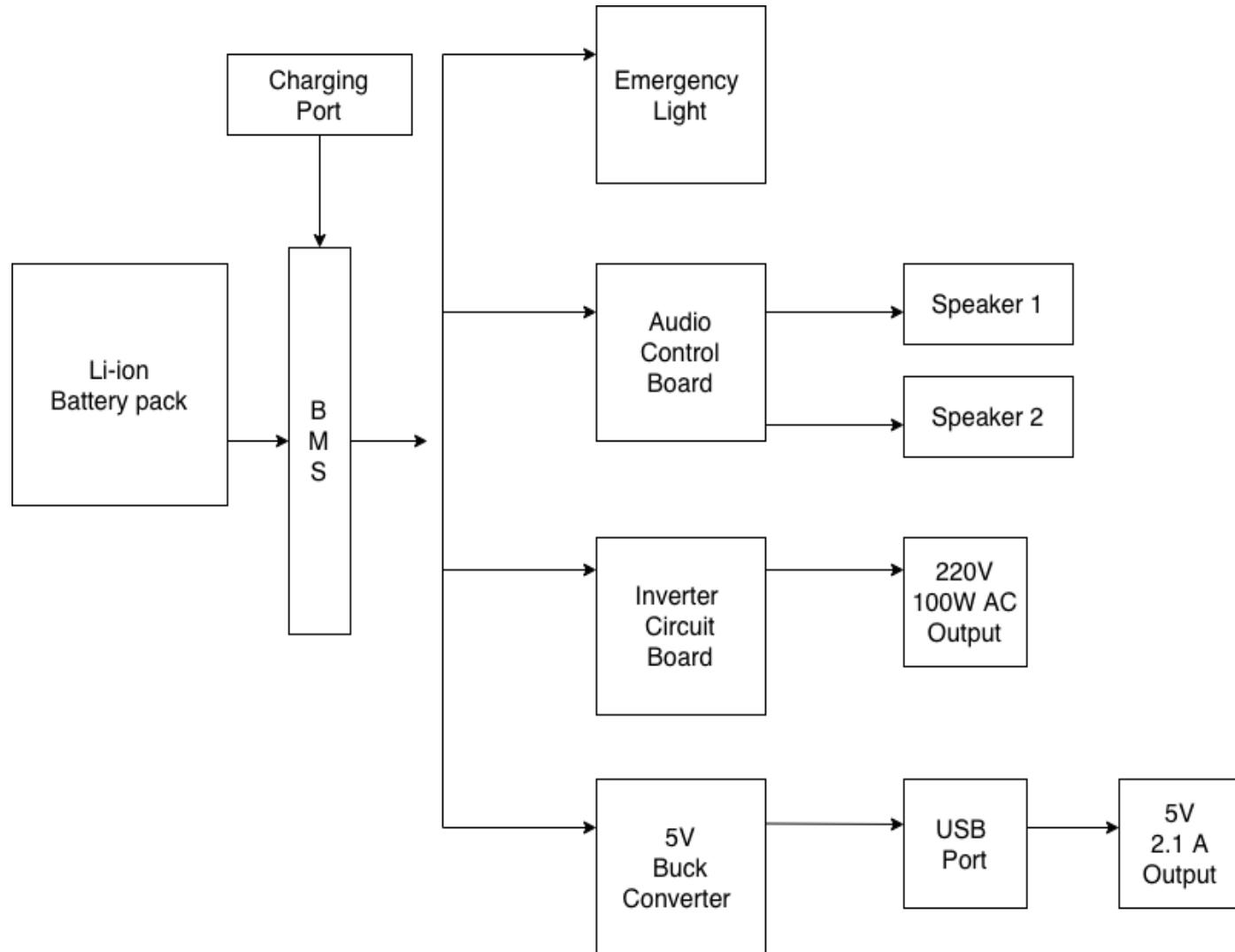
With a compact and lightweight design, this inverter is easy to transport and store, and its rechargeable battery means you can use it multiple times without needing access to a power source. The inverter features multiple outlets, so you can power multiple devices at once, and its built-in protection features prevent damage from overloading or overheating.

Whether you need to power your phone, light or other electronic device, our inverter provides a convenient and reliable solution. It can be charged by using either an ac adapter outlet or through the output of solar tree.

## SPECIFICATIONS

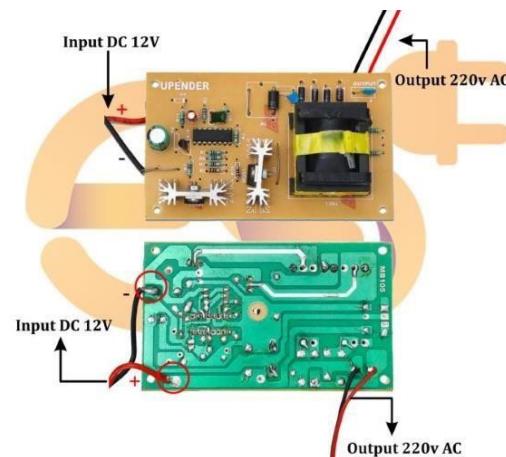
- Battery capacity: 66.6Wh
- Battery type: Li-ion
- Inverter Output: AC 220V, 100W (max.)
- Charging time: 2.7 Hours
- Charging voltage: 12.3 to 13.0 V DC
- Speakers: 10 watts mid-range
- Audio connectivity: SD card, USB drive, AUX, Bluetooth.
- USB Charger output: DC 5V 2A(max.)
- Maximum Current Discharge: 10A
- Emergency LED power: 8W power LED
- Inbuilt LED battery indicator and Volt amp meter
- Auto cut-off while overheating or overloading
- Overcharge Protection
- Easy to carry

# BLOCK DIAGRAM OF INVERTER



# COMPONENTS OF INVERTER

## 1. Inverter Circuit Board



An inverter circuit is an electronic circuit that is used to convert direct current (DC) to alternating current (AC). Inverters are used in a variety of applications, such as in renewable energy systems like solar power and wind power, as well as in backup power systems and in electric vehicles.

## 2. Lithium Ion Battery:



This is a Li-ion Rechargeable Battery. It is cylindrical in shape. This battery has 7.4Wh power capacity per cell. It is reliable and offers long service life so this battery can be recharged again and again after use. The inner part of the battery is built from high carbon steel which protects the battery from bursting and also protect the battery from overheating at the same time. Due to their low maintenance and low price, these lithium batteries are preferred for this portable inverter.

### 3. Battery Management system:



A BMS is an electronic system that manages and protects the battery pack, ensuring that it operates safely and efficiently. The 3S BMS is specifically designed for use with 3-cell Li-ion battery packs, which are commonly used in portable electronic devices such as laptops, tablets, and smartphones.

The 3S BMS typically includes the following components:

1. Battery protection circuit
2. Voltage detection circuit
3. Current detection circuit
4. Temperature detection circuit
5. Balancing circuit

## **4. Speakers:**

The 10-watt full-range speaker is a high-quality audio device that offers a full spectrum of sound, delivering crystal-clear audio for your listening pleasure. It is designed with a rugged construction to withstand even the most demanding applications.

The speaker is perfect for use in home theatre systems, car audio systems, and other audio applications.

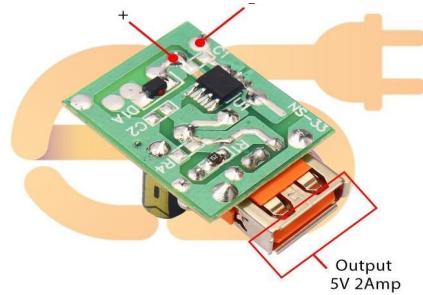


## 5. Audio amplifier module:

The audio amplifier module is a compact and versatile audio device that allows you to play high-quality audio from a variety of sources. This module can play MP3 files from USB drives and SD cards, as well as stream music wirelessly from Bluetooth-enabled devices.



## 6. Step down module with USB port:



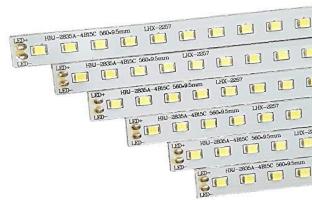
A step-down module is a compact and versatile power conversion device that allows you to convert a higher DC voltage into a lower DC voltage suitable for powering various electronic devices. This module can be used to step down voltages from 4.5V to 28V to a stable 5V output, which is ideal for powering USB devices like smartphones, tablets, and other portable electronics.

## 7. Voltmeter and Ammeter Display Module:



The voltmeter and ammeter display module is an electronic device designed to measure and display voltage and current levels in a circuit. It consists of two display panels, one for voltage measurement and the other for current measurement, along with associated circuitry to measure and display the readings.

## 8. Emergency LED Light:



The Emergency Light in the portable inverter is made of Power LED strips, which are a type of lighting product that consists of a inflexible strip with integrated LED lights. Unlike traditional LED strips, hard power LED strips are designed to be more durable and withstand harsh conditions, making them ideal for outdoor and industrial applications.

## 9. LED battery indicator:



A battery indicator is a compact device that helps you keep track of the battery level of your system. It is designed to work with any 12V battery. The indicator is usually mounted on the control panel of the system and provides an instant visual indication of the battery voltage.

## FEATURES OF INVERTER

One of the most significant features of this portable inverter is the emergency flashlight. In emergency situations such as power outages, this feature can provide much-needed light to navigate through dark spaces. The flashlight is usually powered by LED lights, which have a longer lifespan and are energy-efficient.

Another essential feature of this device is the USB charging port. This allows the user to charge their devices on the go, such as smartphones, tablets, or cameras.

An additional feature of this portable inverter is the inbuilt Bluetooth speaker. This feature allows the user to play music or other audio files wirelessly from their smartphones or other Bluetooth-enabled devices.

One of the most significant benefits of this portable inverter is its portability. The device is usually compact and lightweight, making it easy to carry around. This feature makes it especially useful for outdoor activities such as camping, where traditional power sources may not be available.

In emergency situations such as power outages, natural disasters, or when camping or traveling, the portable inverter can prove to be a valuable resource.

Another significant benefit of this device is its versatility. The various features of the device, such as the emergency flashlight, USB charging port, and inbuilt Bluetooth speaker, make it useful in a wide range of situations.

## CONCLUSION:

The convenience of this device cannot be overstated. The ability to charge devices on the go and play music wirelessly provides a level of convenience that traditional power sources cannot match. This device eliminates the need to carry multiple devices such as flashlights, power banks, and Bluetooth speakers, making it a must-have for any outdoor enthusiast.



Firstly, the controls of the inverter are designed to be intuitive and easy to use. Most models have simple buttons or switches that allow you to turn the inverter on or off, and select the desired function. For example, if you want to use the inbuilt flashlight, you would simply need to flip the switch on the control panel.



The user-friendliness of this portable inverter with additional features such as emergency flashlight, USB charging port, and inbuilt Bluetooth speaker, makes them a convenient and reliable power source for a wide range of applications. They are easy to use, safe, and equipped with features that enhance their functionality and usefulness in various situations.

# DESIGN OF SOLAR TREE

Batch B17 Team Members:

MUTHUKUMAR M	211419105085
NAVEEN R	211419105088
NAVEENRAJ A	211419105092
PRAVEEN KALAI SELVAN M	211419105107

## 2.1 PROCESS OF BUILDING A SOLAR TREE

The first step in building a solar tree is to design the structure. The design should take into account the location of the solar tree, the desired height and width, and the number and placement of solar panels and LED lights. The design should also consider the weight of the solar panels and LED lights, and the wind and weather conditions in the area.

Once the design is finalized, the next step is to gather the necessary materials. The materials needed for building a solar tree include metal pipes for the trunk and branches, solar panels, LED lights, wiring, and a battery bank.

The assembly process involves welding the metal pipes together to create the tree structure. The solar panels are then installed on the branches, and the wiring is run from the solar panels to the battery bank. It is important to ensure that the wiring is properly insulated and protected from the elements to avoid any short circuits or damage.

The LED lights are then installed on the branches and wired to the battery bank. The lights can be programmed to turn on and off at specific times using a timer or a light sensor. It is important to choose LED lights that are energy-efficient and can withstand outdoor conditions.

Once the solar tree is fully assembled, it is important to test the system to ensure that everything is working properly. This includes checking the voltage output of the solar panels, testing the LED lights, and making sure that the battery bank is charging and discharging correctly. Any issues or errors should be addressed before the installation.

The final step in building a solar tree is to install it in the desired location. This may involve digging a hole for the base of the tree and securing it with concrete, or attaching the base to a pre-existing concrete foundation. It is important to ensure that the solar tree is securely anchored and will not tip over in strong winds.

# MATERIALS USED

## 1. Metallic Components:

### i) Mild Steel (MS):

Mild steel is a type of carbon steel that is commonly used in various industrial applications due to its unique properties. It is an alloy of iron and carbon, with the carbon content. Other elements such as manganese, sulfur, and phosphorus are also added in small amounts to improve certain properties of the material.

One of the most significant advantages of mild steel is its malleability, which refers to its ability to be easily formed or shaped without breaking or cracking. This property makes it a popular choice for use in the construction industry, where it is commonly used to create pipes, tubes, and sheet metal. It is also a popular material for use in the production of automobile bodies, appliances, and machinery.

Another advantage of mild steel is its excellent weldability, which makes it easy to join pieces of mild steel together. It can be welded using a variety of methods, including arc welding, MIG welding, and TIG welding. The welding process of mild steel is relatively simple and straightforward, and it does not require any preheating or post-weld heat treatment.

Mild steel is also known for its corrosion-resistant properties, which make it an ideal material for outdoor applications. It is highly resistant to rust and corrosion, which makes it suitable for use in harsh environments.

In terms of cost, mild steel is relatively inexpensive compared to other materials such as stainless steel and aluminum. This makes it an attractive option for many industrial applications where cost is a significant factor.

The components that are made up of mild steel are mentioned as below:

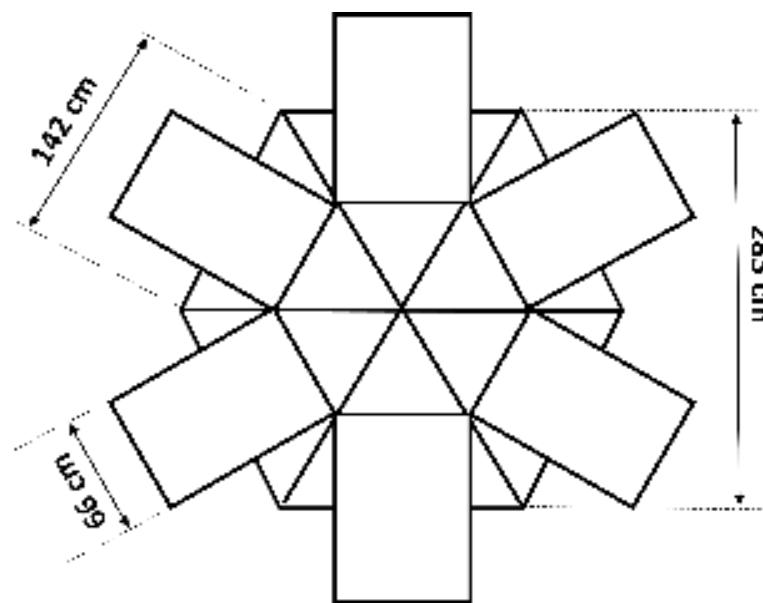
- MS square tube
  - Dimensions: 25mm x 25mm
  - Thickness: 1.5mm
  - Length: 42 meters
- MS pipe
  - Thickness: 2mm
  - Inner diameter: 90mm
- MS Base plate:
  - Thickness: 6mm
- MS hinge
  - Quantity: 6 pieces
  - Dimensions:
- MS Flange
  - Diameter: 90mm
  - Quantity: 2 pieces
- MS Sheet metal
  - Thickness: 2mm
  - Area:  $111.36\text{m}^2$
- MS Lock
  - Quantity: 4 pieces
- MS Flat bars
  - Length: 4 meters

- ii) Base Plate 2 pieces
- iii) 14mm Bolt nut 2 pcs
- iv) 8mm bolt nuts 12 pcs
- v) Hooks 40 pcs

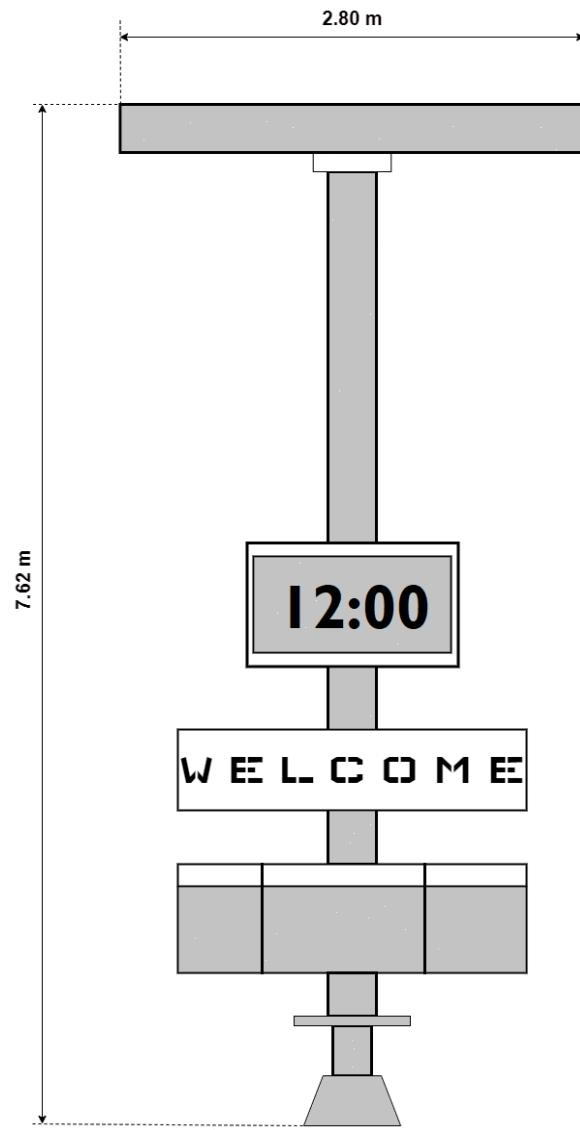
## 2. Paint

- i) Red Oxide 1 liters
- ii) Silver Paint 1 liters

# STRUCTURE OF SOLAR TREE



*Top View*



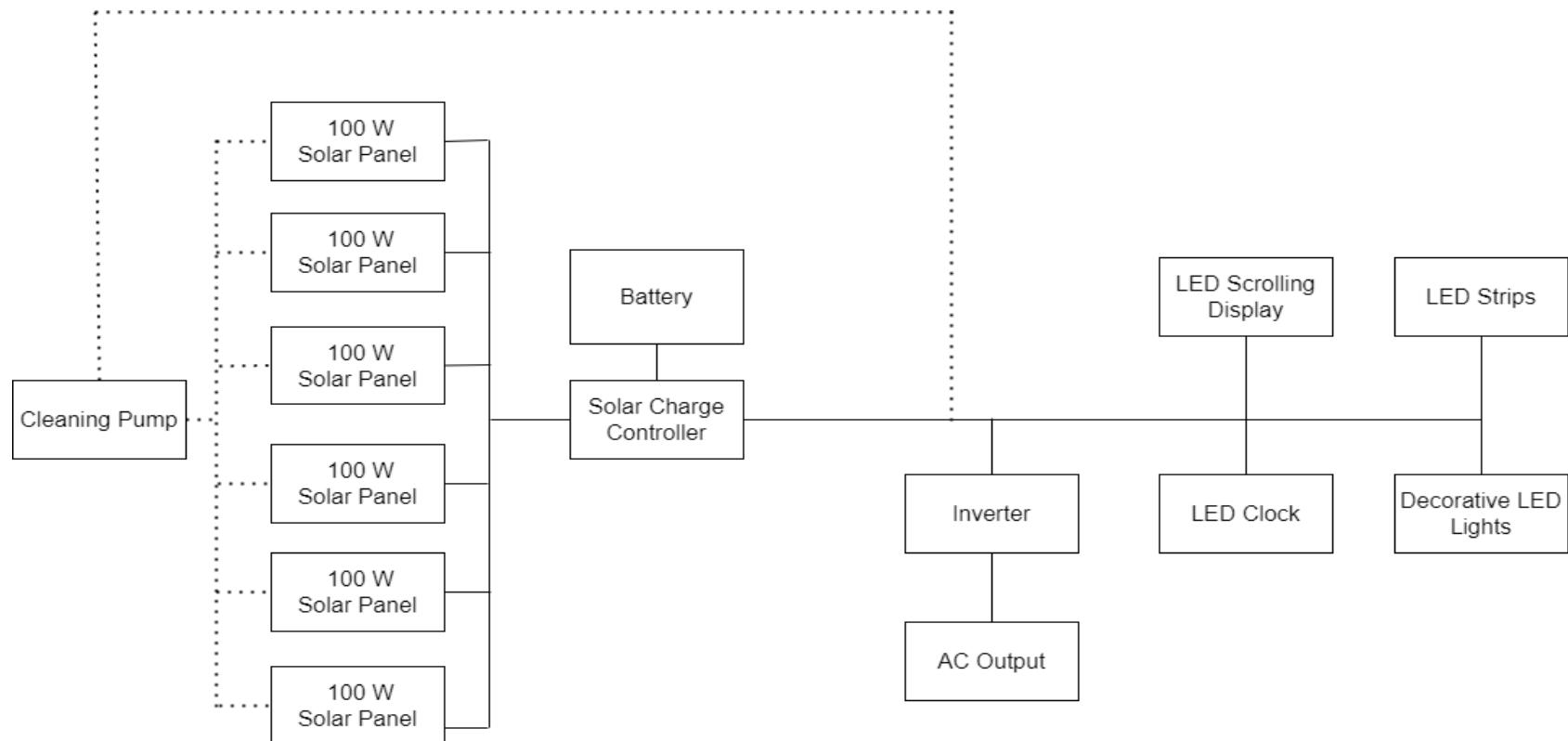
*Front View*

# **HARDWARE COMPONENTS OF SOLAR TREE**

Batch B18 Team Members:

ARI RAMAMOORTHY  
211419105013  
SARABESHWARAN P  
211419105127  
NAVEENRAJA  
211419105091  
VADIVELAN R  
211419105158

# BLOCK DIAGRAM OF SOLAR TREE



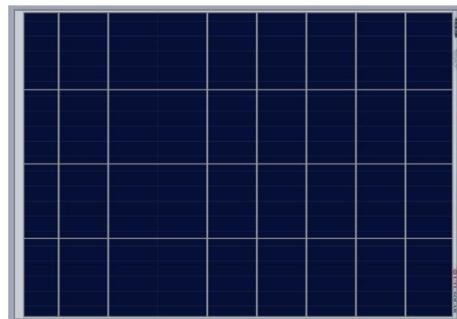
*Block diagram*

# ELECTRICAL COMPONENTS

## i) Solar Panel:

A solar panel is a device that converts sunlight into electricity through photovoltaic cells. The cells are made of semiconductor material, such as silicon, that generates electricity when exposed to sunlight. The electrical energy produced by the cells is converted into usable power through an inverter.

Solar panels are commonly used in solar energy systems, which are a popular source of renewable energy. They can also be used for portable applications, such as camping and emergency power.



**Specifications:**

PARTICULARS	DESCRIPTION
Solar Panel Rating	100 Watt
Panel Type	Polycrystalline
Short circuit current	6.3 ampere
Operating voltage at Pmax VMP	17.9 volt
Operating current Imp	5.7 ampere
Open circuit voltage VOC	21.6 volt
Module efficiency	>15 %
Operating temperature	-40 °C to 80 °C
Maximum system voltage	100 V
Power tolerance	0.03
Fill factor	0.77
Standard test condition	Irradiance of 1000 W/m square, spectrum AM 1.5 and cells temperature of 25 °C
Max. series fuse rating	10
No. of Busbar	4BB
No. of cells	36
Cell arrangement	9*4
Module dimension	1006*666*35 mm
Weight	10.5 Kg
Module protection rating	IP65
Frame	Anodized Aluminium Alloy
Front glass	3.2mm Toughened Textured
Cables and connectors	4mm, AWG 1000V/mc4 connectors

## ii) Solar charge controller:

A solar charge controller is an electronic device used in solar power systems to regulate the voltage and current that is coming from solar panels before it is fed into a battery bank. The primary function of a solar charge controller is to prevent overcharging and over-discharging of batteries, which can cause damage and reduce their lifespan. A solar charge controller is a critical component in a solar power system, as it helps to protect your batteries and ensure that your system operates efficiently and effectively.

There are Two Types of solar charge controllers: PWM (Pulse-Width Modulation) and MPPT (Maximum Power Point Tracking).



### **iii) Solar C10 Lead acid Battery**

C10 lead-acid battery refers to a type of lead-acid battery that is designed to be discharged over a 10-hour period. The C10 rating is a standard used to measure the discharge capacity of lead-acid batteries. It refers to the rate at which a battery can be discharged over a 10-hour period while maintaining a specific voltage.

Lead-acid batteries are one of the oldest and most widely used types of rechargeable batteries. They are commonly used in applications such as backup power supplies, solar power systems, and automotive batteries. C10 lead-acid

The capacity of a lead-acid battery is typically measured in ampere-hours (Ah). A C10 lead-acid battery rated at 150Ah can deliver a current of 15 amps over a 10-hour period before the voltage drops below a certain level. The actual capacity of the battery may vary depending on factors such as temperature and the depth of discharge.

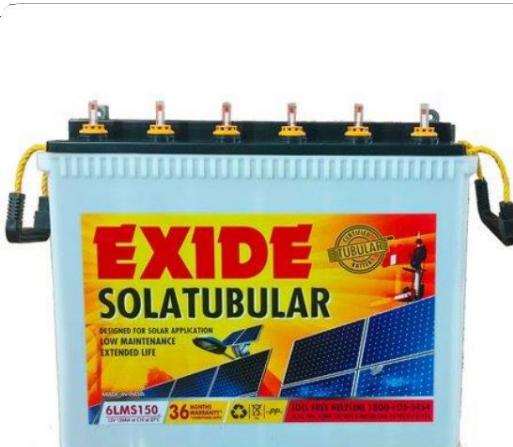


Fig.3.4 Solar battery

#### iv) Cleaning Pump:

A diaphragm style water pump that is used to clean solar panels is a compact and powerful pump designed to provide reliable and efficient water pressure for cleaning solar panels. It is specifically designed to be used with a water-fed pole system for cleaning solar panels, which is a common method used in the solar industry.



## v) LED clock:

The clock's design includes a circular LED display with a diameter of 36 inches, which is encased in a durable aluminum frame that is weather-resistant. The LED lights are bright and have a viewing angle of 180 degrees, making it easy to read the time from a distance. The clock has a sleek and modern design that complements any outdoor space.

The clock uses GPS technology via a smartphone to synchronize with the atomic clock, ensuring accurate timekeeping. It can display time in both 12-hour and 24-hour formats. The clock is powered by the battery that is charged by the solar panels on the solar tree.



## vi) LED Display:

A scrolling LED display board is a type of electronic display board that consists of a series of LED lights arranged in a matrix pattern. It is typically long and narrow, with various sizes available depending on the specific application. The display is designed to be easy to read even in bright sunlight and from a distance, making it ideal for outdoor use.

The display board is controlled by a microprocessor, which can update the display in real-time with the latest information. This allows for the display of important information such as news updates and messages. The display board can also be used for emergency notifications, displaying urgent messages to large crowds in real-time.



## vii) LED Lights:

LED stands for "Light Emitting Diode," which is a semiconductor device that produces light when an electric current passes through it. LEDs are a type of solid-state lighting that is more efficient and longer-lasting than traditional incandescent bulbs. They use less energy and generate less heat, making them an eco-friendlier option. LED technology has advanced significantly in recent years, allowing for the production of high-quality and high-brightness LEDs that can be used for various applications. Here we are using 2 types of LED segments:

# Serial LED lights

Serial LED lights, also known as string lights, are a type of decorative lighting that consists of a series of LED lights connected together in a sequence, or "string". They are commonly used for outdoor and indoor decoration, providing a warm and festive atmosphere for various occasions and events.



- **Strip LEDs:**

LED strip lights are a type of flexible lighting that consist of a series of small LED lights mounted on a thin, flexible circuit board. They are commonly used for decorative and functional lighting in a variety of settings.

The LED lights on the strip are typically low voltage and energy efficient, which allows for long-lasting and cost-effective use. They can be cut to custom lengths to fit specific spaces, and some models can even be bent or shaped to fit curved surfaces.





*LED Glow*

## viii) Fuse and switches:

- **Panel Mount Fuse:**

A fuse is a safety device that is designed to protect an electrical circuit from overloading or short-circuiting. It is a small, replaceable component that is inserted into an electrical circuit and is made of a wire or filament that is designed to melt and break the circuit if too much current flows through it.



*Fuse*

- **Toggle Switches:**



*Fig.3.13 Toggle Switches*

This is a mini metal body toggle switch. It is actuated by moving a lever back and forth to open or close an electrical circuit. This switch changes its position when actuated and will remain in that position until actuated again.

**Thank You**