Design and Implementation of a High Luminosity Lantern Using Photovoltaic Generation of Electrical Power

Mentor: Jayant Parekh

Team Members:Koray Cicek,Vikas Advani Navani,Yong Han

Stony Brook University
Electrical and Computer Engineering

Background

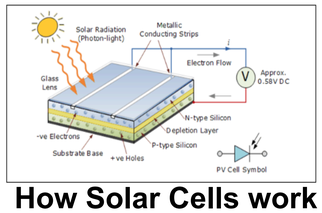
When we started this project our motivation was to create a lamp that can provide light and electricity for those who are in need and depending on dangerous Kerosene gas lamps and have no access to electricity, because after our research we found out that the burning of Kerosene lamps leads to the death of 1.5 million people every year ,and replacing them with solar powered clean energy can save lives and can provide clean energy for the environment .

Introduction

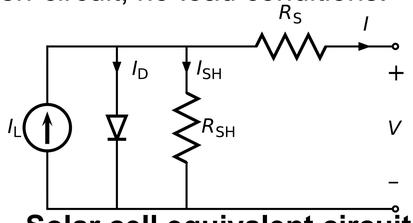
The main objective of our project is to create a solar powered lantern which implements high luminosity LED light powered by a lead acid battery that is charged by a solar panel.The project works by the following routine.The solar panel is placed outdoors under sunglight where it would charge the battery.The battery is removable ,and the power from the solar panel goes into the charge controller first to prevent from damaging the battery.Once the battery is charged ,it will be moved indoors where it will be connected to the lantern.

Solar

Sunlight is composed of photons, or particles of radiant solar energy. These light particles contain various amounts of energy depending on the wavelength of the solar spectrum.Photovoltaic (PV) cells generate electricity by absorbing these photons and use it to create an electrical current.A typical silicon PV cell produces about 0.5 – 0.6 volt DC under open-circuit, no-load conditions.



How Solar Cells work



Solar cell equivalent circuit

Design of the Solar Lantern

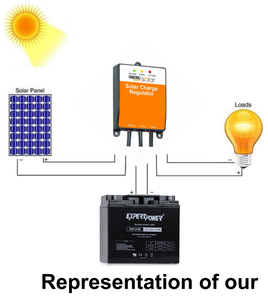
The requirement from the lantern is outputting 1500 lumens of light for more than 9 hours which is equal to 3 days for 3 hours running time each day. We decided to use Cob LED , which means the LED with chip on board , it has many advantages over the other light sources . They are efficient , easy to use , has a long lifetime and uniform light output.

4 of these Cob LEDs are placed in the glass dome for the cleaer output . The leds are added in series connection. There is a hole at the bottom for the cables. We chose this shape over square for getting the best efficiency and brightness from our lantern.

Our design indicates that a copper rod would be placed in the middle of the lantern so it absorbs all the heat required in heat sink caused by the COB LED.

Battery

The battery requires a charge controller when it is charged by solar panel . The primary role is to manage the charging of the battery bank, prevent it from overcharging and control the rate of the current and voltage at which it charges .

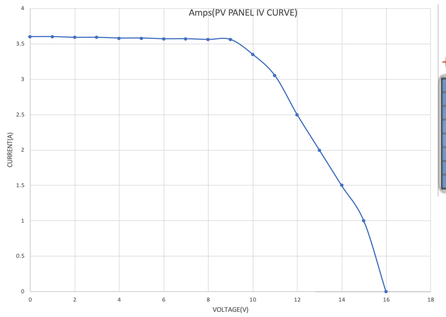


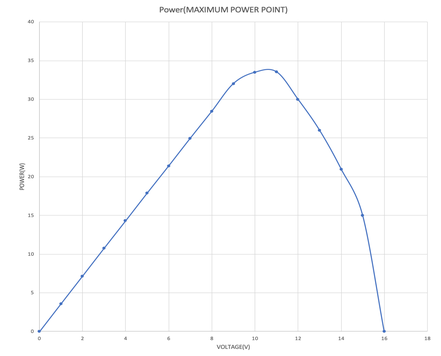
Representation of our charging system

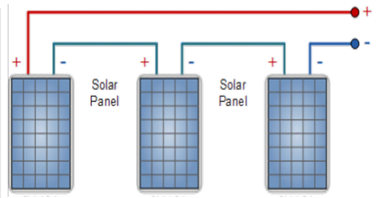
The battery we used

Design of the Solar Panel

By connection 30 solar cells together in series , we can achieve approximately an ideal output of 15V open circuit voltage.In the figures below the IV characteristics and Mpp characteristics are given. **Voc=15V / Isc=3.6A**

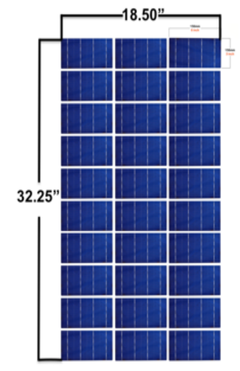






Series connections of PV Cells

Individiual solar cells added to create the Solar Panel



Glossary

Voc:Open circuit voltage
Mpp:Maximum power point
Isc:Short circuit current
Imp:Current at max power
Cob:Chip on board

Acknowledgements

We would like to express our sincere gratitude to professor Jayant Parekh for providing us an opportunity to do this project .We also would like to thank Proessor Harbans Dhadwal for guiding and teaching us in ESE 440 and 441.

SOLAR