

“Design and Fabrication of Solar Tree with Photovoltaic Panels”

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Abstract- Recently with rising population and energy demands, we should get an option of renewable energy source and that energy source should not cause pollution and other natural hazards. For this condition the Solar Energy is best alternative for us. A Solar Power Tree is the best innovative way, which requires very less place to produce energy efficiently. We can also use the “0.3W Solar Modules” to improve the efficiency of the plant. It is far superior to conventional sun powered PV framework in zone perspective and furthermore efficient. So this will be a very good option and will be implemented. SPIRALLING PHYLLATAXY is the method which is utilized in structuring of sun powered tree. This innovation is utilized to improve the proficiency of plant. So this will be a generally excellent alternative. However the main problem associated with tapping solar energy is the requirement to install large solar collector requires very big space. We can likewise utilize the procedure called “SPIRALLING PHYLLATAXY” to improve the proficiency of the plant.

Key words: Solar cells, Fibonacci series, solar energy, PV cell, spiralling phyllataxy

1. INTRODUCTION

Now days with growing population and there is a necessity for large amounts of energy and the sources to produce these energies are decreasing day by day. It is a form of renewable energy resource that is some measure serious with fossil fuels. Hydro power is the power of vitality of moving water. It provides about 96% of renewable energy in the united state. Hydro electric power plants don't utilize any assets to make power and they do not pollute the air. The sun is a hydrodynamic spherical body of extremely hot ionized gases (plasma), generating energy by process of the thermonuclear fusion. The temperature of inside the sun is assessed at 8×10^6 k to 40×10^6 k, where energy is discharged by combination of hydrogen and helium.

Solar energy is accessible in abundance and considered as least demanding cleanest methods for tapping the renewable energy. For direct conversion of solar radiation into usable form, the routes are: solar thermal, solar photovoltaic and solar architecture. Solar tree is revolutionary urban lighting concept that represents perfect symbiosis between pioneering design and cutting-edge eco-compatible technology. Solar tree opens up new prospect for urban lighting in that it satisfies today's most pressing

environmental, social, cultural and aesthetic demands. The ability to combine innovative design with advanced technology along with an acute sensitivity to environmental concerns make Artemide the ideal vehicle for the development of this project conceived by Ross Lovegrove the collaboration of Sharp Solar the world's leading manufacturer of solar cells.

2. COMPONENTS OF SOLAR TREE

1) Solar Panels: (2.5W)

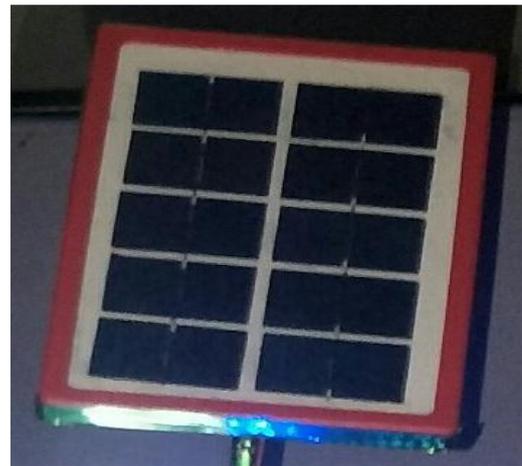


Fig. 1 solar panel

A solar panel is a series of interconnected silicon cells consolidated to form a circuit. In more number of amount of power produced by these interconnected cells can be expanded and utilized as an electricity production system. Solar panels are in different sizes for different purposes. Mono-crystalline solar panels are slightly more expensive but also slightly more space-efficient. If there is one poly-crystalline and one mono-crystalline solar panel both rated 220-watt, it would generate the same amount of electricity but one made of mono-crystalline silicon would take up less space. In figure 1 we used poly-crystalline solar panel.

The raw materials of silicon dioxide of crushed quartz is first taken into an electric arc furnace where carbon arc is applied to release the oxygen. The production are carbon dioxide and molten silicon in this way solar cells are made up. When light energy strikes the solar cell, electrons are knocked loose from the atoms in semiconductor material. If electrical

conductors are attached to the positive and negative sides forming an electrical circuit, the electrons can be captured in the form of an electric current that is electricity. In the solar tree 12V capacity of solar panels are being used having 12W power. The size of solar panel is about 0.5*0.4m from its length to its breadth and thickness of 0.03m. The total amount of energy can be produced in an hour by solar tree is 144W.

2) Solar Charge Controller: (12V/24V-6A/10A)

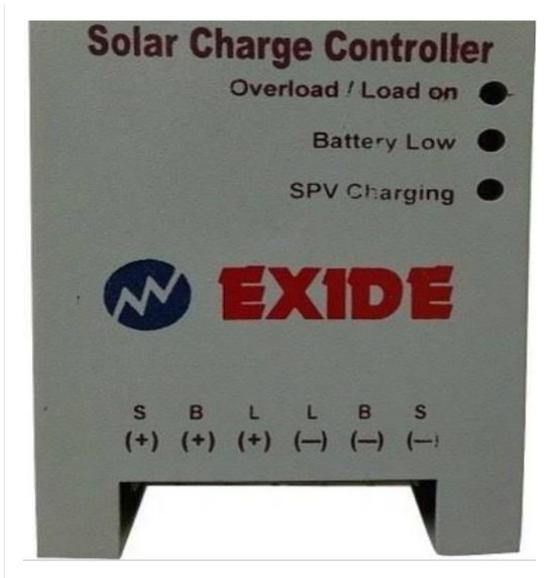


Fig. 2 solar charge controller

A charge controller is basically voltage or current regulator to keep batteries from overcharging. It regulates the voltage and current coming from solar panels going to the battery. Most batteries need around 14 to 14.5 volts to get completely energized. A charged controller limits the rate at which electric current is added to or drawn from electric batteries. It prevents overcharging and it protect against overvoltage which can reduce battery performance. A solar charge controller manages the power going into the battery bank from solar array. It guarantees that profound cycle batteries are not overcharged during the day and that power does not run reverse to the solar panels for time being and drain the batteries. A solar charge controller is accessible in two unique advances, PWM and MPPT. Here we have to used PWM type charge controller as shown in figure.

3) Battery: (Li-Ion 5V)

A lithium-Ion battery is a sort of rechargeable battery that is charged and released by lithium ions moving between the negative . Lithium-ion batteries are commomnly used for portable electronics and electric vehicles . These are growing



Fig. 3 Li-ion battery

In popularity for military and aerospace applications . In the batteries , lithium ion moves from the negative electrode through an electrolyte to the positive electrode during discharge and back when charging . Li-ion batteries use an intercalated lithium compound as the material as the positive electrode and typically graphite at the negative electrode . The batteries have large energy thikness , no memory impact and low self- release. These batteries are characterized by exchange of lithium particles between electrodes during charge and release reactions.

4) Pipes: (Single pipe 5ft and 2inch size)



Fig. 4 pipes

Solar PV modules are mounted on single tall pole made of single tall pole made of Galvanized Iron (GI) pipe having diameter 3 inches and 5 feet height . The branches of the solar tree are made of cast iron and are circular in shape . The branches are tilted at an angle of 45 degree for acquiring more amount of sun rays . To get the required power for small household purpose total of 6 branches are being

installed containing solar panels at the top of pole consist of one solar panel having tilting mechanism to tilt the topmost solar panel at different angles through the day. The figure 2.4 shows no of iron pipes out of this single iron pipe used in our Solar tree for support and installation

3. DESIGN AND IMPLEMENTATION:

1) Block diagram-

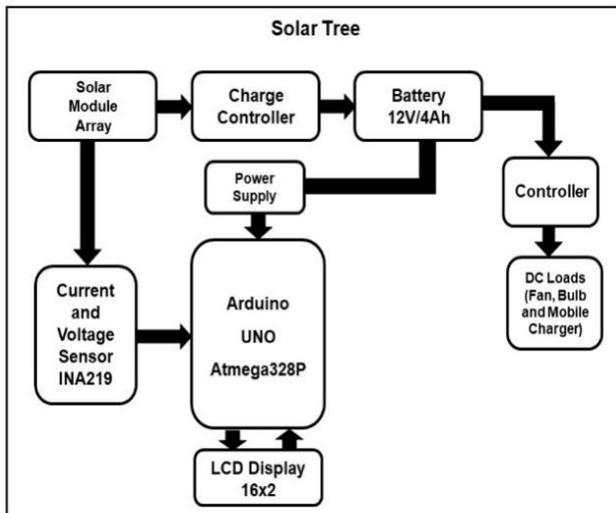


Fig. 5 Block Diagram of Solar Tree

The Fig. 5 shows the block diagram of solar tree. It also illustrates the entire process of generation of energy. In the above diagram we can see that 6 solar module are connected in the combination of series and parallel to attain the desired voltage and current values. 2 output are taken out from the solar module from which one is given to the Charge controller and another is given to the current and voltage sensor. Charge controller is a device that prevents the battery from over-charging and also prevents the battery from discharging completely. The battery of 12V/4Ah is connected next to the charge controller which stores the dc power generated from the solar module array. Then we can connect the DC load (Fan, Bulb and Mobile charger) and it start on that power supply which is coming from battery.

The sensors are provided operating supply through the solar module itself. The sensors provide real time information to the Arduino UNO At mega 328P where it is monitored, stored and compared with the reference values provided. If generated values exceed or drops below the reference values the Arduino sends a signal to the LCD Display. The value of voltage and current are display on LCD screen.

2) Structure -

The Fig. 6 shows the typical model of solar tree prepared by us in which all solar panels are connected with each other

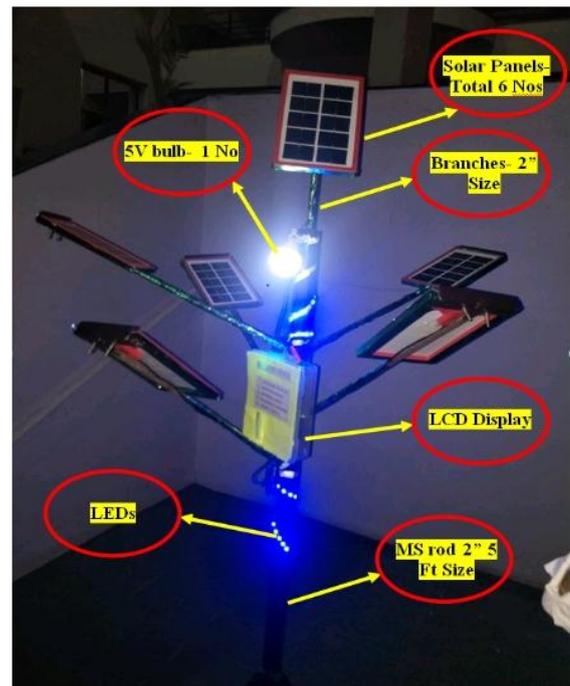


Fig. 6 Structure of Solar Tree

mounted on a single pole and the electricity generated by them are stored in a battery which can be further used as per requirements. To spare roof best space of buildings is required of solar tree. Solar Tree is having a tree like structure made of metal bars and solar panels. Arranged in such a manner that shadow of any solar panel is fall on other solar panels. Because of such structures it requires less space and it can be installed besides the roads or in a garden. The solar tree can be installed at one corner on the roof top of building and rest of the space can be used for any other purposes. The only thing that has to be care about that shadow of anything not fall on the panels it may reduce the efficiency of solar tree.

Total 6 panels used in below mentioned configuration

No of Panels	Ratings of Panel	Connection type
2	5W 10V	Series
2	10W 10V	Parallel
2	15W 10V	Parallel

Table no 1 Panel configuration.

4. RESULT&CONCLUSION:

In this project Solar tree gives 10V of energy but our battery required 5V so that 10 V change to 5V by utilizing of bulk converter. Then we can charge Mobile and also used as decorative purpose in street lighting. To fulfil the increasing energy demand the people and saving of land this project is very successful one. This can gives power with any no power cut issue . The additional energy can be given to the grid.

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