

## Floating Solar Power Plant

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**Abstract-** The excessive amount of use of fossil fuels to produce electricity has been continuously resulting in the depletion of the conventional resources. **Solar Energy**, the most abundant renewable energy resource is the most preferable alternative for the production of electricity. Solar power plant needs some amount of land to be set up on depending upon its capacity. Cost of the land plays an important part in setting up a solar power plant. Due to unavailability of proper land, the cost of land goes high. Due to this, we propose to set up a solar power plant that floats on water bodies. This would have its own advantages such as, it would prevent the water from evaporating, prevent the growth of algae, and majorly, the cooling provided by water would help in boosting the efficiency of the solar plant. The output of the plant can be used to power nearby irrigation systems, street lights, etc. This paper deals with the design of floating structure.

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**Keywords-** Floating Structure, Solar Energy, Renewable Energy, Design parameters, Sun tracker

### I. INTRODUCTION

Solar energy is the most abundant source of energy on this planet. There has been a shift from the use of conventional energy sources to the renewable energy sources over the passage of time. Solar energy has been the most preferable alternative. Since the solar energy is an indirect source of energy, we need two components to utilize it properly, i.e. a collector and a storage device. Solar panel acts a collector for solar radiations. There are 3 types of collectors, i.e. flat plate collector, focussing collectors and passive collectors. Out of these three mostly flat plate collectors are used. Output of this panel would depend upon the radiation intensity, size of the panel, cleanliness of panel, etc.

Solar panels help converting the solar radiations into electrical energy. The output of the panel is DC. There has to be converters connected at the end of the solar panel arrangement. The DC output of the panel can be either stepped up or stepped down using a DC to DC converter. The converted voltage can be used as an input to the inverter to be further converted to AC for transmission or to supply to the grid. Also, dc voltage can be used to charge up DC batteries used for DC supply.

Now, the concept of floating panels deals with the setting up of solar panels on floating platforms that help it remain afloat on water. This would solve the problem of land and also has many other environmental advantages.

We know that the water from the small and medium water bodies, as well as summer canals evaporate during high temperatures. The setting up of the floating solar power plant would help in:

- Preventing the water from evaporating
- Prevent the growth of algae
- Sustain the aquatic life
- The cooling effect of water will help in increasing the efficiency of the solar plant
- It cost lesser than the solar plant set up on water
- There is no extra water need to clean the panels, the water from the water body can be used to clean the panel.

### II. PURPOSE OF PROJECT

The main purpose of this project is to design and install a floating structure on the surface of water bodies that would accommodate a solar power plant. In India, acquiring a land is big problem. Lack of availability and the increasing rates of land make it very difficult to purchase a land. On the other hand, there are hundreds of water bodies that are available across the country. Hence those small and medium water bodies can be utilized to set up this plant. This plant floats on shallow waters too.

### III. CONSTRUCTIONAL DETAILS

The major concern regarding this project was about the design of the structure. A simple design has been made for the floating structure. The size of the float is kept more than the size of the panel. A rectangular float base is designed which is

made up of thermocol. Thermocol is hardened using epoxy hardener and fibre cloth. A small sheet of pvc is used to make a stand support for the panel. All the electrical circuitry is attached and connected at the back of the panel that makes it free from any kind of water contact.

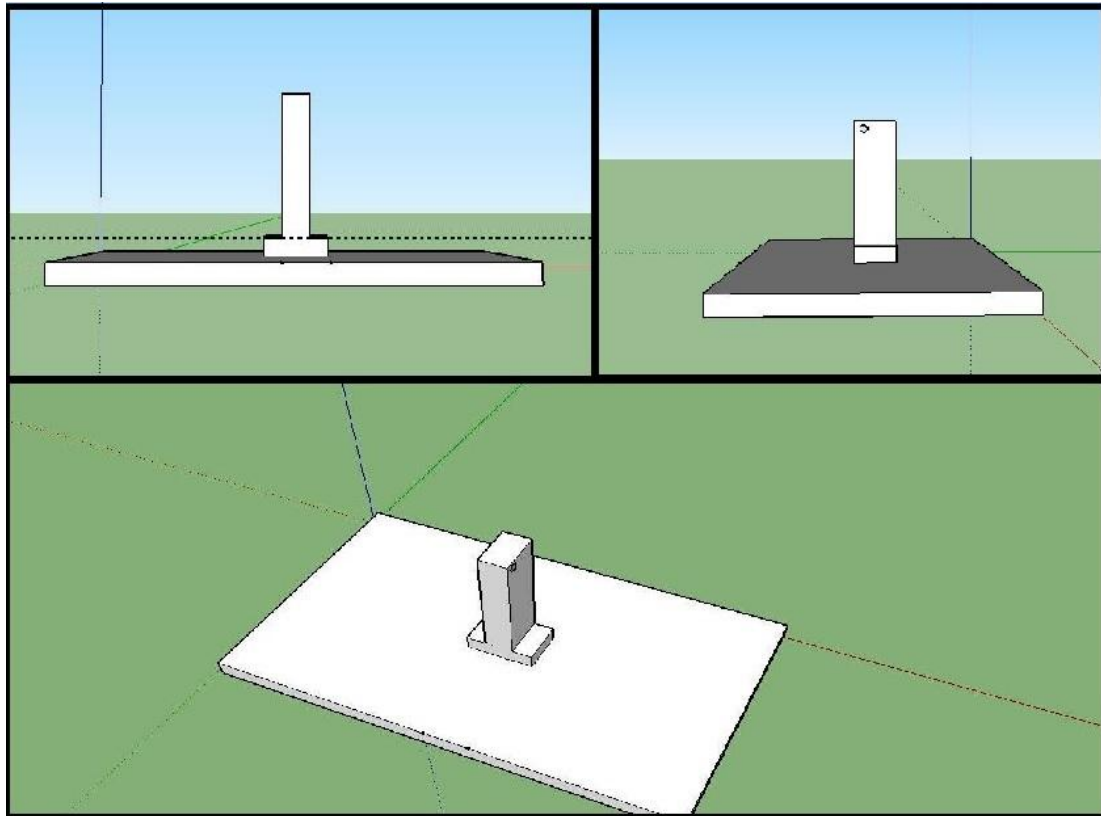


Fig 3.1: Front, right and top view of the floating structure.

The floating structure needs to be attached to the shore via ball floats or they can be anchored down in the water body. This will help the structure keep it stay afloat in case of heavy waves. A servomotor controlled by auordinonano processor is used to tilt the solar panel according to the sun's position.

#### **IV. COMPONENT AND MATERIAL USED**

##### **4.1 Solar Panel :**

Solar panels containing solar cells are devices that are used as collectors. They collect the solar radiations and convert them to electrical energy. Solar cells are made up of silicon or germanium metals. When the solar radiations fall on the solar cells, the valance electrons in the valence bands absorb that energy and get excited and jump to the conduction band. Then they become free. These free electrons are accelerated to a band of higher potential (Galvani Potential). This produces an electromotive force and thus the sunlight is converted to electrical energy.



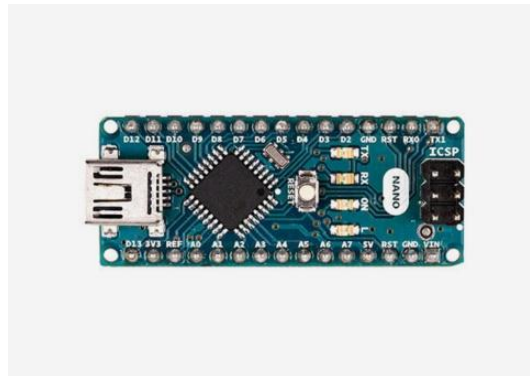
*Figure 1: Solar Panel*

#### **4.2 DC-DC Converter**

A dc to dc converter is a circuit that steps down the dc voltage supplied by the solar panel to 12V for battery charging. It consists at least two transistors, at least one energy storage element (inductor or capacitor or both). To reduce the voltage ripples, capacitors are used. The 12V dc is used to charge DC batteries. Also it is used as a supply to the servomotors.

#### **4.3 Arduino Nano processor:**

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328. It is a controller that requires programming according to the requirement. The programming can be changed according to the requirement. In this project, the arduino is used to control the motion of servomotors according to the position of the sun.



*Fig 4.2: Arduino Nano*

#### **4.4 Servomotors:**

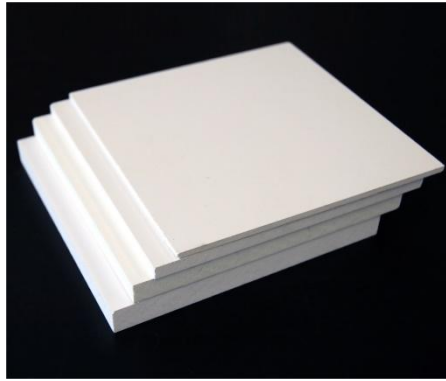
A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors. Servomotors are not a specific class of motor although the term servomotor is often used to refer to a motor suitable for use in a closed-loop control system. Servomotors are used in applications such as robotics, CNC machinery or automated manufacturing.



*Fig 4.3: Servomotor*

#### **4.5 PVC Sheets:**

The Polyvinyl chloride more correctly but unusually poly(vinyl chloride), commonly abbreviated PVC, is the world's third-most widely produced synthetic plastic polymer, after polyethylene and polypropylene. PVC comes in two basic forms: rigid (sometimes abbreviated as RPVC) and flexible. The rigid form of PVC is used in construction for pipe and in profile applications such as doors and windows.. It can be made softer and more flexible by the addition of plasticizers, the most widely used being phthalates. In this form, it is also used in plumbing, electrical cable insulation, imitation leather, signage, phonograph records, inflatable products, and many applications where it replaces rubber. Pure poly(vinyl chloride) is a white, brittle solid. It is insoluble in alcohol but slightly soluble in tetrahydrofuran.



**Fig 4.4: PVC Sheet**

#### **4.6 Epoxy Resin and Fibre Cloth**

Epoxy is either any of the basic components or the cured end products of epoxy resins, as well as a colloquial name for the epoxide functional group. Epoxy resins, also known as polyepoxides, are a class of reactive prepolymers and polymers which contain epoxide groups. Epoxy resins may be reacted (cross-linked) either with themselves through catalytic homopolymerisation, or with a wide range of co-reactants including polyfunctional amines, acids (and acid anhydrides), phenols, alcohols and thiols. These co-reactants are often referred to as hardeners or curatives, and the cross-linking reaction is commonly referred to as curing. Reaction of polyepoxides with themselves or with polyfunctional hardeners forms a thermosetting polymer, often with high mechanical properties, temperature and chemical resistance. Epoxy has a wide range of applications, including metal coatings, use in electronics / electrical components/LED, high tension electrical insulators, paint brushes manufacturing, fiber-reinforced plastic materials and structural adhesives. Fibre cloth is covered with epoxy resin plus alcohol solution and then wrapped around the thermocol. After the fibre cloth dries on the thermocol, the thermocol becomes quite hard.

#### **V. OUTCOME OF PROJECT**

1. The main objective of this project was to improve the efficiency.
2. Water would provide cooling to the solar panel. Cooling of panel resulted in improved output.
3. If the efficiency of one panel increases, eventually leads to increase in the efficiency of the whole plant, as the output of the panels is improved.
4. The output of the plant can be utilized to power the nearby irrigation systems, street lights.

#### **VI. APPLICATIONS**

- The output from the solar panel is used to charge the DC battery.
- The dc output can be boosted up through a dc dc converter and fed into an inverter for conversion to ac. The ac can be stepped up for further transmission or supplying it to grid.
- The nearby irrigation systems, street lights can be powered by the output from the solar plant.
- Since water evaporation is reduced, that same water can be used to pump it to the farms.

#### **VII . CONCLUSION**

- Panels are naturally cooled as the air just above the water bodies has high content of moisture and hence it automatically solves the issue of heating losses that occur during its operation.
- Reduce evaporation by up to 70%.
- Cement structures like boilers and chimneys that are used in power plants like thermal have no scope in such a plant. Also electro-mechanical machines like generators are not required which reduce the amount of steel structures in the plant. Therefore, such plants are comparatively more eco-friendly.
- It can also improve water quality. As water bodies are exposed to the sun, photosynthesis promotes growth of organic matter, including algae.
- By shading the water, algae growth is reduced, minimizing the associated treatment and labor costs.

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