

Design and Development of Solar Tracking System & Cleaning System.

Palve Nikhil¹, Nikam Akshay², Lahane Ankush³, Nyaharkar Dhananjay⁴, P.C. Bhavsar⁵.

¹BE student Dept. Of Mechanical, SND COE & RC, YEOLA, Maharashtra, India

²BE student Dept. Of Mechanical, SND COE & RC, YEOLA, Maharashtra, India

³BE student Dept. Of Mechanical, SND COE & RC, YEOLA, Maharashtra, India

⁴BE student Dept. Of Mechanical, SND COE & RC, YEOLA, Maharashtra, India

⁵Asst. Prof. Dept. Of Mechanical, SND COE & RC, YEOLA, Maharashtra, India

Abstract

Solar energy is the most abundant source of energy for all the forms of life on the planet Earth. It is also the basic source for all the sources of energy except Nuclear Energy. But the solar technology has not matured to the extent of the conventional sources of energy. It faces lots of challenges such as high cost, erratic and unpredictable in nature, need for storage and low efficiency. This project aims at increasing the efficiency of solar panel which leads to reduction in plant output and overall plant efficiency. It purposes to develop the "Solar Tracking and Cleaning System". The Solar Tracking System is a power generating method from sunlight. This method of power generation is simple and is taken from natural resource. This needs only maximum sunlight to generate power.

This project helps for power generation by setting the equipment to get maximum sunlight automatically. This system is tracking for maximum intensity of light. When there is decrease in intensity of light, this system automatically changes its direction to get maximum intensity of light. The cleaning system is using to remove the accumulated dust on its surface on a regular basis and maintain the solar panel output the system is robotic system which could have the nozzle from which the water is sprinkle on the panel and thus the panel get clean. This project is also aims to reduce the human involvement in the process of solar panel rotating and cleaning.

Keywords – Solar panel, Timer, DC Motor, solar energy, battery.

1. Introduction –

Solar energy is clean and available in abundance. Solar technologies use the sun for provision of heat, light and electricity. These are for industrial and domestic applications. With the alarming rate of depletion of major conventional energy sources like petroleum, coal and natural gas, coupled with environmental caused by the process of harnessing these energy sources, it has become an urgent necessity to invest in renewable energy sources that can power the future sufficiently. The energy potential of the sun is immense. Despite the unlimited resource however, harvesting it presents a challenge because of the limited efficiency of the array cells. The best efficiency of the majority of commercially available solar cells ranges between 10 and 20 percent. This shows that there is still room for improvement. This project seeks to identify a way of improving efficiency of solar panels. Solar tracking is used. The tracking mechanism moves and positions the solar array such that it is positioned for maximum power output. Other ways include identifying sources of losses and finding ways to mitigate them.

When it comes to the development of any nation, energy is the main driving factor. There is an enormous quantity of energy that gets extracted, distributed, converted and consumed every single day in the global society. Fossil fuels account for around 85 percent of energy that is produced. Fossil fuel resources are limited and using them is known to cause global warming because of emission of greenhouse gases. There is a growing need for energy from such sources as solar, wind, ocean tidal waves and geothermal for the provision of sustainable and power. Solar panels directly convert radiation from the sun into electrical energy. The panels are mainly manufactured from semiconductor materials, notably silicon. Their efficiency is 24.5% on the higher side. Three ways of increasing the efficiency of the solar panels are through increase of cell efficiency, maximizing the power output and the use of a tracking system. Maximum power point tracking (MPPT) is the process of maximizing the power output from the solar panel by keeping its operation on the knee point of P-V characteristics. MPPT technology will only offer maximum power which can be received from stationary arrays

of solar panels at any given time. The technology cannot however increase generation of power when the sun is not aligned with the system. Solar tracking is a system that is mechanized to track the position of the sun to increase power output by between 30% and 60% than systems that are stationary.

2. Problem Statement –

The efficiency of solar cells is only about 22%. The rest of the sunlight that strikes the panel is wasted as heat. More efficient photovoltaic cells have been discovered (up to 43% efficient - see How efficient is solar energy? - but these are still in their experimental phase and are expensive to manufacture). - written by Solar Power is the future.com. The problem states above, shows that only 22% is efficient. Thus, the innovation of Solar Tracker with semi-automated module cleaning innovated to help the solar panel achieve its efficiency to absorb the light energy from the sunlight by removing dust, cooling the panel and tracking the sun light.

3. General Information –

3.1. Objectives

The project was carried out to satisfy main objectives:

- Design a system that tracks the solar UV light for solar panels.
- Prove that the tracking indeed increases the efficiency considerably.
- The range of increase in efficiency is expected to be between 30 and 40 percent.
- This mechanism will ensure that the light with maximum intensity will be falling on the solar panel throughout the day.

3.2 Scope

The machines have been designed to support human beings by helping them to do tedious and back breaking works. However, the industry has made only the limited use of high technology production concept. There is general need to nature the development program in automation and robotics. Machines have been employed in various tasks including material handling various interior and exterior finishing task, including material handling the high expectations of the stemmed from the very serious problems the industry is facing.

- Continuous declining productivity
- A high accident rate.
- Low quality
- In sufficient control of construction site
- Vanishing of skilled work force.

In recent years the use of new technologies within the industry has shown great potential although little has been implemented. For example robotic systems and other programmable machines are needed to perform tasks that involve hazardous of rate or in some way physically dangerous to human the development of robotics systems in construction advance very slowly owing to several challenges one of the obstacles in the development of the required software component such development for highly trained programmed and export software engineers.

4. Working –

A solar tracking mechanism is an effort to increase the efficiency of power generation through the solar module. The conventional solar module are stationary hence the sun rays falling on them are at different angles at different points of time and the duration of the sun rays falling perpendicular to the surface of the solar module is very small. Please refer to Fig 4.1. Thus large part of energy from sun is wasted. This decrease the efficiency of the system as the maximum efficiency is obtain only during the time when sun is exactly perpendicular to the surface of solar module. During the morning and evening hours the efficiency of the solar module is as low as negligible. Those factors lead to problem of very low output by system. The output of the system can be efficiently increase by the solar tracking mechanism. By the use of this mechanism we can rotate the module

according to the movement of the sun is that the sun rays fall exactly perpendicular to the module throughout the day.

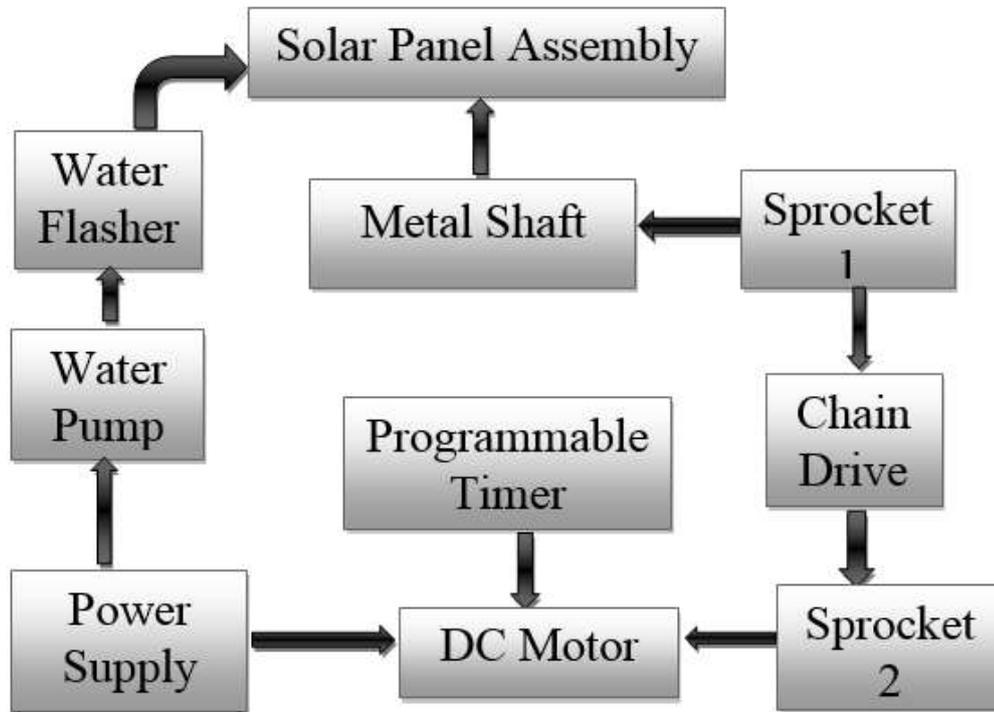


Fig. 4.1. Block diagram of System

The power gets supplied from the switch towards the DC motor as the switch is turned on and hence the motor get start. The motor is attached to the shaft with the help of belt as the motor start to rotate the shaft get rotate and with the help of the shaft the solar panel will be move. The cyclic timer is one of the main device which can control the rotation of panel time interval. The motor is also operating on the timer. Hence as the sun moves from one side to another the panel follow the motion of sun and we get maximum energy the other side of the working is cleaning of panel. The tank is fill with the water. The water pump directly place in the tank.

The pump is operating on the on/off switch. As the pump get start it supply water towards the nozzle with the help of piping system. The nozzle sprinkle water on the solar panel so that with the help of water dust and dirt on the panel get clean. After that the water can be filter and reuse for the system. This system operates twice in a day first at morning before sun rise and second at evening after the sun sets.

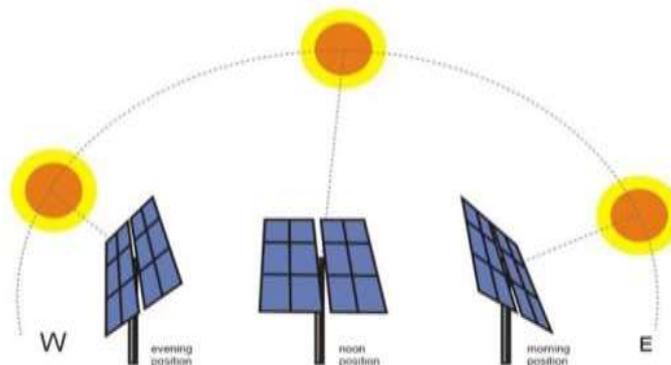
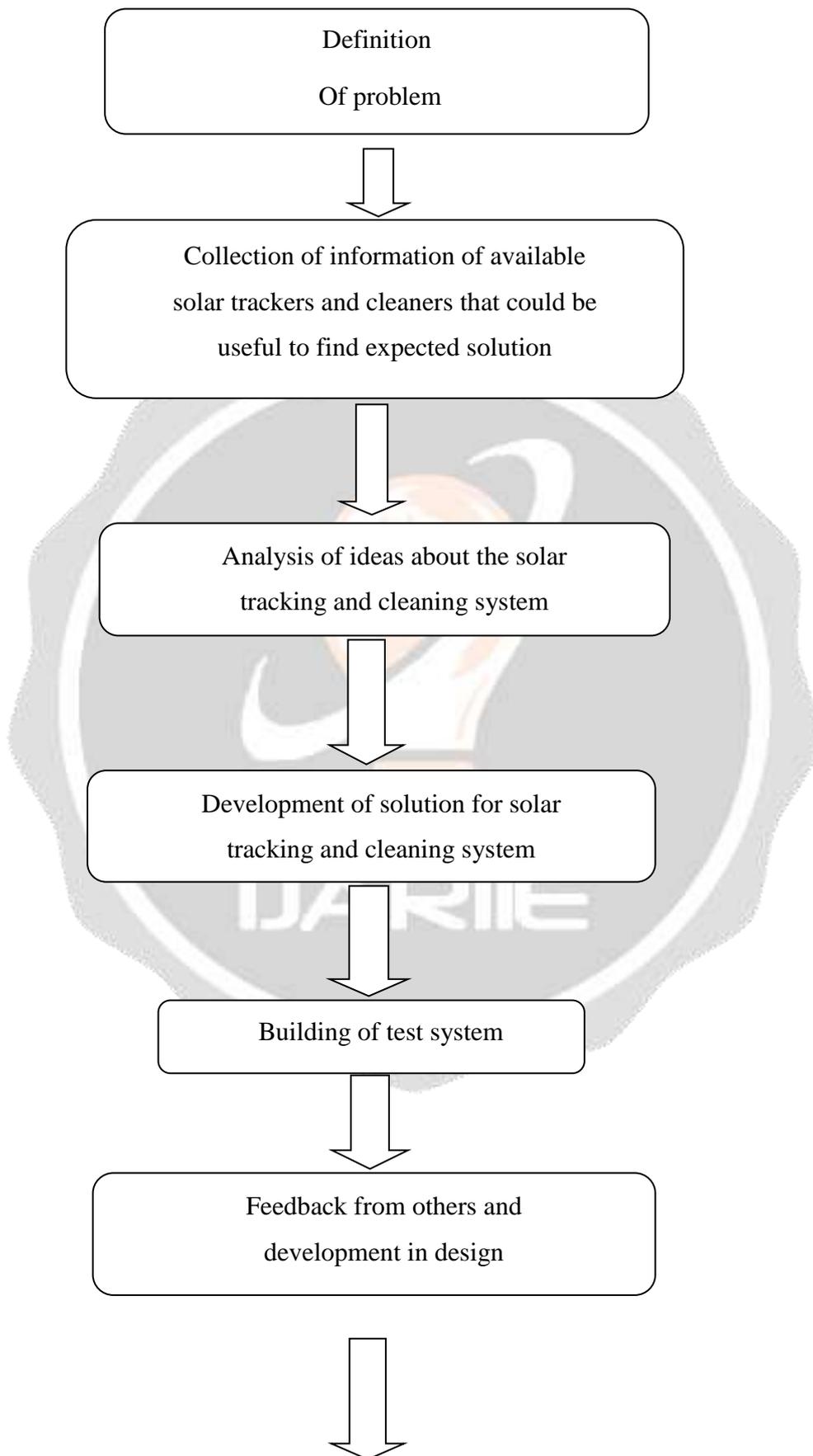
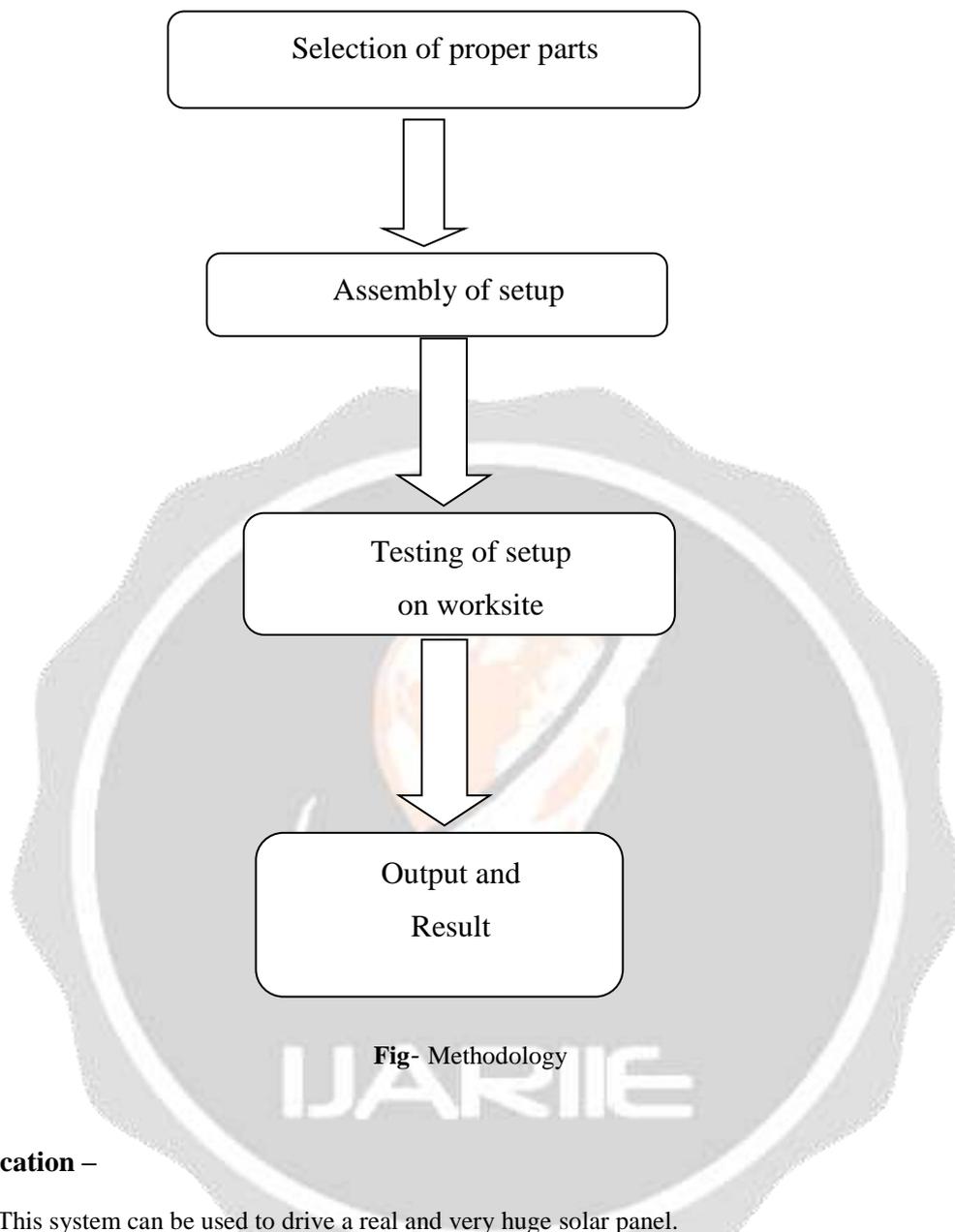


Fig. 4.2. Block diagram of System

5. Methodology –





6. Application –

- This system can be used to drive a real and very huge solar panel.
- This system used as an energy source for drilling and cutting machine in U.S.A.
- Solar power is used for charging large batteries so that solar powered devices can be used in the night.

7. Advantages-

- This automatic solar tracker is easy to implement since its construction is simple.
- 25% to 30% energy increased by system over the conventional solar system
- Very less consumption by the system itself.
- Extract maximum energy by surrounding.
- Independent control.
- This automatic solar tracker is easy to implement since its construction is simple.

8. Disadvantages

- This system cannot be used in rainy season.
- Initial cost is high.
- Water should be cleaned for system.
- Solar panels can be costly to install resulting in a time lag of many years for savings on energy bills to match initial investments.
- Generation of electricity from solar is dependent on the country's exposure to sunlight.

9. Conclusion –

From this project we can conclude that the proper utilisation of solar system and the cleaning purpose too. above system can be kept inclined in north or the south direction accordingly to achieved the better energy generation from the PV module of given voltage ratings. This system can be extended to two axis tracking by rotating one axis manually and other axis are automatically as rotated in this system the mechanism does not require any synchronization for tracking the sun.

References –

1. **'Design and Development of Solar Panel Cleaning Machine'**, Dabhi Chirag, Gandhi Mayank, Jadeja Mandipsinh, Prajapati Parimal. International Journal of Advance Engineering and Research Development Scientific Journal of Impact Factor (SJIF): 4.72 Special Issue SIEICON-2017, April - 2017 e-ISSN: 2348-4470 p-ISSN: 2348-6406.
2. **'Automatic solar tracking system for power generation using microcontroller and sensor'**, IS.SIVASAKTHI M.E., Assistant Professor, Department of Electronics & communication Engineering, TRP Engineering College (SRM Group) Irungalur, Trichy-621105. Tamilnadu, India. International Conference on Explorations and Innovations in Engineering & Technology (ICEIET - 2016)
3. **'Arduino based solar tracking system'**, Ms. Ayushi NitinIngole, Satellite Conference ICSTSD 2016 International Conference on Science and Technology for Sustainable Development, Kuala Lumpur, MALAYSIA, May 24-26, 2016.
4. **Solar Tracking System'**, Reshmi Banerjee. International Journal of Scientific and Research Publications, Volume 5, Issue 3, March 2015 1 ISSN 2250-3153.
5. **Design and Implementation of Solar Tracking System**, Liping Dong, Zhen An, Lina Hao , International Conference on Applied Science and Engineering Innovation (ASEI 2015).
6. **Improvement Of Efficiency Of Solar Panel Using Different Methods**. Rupali Nazar Mtech. Student, Department Of Electrical And Electronics Engg., Lingaya's University, Faridabad, (India), IJEEE, Volume 07, Issue 01, Jan- June 2015.
7. www.google.com
8. www.youtube.com