© 2018 IJSRST | Volume 4 | Issue 7 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X
Themed Section: Science and Technology

Fabrication of Maximum Solar Energy Tracing System

Barmavatu Praveen[1], Swathi Priya Soogoor[2]

[1]M-Tech(Ph.D.), Research Scholar, Shri Jagdishprasad Jhabarmal Tibrewala University(Jjtu), Rajasthan, India

[2]B-Tech, Department of Mechanical Engineering,Anurag Group of Institutions,Venkatapur(V), Ghatkesar, India

ABSTRACT

Solar energy is rapidly advancing as an important means of renewable energy resource. Solar tracking enables more solar energy to be generated because the solar panel is able to maintain a perpendicular profile to the sun's rays. Though initial cost of setting up a solar tracking system is high, this paper proposes a cheaper solution. Design and construction of a prototype for solar tracking system with single degree of freedom, which detects the sunlight using Light Dependent Resistors (LDR), is discussed in this paper. The control circuit for the solar tracker is based on an ATMega8 microcontroller. This is programmed to detect the sunlight through the LDRs and then actuate the motor to position the solar panel where it can receive maximum sun light. Theoretical analysis and research results have been shown in this project to advocate that the designed system realized precise automatic tracking of the sun and can greatly improve the utilization of solar energy.

Keywords : Light Dependent Resistors, Solar Energy, PLC, Photo Detector

I. INTRODUCTION

The sun at the heart of our solar system is a yellow dwarf star, a hot ball of glowing gases. Its gravity holds the solar system together, keeping everything from the biggest planets to the smallest particles of debris in its orbit. Electric currents in the sun generate a magnetic field that is carried out through the solar system by the solar wind — a stream of electrically charged gas blowing outward from the sun in all directions. The connection and interactions between the sun and Earth drive the seasons, ocean currents, weather, climate, radiation belts and aurorae. Though it is special to us, there are billions of stars like our sun scattered across the Milky Way galaxy.

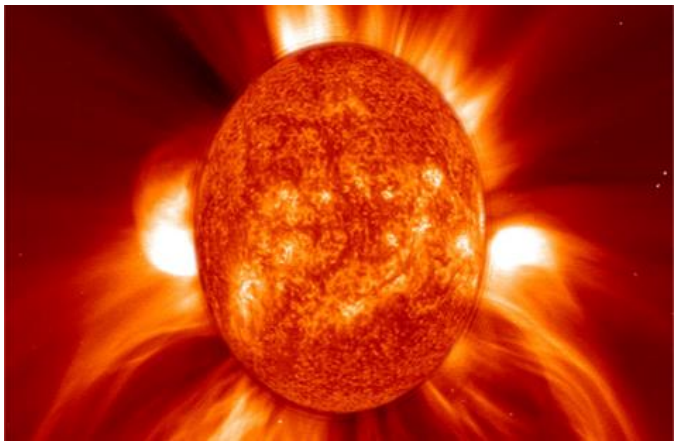

Figure 1 shows the conceptual diagram of a typical existing sun tracking mechanism. In the closed-loop system the sensor senses the position of the sun and sends a signal to the controlling unit, whereas in an open-loop system control algorithms are preloaded in the controlling unit, which determines the amount of actuation required and sends an appropriate signal to the motor which tilts the solar device towards the sun.

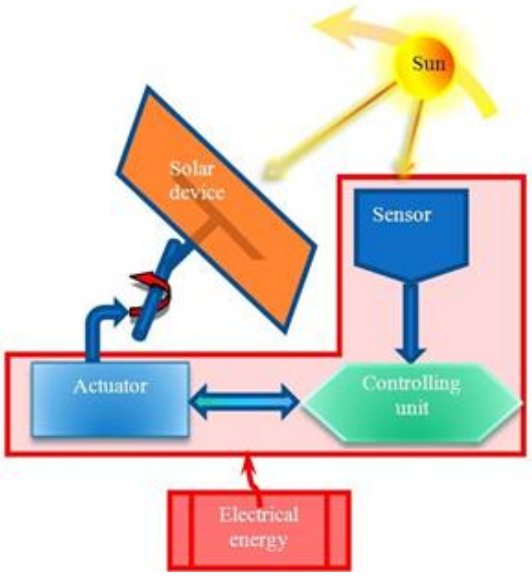

Figure 1. Working elements of a typical currently existing sun tracking mechanism

In all the above, the sun tracking mechanisms there is a requirement for a certain amount of electrical energy input for the controlling units(PLC, micro-controller, electronic circuit), for the actuators (electrical motor),and, for the sensors (Photo Detector, Light Dependent Resistors). Since electrical energy is needed as an external source to energize the motor, the employability of such mechanisms is restricted only to areas where electrical energy is easily and continuously available or when the unit itself is an electricity generator.

CHAPTER – 2
LITERATURE SURVEY

- 1839: French physicist **Alexandre-Edmond Becquerel** (father of radioactivity pioneer Henri Becquerel) discovers some metals are photoelectric: they produce electricity when exposed to light.
- 1873: English engineer **Willoughby Smith** discovers that selenium is a particularly effective photoconductor (it's later used by Chester Carlson in his invention of the photocopier).
- 1905: German-born physicist **Albert Einstein** figures out the physics of the photoelectric effect, a discovery that eventually earns him a Nobel Prize.
- 1916: American physicist **Robert Millikan** proves Einstein's theory experimentally.
- 1940: **Russell Ohl** of Bell Labs accidentally discovers that a doped junction semiconductor will produce an electric current when exposed to light.
- 1954: Bell Labs researchers **Daryl Chapin**, **Calvin Fuller**, and **Gerald Pearson** make the first practical photovoltaic silicon solar cell, which is about 6 percent efficient (a later version manages 11 percent). They announce their invention—initially called the "solar battery"—on April 25.
- 1958: Vanguard, Explorer, and Sputnik space satellites begin using solar cells.
- 1962: 3600 of the Bell solar batteries are used to power Telstar, the pioneering telecommunications satellite.
- 1997: US Federal government announces its Million Solar Roofs initiative—to construct a million solar-powered roofs by 2010.
- 2002: NASA launches its Pathfinder Plus solar plane.
- 2009: Scientists discover that perovskite crystals have great potential as third-generation photovoltaic materials.
- 2014: A collaboration between German and French scientists produces a new record of 46 percent efficiency for a four-junction solar cell.
- 2020: Solar cells are predicted to achieve grid parity (solar-generated electricity you make yourself will be as cheap as power you buy from the grid).

COMPONENTS AND FABRICATION

Need for Sun Path Tracing Mechanism

Solar energy can be collected in many ways. But collecting solar energy using solar panel stands first in the race.

As we know the panel is placed in the presence of sunlight it collects the energy. We noticed that when panel is placed at right angle to the sun rays it collects maximum amount of energy. As sun travels from east to west direction it means the point of projection of light is not constant. So we developed a new sun path tracing mechanism which does not consume energy to work.

SUN PATH TRACING MECHANISM

The mechanism is similar to that of common balance where we replaced the pans with a tank on one side and panel supporting frames on the other side

Block diagram

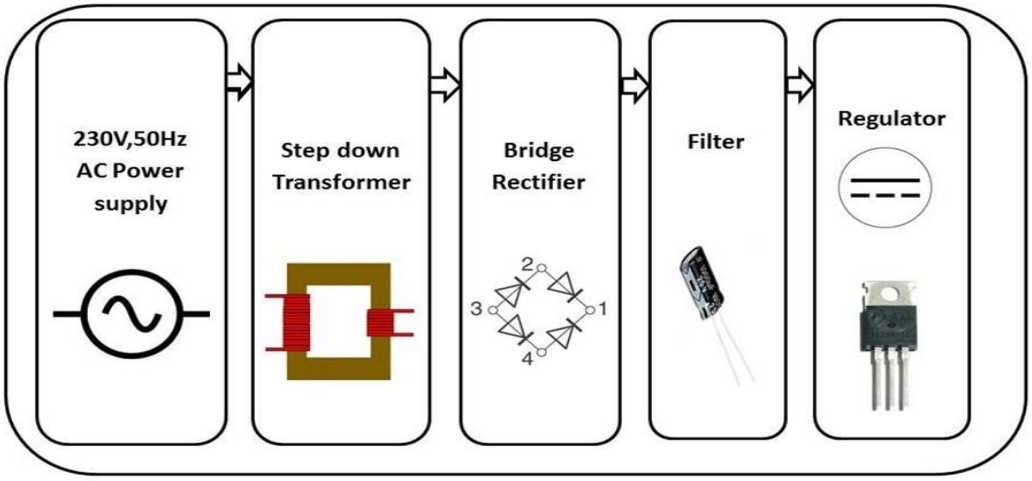

Figure 2

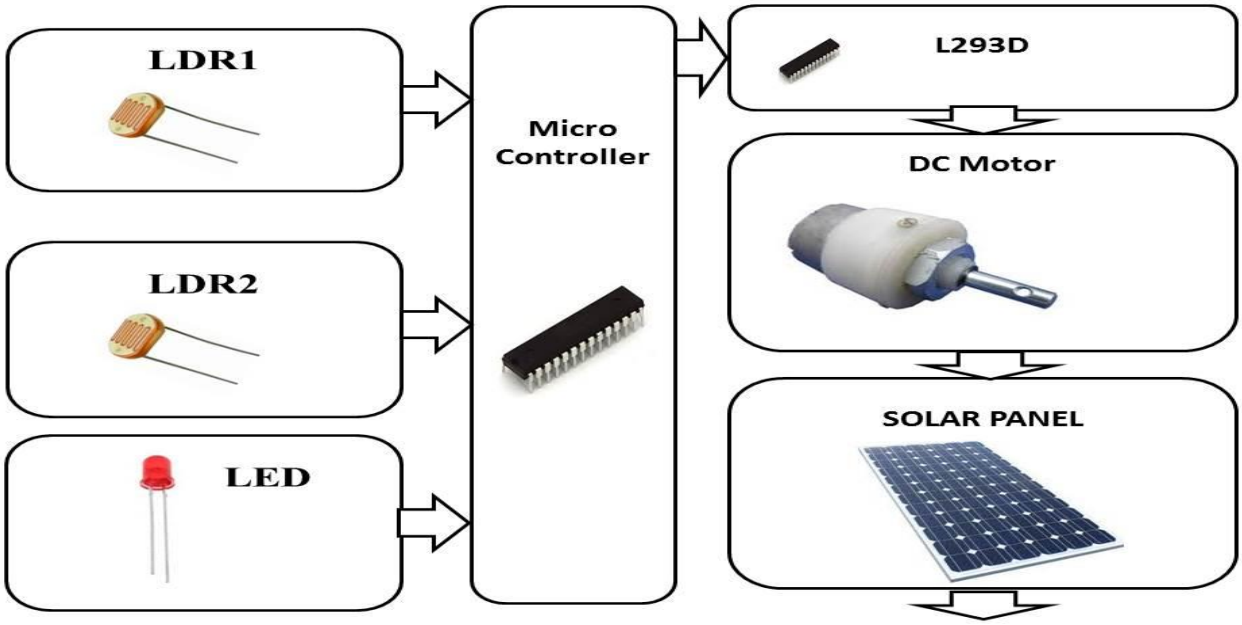

Figure 3

Block diagram using modules

1) Solar panel

2) Dc motor
3) Microcontroller
4) LDR
5) L293D motor drivers
6) Battery
7) Mini invertor
8) Power supply

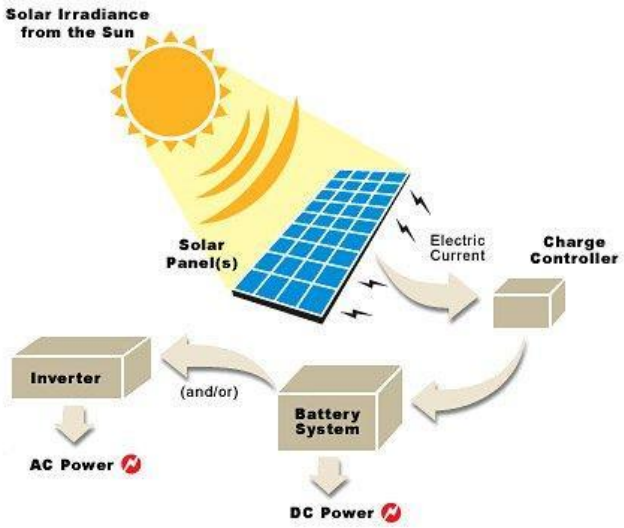

Figure 4

II. WORKING OF SOLAR TRACKING

useable electricity from the sun was made possible by the discovery of the photoelectric mechanism and subsequent development of the solar cell i.e., a semiconductive material that converts visible light into a direct current. By using solar arrays, a series of solar cells electrically connected, a DC voltage is generated which can be physically used on a load. Solar arrays or panels are being used increasingly as efficiencies reach higher levels and are especially popular in remote areas where placement of electricity lines is not economically viable.

This alternative power source is continuously achieving greater popularity especially since the realization of fossil fuel's shortcomings. Renewable energy in the form of electricity has been in use to some degree as long as 75 or 100 years ago. Sources such as Solar, Wind, Hydro and Geothermal have all been utilized with varying levels of success.

The most widely used are hydro and wind power, with solar power being moderately used worldwide. This can be attributed to the relatively high cost of solar cells and their low conversion efficiency. Solar power is being heavily researched and solar energy costs have now reached within a few cents per kW/h of other forms of electricity generation, and will drop further with new technologies such as titanium oxide cells. With a peak laboratory efficiency of 32% and average efficiency of 15-20%, it is necessary to recover as much energy as possible from a solar power system.

This includes reducing inverter losses, storage losses and light gathering losses. Light gathering is dependent on the angle of incidence of the light source providing power (i.e. the sun) to the solar cell's surface and the closer to perpendicular, the greater the power. If a flat solar panel is mounted on level ground, it is obvious that over the course of the day the sunlight will have an angle of incidence close to 90° in the morning and the evening. At such an angle, the light gathering ability of the cell is essentially zero, resulting in no output. As the day progresses to midday, the angle of incidence approaches 0°, causing a steady increase in power until at the point where the light incident on the panel is completely perpendicular and maximum power is achieved.

As the day continues toward dusk, the reverse happens and the increasing angle causes the power to decrease again toward minimum again. From this background, we see the need to maintain the maximum power output from the panel by maintaining an angle of incidence as close to 0° as possible. By tilting the solar panel to continuously face the sun, this can be achieved. ***The process of sensing and following the position of the sun is known as Solar Tracking.*** It was resolved that real-time tracking

would be necessary to follow the sun effectively, so that no external data would be required in operation.

Many different methods have been proposed and used to track the position of the sun. The simplest of all uses an LDR (Light Dependent Resistor) to detect light intensity changes on the surface of the resistor.

BLOCK DIAGRAM:

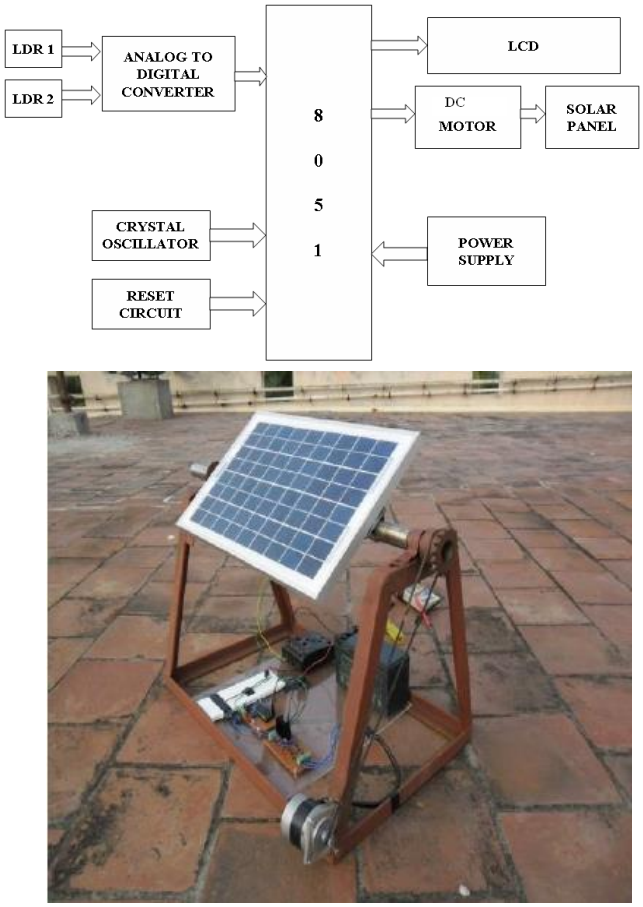

Figure 5

Applications of solar panels with mechanism

Solar trackers increase the amount of energy produced per module at a cost of mechanical complexity and need for maintenance. They changes according to the direction of the Sun as the motion of the path is being manipulated with balancing mechanism. There are many practical applications for the use of solar panels or photo voltaic. It can first be used in agriculture as a power source for irrigation. In health care solar panels can be used to refrigerate medical supplies. Following are the main fields were we find use of this mechanism

- ✓ Photovoltaic power stations
- ✓ Rooftop solar PV systems
- ✓ Standalone PV systems
- ✓ Solar hybrid power systems
- ✓ Concentrated photovoltaic's
- ✓ Solar-pumped lasers

III. CONCLUSION

A solar tracker is designed employing the new principle of Real Time Clock, for effective change of relative angle of solar panel with the sun. By using this method, the solar tracker was successful in maintaining a solar array at a sufficiently perpendicular angle to the sun

IV. REFERENCES

[1]. Ulanoff, L. Elon Musk and SolarCity unveil 'world'smost efficient' solar panel, Mashable, October 2, 2015, accessed June 28, 2016

[2]. Jump upMilestone in solar cell efficiency achieved: New record for unfocused sunlight edges closer to theoretic limits. Wilson da Silva. Science Daily. May 17, 2016

[3]. Jump upUniversity of New South Wales. "Milestone in solar cell efficiency achieved: New record for unfocused sunlight edges closer to theoretic limits." ScienceDaily, 17 May 2016.

[4]. Jump upLi, Wei; Rubin, Tzameret H.; Onyina, Paul A. (2013-05-01). "Comparing Solar Water Heater Popularization Policies in China, Israel and Australia: The Roles of Governments in Adopting Green Innovations". Sustainable Development. 21 (3): 160–170.doi:10.1002/sd.1547. ISSN 1099-1719.

[5]. Jump up to:a b c Morgan Baziliana; et al. (17 May 2012). Re-considering the economics of

photovoltaic power. UN-Energy (Report). United Nations. Retrieved 20 November 2012.

[6]. Jump upKING, R.R., et al., Appl. Phys. Letters 90 (2007) 183516.

[7]. Jump up"SunPower e20 Module".

[8]. Jump up"HIT® Photovoltaic Module" (PDF). Sanyo / Panasonic. Retrieved 25 November 2016.

[9]. Jump up"Improving the efficiency of solar panels". The Hindu. 24 October 2013. Retrieved24 October 2013.

[10]. Jump up"Micro Inverters for Residential Solar Arrays". Retrieved 2015-09-29.

[11]. Jump upwww.cell-to-module.com

[12]. Jump upPhotovoltaics Report, Fraunhofer ISE, 28 July 2014, pages 18,19 Jump up[1]