

A Review Paper on Automatic Sun Tracking System Using on Application of Robotic System

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Abstract—In this paper we will discuss about the Automatic sun tracking system which we will implement on metal detection robotic system, where robotic spontaneous sun tracing system is a hybrid hardware/software prototype, which automatically furnish best positioning of panel with the sunlight to get maximal electric charge generation through solar panel. It's active sensors continuously observed the monochromatic rays of sun and spin the panel about the direction where the potential of sun rays is maximal. A micro-controller works on automatic sun tracing device connected with the new solar power transform unit is developed & execute. The automatic sun tracker is executed with a DC motor and a DC Motor controller. The conditions of the hardware subjected to the changes of the environmental conditions. In the new unit of the MAXIMUM POWER POINT is resolved to easy insertion software with a present sweep perspective, with this new perspective the standardization of the transform from solar energy to electric energy at its maximal power point can be develops extra definitive and extra authentication.

Keywords—Metal detection, MPP, Solar powered, Solar panel, microcontroller, ASTS.

1. Introduction

Automatic Sun Tracing System is a hybrid hardware/software prototype, which automatically anticipate with well positioning of solar panel to the sun, to get maximal outcome (electricity). And the specific characteristics of the system which is in place of taking the earth as its center cited point, and it follows sun as source and guide itself. Its active sensors continuously surveil the sun-light and rotate the panel towards the direction where the potential of sun rays is maximal. The basic functional blocks of this system are 6-sensor, & their action rely on the potency (intensity) of sun rays falling on panel. All sensors (each with different functionality) send their outcomes data to micro-controller AT89C52. Then the micro-controller implement considering task in it's software. As no human made system is so perfect so an unpredictable fault may occur in the any system. That is why a manual control option was also kept in ASTS. While designing this part of control two objectives were kept in mind, the manual control should work efficiently. It should be as user friendly as possible. Standalone system control Unit Computer based control unit.

A micro-controller primarily based automatic solar tracker mixed with the latest photo voltaic power transformation unit is developed and executed. The automated solar tracker is carried out with a DC motor & controller. The photo voltaic power transform unit incorporate with an array of photo voltaic panels a step-up chopper, a single-phase inverter, an AC mains electricity supply and a micro-controller based totally manipulate unit. The originality of this unit is that the switching system of the chopper is no longer solely used for strength transformation however also for most electricity factor (MPP) detection. With the new technique, the modularization of the transformation from photo voltaic energy to electric powered strength at its most strength factor can be made greater compact and extra reliable.

2. Literature Review

The solar panel transform sunlight into DC electricity for charging the cell. This DC electricity is fed to the battery via a solar regulator which ensures the battery is charged properly and not damaged. DC gadget get electric energy instantly from the battery, but AC gadgets require an inverter to transform it into the DC electricity to 240 volt AC Power a photovoltaic (PV) module or solar electric panel is the smallest replaceable unit in a PV array. The module is an integral unit that provides support for a number of PV cells connected electrically and protected from the elements. The electrical outcome of the component dependent on the shape-size and no. of battery, their electrical inter-connection, and at the environment position to which the set is open up externally. Solar electric panels come in all shapes and Sizes, and may be made from different materials. However, the most commonly used module is a 'glass-plate-sandwich' that has 36 PV cells connected in series to produce enough voltage to charge a 12 volt battery. The purpose of the structure is to provide a rigid package and protect the inter-cell connections from the environment Plus (+) and minus (-) connectors are located on the back of the module for inter-connection. The modules may have an individual metal frame or be protected by a rubber gasket and intended for installation in a larger mounting system designed to hold several modules.

Capacitor:- A capacitor essentially consist of two conducting surface separating by a layer of an insulating medium called dielectric. The conducting surface may be in form of either circular or rectangular plates or be of spherical or cylindrical shape. The purpose of a capacitor is to store the electrical energy by electrostatic stress in the dielectric.

PN Junction Diode:- It is a P type region and an N type region formed in the same crystal structure, a PN junction diode is produced.

Some of the conduction electrons near the junction diffuse into the P-type semiconductor from the N-type semi-conductor across the junction combining with the holes. The loss of electron makes the N type semiconductor positively charged and hence the neutralization of the holes. On the other hand makes the P type semiconductor negatively charged. This region where positive & negative charges develop is called depletion region.

Resistors:- Resistors are the electronic components used to control the current passing through the circuit elements having the function of introducing electrical resistance into the circuit. There are 3 basic types:-

1. Fixed Resistor.
2. Rheostat.
3. Potentiometer.

Regulator:-The MC78XX1LM78XX1MC78XXA series of 3-terminal +ve controller are present on the T.O.-220 bundle pack and various fixed outcome voltages, put them to utilitarian in a wide varieties of appsⁿ. If adequate heat sinking is provided, they can deliver over output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

Features

- Output Current up to 1A
- Output Voltages of 5, 6, 8, 9, 10, 12, 15, 18, 24V
- Thermal Overload Protection
- Short Circuit Protection
- Output Transistor Safe Operating Area Protection

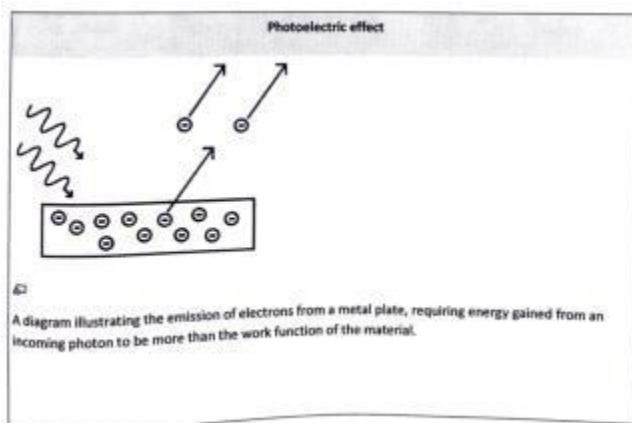
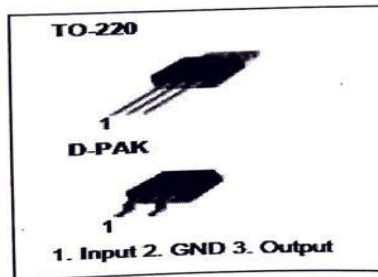


Fig.1 Photoelectric Effect

Sensor:- The sensor used to detect the light from LED is photo-resistor & light depending on cadmium-sulphide (Cds) cell is a resistor whose resistance decreases with maximising of the incident rays of sun light potency. It can also be referred to as a photo-conductor.

Capacitor:- A capacitor essentially consists of two conducting surfaces separated by a layer of an insulating medium called dielectric. The conducting surface may be in the form of either circular or rectangular plates or be of spherical or cylindrical shape. The purpose of a capacitor is to store the electrical energy by electrostatic stress in the dielectric.

Diodes:- PN Junction diodes- It is a P-type region and an N-type region formed in the same crystal structure, a PN junction Diode is produced.

An ideal diode is one which behaves as a perfect conductor when forward biased & as a perfect insulator when reverse biased. Obviously in such a hypothetical situation forward resistance equal to zero & potential barrier voltage is considered negligible.

Resistor:- Resistors are the electronic components used to control the current passing through the circuit elements having the function of introducing electrical resistance into the circuit. There are 3 basic types:

1. Fixed Resistor.
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CARBON COMPOSITE RESISTORS:- Molded fixed composition resistors are limited for general purpose use in electronic equipment. These are able to withstand configuration, have very low inductance and capacitance, can tolerate rough handling installation & are inexpensive.

CHARACTERISTICS OF COMPOSITE TYPE RESISTOR:-

1. Inexpensive and small in size.
2. Reliability is good.
3. Stable.
4. Voltage coefficient is appreciable and high frequency characteristics are satisfactory.
5. Temperature coefficient is large.

Stepper Motor:- There are many kinds of stepper motor available like, Unipolar type, bi-polar type, single phase type, multi-phase type. Generally single phase is used for watch.

The operation occurs in 2-Phase unipolar type stepper motor the PERMANENT MAGNET is used for rotor and coils are put on stator. The stepper motor model which has 4-poles in that case of this motor, step angle of the rotor is 90°

As for 4-Poles, THE TOP AND THE BOTTOM AND EITHER SIDE ARE A PAIR. X-COIL and Y-COIL corresponds respectively. The rotor rotational speed and the direction of the turn can be controlled by these aspects of stepper motor.

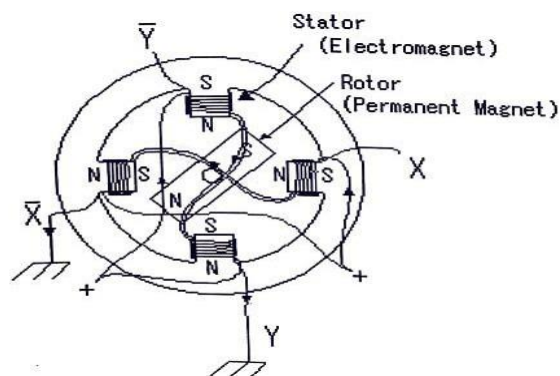


Fig.2 Stepper Motor

LED'S:- LED are known as light emitting diodes, They are used to sense the signal & to give acknowledgement. When this LED didn't received any signal they will not glow, but as soon as system or circuit produce any signal, they will sense by this LED and it will glow to give an acknowledgement that means it has some signal over there.



PCB DESIGN:- Layout of desired circuit diagram and preparation is first and most important operation in any printed circuit board manufacturing process. First of all layout of component side is to be made in accordance with available component dimensions.

The following points are to be observed while forming the layout of PCB:-

- (a). Between the components, sufficient space should be maintained.
- (b). Maximum dissipated components should be mounted at sufficient distance from semiconductor and electrolyte capacitor.
- (c). The most important point is that the component layout is making proper compromise with copper side circuit layout.

3. Research Issue

Problem Identification:-

Automatic sun tracking system faces problem at the winter and rainy season, which is very much difficult for the supply of power to robotic system because in rainy and winter season sun light usually not available for the generation of electricity to run robotic system.

Solution to the problem:-

Above mentioned problem will solved by using the automatic suntracking system. In this system the energy is utilized in more efficiently manner because the system is highly sophisticated technology with low cost. In rainy and cloudy area our system detect the sunlight from the direction where the intensity is high thru sensors and convert it into electrical energy which is further run our robotic system for doing useful work for certain research and analysis.

4. Methodology & Implementation

The outcome of solar battery dependent on potency of sun monochromatic rays and the incoming light rays from sun, called incident light. It results to get higher proficiency, the panel must remain in front of sun during day time. But due to rotation of earth those panels can't sustain their position always in front of sun. This problem results in minimizes of the work efficiency. Thus to get a constant output, an automated system is required which should be capable of constantly rotate the solar panel.

The specific features of this arrangement is that in place of taking place the earth as it's center cited point. It follows sun source as to get guidance for the moving of panel set. It's occupied sensors continually detect the sun rays and rotate the panel as to the direction where the potential photon of sunlight is extreme. In case if the sun gets unapparent e.g; in dark weather, Then without tracking the sun the ASTS keeps rotating the solar panel in opposite direction to the rotation of earth. And when the sun again gets visible, the solar panel will come exactly in front of sun.

Equipment Required:-

PCB Board, micro-controller, LED, stepper motor, 12volt battery, solder kit.

5. Result & Analysis

The sun tracking solar circuit has been implemented using a simple transistor, microcontroller, resistor, diode, buzzer, switch & a stepper motor. The implementation of this simple circuit is very much helpful and efficient for the generation of electricity and run the robotic device in open area where sun light directly falls on the panel.

There are various hypothetical and real life application of automatic sun tracking system takes place are:-

- (a). Solar energy are using in home appliances in wide range, solar cooker, solar heater etc.
- (b). In satellite communication various satellite vehicles are driven by energy produced by solar panel.
- (c). Electricity produced by solar panel in rural and distant areas where usual methods of generation of electricity is very difficult.

6. Conclusion

CONCLUSION AND FUTURE DIRECTIONS:-

ASTS will be very efficient and effective for the running of robotic system for the work area in open atmosphere where sun rays directly falls. Solar energy is renewable or non-conventional source of energy, which is in enormous amount and it is future of our energy need. And ASTS will be the perfect example of the application.

Following are the future scope for the ASTS:-

- (a). Formation of electrical energy from solar energy basic designed circuit will be further studied.
- (b). Application of solar panel can be enhanced from simple solar cooker to space shuttle.
- (c). Thus the solar energy can be used to drive DC driven as well as AC devices by the use of inverter.

References

1. <http://www.8051projects.info/threads/solar-tracking-system-at-89c2051.5/page-6>.
2. <https://electrosome.com/powersupply-design-5v-7805-voltage-regulator/>
3. Non Conventional energy sources by G.D Rai.
4. www.ijettjournal.org/volume4/issue-9/IJETT-V4I9P203.pdf
5. www.ijser.org/researchpaper%5CSun-Tracking-System-with-Microcontroller.
6. F. Huang, D. Tien, J. Or. "A microcontroller based automatic sun tracker combined with a new solar energy conversion unit", 1998 International Conference on Power Electronic Drives and Energy Systems for Industrial Growth, 1998. Proceedings., 1998
7. Murad Shibli. "chapter 19 Solar Photovoltaic Servo Tracking Controlled System", IGI Global, 2014
8. Christopher, I. William, R. Ramesh, and C. Saravanan. "Low cost automatic solar energy trapping system", 2011 1st International Conference on Electrical Energy Systems, 2011.
9. M. Al-Enezi, E. Al-Qattan, S. E. Esmaeili. "The Design of a Sun Chaser Robot Prototype", 2017 9th IEEE-GCC Conference and Exhibition (GCCCE), 2017
10. J. Kihedu, C.Z.M. Kimambo. "Solar Battery Charging Stations for Rural Electrification: The Case of Uzi Island in Zanzibar", Elsevier BV, 2006
11. Ping Wang. "Physical Sensors and Measurement", Advanced Topics in Science and Technology in China, 2011
12. Low Kok Hau, Gowrishankar Kasilingam, K.Nithiyannan. "Development of Prototype model for Wireless based Controlled Pick and Place Robotic Vehicle", TELKOMNIKA Indonesian Journal of Electrical Engineering, 2015
13. Vineet Saini, Lovdeep Sahota, V.K Jain, G.N. Tiwari. "Performance and cost analysis of a modified built-in-passive condenser and semitransparent photovoltaic module integrated passive solar distillation system", Journal of energy storage 2019.
14. F. Huang, G. Zhimin, T. Forughian, D. Tien. "A new microcontroller based solar energy conversion modular unit", Proceedings of Power Conversion Conference - PCC '97, 1997
15. Ronald F. DeMara, Soheil Salehi. "Workshop on Virtualized Active Learning in STEM", 2019 IEEE Frontiers in Education Conference (FIE), 2019
16. Yogesh Murthy.N .. "A REVIEW ON POWER ELECTRONICS APPLICATION ON WIND TURBINES", International Journal of Research in Engineering and Technology, 2013.
17. Graham Bishop. "Linear Electronic Circuits and Systems", Springer Science and Business Media LLC, 1983

18. Sougata Das, Nilava Debabhuti, Rishabh Das, Sayantan Dutta, Apurba Ghosh. "Embedded system for home automation using SMS", 2014 First International Conference on Automation, Control, Energy and Systems (ACES), 2014
19. Hanwei Wang, Cheng Zhang, Yun Yang, Rebecca Hui Wen Liang, S. Y. Hui. "A Comparative Study on Overall Efficiency of 2-Dimensional Wireless Power Transfer Systems Using Rotational and Directional Methods", IEEE Transactions on Industrial Electronics, 2021.
20. Rolf E. Hummel. "Chapter 8 Semiconductors", Springer Science and Business Media LLC, 2001.