SINGLE AXIS SOLAR TRACKING SYSTEM USING ARDUINO

[1]Sattik Halder, [2]Akash Sharma, [3]Ruchika Doda
[1,2]Student, [3]Assistant Professor
Department of Electronics and Communication Engineering
Mahavir Swami Institute of Technology, Sonipat, India

Abstract: This project discusses on the development of horizontal single axis solar tracker using Arduino UNO which is cheaper, less complex and can still achieved the required efficiency. For the development of horizontal single axis solar tracking system, five light dependent resistors (LDR) has been used for sunlight detection and to capture the maximum light intensity. A servo motor is used to rotate the solar panel to the maximum light source sensing by the light dependent resistor (LDR) in order to increase the efficiency of the solar panel and generate the maximum energy. The efficiency of the system has been tested and compared with the static solar panel on several time intervals. A small prototype of horizontal single axis solar tracking system will be constructed to implement the design methodology presented here. As a result of solar tracking system, solar panel will generate more power, voltage, current value and higher efficiency.

1. INTRODUCTION

In this day, renewable resource is one of the major concerns because of increasing more power demand but the quality and availability of conventional energy sources are not enough. Energy is essential factor for the development of any nations of all over the world. Most of the energy production depends on fossil fuel. The resources of the fossil fuels are limited, so that there are growing demand for energy from renewable resources like solar, geothermal and ocean tidal wave. Among all renewable systems, photovoltaic system is the one which has great chance to replace the conventional energy resources. To enhance the performance of solar panel the only way is to increase the intensity of light falling on it. Solar tracker is the best technology to increase the efficiency of solar panel by keeping panel aligned with the suns position. The advantage of using solar power for small power generation is its probability; it can be carried whenever or wherever small power generation is required. Deployment Models

In this research, a microcontroller based simple and easily programmed automatic solar tracker is presented. Design and construction of a prototype for solar tracking system detected the sunlight using Light dependent Resistors (LDR), is discussed in this work. The control circuit for the solar tracking system is based on Arduino Uno. This is programmed to detect the sunlight through the LDRs and then actuate the stepper motor to position the solar panel where it receives maximum sunlight. Compared with any other type of motor, the stepper motor is more controllable, more energy efficient, steadier and having high tracking accuracy and suffering little environmental effect. In this paper, there are mainly five sections to implement this control system. The purposes of this research are to develop a tracking system that control and monitor the movement of solar panel based on the intensity of the light, to measure output voltage, current and power, P=IV and to compare the efficiency increase of a solar system between fixed solar system and solar tracking system.

2. BLOCK DIAGRAM

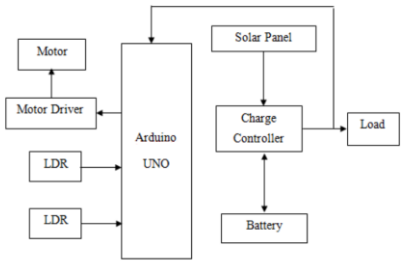


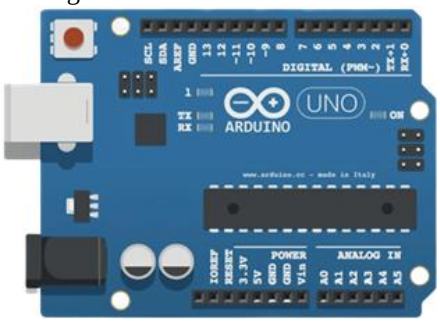
Figure 1. Block diagram of Solar Tracking System

3. HARDWARE USED

- Arduino UNO
- Voltage Regulator (7805)
- 2 IR Sensor with LDR
- Solar Plates
- 10 RPM Gear Motor
- L298N Motor Driver
- 9 Volt Battery
- LED's
- Switches

3.1. MICROCONTROLLER

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog



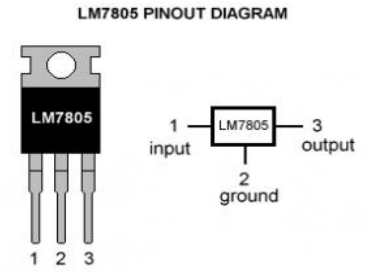
Input/output pins that may be interfaced to various expansion boards and other circuits.

It has 14 digital input/output pins (of which 6 can be used as

PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

3.2. VOLTAGE REGULATOR (7805)

A voltage regulator IC maintains the output voltage at a constant value. 7805 IC, a member of 78xx series of fixed linear voltage regulators used to maintain such fluctuations, is a popular voltage regulator integrated circuit (IC). The xx in 78xx indicates the output voltage it provides. 7805 IC provides +5 volts regulated power supply with provisions to add a heat sink.



3.3. 2 IR SENSORS WITH LDR

The IR sensors are very effective and give the good coverage. RC- automation will also use the LDR sensor for the exterior night light. It will work as soon as it senses the light and turn off the light. LDR (light dependent resistor) is a light dependent sensor, it detects the light as the retina of a human eye does.

3.4. SOLAR PANEL

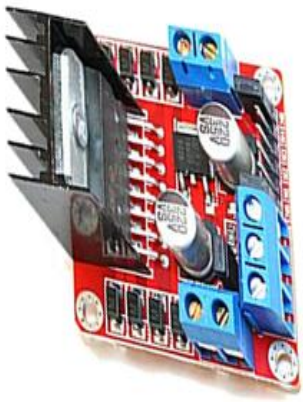
The photovoltaic cell is the basic building block of a photovoltaic system. The individual cells can vary from 0.5 inches to 4 inches across. One cell can however produce only 1 or 2 watts that is not enough for most appliances. Performance of a photovoltaic array depends on sunlight. Climatic conditions like clouds and fog significantly affect the amount of solar energy that is received by the array and therefore its performance. Most of the PV modules are between 10 and 20 percent efficient.

3.5. 10 RPM GEAR MOTOR

A geared motor is a component whose mechanism adjusts the speed of the motor, leading them to operate at a certain speed. geared motor have the ability to deliver high torque at low speeds, as the gearhead functions as a torque multiplier and can allow small motors to generate higher speeds

3.6. L298N MOTOR DRIVER

The L298N is a dual H-Bridge motor driver which allows speed and direction control of two DC motors at the same time. The module can drive DC motors that have voltages between 5 and 35V, with a peak current up to 2A.

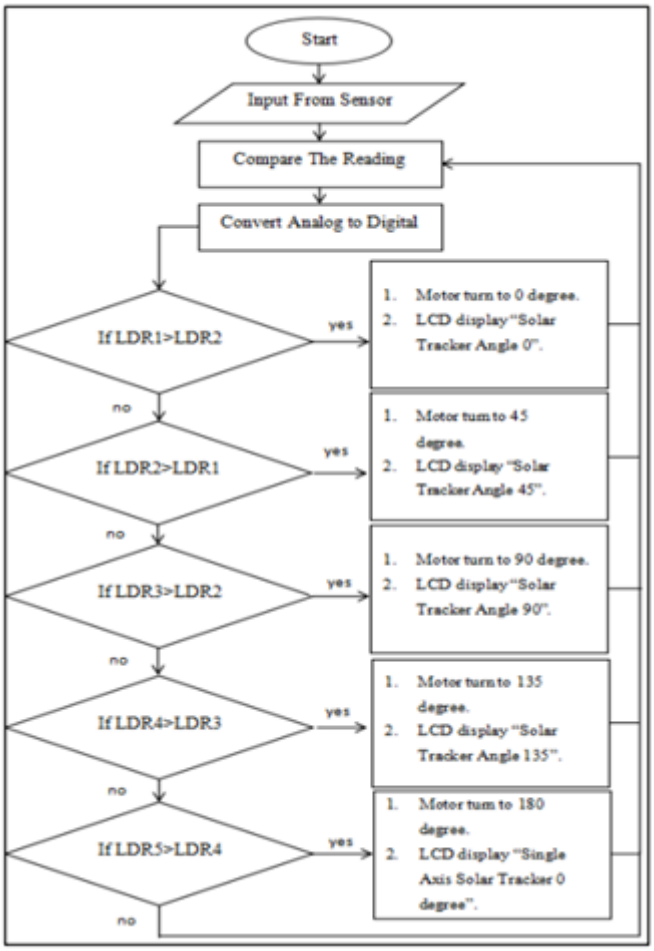


3.7. 9 V BATTERY

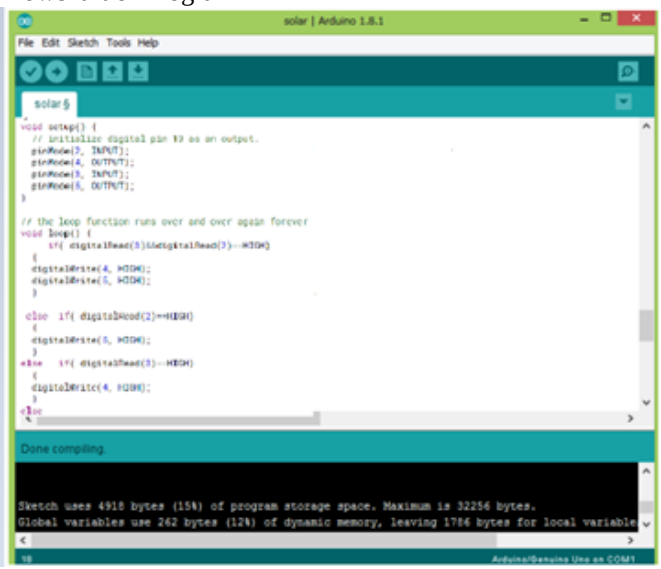
9-volt battery, is a common size of battery that was introduced for the early transistor radios. It has a rectangular prism shape with rounded edges and a polarized snap connector at the top.

4. SOFTWARE IMPLEMENTATION

Firstly the header files, the variable, input and output pins are considered to initialize. Then the dada from LDRs are read. The difference between the two LDR and sensitivity are compared. If the measured difference between the set of sensors is greater than the sensitivity value, the direction pin on Arduino is HIGH.



Flowchart of Program



Compilation Result of Program

8. FUTURE SCOPE

As the proposed prototype is a miniature of main system, it has some limitations which can be mitigated through future developments. A small cardboard is rotated in the system and 12v solar panel is used for analysis. As a miniature system, it works out well. Larger Solar panel must be integrated with the system to prepare better result and cost analysis. It has been proven through our research and statistical analysis that solar tracking system with single-axis freedom can increase energy output by approximately 20%.Further mechanical enhancement can be done to the prototype, to implement dual-axis tracking

REFERENCES

[1] Anne Rosenblatt, Nicole Aaron. 2014. "SOLAR TRACKING SYSTEM', Project Report for Swarthmore College Engineering Department.

[2] Oloka Reagan Otieno, 2009. "SOLAR TRACKER FOR SOLAR PANEL", University Of Nairobi.

[3] Thomas L. Floyd.2007. "Electronic Fundamentals: Circuit, Devices and Application".

[4] S. Armstrong, W.G Hurley. 2009. "Investigating the Effectiveness of Maximum Power Point Tracking for a Solar System", The IEEE Conference on Power Electronics Specialists.

[5] Damm,J. 1990. "An active solar tracking system", Home Brew Magazine, Issue # 17.

[6] Simon Monk. 2011. " Programming Arduino: Getting Started with Sketches".

[7] J.A. Beltran, J.L.S. Gonalez Rubio, C.D. Garcia Beltran. 2007. " Design, Manufacturing and Performance Test of a Solar Tracker Made by Embedded Control, CERMA, Mexico

