SUN TRACKING SOLAR PANEL

A PROJECT BASED LEARNING REPORT

Submitted by

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BONAFIDE CERTIFICATE

Certified that this project report "**SUN TRACKING SOLAR PANEL"** is the bonafide work of **"DHARANIDHARAN RK, INDHIRA KUMAARAN S, JASWANTH T, MOOPANAR SHREERAM B**" who carried out the Project Based Learning work under my supervision.

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TITLE OF CONTENT

ABSTRACT:

Energy crisis is one of the prime issues in the developing country like India. There is an enormous gap between generation and demand of electrical energy. Renewable energy is the only answer to solve this issue.

Solar energy is one of the most effective resources of the renewable energy which could play a significant role to solve this crisis.

This research presents a performance analysis of the dual axis solar tracking system using Arduino. The main objective of this research is whether a static solar panel is better than solar tracker or not.

This work is divided into two parts hardware and software system. In hardware part, four light dependent resistors (LDR) are used to detect the utmost light source from the sun. Two servo motors conjointly used to move the solar panel to maximum light source location perceived by the LDRs.

In software part, the code is written by using C programming language and has targeted to the Arduino UNO controller.

The outcome of the solar tracker system has analyzed and compared with the fixed or static solar panel found b Therefore, the solar tracker is proved more practical for capturing the maximum sunlight supply for star harvesting applications.

The result showed dualaxis solar tracking system produced extra power compared with fixed and single axis solar tracking system. Better performance in terms of voltage, current and power.

CHAPTER 1

INTRODUCTION

Solar energy is emerged as a possible source of renewable energy over the past two to three decades. This solar energy is converted into electrical energy by using solar panel according to the principle of photovoltaic effect. Out of various renewable energy sources solar energy is widely used. Because it is simple and it is easy to use in household too. Solar Trackers is a device used for the rotation of solar panel according to the sun's rays. To utilize this renewable solar energy solar trackers are employed. For static solar panel, there is no movement in the panel. But the position of the sun changes during rising and setting (sun rises in the east and sets in the west). Due to this reason, single axis solar tracker is developed for rotation of solar panel in east and west direction. But due to the rotation and revolution of earth we cannot get equal amount of sunrays throughout the year. So, that the dual axis solar tracker is developed to utilize the solar energy effectively and efficiently by rotating the panel in both horizontal and vertical direction. The main objective of dual axis solar tracker is to increase the efficiency of the solar panel by 30-45% when compared to the static and single axis solar tracker. The literature survey clearly shows the different methods of solar tracking for maximum utilization of solar power.

The single axis tracker is able to rotate only on horizontal (or) vertical. But this dual axis tracker is able to rotate on both horizontal and vertical movement. This dual axis solar tracker was implemented by using Arduino board. Low cost of implementation by Arduino is the reason behind choosing Arduino in this project.

CHAPTER 2

2.1 Introduction to Arduino UNO:

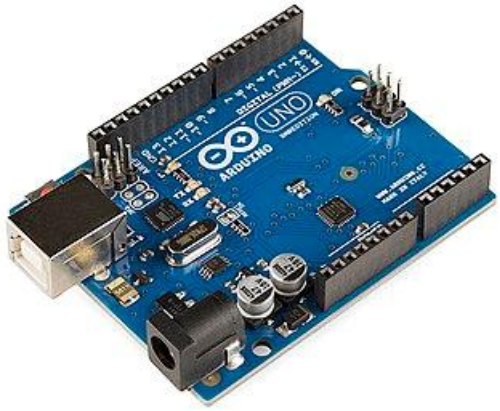

Fig.1.Arduino UNO

The Arduino Uno is a type of Arduino board that is provided as an open-source board that uses an ATmega328p microcontroller in the board. The Arduino Uno contains a set of analog and digital pins that are input and output pins which are used to connect the board to other components. There are a total of fourteen I/O pins placed inboard in which six are analog input pins. The board has a USB connection that can be used to a power supply to the board. The board is used for electronics projects and used to design the circuit.

The Arduino UNO is categorized as a microcontroller that uses the ATmega328 as a controller in it. The Arduino UNO board is used for an electronics project and mostly preferred by the beginners. The Arduino UNO board I type of Arduino board only. The Arduino board is the most used board of all Arduino boards. The board contains 14 digital input/ output pins in which 6 are analog input pin, one power jack, USB connector, one reset button, ICSP header, and other components. All these components are attached in the Arduino UNO board to make it functioning and can be used in the project. The board is charged by USB port or can be directly charged by the DC supply to the board.

2.2 Pin Configuration of Arduino UNO:

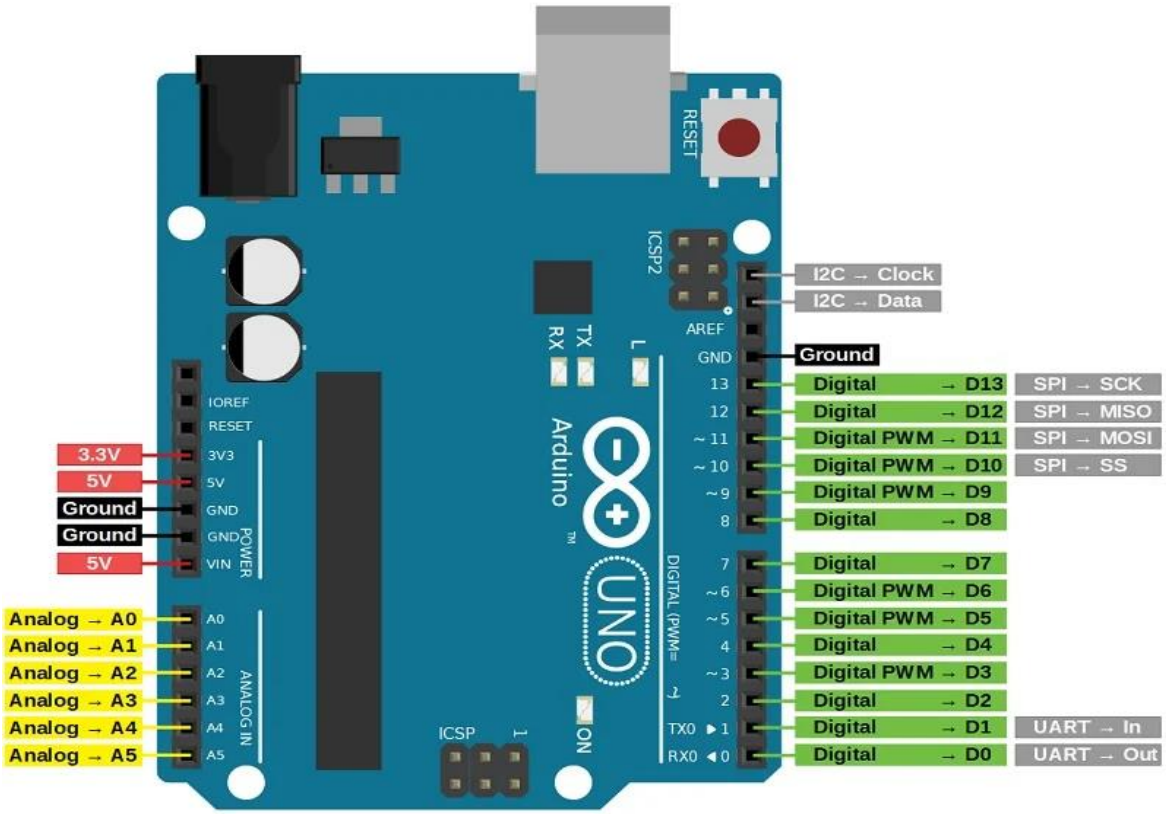

Fig.2.PIN CONFIGURATION OF ARDUINO UNO

Vin: This is the input voltage pin of the Arduino board used to provide input supply from an external power source.

5V: This pin of the Arduino board is used as a regulated power supply voltage and it is used to give supply to the board as well as onboard components.

3.3V: This pin of the board is used to provide a supply of 3.3V which is generated from a voltage regulator on the board

GND: This pin of the board is used to ground the Arduino board.

Reset: This pin of the board is used to reset the microcontroller. It is used to Resets the microcontroller.

Analog Pins: The pins A0 to A5 are used as an analog input and it is in the range of 0-5V.

Digital Pins: The pins 0 to 13 are used as a digital input or output for the Arduino board.

Serial Pins: These pins are also known as a UART pin. It is used for communication between the Arduino board and a computer or other devices. The transmitter pin number 1 and receiver pin number 0 is used to transmit and receive the data respectively.

External Interrupt Pins: This pin of the Arduino board is used to produce the External interrupt and it is done by pin numbers 2 and 3.

PWM Pins: This pins of the board is used to convert the digital signal into an analog by varying the width of the Pulse. The pin numbers 3, 5, 6,9,10 and 11 are used as a PWM pin.

SPI Pins: This is the Serial Peripheral Interface pin, it is used to maintain SPI communication with the help of the SPI library. SPI pins include:

1. SS: Pin number 10 is used as a Slave Select
2. MOSI: Pin number 11 is used as a Master Out Slave In
3. MISO: Pin number 12 is used as a Master In Slave Out
4. SCK: Pin number 13 is used as a Serial Clock

LED Pin: The board has an inbuilt LED using digital pin-13. The LED glows only when the digital pin becomes high.

AREF Pin: This is an analog reference pin of the Arduino board. It is used to provide a reference voltage from an external power supply.

CHAPTER 3

3.1 Introduction to servo motor - SG90

Fig.3.SERVO MOTOR

Motors are high torque motors which are commonly used in robotics and several other applications due to the fact that it's easy to control their rotation. Servo motors have a geared output shaft which can be electrically controlled to turn one (1) degree at a time. For the sake of control, unlike normal DC motors, servo motors usually have an additional pin asides the two power pins (Vcc and GND) which is the signal pin. The signal pin is used to control the servo motor, turning its shaft to any desired angle.

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3.2 Pin configuration of servo motor

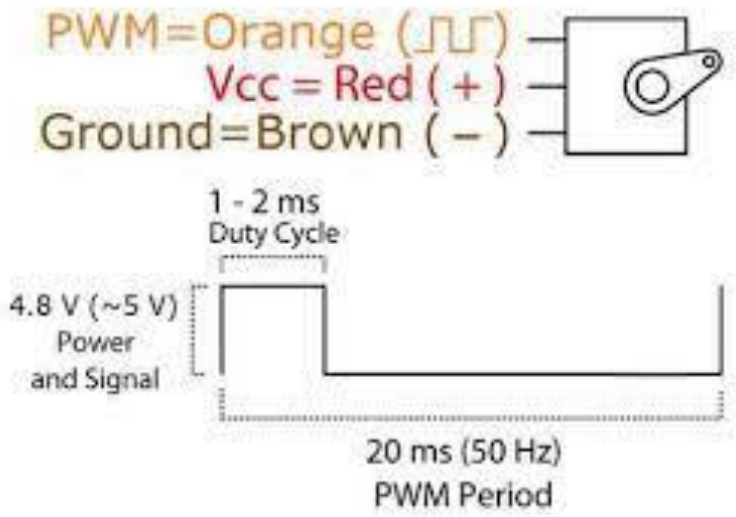

Fig.4.PIN CONFIGURATION OF SERVO MOTOR

The schematic for this project is quite simple as we will be connecting just the servo motor to the Arduino.

Servo motors generally have three pins/wires, this includes the VCC, GND, and the Signal pin. The Signal pin is the one used to feed the control signal from the microcontroller to the servo, to get the servo rotate to a particular angle.

CHAPTER 4

4.1 RESISTER:

Fig.5. Resistor

A **resistor** is passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses. High-power resistors that can dissipate many watts of electrical power as heat may be used as part of motor controls, in power distribution systems, or as test loads for generators. Fixed resistors have resistances that only change slightly with temperature, time or operating voltage. Variable resistors can be used to adjust circuit elements (such as a volume control or a lamp dimmer), or as sensing devices for heat, light, humidity, force, or chemical activity.

Resistors are common elements of electrical networks and electronic circuits and are ubiquitous in electronic equipment. Practical resistors as discrete components can be composed of various compounds and forms. Resistors are also implemented within integrated circuits.

The electrical function of a resistor is specified by its resistance: common commercial resistors are manufactured over a range of more than nine orders of magnitude. The nominal value of the resistance falls within the manufacturing tolerance, indicated on the component.

4.2 LIGHT DEPENDENT RESISTOR :

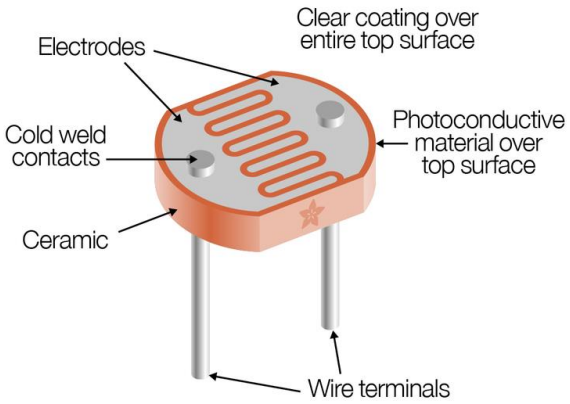

Fig.6. LDR

A **photoresistor** or LDR is a passive component that decreases resistance with respect to receiving luminosity on the component's sensitive surface. The resistance of a photoresistor decreases with increase in incident light intensity; in other words, it exhibits photoconductivity. A photoresistor can be applied in light-sensitive detector circuits and light-activated and dark-activated switching circuits acting as a resistance semiconductor. In the dark, a photoresistor can have a resistance as high as several MΩ, while in the light, a photoresistor can have a resistance as low as a few hundred ohms. If incident light on a photoresistor exceeds a certain frequency, photons absorbed by the semiconductor give bound electron enough energy to jump into the conduction band. The resulting free electrons conduct electricity, thereby lowering resistance. The resistance range and sensitivity of a photoresistor can substantially differ among dissimilar devices. Moreover, unique photoresistor may react substantially differently to photons within certain wavelength bands.

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4.3 BATTERY:

Fig.7. Battery

The **nine-volt battery**, or **9-volt battery**, in its most common form was introduced for the early transistor radios. It has a rectangular prism shape with rounded edges and a polarized snap connector at the top. This type is commonly used in walkie talkies, clocks and smoke detectors.

The nine-volt battery format is commonly available in primary carbon-zinc and alkaline chemistry, in primary lithium iron disulfide, and in rechargeable form in nickel-cadmium, nickel-metal hydride and lithium-ion. Mercury-oxide batteries of this format, once common, have not been manufactured in many years due to their mercury content.

Most nine-volt alkaline batteries are constructed of six individual 1.5V LR61 cells enclosed in a wrapper. Carbon-zinc types are made with six flat cells in a stack, enclosed in a moisture-resistant wrapper to prevent drying. Primary lithium types are made with 3 cells in series.

In 2007, 9-volt batteries accounted for 4% of alkaline primary battery sales in the US. In Switzerland in 2008, 9-volt batteries totalled 2% of primary battery sales and 2% of secondary battery sales.

CHAPTER 5

SUN TRACKING SOLAR PANEL

5.1 Circuit diagram:

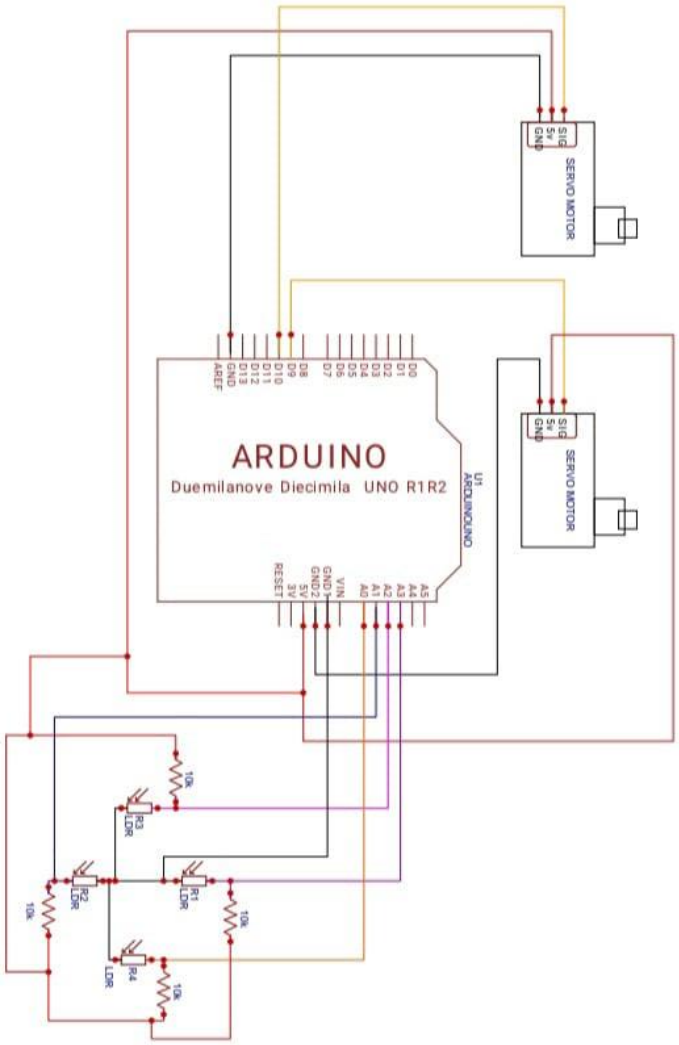

Fig.8. SUN TRACKING SOLAR PANEL

5.2 Operation:

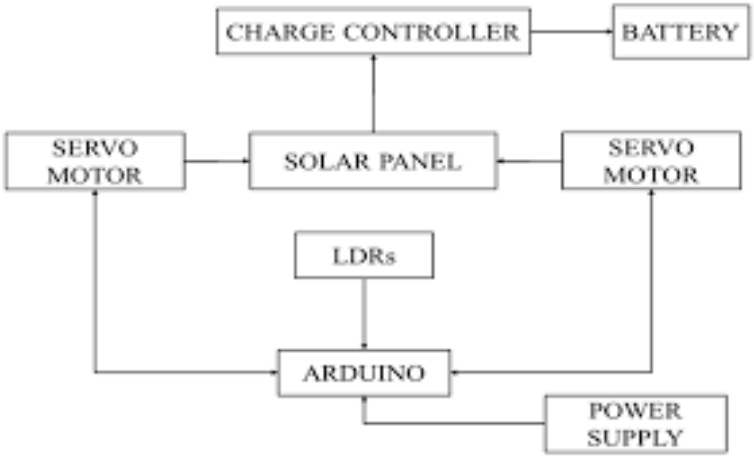

Fig.9. BLOCK DIAGRAM

In this system, four LDRs are fixed to sense the intensity of light this output is given as an input to the Arduino board. The output of the Arduino is given to the servo motor circuit. Two servo motors are used, one for vertical and another one for horizontal movement. The servo motor rotates the solar panel perpendicular to the position of sun's rays... In this project, LDR plays an important role.

CHAPTER 6

CONCLUSION:

The Arduino based dual axis solar tracking based solar panel is designed and successfully implemented to increase the efficiency of solar panel. The proposed dual axis solar tracker is more effective than the existing single axis solar tracker and fixed mount. The proposed solar tracker which automatically tracks the sun to grab maximum solar power with the help of Arduino board was effectively achieved. The implementation cost of Arduino board for tracking solar power is low and it is implementation is simple. Finally, experimental system clearly reveals that proposed system effectively tracks the sun in both good and bad weather conditions. During different time periods in a day compared with the existing system and efficiency of solar panel is effectively improved.

REFERENCE:

https://sustainableveryday.blogspot.com/search/label/DIY%20dual%20axis%20solar%20tracker

APPENDIX: