An IoT Micro Project Report

on

ROTATING SOLAR PANELS FOR MAXIMUM POWER UTILIZATION

Submitted in partial fulfilment of the requirements

for the award of the Degree of BACHELOR OF

ENGINEERING

IN

COMPUTER SCIENCE & ENGINEERING

BY

S.V.N RAMAKANTH

1602-19-733-118

R.V. NIKHIL SAI

1602-19-733-082

Department of Computer Science & Engineering

Vasavi College of Engineering (Autonomous)

(Affiliated to Osmania University)

Ibrahimbagh, Hyderabad-31

2022

Vasavi College of Engineering (Autonomous)

(Affiliated to Osmania University)

Hyderabad-500 031

Department of Computer Science & Engineering

DECLARATION BY THE CANDIDATE

We, **S.V.N RAMAKANTH and R.V. NIKHIL SAI** bearing hall ticket numbers **1602-19-733-118** and **1602-19-733-082** respectively, hereby declare that the project report entitled **"ROTATING SOLAR PANEL FOR MAXIMUM POWER UTILIZATION"** Department of Computer Science & Engineering, VCE, Hyderabad, is submitted in partial fulfilment of the requirement for the award of the degree of **Bachelor of Engineering** in **Computer Science & Engineering**.

This is a record of bonafide work carried out by us and the results embodied in this project report has not been submitted to any other university or institute for the award of any other degree or diploma.

SVN. RAMAKANTH

1602-19-733-118

R.V. NIKHIL SAI

1602-19-733-082

Vasavi College of Engineering (Autonomous)

(Affiliated to Osmania University)

Hyderabad-500 031

Department of Computer Science & Engineering

BONAFIDE CERTIFICATE

This is to certify that the project entitled **“ROTATING SOLAR PANEL FOR MAXIMUM POWER UTILIZATION”** being submitted by **S.V.N RAMAKANTH** and **R.V.NIKHIL** bearing hall ticket numbers **1602-19-733-082** and **1602-19-733-118** respectively, in partial fulfilment of the requirements for the award of the degree of Bachelor of Engineering in Computer Science & Engineering is a record of bonafide work carried out by him/her under my guidance.

S.VINAY KUMAR

Assistant Professor

Dept. of CSE

ACKNOWLEDGEMENT

With immense pleasure, we record our deep sense of gratitude to our guide , Mr. P. S.VINAY KUMAR, Assistant Professor, Vasavi College of Engineering, Hyderabad, for the valuable guidance and suggestions, keen interest, and thorough thoroughness encouragement extended throughout the period of the project work. We consider ourselves lucky enough to be part of this project. This project would add as an asset to our academic profile.

We express our thanks to all those who contributed to our project work's successful completion.

ABSTRACT

Solar panel has been used increasingly in recent years to convert solar energy to electrical energy. The solar panel can be used either as a stand-alone system or as a large solar system that is connected to the electricity grids. The earth receives 84 Terawatts of power and our world consumes about 12 Terawatts of power per day. We are trying to consume more energy from the sun using solar panel. In order to maximize the conversion from solar to electrical energy, the solar panels have to be positioned perpendicular to the sun. Thus the tracking of the sun's location and positioning of the solar panel are important. The goal of this project is to design an automatic tracking system, which can locate position of the sun. The tracking system will move the solar panel so that it is positioned perpendicular to the sun for maximum energy conversion at all time. Photoresistors will be used as sensors in this system. The system will consist of light sensing system, microcontroller, gear motor system, and a solar panel. Our system will output up to 40% more energy than solar panels without tracking systems.

TABLE OF CONTENTS

1.LIST OF FIGURES

2. INTRODUCTION

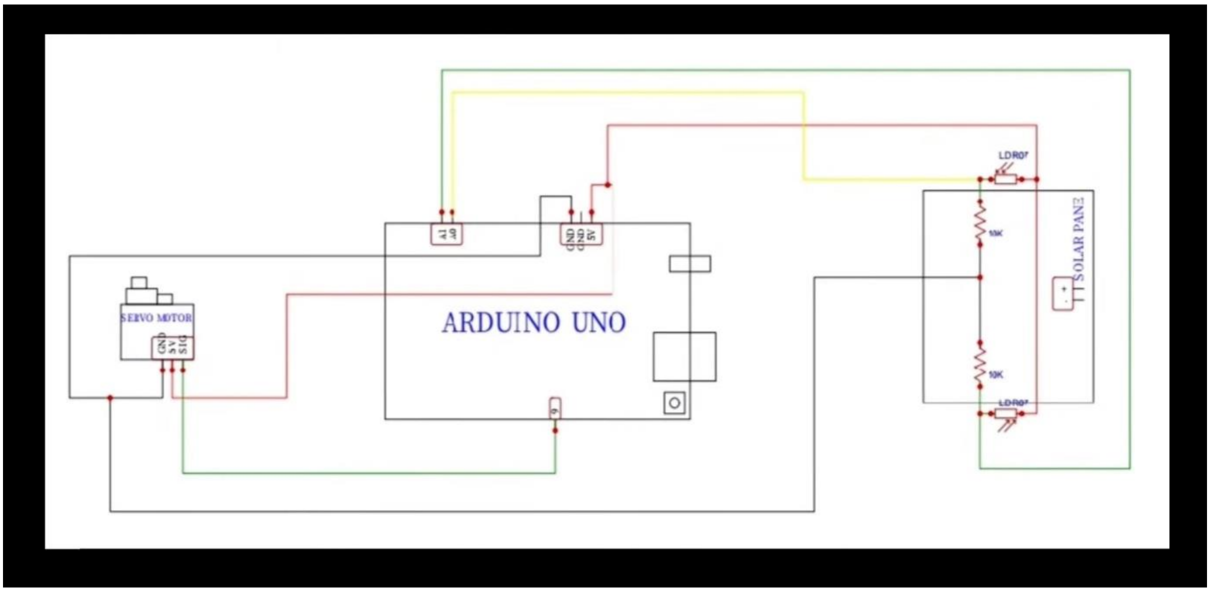
The main objective of this project is to track the sun and rotate the solar panel accordingly, to fully receive sunlight always during the daytime. This movement is achieved by interfacing a servo motor to the solar panel that changes its direction according to the positioning of the sun. This is achieved using LDR sensors that detect the amount of light being received and based on the reading of the LDR sensors the servo motor makes the solar panel rotate to the direction receiving maximum sunlight to generate maximum power which is stored in batteries and for future use. The main objective of this project is to harness the maximum amount of sunlight from the sun and convert it to electricity so that it can be easily used and transferred. This is done by aligning the solar panel perpendicular to sun rays to convert maximum sunlight into electrical form. The advantage of this project is to provide access to everlasting and pollution-free energy. This project can be used in form of decentralized generation.

2.1 OVERVIEW

Today's world has increasing demands for energy by the day, which is against the continuous reduction in existing resources of fossil fuels and ever-growing concern regarding environmental pollution which has pushed mankind to explore new technologies to produce electrical energy. A prominent non-conventional renewable source of energy is solar energy which provides a great prospect for conversion into electrical power, which in turn ensures an important part of the electrical needs of the planet.

CIRCUIT DIAGRAM:

The setup consists of 2 LDR sensors mounted onto 2 opposite free sides of the solar panel. This panel is now attached to the servo motor. The code is written into Arduino and the necessary connections are made for the prototype to work properly. The servo motor is mounted on a support that is connected vertically to the MDF board for support. The system is then activated when power is sent to it.



COMPONENTS USED:

1. **ARDUINO UNO**

   The Arduino UNO is a microcontroller board-based chip on the ATmega328P. It has sets of digital input/output pins (of which some can be used as ultrasonic sensor inputs), 6 analog inputs, 14 digital inputs - 4 of which are programmable with Arduino IDE using USB cable. Arduino Uno can be powered using an external power supply which ranges from 7-20 volts. The USB port in the Arduino board is used to connect the board to the computer using the USB cable. The cable acts as a serial port and as the power supply to interface the board. Such dual functioning makes it unique to recommend and easy to use for beginners.

Figure 2.2.2

2. LDR SENSOR

An LDR is a component that has a (variable) resistance that changes with the light intensity that falls upon it. This allows them to be used in light sensing circuits. Light Dependent Resistors (LDR) is also called photoresistors. The light sensor is a passive device that converts this "light energy" whether visible or in the infrared parts of the spectrum into an electrical signal output. Light sensors are more commonly known as "Photoelectric Devices" or "Photo Sensors" because they convert light energy (photons) into electricity (electrons).

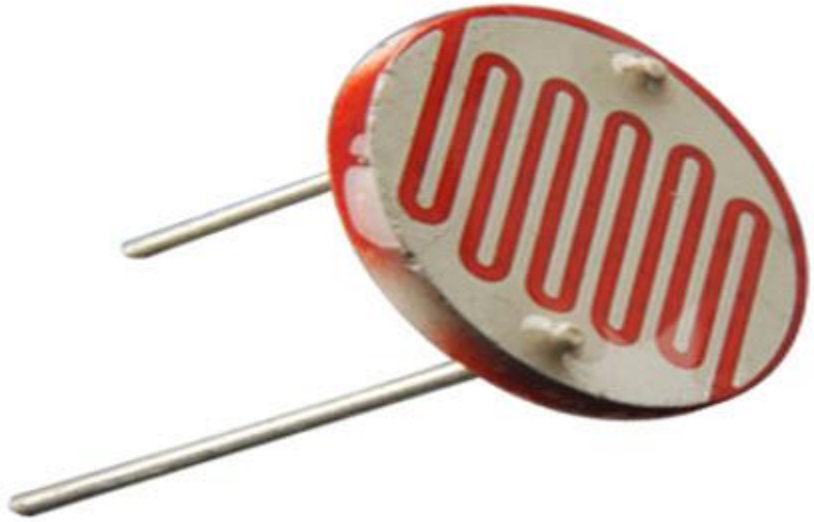


Figure 2.2.3

3. RESISTOR

A resistor is an electrical component that limits or regulates the flow of electrical current in an electronic circuit. Resistors can also be used to provide a specific voltage for an active device such as a transistor. At any instant, the power *P* (watts) consumed by a resistor of resistance *R* (ohms) is calculated as:

P=IV

Here,
P=Power
V=Voltage
I=Current

Figure 2.2.4

4. SERVO MOTOR

A servo motor is a rotary actuator that allows for precise control of the angular position. It consists of a motor coupled to a sensor for position feedback. It also requires a servo drive to complete the system. The drive uses the feedback sensor to precisely control the rotary position of the motor. The servo motor is usually a simple DC motor controlled for specific angular rotation with the help of additional servomechanism (a typical closed-loop feedback control system). Nowadays, servo systems are used widely in industrial applications.

Figure 2.2.5

5. SOLAR PANEL

Solar panels can be used for a wide variety of applications including remote power systems for cabins, telecommunications equipment, remote sensing, and of course to produce electricity by residential and commercial solar electric systems. Solar power is the cheapest source of power, leaving zero carbon footprint on the planet. So, go solar today and save on electricity bills while contributing toward a greener and more sustainable planet. At Luminous, we have a wide range of PV solar panels that are writing the next chapter in technology and setting benchmarks for the industry.

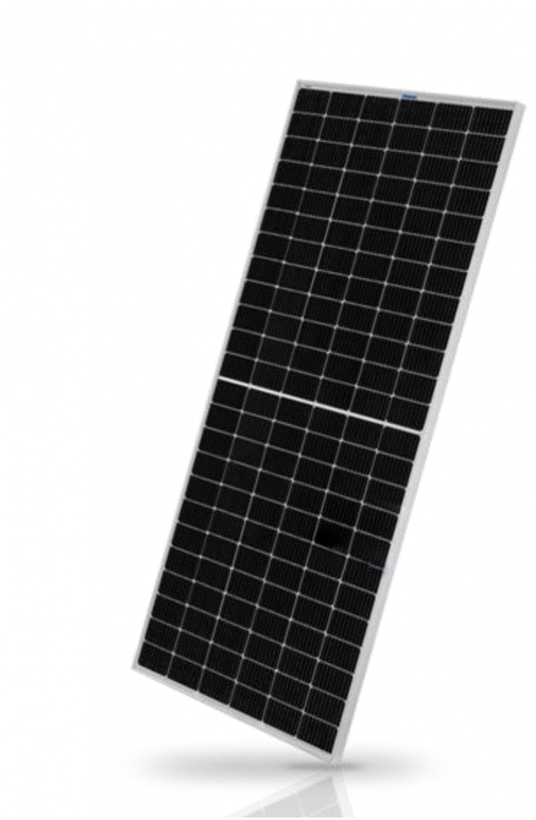


Figure 2.2.6

2.2 PROBLEM STATEMENT

The efficiency of solar cells is just 30%. It is evitable that a lot of power is not properly utilized. When we use grounded solar panels, sensing is done in a static way in which heat from the sun is not utilized to a greater extent. This adds to the inefficient power utilization of solar cells.

For this problem statement, we came up with the concept of solar trackers. They come in handy in this situation. By using single-axis and double-axis solar trackers, efficiency increases to a greater extent. Double-axis solar trackers are quite costly to implement so we use single-axis trackers here. In single-axis solar trackers the panel can move from one direction to the other in a linear fashion.

2.3 WORKING OF SOLAR PANELS

Basic Steps in Solar Energy Generation and Transmission:

- Sunlight hits the solar panels and creates an electric field.
- The electricity generated flows to the edge of the panel, and into a conductive wire.
- The conductive wire brings the electricity to the inverter, where it is transformed from DC electricity to AC, which is used to power buildings.
- Another wire transports the AC electricity from the inverter to the electric panel on the property (also called a breaker box), which distributes the electricity throughout the building as needed.
- Any electricity not needed upon generation flows through the utility meter and into the utility electrical grid. As the electricity flows through the meter, it causes the meter to run backward, crediting your property for excess generation.

3. SYSTEM REQUIREMENTS

Hardware:

- Arduino UNO
- LDR sensor
- Resistor
- Servo Motor

Software:

- Chrome 76.0 or above
- Windows 7 or above

4. IMPLEMENTATION

```
#include <Servo.h>
//including the library of servo motor
Servo myservo;
int initial_position = 90;
int LDR1 = A0;
//connect The LDR1 on Pin A0

int LDR2 = A1;
 //Connect The LDR2 on pin A1

int error = 5;
int servopin=9;
//You can change servo just make sure its on Arduino's PWM pin

void setup()
{
  myservo.attach(servopin);
  pinMode(LDR1, INPUT);
  pinMode(LDR2, INPUT);
  myservo.write(initial_position);
  //Move servo at 90 degree
  delay(2000);
}

void loop()
{
  int R1 = analogRead(LDR1);
  // read  LDR 1
  int R2 = analogRead(LDR2);
  // read  LDR 2
  int diff1= abs(R1 - R2);
  int diff2= abs(R2 - R1);
```

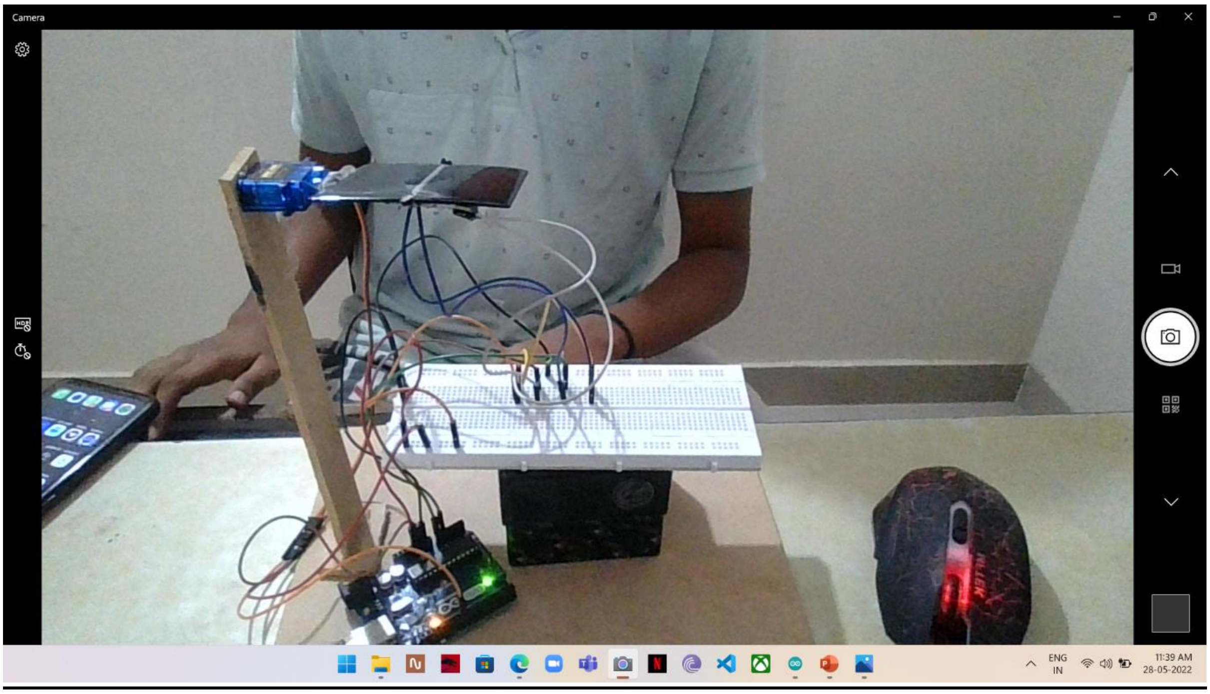
```
 if((diff1 <= error) || (diff2 <= error))
 {
 }
 else {
   if(R1 > R2)
   {
   initial_position = --initial_position;
   }
   if(R1 < R2)
   {
     initial_position = ++initial_position;
   }
 }

  myservo.write(initial_position);
  delay(100);
}
}
```

OUTPUT:

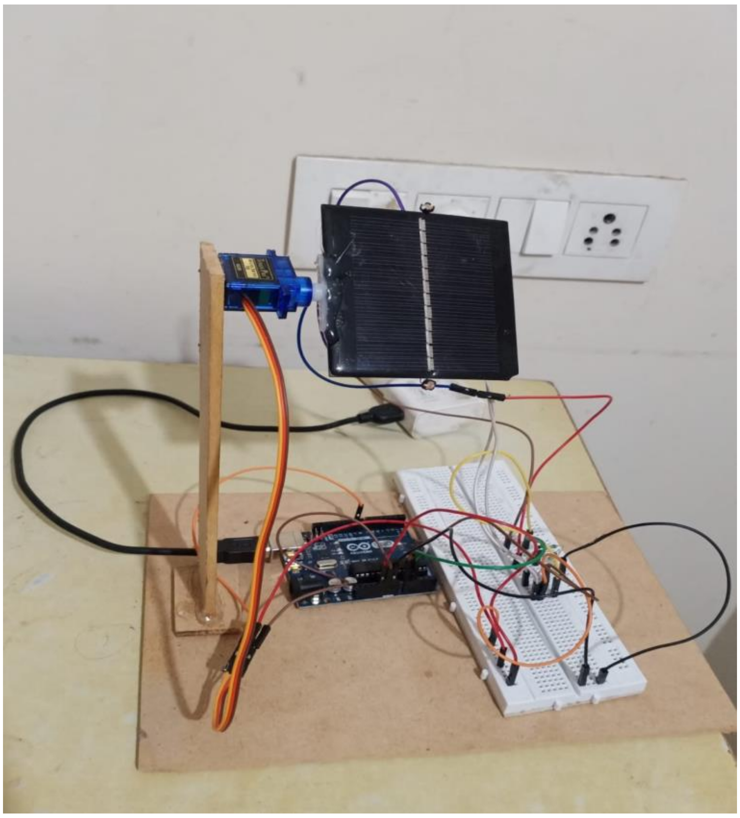
When the difference in intensity levels sensed by the LDRs is greater than a particular threshold/error (50 in this case), the rotation of the panel takes place in the same direction. Practically, the intensity value of the sun outdoors can be calculated experimentally and can be configured to work for those conditions. In the absence of sun, the intensity difference between the LDRs is lesser than the error hence panel doesn’t rotate. This is the way Solar Tracker works. This can be used in commercial spaces by replacing LDRs with efficient photovoltaic and photo detective cells

OUTPUT SCREENSHOTS:

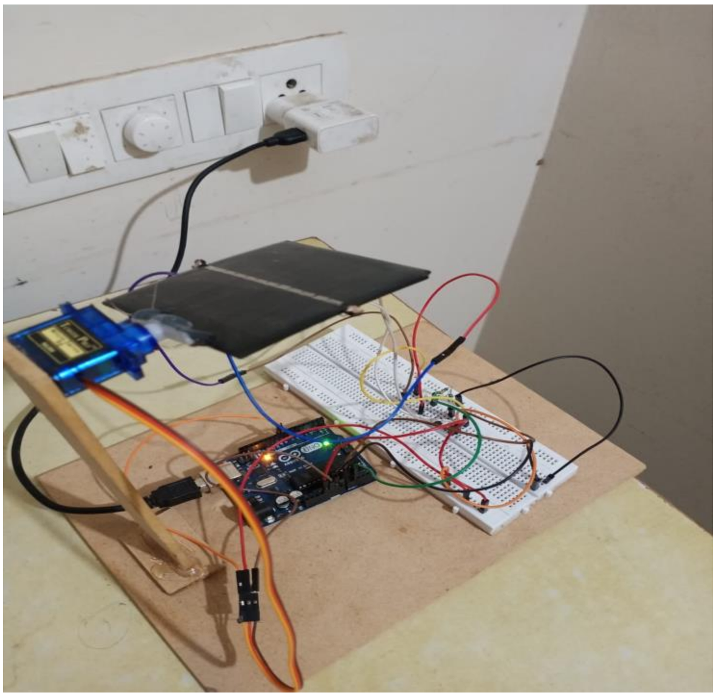
Live demo



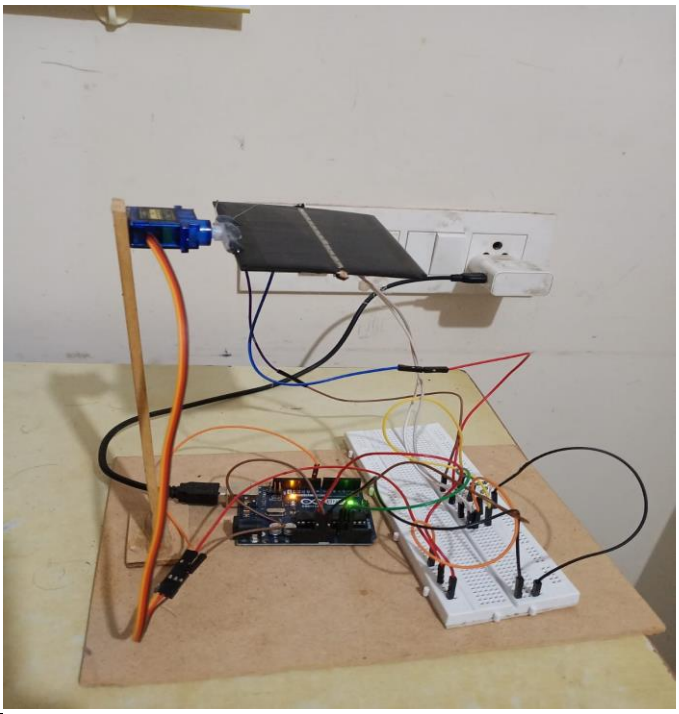
Panel Towards East



Panel Towards West



Panel When No sun



6. CONCLUSION AND FUTURE WORK

The main aim of this project is to increase the efficiency of solar power and increase the use of renewable energy as much as possible. The innovative designs in sun-tracking systems have enabled the development of many solar thermal and photovoltaic systems for a diverse variety of applications in recent years compared to the traditional fixed panels. Solar systems which track the changes in the sun’s trajectory over the day collect a far greater amount of solar energy, and therefore generate a significantly higher output power. We would like to scale this project so that this can reach every person in the future. In the future, the present paper details will be useful in selecting an accurate tracker concerning the region, available space, and estimated cost. The present work may be useful to improve the design characteristics of different types of solar tracking systems to improve performance.

7. REFERENCES

- **https://docs.arduino.cc/hardware/uno-rev3/**
- **https://en.wikipedia.org/wiki/Solar_tracker**
- **https://www.goodenergy.co.uk/how-do-solar-panels-work/**
- **Servo Motors and Control with Arduino Platforms | DigiKey**