DUAL AXIS SOLAR TRACKING SYSTEM

A PROJECT REPORT

Submitted by

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SAMAYAPURAM – 621 112

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BONAFIDE CERTIFICATE

Certified that this project report titled **"DUAL AXIS SOLAR TRACKING SYSTEM "** is the bonafide work of SANTHOSH KUMAR A (811721104039), SHEIK ABDULLAH J (811721105040), SHYAM A (811721105042), VIKASH G (811721105054)**,** who carried out the project under my supervision. Certified further, that to the best of my knowledge the work reported herein does not form part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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INTERNAL EXAMINER

EXTERNAL EXAMINER

DECLARATION

We jointly declare that the project report on **"DUAL AXIS SOLAR TRACKING SYSTEM"** is the result of original work done by us and best of our knowledge, similar work has not been submitted to **"ANNA UNIVERSITY CHENNAI"** for the requirement of Degree of **BACHELOR OF ENGINEERING**. This project report is submitted on the partial fulfillment of the requirement of the award of Degree of **BACHELOR OF ENGINEERING**.

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SHYAM A

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VIKASH G

Place: Samayapuram
Date:

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ABSTRACT

This Project presents a performance analysis of the dual axis solar tracking system using Arduino.The main objective of this Project 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, two light dependent resistors and (LDR) is used to detect the utmost light source from the sun.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ABBREVIATIONS

- **LDR. - Light dependent resistor**
- **Motor driver L298n theory**
- **Arduino uno**

CHAPTER 1

INTRODUCTION

1.1 THE CURRENT SITUATION

Bustling civilization is the vein through which modern civilization is operated. Energy day by day is put to use at its best to fulfill the desires and ambition of the peoples at large. Each and every corner of our life is caged with various layers of impediment and in this response; energy is becoming an indispensable factor. Therefore, the source of energy needs to be endless/ perpetual in order to carry this colossal population ahead. Human beings being evolutionary in nature are perhaps the best ever creation of nature is always in the race of envisaging the probable and available comforts and benefits in every possible angle in this perilous world. The evidential matrix manifests that in a dichotomy of various opinions what options best expedite the scarcity of energy in an immensely heterogeneous society like ours. Our motto is to Endeavour in forwarding such noble goal of energy conservation. Taking a look at the present scenario it is evident that conventional sources of energy such as coal, natural gas, oil, etc. are at the edge of extinction. Being in mortal combat with time itself to fulfill every demand for energy the demand for these resources for energy has escalated to its zenith. The conventional use of energies due to the burning of fossil fuels like coal, oil and natural gas, the whole environment is getting polluted.

The present project, therefore, is orchestrated with components like LDR module, DC Motor, Photovoltaic array etc. according to which while the functioning of, unlike other use of the conventional energies, would not emit any pollution and in turn act as a reservoir of energy taken from the Sun itself. As adumbrated no other energy is more abundant than solar energy as per as its availability and freeness are concerned, utilization of which, compounded with rest of the fact of its conversion into electrical energy. Historically if counted, in the year 1881 for the first time ever solar panel was invented. Later on, all through the hands of Russell Ohl in the year, 1941 concept of the solar cell was conceived and subsequently workability of a solar panel has also advanced in comparison with the earlier span. Though it is improbable still it is not impossible as per as tracking of the mother energy is concerned in furtherance to which attempt has been taken through this project to confine every drop of energy from being left out. The DC Motor adjacent with the system with the help of LDR module by INTRODUCTION 2 AEIE, RCCIIT measuring the intensity of the sun rays fixed on the upper edge of the solar panel will help the solar panel to revolve around proportionately with the movement of the Sun itself in order to grab and store the

maximum amount of energy as it can. In pursuance of such objectivity, this project comes forth into existence. When heat is the source of every creation, Sun produces the biggest ever energy in this solar system to produce and transcend life from one organism to the other.

In this response, the project called "Automatic Solar Tracking System" serves the purpose of utilizing the maximum amount of energy taken from the Sun and to convert such energy into some other production. The basic Endeavour is crooned to scoop out from this project in making this system an economically convenient subject, accessibility of which is easy and functioning of which is optimum in the end. In the wake of technological advancement when the pace of time is at its best to pass by, this system is a time worthy production, produced to create the best of its kind. In a stretch, it could be signified that this project which is an extension of solar energy, is a renewable source of energy, never-ending phenomena. It's only 10 to 20 per cent of the solar cells that are being used commercially out of which the best potential of the cells gets reflected and therefore scope for better use of the solar cells exist. In the world of pollution, this system is an eco-friendly alternative, hence a valuable asset. When the ocean of pollution is encumbering every corner of life, this system would be able to create ripples of hope in the midst of this bustling civilization. The survivability of this system lies upon its workability. In the trend of comparison with other mind-boggling systems, it could be a trailblazer.

1.2 NECESSITY OF DUAL AXIS SOLAR TRACKING SYSTEM

Solar tracking system can substantially improve the amount of power produced by a system by enhancing morning and afternoon performance. The biggest benefits of solar tracking system is that it offers a boost in electricity production .The use of solar energy can be found in water heating, cooking, refrigeration, power generation, and various industrial applications and can contribute towards energy efficient building. As a renewable source of solar energy has an important role in reducing greenhouse gas emissions and mitigating climate change.

CHAPTER 2

LITERATURE REVIEW

2.1 Hossein mousazadeh et ai.,[(2011),journal of solar energy engineering studied and investigated maximization of collected energy from an board PV array on a solar assist plug in hybrid electric tractor.

The paucity of available resources has forced contemporary society to look for measures to consummate the demands of the latter. With the nurturing civilization, the depletion of conventional fuels, due to human practices has been an alarm to sustainable development issues. The scarcity of energy and its source guided us towards the optimistic approach of using the alternative resources bestowed to humankind–Solar, tidal etc. The Sun has been looked upon as an imperative source of energy. Solar energy is an eco-friendly resource as compared to its counterparts. The advancement of technology has out-turn foster techniques to utilize this energy into its own good use.

Be it as thermal energy, electricity, fuel production and many more. Photovoltaic or concentrated solar power (CSP) systems are operated to transfigure the solar power expropriated by the earth into electricity. Solar tracking device utilizes this expropriated solar power through the channel of photovoltaic arrays, an oriented scaffolding of photovoltaic/solar cells.[1] Solar cells, also known as photovoltaic cells are used to convert light energy into electricity. Photovoltaic cells work on the principle of the photovoltaic effect, which is similar to the photoelectric effect. Differences being that the electrons in photovoltaic are not emitted instead contained in the material around the surface, creating a voltage difference. Solar cells are forged with crystalline silicon.

It is the most commonly used material in a solar cell. The use of silicon in the solar cell has been very efficient and low cost. Two forms of crystalline silicon can be used to make solar cells. Other than silicon, solar cells can be fabricated with cadmium telluride (CdTe), Copper indium gallium (di)solenoid (CIGS) etc. the fabrication of solar cells with materials other silicon is slightly expensive, thus making silicon the best material to be used in solar tracking systems.

2.2. EFFICIENCY TRAJECTORY OF PV OUTPUT DUE TO DUAL AXIS TRACKERS OVER THE PAST TWO DECADE

In 1997 Hoffmann, R., et al. reported an efficiency improve of more than 30% on an open loop active tracker which was evaluated on PV concentrators (9). In 1998 an experimental review of closed loop active tracker, with solar cell used to sensor the position of the sun result in improvement of efficiency 30-50%. The tracking was tested in northern regions of Chile (10). Yusuf, H. (1999) (11) developed a tracker that deployed an artificial intelligence approach. A PC based fuzzy logic control, which acquired data through photo-diode to drive motors was engaged, the system increased conversion efficiency of PV system by 50%. A study on performance of different tracking configuration carried out in Germany outlined a 30% increase due to active tracker (12). Dougherty, B. (2001) describes a mobile tracking device with was part of Building Integrated PV testing facility achieved 40% conversion efficiency over fixed (13). A field tested (in Malta) auxiliary PV cell based, roof mounted tracking system recorded a 40% efficiency increase (14). A tracker used in water pumping is reported to efficiency increase of 19-24% (15). Abdullah, S. and Nijmeh, S. (2004) Carried out experimental evaluation on a PLC deployed in a real time based tracking system in Jordan. The authors found a 41.34% increase of efficiency (16). In 2005 Piao, Z.G., et al developed and conducted laboratory test for a time based active tracker, which used a micro-controller and engaged idle mode in gloomy sky conditions. Furthermore a 21% efficiency increase was reported (17). Experimentally tested tracking system in Jordan by Mamlook, et al., (2006) achieved efficiency improvement of 40%. This tracker was a solar mathematical formulae based with a PLC (18). Rubio, F., et al., (2007) developed and experimentally tested a PC controlled through mathematical formulae with PV arrays used as feedback sensors. SCADA used for supervision and monitoring with an application developed in LABVIEW.

The system attained a 40% efficiency over fixed PV collector (19). Chen-Sheng, et al., (2008) repots a 49.2% increase in efficiency due to a system, developed and filed tested in Tibet. The tracker was developed to deploy a Microprocessor as a controller, (time based system with feedback from position sensors). Also it had a poor environment protection (Wind, Vibrations and cloud) and human -machine interface. (20) In 2009 Cemil Sungur recorded 42.6% efficiency improved after experimentally testing a real time based, PLC controlled and DC motor driven tracker in Turkey (21). Barsoum, N. and Vasant, P., (2010) achieved 40% efficiency improvement over fixed through a microcontroller (PIC16F84A), LDRs and DC Motor based tracker (22). A Micro-controller was used for multi-function approach tracking, by Kassem, A. and Hamad M. (2011) achieved a 64% (23). In 2012 Eke, R. and Senturk, A., evaluated a commercial (in Turkey) Pesos SF-40SD dual axis tracking mounted on Mono Crystalline silicon PV and found a 30.79% increase in efficiency. (24). Anusha, K. and Chandra Mohan Reddy,S. (2013) realised a 40% increase due to a system real time based, which deployed Microcontroller (LPC2148) and Stepper Motor (25). Singh, K.P., and Gupta, B., (2014) Experimental (India) Microcontroller (P1C16F877A programmed in DOTNET),

Stepper Motor geared (Worm and spur) Infra-red sensor 35-42% (26). In 2015 Ceyda, A.T., and Cenk, Y., (2015) evaluated a microcontroller (PIC16F877A programmed in MPLAB IDE) with linear actuators and potentiometer (feedback sensors) based tracking system at laboratory scale in Turkey. In this study efficiency of 40% was recorded (27). A Microcontroller (Atmega 8), LDRs, DC motor geared and L293D motor driver was also constructed and tested at experimental scale by Shashwati, R. and Tripathi, A.K (2016) and 40% efficiency was realised (28). Akbar, H.S., et al., (2017) developed a microcontroller (Atmega 328), LDRs, DC motors and relays. Through the system efficiency of about 55-30% was recorded (29).

CHAPTER 3

DESIGNING OF CIRCUIT

3.1EXISITING SYSTEM:

Fig 3.1. Existing System

In existing system there is no rotation operation corresponding of sun light. In this case efficiency of solar power is drastically reduced because of same direction of solar panel. It only peak in same direction of panel and sun light otherwise the efficiency is reduced. It is not operate in automatically so the man power is required.

3.2 PROPOSED SYSTEM BLOCK DIAGRAM:

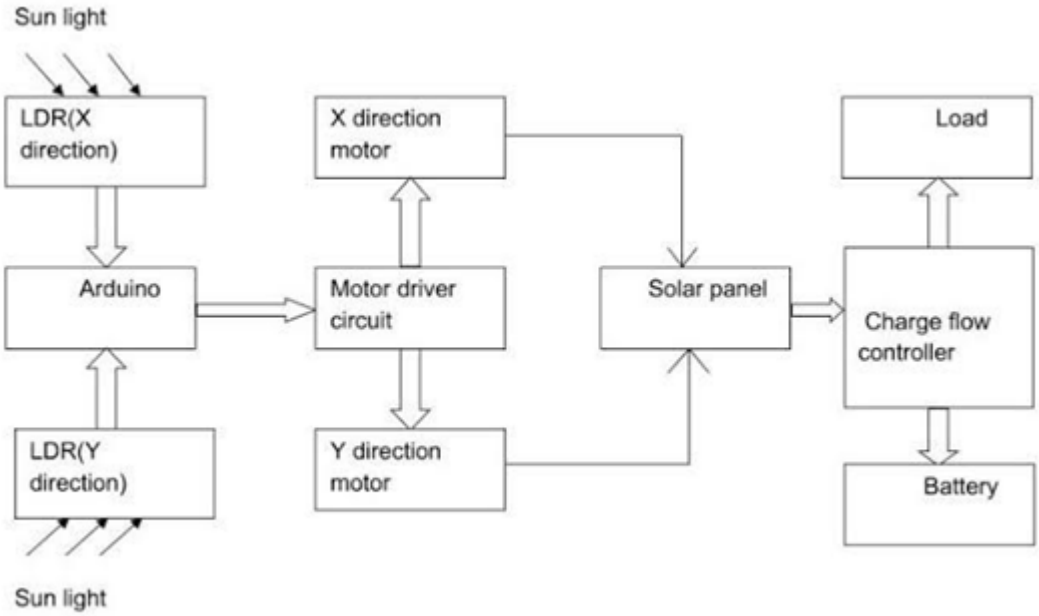

Fig. 3.2 Proposed System Block Diagram

In proposed system there is attached the rotation operation. There are two light sensing (LDR) sensor are attached. So, the panel rotates corresponding of motor rotation.

The motor rotates with the signal of LDR sensor and it is controlled by arduino microcontroller. Additionly added the motor driver to rotate the motor with corresponding of pulse.

3.3 PROPOSED SYSTEM CIRCUIT DIAGRAM:

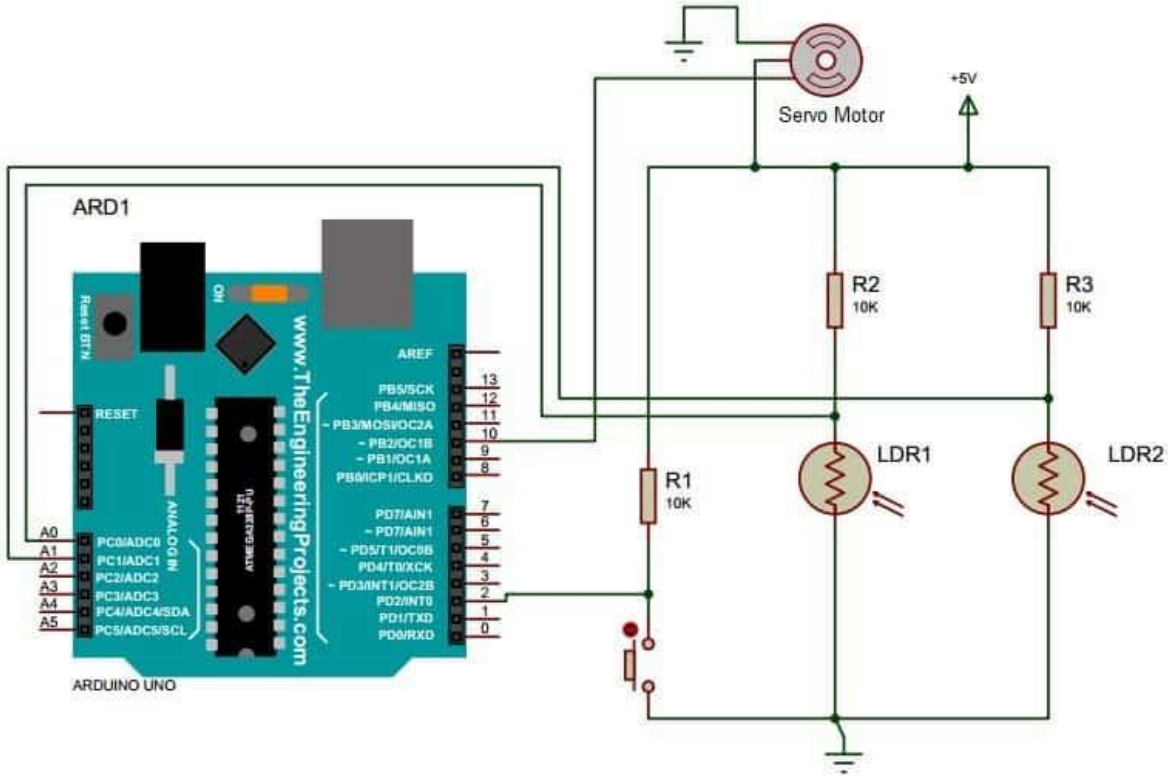

Fig. 3.3 Proposed System Circuit Diagram

Adjust the direction that the solar panel is facing according to the position of the sun in the sky.by keeping the panel perpendicular to the sun,more sunlight strikes the solar panel,less light is reflected,and energy is absorbed.that energy can be converted into power.

CHAPTER 4

MATERIALS AND METHODS

4.1. ARDUINO UNO R3

Arduino can be used to develop stand-alone interactive objects or can be connected to software on your computer (e.g. Flash, Processing, MaxMSP). The open-source IDE can be downloaded for free (currently for Mac OS X, Windows, and Linux). Arduino Uno R3 is one kind of ATmega328P based microcontroller board.

Fig. 4.1 Arduino UNO R3

4.1.1 THEORY AND CONSTRUCTION

The construction of our project we added the two light detecting sensor to rotate the solar panel with corresponding movement of gear motor. The gear motor is driven by motor driver. Arduino UNO is used to control the movement of gear motor. The gear motor drives the solar panel by the response of LDR sensors. There are two LDR sensors which placed in opposite directions for detect the sun light.

4.2Motor driver L298n theory

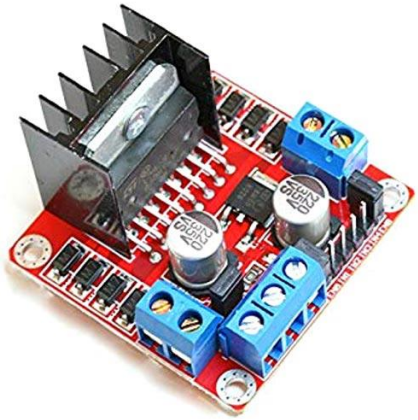

Fig. 4.2Motor Driver

4.2.1Features & Specifications

- **Driver Model: L298N 2A**
- **Driver Chip: Double H Bridge L298N**
- **Motor Supply Voltage (Maximum): 46V**
- **Motor Supply Current (Maximum): 2A**
- **Logic Voltage: 5V**
- **Driver Voltage: 5-35V**
- **Driver Current:2A**
- **Logical Current:0-36mA**
- **Maximum Power (W): 25W**
- **Current Sense for each motor**
- **Heatsink for better performance**
- **Power-On LED indicator**

4.3 LDR SENSOR

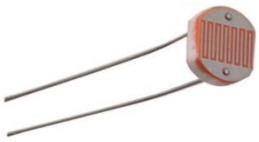

Fig. 4.3LDR

Photo resistors, also known as light dependent resistors (LDR), are light sensitive devices most often used to indicate the presence or absence of light, or to measure the light intensity. In the dark, their resistance is very high, sometimes up to 1 MΩ, but when the LDR sensor is exposed to light, the resistance drops dramatically, even down to a few ohms, depending on the light intensity. LDRs have a sensitivity that varies with the wavelength of the light applied and are nonlinear devices. They are used in many applications, but this light sensing function is often performed by other devices such as photodiodes and phototransistors. Some countries have banned LDRs made of lead or cadmium over environmental safety concerns.

4.3.1 THEORY AND CONSTRUCTION

LDR (Light Dependent Resistor) as the name states is a special type of resistor that works on the photoconductivity principle means that resistance changes according to the intensity of light. Its resistance decreases with an increase in the intensity of light.

CHAPTER 5

EXPERIMENTAL SETUP AND RESULT

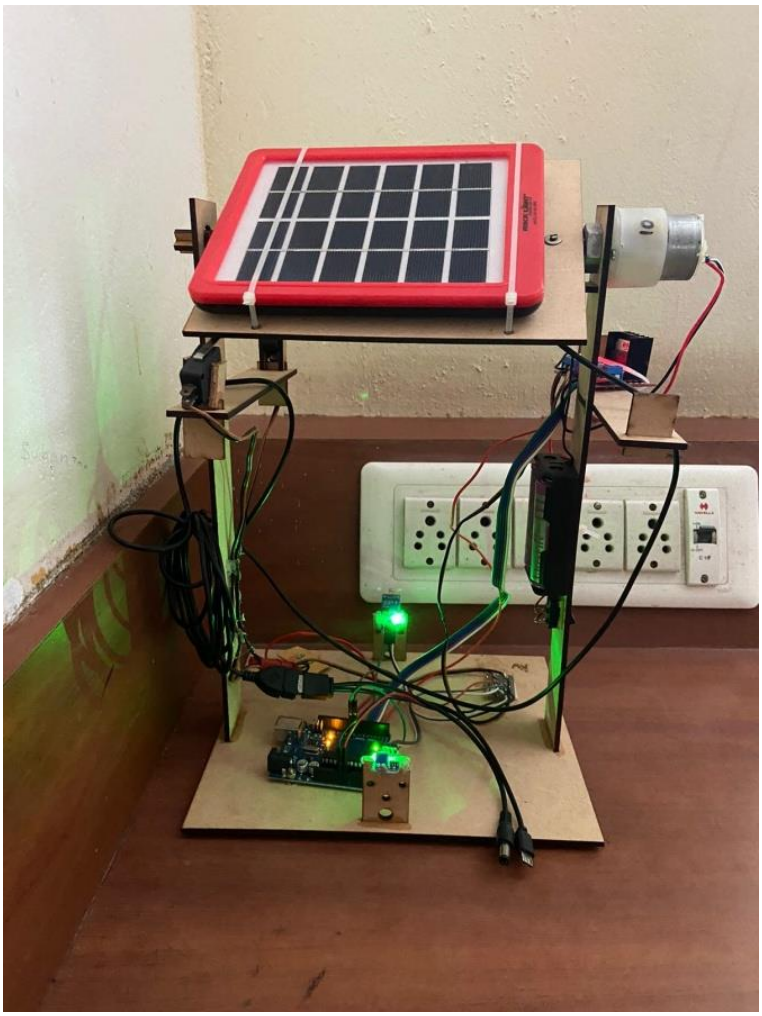

Fig. 5.1Experimental Set up

5.1 RESULT AND DISCUSSION:

The result of our project is 100 percentage completed. The motor drives the solar panel perfectly. The ldr sensor sense the light and it delivers the signal to the arduino uno and it give the pulse to the motor driver perfectly.

5.2 CODE USED

```
#DEFINE ENA 2   // MOTOR DRIVER ENABLE PIN 1
#DEFINE IN1 3   // MOTOR DRIVER INPUT 1
#DEFINE IN2 4   // MOTOR DRIVER INPUT 2
#DEFINE IN3 5   // MOTOR DRIVER INPUT 3
#DEFINE IN4 6   // MOTOR DRIVER INPUT 4
#DEFINE ENB 7   // MOTOR DRIVER ENABLE PIN 2

INT F=0;

VOID SETUP() {
 PINMODE(ENA, OUTPUT);
 PINMODE(IN1, OUTPUT);
 PINMODE(IN2, OUTPUT);
 PINMODE(ENB, OUTPUT);
 PINMODE(IN3, OUTPUT);
 PINMODE(IN4, OUTPUT);
 PINMODE(8, INPUT);
 PINMODE(9, INPUT);
 PINMODE(10, INPUT);
 PINMODE(11, INPUT);
  SERIAL.BEGIN(9600);
}
VOID LOOP()
{
 INT A = DIGITALREAD(8);
```

```
 SERIAL.PRINTLN("SEN1");
 SERIAL.PRINTLN(A);



 INT B = DIGITALREAD(9);
 SERIAL.PRINTLN("SEN2");
 SERIAL.PRINTLN(B);



 INT C = DIGITALREAD(10);
 SERIAL.PRINTLN("SWITC1");
 SERIAL.PRINTLN(C);



 INT D = DIGITALREAD(11);
  SERIAL.PRINTLN("SWITC2");
 SERIAL.PRINTLN(D);



IF ((B==0)&&(C==0))
{
 DIGITALWRITE(IN1, HIGH);
    DIGITALWRITE(IN2, LOW);
    DIGITALWRITE(IN3, LOW);
    DIGITALWRITE(IN4, HIGH);
   ANALOGWRITE(ENA, 255); // ADJUST SPEED AS NEEDED
```

```
 analogWrite(ENB, 255); // Adjust speed as needed
}

else if ((a==0)&&(d==0))
{
 digitalWrite(IN1, HIGH);
 digitalWrite(IN2, LOW);
 digitalWrite(IN3, HIGH);
 digitalWrite(IN4, LOW);
 analogWrite(ENA, 255); // Adjust speed as needed
 analogWrite(ENB, 255); // Adjust speed as needed
}
else if ((a==0)&&(d==1))
{
 analogWrite(ENA, LOW);
  analogWrite(ENB, LOW);
}
else if ((b==0)&&(c==1))
{
 analogWrite(ENA, LOW);
  analogWrite(ENB, LOW);
}
else
{
  analogWrite(ENA, LOW);
  analogWrite(ENB, LOW);}}
```

CHAPTER 6

CONCLUSION AND LIMITATIONS

6.1 CONCLUSION

The motor rotates the panel to orient it toward the sun. A solar panel that is precisely perpendicular to the sun generates higher power than the one that is not perpendicular.The panel gets activated due to the higher strength of sunlight and conveys it to the sensors. The sensor output is conveyed to the PLC.

6.2 LIMITATIONS

- THE PROCESS OF ATTAINING SOLAR ENERGY IS UNSOIL
- IT IS RENEWABLE SOURCES OF ENERGY
- SOLAR ENERGY IS A PERENNIAL SOURCE OF ENERGY

CHAPTER 7

FUTURE SCOPE OF DEVELOPMENT

7.1 FUTURE DEVELOPMENT

Improved Efficiency and Accuracy:

- Enhanced tracking algorithms and sensor technologies will lead to more accurate and efficient solar tracking.

- Machine learning and artificial intelligence may be integrated to predict solar movements, weather conditions, and optimize tracking strategies accordingly.

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2. HTTPS://SAVREE.COM/
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7. HTTPS://R.SEARCH.YAHOO.COM/_YLT=AWRO7FIKRORLPN0KYKJXNYOA;_YLU=Y29SBWNNCTEECG9ZAZIEDNRPZAMEC2VJA3NY/RV=2/RE=1703196325/RO=10/RU=HTTPS%3A%2F%2FWWW.RESEARCHGATE.NET%2FPUBLICATION%2F349924629_DUAL_AXIS_SOLAR_TRACKER_SYSTEM/RK=2/RS=V2UBTT7KF8O5PLA8ZBJPEJDDO2E-