

CONSTRUCTION OF DUAL AXIS SOLAR TRACKER SYSTEM

**A Project and Thesis submitted in partial fulfillment of the
Requirements for the Award of Degree of
Bachelor of Science in Electrical and Electronic Engineering**

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Department of EEE
Faculty of Engineering**



**DEPARTMENT OF ELECTRICAL AND ELECTRONIC
ENGINEERING
FACULTY OF ENGINEERING**

DAFFODIL INTERNATIONAL UNIVERSITY

TO
OUR BELOVED PARENTS
&
HONOURABLE SUPERVISER
MdDaraAbdusSatter

Approval

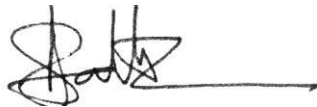
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Certification

This is to certify that this project and thesis entitled “Solar Tracker Device(Dual Axis) system” is done by the following students under my direct supervision and this work has been carried out by them in the Department of Electrical and Electronic Engineering under the Faculty of Engineering of Daffodil International University in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering. The presentation of the work was held on March 2018.

Signature of the candidate

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The project and thesis entitled “Solar tracking system(Dual Axis)” submitted by Pingku Kumar Shaha, ID No:131-33-1286, Md. Rokon Ujjaman, ID: 133-33-1711, Session: Spring 2013, Fall 2013 has been accepted as satisfactory in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering on March 2018.

ACKNOWLEDGEMENT

We would relish to express our sincere gratitude to our honorable supervisor Senior Lecturer Mr. MdDaraAbdusSatter, Department of Electrical and Electronic Engineering, DIU who inspired us in every moment. We are thankful to him for his perpetual inspiritment, kind co-operation, and scholastic guidance all along the project work. He has always been profoundly munificent with his time, cognizance and conceptions and sanctioned us great liberation in this research. We withal want to convey our thankfulness to Prof. Dr. MdShamsulAlam, Dean, Faculty of Engineering for his avail, support and constant inspiritment. We express our humble gratitude to all edifiers of Department of Electrical and Electronic Engineering for their fortification in numerous ways throughout this project work. We are withal grateful to the authors whose valuable research papers and books we have considered as reference in this project paper. Apart from that, we would relish to thank our entire friends for sharing erudition; information and availing us in making this project a prosperity. Additionally thanks for lending us some implements and equipment. Conclusively we would relish to thank our parents who have given us tremendous inspirations and fortifies. Without their phrenic and financial fortifies, we would not able to consummate our project.

Authors

ABSTRACT

Solar power energy is the mostly used renewable energy source in these days. Recent years its using increasingly day by day. It convertes solar energy to electrical energy.Solar panel can be used either stand alone or immensely colossal system that connects in the electrical grids. Our planet receives 84 terawatt of puissance and it consumes 12 terawatt of potential per day. We are endeavoring to consume more energy from the sun by utilizing solar panel. From the sun light we can energize our solar panel. In order to maximize the energy from solar panel, it has to be situated directly perpendicular to the sun. On that way we need to track the sun because earth is moving continuously. So that we can not get the sun light properly. In this Situation, we need to track the sun for improve our solar energy. The goal of these project to design an automatic solar tracker, Which can locate position of the sun. The tracking system will move towards the position of the sun. The Tracking System will move the solar panel so that its situated perpendicular to the sun for maximize the energy. Photo-resistor(LDR) will be used as a tracking sensor of the sun light. Our System will Output 37% more energy than solar panel without tracker.

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LIST OF ABBREVIATIONS

LED	Light emitting Diode
LCD	Liquid Crystal Display
LDR	Light-Dependent Resistor
VCC	Voltage Common Collector
AC	Alternating Current
DC	Direct Current

CHAPTER 1

INTRODUCTION

1.1 Introduction

This is a solar tracking system which can be utilized as a puissance engendering method from sunlight. This method of potency generation is simple and is taken from natural resource. This needs only maximum sunlight to engender puissance. This project avails for power generation by setting the equipment to get maximum sunlight automatically. This system is following for optimum intensity of sunshine.

When there's decrease in intensity of sunshine, this system automatically changes its direction to get maximum intensity of light. We are utilizing two sensors in two directions to sense the direction of maximum intensity of light. The distinction between the outputs of the sensors is given to the micro-controller unit. Here we are utilizing the micro-controller for tracking and engendering power from sunlight. It will method the input voltage from the oscillators circuit and management the direction within which the motor needs to be revolved in order that it'll receive most intensity of light from the sun.

1.2 Problem Statement

A solar tracker is utilized in sundry systems for the amendment of harnessing of solar radiation. The quandary that is posed is the implementation of a system which is capable of enhancing engenderment of puissance by 30-40%. The control circuit is implemented by the microcontroller. The control circuit then positions the motor that is utilized to orient the solar panel optimally.

1.3 Aim of the Project

Solar energy refers primarily to the utilization of solar radiation for practical ends. However, all renewable energies, apart from geothermic and recurrent event, derive their energy from the sun. Solar technologies are broadly speaking characterised as either passive or active looking on the means they capture, convert and distribute daylight. Active solar techniques use photovoltaic panels, pumps, and fans to convert sunlight into subsidiary outputs. Passive solar techniques include culling materials with auspicious thermal properties, designing spaces that naturally circulate air, and referencing the position of a building to the Sun. Active solar technologies increase the supply of energy and are considered supply side technologies, while passive solar technologies reduce the desideratum for alternate resources and are generally considered demand side technologies. Solar tracking system will avail us utilize every bit of solar energy in most efficient way.

1.4 Scopes

Solar power energy is that the largely used renewable energy supply in of late. Recent years its victimisation progressively day by day. It converts solar power to current. electrical device may be used either stand alone or vastly large system that connects within the electrical grids. Our planet receives eighty four terawatt of powerfulness and it consumes twelve terawatt of potential per day. we tend to square measure endeavoring to consume a lot of energy from the sun by utilizing electrical device. From the sun light-weight we will energize our electrical device. so as to maximise the energy from electrical device, it's to be set directly perpendicular to the sun. thereon manner we want to trace the sun as a result of earth is moving incessantly. so we will not get the sun light-weight properly. during this state of affairs, we want to trace the sun for improve our solar power. The goal of those project to style AN automatic star huntsman, which may find position of the sun. The following system can move towards the position of the sun. The following System can move the electrical device so its set perpendicular to the sun for maximize the energy. Photo-resistor(LDR) are used as a following device of the sun light-weight.

1.5 Methodology

The circuit of the star hunter system is split into 3 sections. there's the input stage that's composed of sensors and potentiometers, a program in embedded computer code within the microcontroller and finally the driving circuit that has the dc motor. The input stage has 2 LDRs that area unit therefore organized to compose a resistor circuit. there's a metallic frame that homes the parts. The 3 stages area unit designed severally afore being joined into one system. This approach, kindred to stepwise refinement in standard programming, has been utilized because it ascertains a definite and logical approach that is simple and facile to know. This in addition ascertains that if there area unit any errors, they're severally thought of and redressed.

1.6 Organization of the Report

This project report has seven chapters in total. the primary chapter describes a conception concerning our project “Construction & Performance check of a Solertraker Device”, temporary description of the project, quandary verbal expression, scopes and methodology. The second chapter concerning history, diagram, circuit diagram, list of parts. The chapter third concerning part description, analysis of our system .The chapter fourth computer code analysis & program explication. The chapter 5 hardware implementation. Then chapter six describes result & discussion felicitously. once and for all, chapter seven provides the closing remarks, inhibition of our system and suggestion for the longer term works..

CHAPTER 2

SYSTEM REVIEWS

2.1 Introduction

The relevant progress of the solar battery with a electrical phenomenon array that utilizes the facility of the sun rays. the twin axis star hunter may be a project with the mission of chase the sunshine of the sun. The extraction of useful of the photoelectrical mechanism of the electric cell that may changes the likelihood of the longer term project. It will work best as potential with the economical instrumentation. There area unit varied styles of star trackers. A star hunter will increase with the position that's given by the sun. In village the solar battery is extremely vital currently. each family of the village has a minimum of one electric cell in there house. though it's tasking to effort a solar battery however the folks of the village somehow they manage it. The solar battery is generally connected with the electricity in ac circuit however once it takes the dc and changes it within the solar power. we tend to area unit significantly positive that we will build a good solar battery in future. If the govt of our country takes a right action towards the electrical offer company than it'll be obtainable in our country. Man is born free. He has the correct to measure along with his dream. no one will deny the reality. an enormous modification may be a vital modification in your life. we will ne'er suppose that the sun generally hide behind the cloud and that we ignore it. Life cannot ignore it fate. electrical phenomenon energy is that that is obtained from the sun. A cell, ordinarily kened as a electric cell, is that the technology used for conversion of star directly into electrical power. The cell may be a non-mechanical contrivance composed of atomic number 14 alloy. they're particularly standard in remote areas wherever there's no association to the grid. electrical phenomenon energy is that that is obtained from the sun. It will prove that a touch sun light-weight will burn the full world with its inner power. we should always believe the fate of our destiny that belongs to the god. Energy may be collected as several forms however the star hunter is that the best manner which supplies North American nation

inspired to try to to one thing completely different. generally we predict that we tend to area unit pleased with the twin axis with its power.

2.2 GeneralBlock Diagram

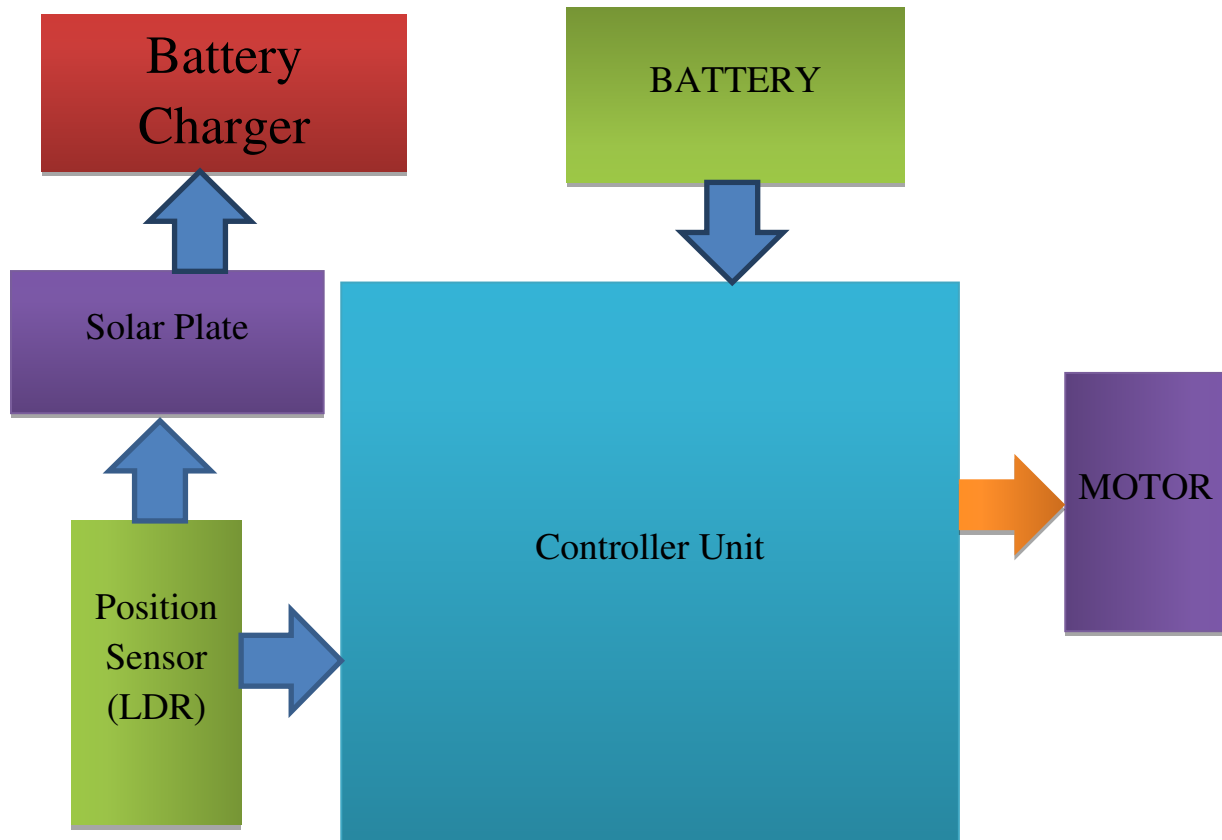


Fig. 2.1: General Block Diagram

2.2.1 Block Diagram Description:

Solar Cell will convert star lightweight energy to current. one cell manufacture a minimum current, in order that it classified along during a electrical panel known as solar battery. Our Sun incessantly diffuse energy.A cell gather the energy and convert in to current. Photons ar packet of energy that composed in daylight.once the photons ar hits the cell,means semiconductor layer of the cell, photons ar absorbed by the fabric. once a gauge boson absorbed, the energy ofphoton is transferred to AN electrical atom. Aperture are magnetize another negatron. Then there engendering another whole. that is flip once

more crammed by negatron from another atom. For that reason output of the solar battery is variable. These system designed to extract the most power from the solar battery. The star charger is particularly created for our system. once the sun goes down the battery power are used. the look of the solar battery battery chargers is thus generous. once the photons are hits the cell,means semiconductor layer of the cell, photons ar absorbed by the fabric. once a gauge boson absorbed, the energy ofphoton is transferred to AN electrical atom. Apertures are magnetize another negatron.These system designed to extract the most power from the solar battery. The star charger is particularly created for our system. once the sun goes down the battery power are used. the look of the solar battery battery chargers is thus generous.Our Sun incessantly diffuse energy.A cell gather the energy and convert in to current.

2.3Circuit Diagram

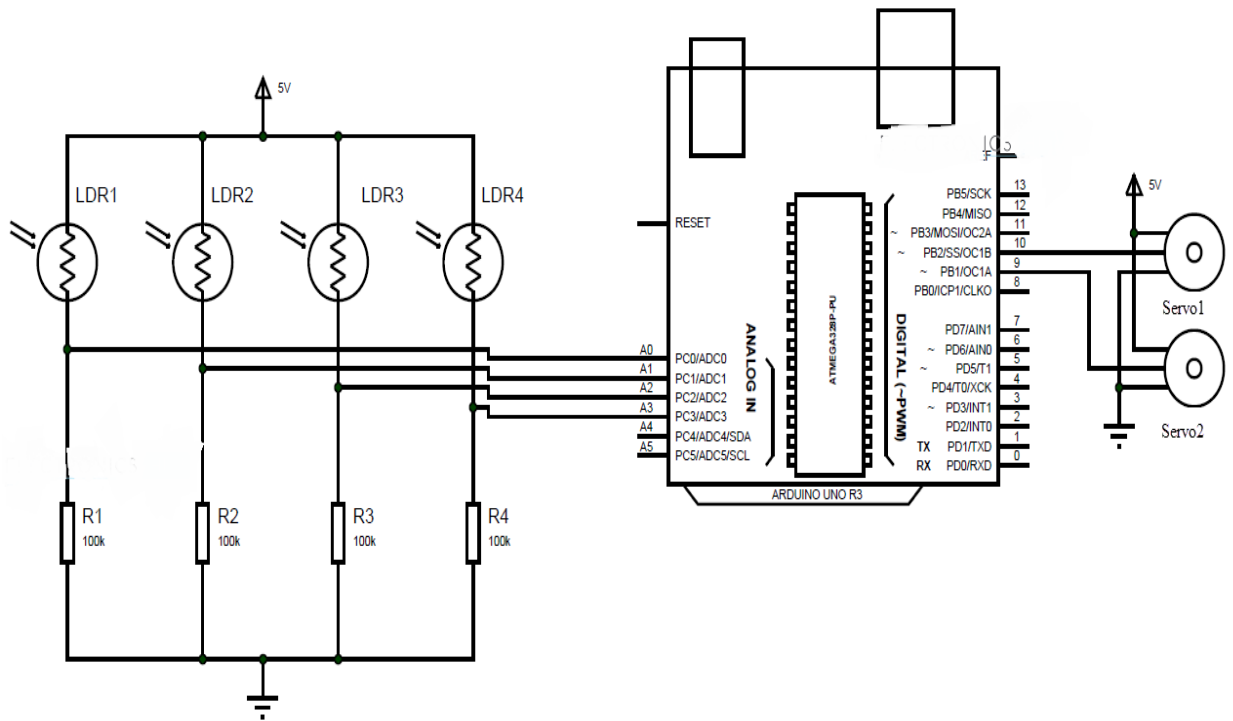


Fig. 2.2: Circuit Diagram

2.3.1 Working Process of our Circuit:

Servo motor kinematics will follow the condition of the LDR. In dual axis solar tracking system, there are 2 Servo motors. One motor is utilized to control vertical axis and another motor is utilized to control horizontal axis.

For Vertical rotation:

In this case top left+top right and bottom left+bottom right LDR sensors are working. The process is adding the value of sensors. If the upper two sensors got highest value means highest intensity of light then vertical servo motor rotate clockwise. When the motor rotate clockwise the solar moves to upwards. If the bottom sensors getting higher value then the upper sensors the servo motor rotates counter clockwise. For the counter rotation solar panel moves downward. In this way we can move the solar panel in vertical axis. If the upper two sensors got highest value means highest intensity of light then vertical servo motor rotate clockwise. If the bottom sensors getting higher value then the upper sensors the servo motor rotates counter clockwise. For the counter rotation solar panel moves downward.

For Horizontal axis rotation:

In that case top left+bottom left and top right+bottom right sensors will work. For the horizontal rotation we used our second servo motor that rotate horizontally. By adding the two sensors value we got an analog value. This case we are adding the value of right portion sensors and left portion sensors. If the left portion sensors got the highest value means highest intensity of light than the right portion sensors, then the horizontal motor will rotate clockwise. For the clockwise rotation mounting solar panel will be rotate in the left. Again if the right portion sensors got the highest value or highest intensity of light the motor will rotate counter clockwise. For the counterclockwise rotation solar panel will be rotate in right side. For the clockwise rotation mounting solar panel will be rotate in the left. Again if the right portion sensors got the highest value or highest intensity of light the motor will rotate counter clockwise.

2.4 List of Components used in Circuit

Table 2.4 : List of components used in circuit

No	Component Name	Quantity	Used
01	Microcontroller(Arduino Uno Atmega328p)	01	To Control the System.
02	LDR light sensor	04	To intensity of light.
03	Servo Motor	02	To move the solar panel.
04	Resistor	04	To controlled amounts of resistance into electrical circuits.
05	Jumper wire	10	To connection.
06	PVCBoard		To make structure.
07	Power Supply	01	To power up microcontroller.

2.5 Conclusion

The aim of this project is to design and fabricate a dual axis solar tracker the produces much more energy than the conventional solar panel. 6-7% more efficiency than the normal using solar panel. There will be mounting four LDR in the solar panel. They are used as a solar tracking sensor. We designed this project as a prototype. Our designed system can work in various weather condition.

CHAPTER 3

COMPONENT DESCRIPTION

3.1 Introduction

Light detective work device that perhaps wont to build star huntsman include; phototransistors, photodiodes, LDR. A congruous, cheap, easy and facile to interface icon device is analog LDR that is that the most rife in physical science. it's usually in type of a photograph resistance composed of sulphide (CdS) or atomic number 31 chemical compound (GaAs). Next in elaborateness is that the photodiode followed by the phototransistor.

3.2 Description of Sensor (LDR)

The simplest optical sensing element may be a gauge boson electrical device or sensing element that may be a light-weight sensitive electrical device these area unit composed of 2 sorts, sulfide (CdS) and metal compound (GaAs). The sun huntsman system designed here uses 2 sulfide (CdS) photocells for sensing the sunshine. The sensing element may be a passive part whose resistance is reciprocally proportional to the number of sunshine intensity directed towards it. it's connected nonparallel with capacitance. The sensing element to be used for the huntsman relies on its dark resistance and lightweight saturation resistance. The term light-weight saturation betokens that additional incrementing the sunshine intensity to the CdS cells won't decrement its resistance any longer. intensity level is quantified in illumination unit, the illumination of daylight is close to thirty,000 illumination unit Photoresistors area unit less sensitive contrivances than photodiodes or phototransistors: the 2 latter elements area unit true semiconductor contrivances, whereas a photoresistor may be a passive part and doesn't have a PN-junction. The photoresistivity of any photoresistor could vary wide counting on close temperature, creating them unsuitable for applications requiring precise quantification of

or sensitivity to light-weight photons. Photoresistors additionally exhibit a definite degree of latency between exposure to light-weight and also the sequent decrease in resistance, sometimes around ten milliseconds.

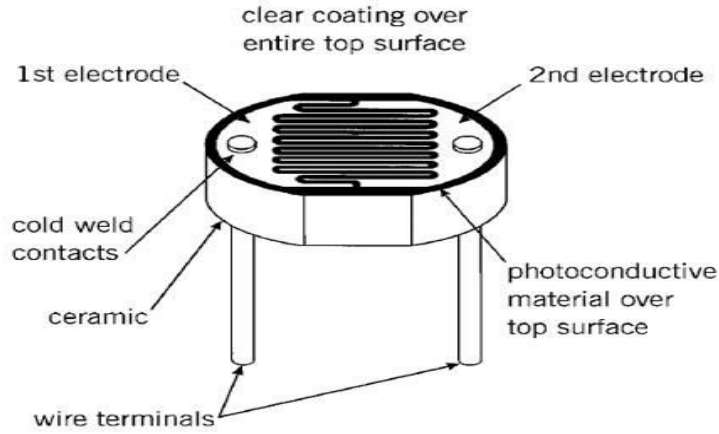


Figure 3.1: LDR construction

Customarily the resistance of AN LDR is extremely high, typically as high as one thousand 000 ohms, however after they square measure lit with lightweight resistance drops dramatically. once the sunshine level is low the resistance of the LDR is high. This averts current from flowing to the bottom of the transistors. Consequently the crystal rectifier doesn't lightweight.

3.2.1The concept of using fourLDRs:

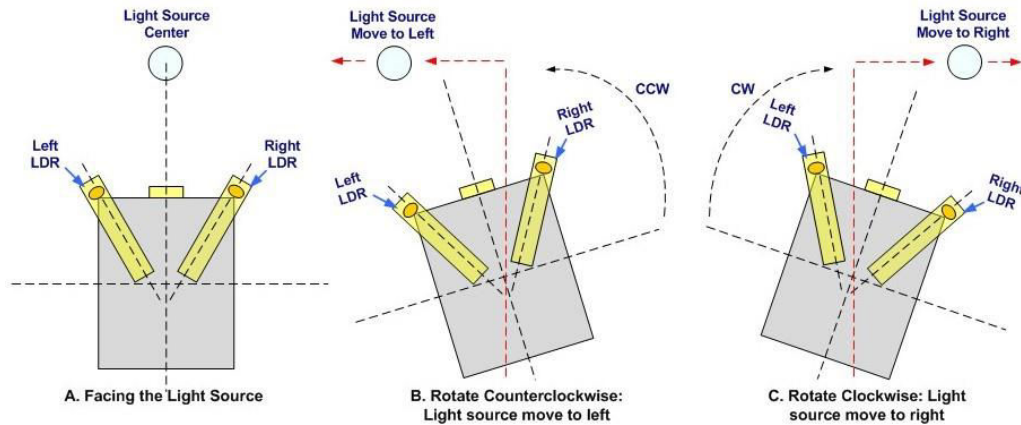


Figure 3.2: Useof Four LDRs.

Concept of utilizing 2 LDRs for sensing is explicated within the figure higher than. The stable position is once the 2 LDRs having constant candlepower. once the sunshine supply moves, i.e. the sun peregrinates from west to east, the caliber of intensity falling on each the LDRs changes and this transformation is tag into voltage utilizing voltage dividers. The transmutations in voltage are compared utilizing integral comparator of microcontroller and motor is used to rotate the solar array during a manner thus on track the sunshine supply.

3.2.2 Construction of detector (LDR):

Light detector style The star huntsman makes utilization of a Cds photoelectric cell for detective work lightweight. There was utilize of a complementary resistance with a price of 100k. The photoelectric cell resistance is quantified below beamy lightweight, average lightweight and dark lightweight conditions. The results ar listed within the table below.

Table 3.1 Photocell Resistance Testing Data

Measured Resistance	Comment
50 K Ω	Dark light conditions (black vinyl tape placed over cell)
4.35 K Ω	Average light conditions (normal room lighting level)
200 Ω	Bright light conditions (flashlight directly in front of cell)

The voltage divider circuit formed is shown below

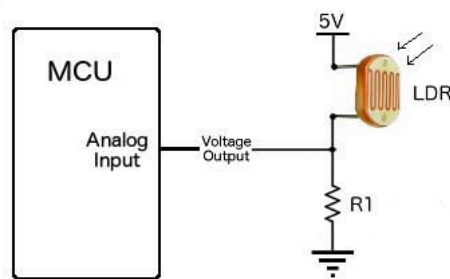


Figure 3.3: The input circuit that employs a voltage divider

From the given relationship, the input-output relationship for the voltage divider circuit is given by:

$$V_i = V_{CC} \left\{ \frac{R_{pot}}{LDR + R_{pot}} \right\}$$

In this case, V_i =- input voltage into the microcontroller

R = Resistance of the [potentiometer which is 10K]

V_{CC} = Supply voltage to Microcontroller and LDRs

V_i = Input voltage to the Microcontroller

3.4 Description of Microcontroller (ATmega328p):

Arduino Uno may be a controller board that have an obsessive chip ATmega328p. It has fourteen digital I/O pins, that contains 6 PWM output pins, vi analog input pins. it's sixteen rate quartz, a USB association, a efficiency jack and a push button. All the parts required to fortify microcontroller hook up with a pc with the USB cable or power it with DC adapter or battery. associate degree extortionate quantity of concerning doing one thing inaccurate, worst case situation you'll follow the chip for some bucks and begin another time. The Uno R3 in addition integrates SDA and SCL pins contiguous to the AREF. In additament, there ar 2 early pins placed close to the RESET pin. One is that the IOREF that sanction the shields to conform to the voltage provided from the board. the opposite may be a not connected and is reserved for future functions. The Uno R3 works with all subsisting shields however will conform to early shields that utilize these supplemental pins. Arduino is associate degree ASCII text file physical computing platform predicated on an easy i/o board and a development atmosphere that implements the Processing/Wiring language. Arduino are often acclimated to develop complete interactive objects or are often connected to package on your pc (e.g. Flash, Processing, MaxMSP). The ASCII text file IDE are often downloaded gratuitously (currently for macintosh OS X, Windows, and Linux).



Fig 3.4: Arduino UNO.

"Uno" designates one in Italian and was opted to mark the relinquishment of Arduino code (IDE) one.0. The Uno board and version one.0 of Arduino code (IDE) were the reference versions of Arduino, currently evolved to a lot of early releases. The Uno board is that the initial in an exceedingly series of USB Arduino boards and also the reference model for the Arduino platform; for an intensive list of current, past or archaic boards optically tell apart the Arduino index of boards. Arduino may be a microcontroller kit for building digital contrivances and interactive objects that may sense and management physical contrivances. These systems offer set of digital and analog pins that may interface to sundry enlargement boards. the primary arduino was introduced in 2005 planning to offer a coffee price, price efficacious contrivances that move with environments utilizing sensors and actuators. associate degree arduino's microcontroller will be preprogrammed with a bootloader that simplifies the uloading of programs to the on-chip flash recollection. Arduino boards were designed by yankee firms. As on 2016, seventeen versions of Arduino hardware had been commercially engendered. Arduino may be a microcontroller kit for building digital contrivances and interactive objects that may sense and management physical contrivances. These systems offer set of digital and analog pins that may interface to sundry enlargement boards. Arduino boards were designed by yankee firms. As on 2016, seventeen versions of Arduino hardware had been commercially engendered.

3.4.2 Specification Arduino UNO

Arduino is an open-source electronic prototyping platform based on accessible and customizable hardware and code. Arduino consists of each a physical programmable printed circuit and a chunk of code, or IDE (Integrated Development Environment) that runs on your pc, accustomed create verbally and transfer coding system to the physical board. The Arduino Uno may be a microcontroller board predicated on the ATmega328 (datasheet). it's fourteen digital input/output pins (of that half dozen will be used as PWM outputs), half dozen analog inputs, a sixteen Mc oscillator, a USB association, a efficiency jack, associate degree ICSP header, and a push. It contains everything required to fortify the microcontroller; merely connect it to a pc with a USB cable or power it with a AC-to-DC adapter or battery to urge commenced. The Arduino Uno may be a microcontroller board predicated on the ATmega328 (datasheet). it's fourteen digital input/output pins (of that half dozen will be used as PWM outputs), half dozen analog inputs, a sixteen Mc oscillator, a USB association, a power jack, associate degree ICSP header, and a push. It contains everything required to fortify the microcontroller; merely connect it to a pc with a USB cable or power it with a AC-to-DC adapter or battery to urge commenced. The Uno differs from all preceding boards therein it doesn't utilize the FTDI USB-to-serial driver chip. Instead, it options the Atmega8U2 programmed as a USB-to-serial convertor.

Microcontroller	<u>ATmega328P</u>
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA

FlashMemory	32 KB (ATmega328P) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 MHz
Length	68.6mm
Width	53.4 mm
Weight	25g

3.4.3 Block Diagram of Microcontroller – (ATmega328p):

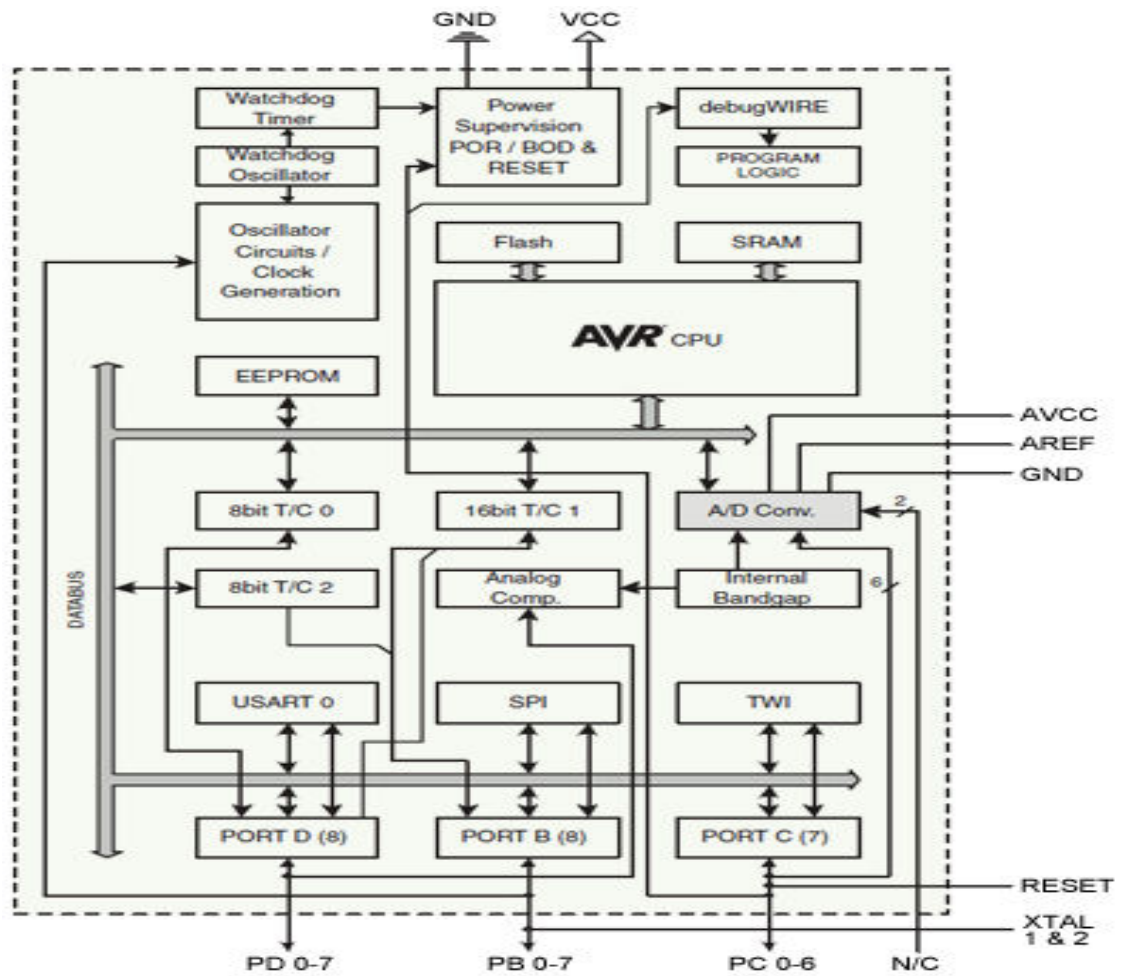


Fig. 3.5 Block Diagram Of Microcontroller – (Atmega328)

3.4.4 Pin Configurations of Microcontroller

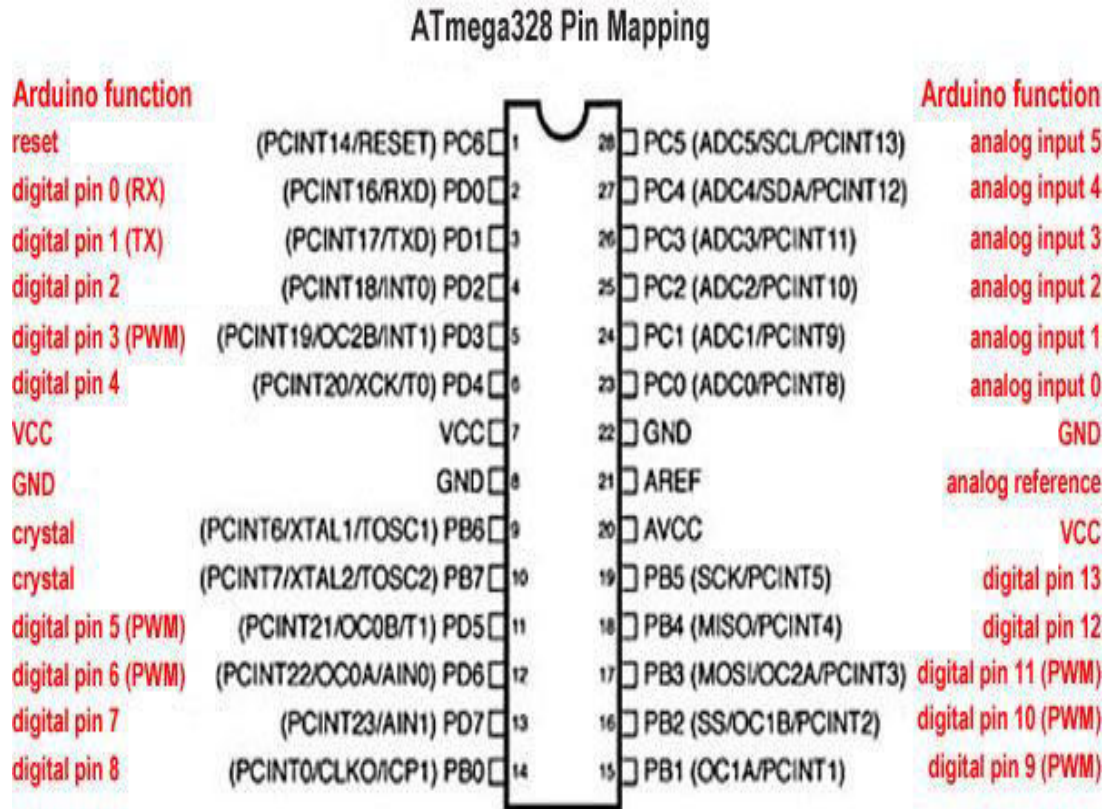


Figure 3.6 Pin Configurations Of Microcontroller – (Atmega328)

3.4.5 Pin Descriptions

Programming

Arduino Uno programmed with the software called Arduino IDE. From the Tools of the software needed to select the board and port. In our case we used a n Arduino Uno, so we had to select Arduino/Genuino Uno from the the board. Afterthat we had to select the port that contains our board to the computer. There was also have a huge collection of example code. It helps us more efficiently.

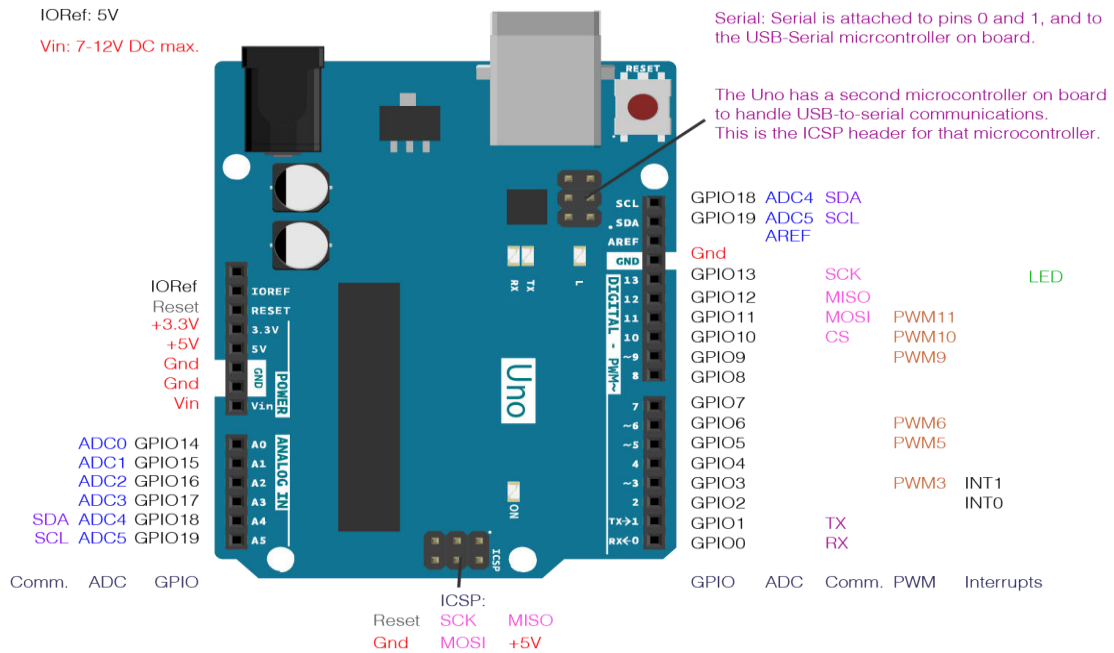


Fig 3.7 Pins of Arduino UNO

Warnings

Arduino has a poly fuse for instant resetting. If any short circuit or over current flow through the USB to board then the poly fuse automatically break the power connection until the short or overload abstracted. The limit of current is 500mA.

Different from other

The Atmega16U2 programmable as a USB to serial converter instead of utilize the FTDI USB to serial driver chip.

Pins Specification

LED: A LED is built in the board, which is driven by pin 13. when the digital pin get voltage the LED is on, either its off.

VIN: 5volts from the USB or external power supply (battery or adapter) will be used to power up the board. The voltage is gone through the VIN pin.

5V: There is a dedicated 5v pin on the board. This is a Out pin. We can use a bypass 5v voltage from this if we needed.

3.3V: There is also a 3.3V power supply generated by the board. It contains 50mA maximum current

GND:It contains also three ground pins.

IOREF: For operating microcontroller with voltage reference, this pin will be used. A configured Shield can read the IOREF pin voltage to select the appropriate power source or enable voltage translators.

Reset: It can be used to add a reset button to resetting the board.

Power

The Board can be powered by the USB or external DC power supply. Power can come from AC-DC adapter or DC battery. By 2.1mm center positive plug the adapter can used as power supply. Or an external battery can power up the board by connecting in VIN and GND pin.

The external power should be always higher than 7v. Because the minimum working voltage of the board is 7v. If it's less than 7v it may not work properly, %v pin cannot supply five volts and the board become unstable. If the input power is exceeds 12v then the voltage regulator may overheat and damage the board. The range is 7-12v.

The Board can be powered by the USB or external DC power supply. Power can come from AC-DC adapter or DC battery. By 2.1mm center positive plug the adapter can used as power supply.

Memory

The ATmega328p has 32 KB storage. Which 0.5KB storage is occupied by the bootloader. It has 2KB of SRAM and 1KB of EEPROM, which can be read by the EEPROM library.

Input and Output

The fourteen digital pins of arduinouno may be used as input and output. `pinMode()`, `digitalWrite()`, and `digitalRead()` are unit functions. Their operational voltage is 5v. All of the pins will give or receive 20mA in operational condition. 40mA is that the most current for every pins, that's the worth for I/O. should not be exceeded 40mA either it cause harm the microcontroller.

Some of the pins have uncommon functions:

Serial Pin: zero,1(RX,TX). They want to knowledge receive and transmission. These pins are unit connected to ATmega8U2 USB to TTL.

Serial Chip: two,3. Those pin may be designed to trigger an occasional price, a falling edge, or a transmission price.

PWM(Pulse breadth Modulation): three,5,6,9,10 and 11. Those pins are unit give 8-bit PWM output with the analog operate.

SPI: 10(SS), 11(MOSI), 12(MOSI), 13(SCK). For SPI communication with the SPI library, these pins support the board.

I²C: A4 pin and A5 pin support I²C communication with the wire library.

There is half dozen analog pins for input A0 to A5, all the pins are unit give ten bits of resolution. They quantify ground to 5v by default. there's AREF pin and Analog Reference() operate to transmit the higher surcease of their vary. another pins on the board:There is half dozen analog pins for input A0 to A5, all the pins are unit give ten bits of resolution.

AREF: Reference voltage of analog inputs. Analog Reference().

Reset: By lowing this pin we will reset the microcontroller.

Communicate

There is a great deal of facilities for human activity through a laptop with Arduino Uno or different microcontrollers. Arduino Uno board provides 5v serial communication that is offered on the RX and American state pin. there's a serial communication over USB and thru a virtual com port to the pc package. The 16U2 microcode coverts the standerd USB COM driver.there's no would like for external drivers. A .inf file is needed. A Serial Monitor is includes with the package. that sucks sample matter information to send or from the board. RX and American state LEDs on the arduino can flash once the information transmitted or received from the pc.

Wire library are includes to the Arduino Uno IDE package for simplifying I2c bus, ATmega328p fortifies I2C and SPI communication. Utilizing SPI library for SPI communications.onceuplosading code physically reset is requiring instead of package reset.Uno board is functioning in a very approach that reset by running package on a connected laptop. ATmega8U2/16U2 is connected to reset pin via one hundred nanofarade capacitance.

The other implication will have connected the road declarative capability to reset the chip. The bootloader may have a shorter timeout state of affairs that remains betokens. The coordination of the DTR is as lower because the deliver project. The compatible style that produces the items higher once UNO is connected with servo with terribly tight. we will use the operate as we all know. Life is sure with disorder of the machine. Magician makes the planet nice so the planet will do a far better fever to North American nation. UNIX is that sort of package that to a lower place the tower of the mountain of the parisifel tower. The interface of this project is to believe that we tend to can not be serious like that. this can be not one thing that we wish should.

If it's unheeded to deformed information, it'll interrupt the in no time a little bytes of information causation to the board before a affiliation is closed. If a code running on the board receiving only once or different information for initial command, assumed of the package with the human activity for a moment once a second gap to causation this information. ARduino Uno board contains a trace that might be incapacitate the auto-reset. For re-enable it is soldered along. The labeling are RESET-EN. For machine reset it is through with one hundred ten ohm resistance from 5v to the reset line.

Revised

The 3 options of the revised issue as follows:

1.0 pin out: SDA and SCL integrated pins that are proximate to the AREF pin and 2 different pins have placed proximate to the RESET pin and therefore the IOREF that sanction the shields habituating to the voltage that provided from the board. Shields and AVR are compatible and used the board, that operates five.5V and embody the three.3V. the long run functions of revised that matter the output pin isn't connected.

3.5 Servo Motor:

3.5.1 Description:

If you have got a guided model automotive, airplane, or heavier-than-air craft, you're utilizing a minimum of some servos. Servo motors (or servos) are self-contained electrical contrivances (optically make out Figure one below) with nice preciseness that rotate or push elements of a machine. you'll realize servos in several places: from toys to home physics to cars and airplanes.. during a model automotive or craft, moving servos levers back and controlling the forth and steering or alter wing surfaces. By rotating a shaft connected to the engine throttle, a servo regulates the haste of a fuel-powered automotive or craft. Servos even so appreciate the scenes in contrivances we tend to utilize a day. In 21st-century vehicles, but servos manage the car's speed: not solely The accelerator pedal however additionally consistent to the amount management on a radio, sends associate electrical signal that tells the car's pc however way down it's being ironed. when hard that

info and different knowledge from different sensors the pc sends a sign to the servo annexed to the throttle to regulate the engine rate.



Fig 3.8: Servo Motor.

3.5.2 How does a servo motor work?

The simplicity of a servo is among the options that build them thus reliable. The center of a servo could be a minuscule electrical energy (DC) motor, kindred to what you would possibly realize in a reasonable toy. A minuscule motor doesn't have a lot of force, however it will spin genuinely prompt (diminutive force, vastly prodigious distance). These motors run on electricity from a battery and spin at high rate (rotations per minute) however place out terribly low force (a convoluting force wont to do work— you apply force after you open a jar).

An arrangement of gears takes the high speed of the motor and decelerates it whereas at constant time incrementing the force. (Rudimental law of physics: work = force x distance.) A minuscule motor doesn't have a lot of force, however it will spin genuinely prompt (diminutive force, vastly prodigious distance). The gear style within the servo case converts the output to a far additional gradual rotation speed however with additional force (sizably voluminous force, very little distance).

The amount of authentic work is identically equivalent, simply additional subsidiary. Gears in a reasonable servo motor area unit usually composed of plastic to stay it lighter and fewer pricey. On a servo designed to produce additional force for heavier work, the gears area unit composed of metal and area unit tougher to break.

3.6 Resistance:

3.6.1 Resistance Description:

When electrons permeate a bulb or another conductor, the conductor will offer some obstruction to the current. This obstruction is named electric resistance.

The longer the conductor, the higher the resistance.

The thinner the conductor, the higher its resistance.

Every material has an associated degree of electric resistance and it's the explanation that the conductor provides out heat once the current passes through it.



Figure 3.9: 330ohm&10k Resistance.

When electrons permeate a bulb or another conductor, the conductor will offer some obstruction to this. This obstruction is named electrical phenomenon.

The longer the conductor, the higher the resistance.

The thinner the conductor, the higher its resistance.

Every material has an associated degree of electrical phenomenon and it's the explanation that the conductor provides out heat once this passes through it.

Resistance is that the opposition that a substance offers to the flow of electrical current. It's portrayed by the majuscule letter R. Once an electrical current of 1 ampere passes through a part across that a possible distinction (voltage) of 1 potential unit subsists, then the resistance of that part is one ohm.

In general, once the applied voltage is command constant, this in an exceedingly direct-current (DC) electrical device is reciprocally proportional to the resistance. This rule yet holds true for many low-frequency alternating-current (AC) systems, like house utility circuits. In some AC circuits, particularly at high frequencies, true is a lot of tangled, as a result of some elements in these systems will store and relinquish energy, similarly as dissipating or changing it.

The electrical phenomenon per unit length, area, or volume of a substance is kened as impedance. impedance figures ar usually selected for copper and aluminium wire, in ohms per kilometre.many low-frequency alternating-current (AC) systems, like house utility circuits. In some AC circuits, particularly.

Opposition to AC, however to not DC, may be a property kened as electrical phenomenon. In associate degree AC circuit, the resistance and electrical phenomenon pile up vector ally to yield electrical phenomenon.In associate degree AC circuit, the resistance and electrical phenomenon pile up vector ally to yield electrical phenomenon.

3.6.2 Resistor Color Code:

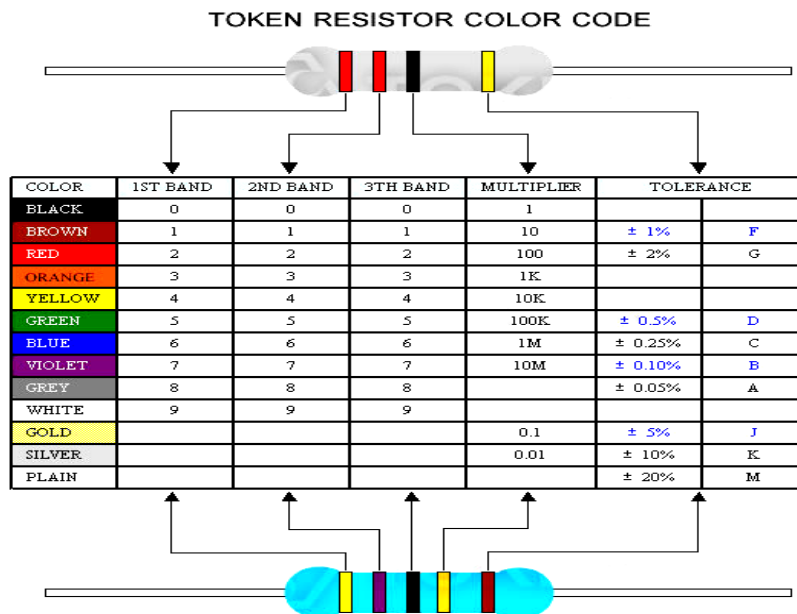


Figure 3.10: Resistor color code.

3.7 Wires

In this project we need couples of Female to Male and Male to Male jumper wire. That is for connecting Bluetooth module and IR module to the Arduino Mini board.

3.8 Cost Analysis

In this section we will show cost of our project that means cost sheet representation of our project.

3.8.1 Cost Sheet:

Table No. 3.2

No	Component Name	Quantity	Purchase Price (TK)
1.	Microcontroller(Arduino Uno)	1	450.00
2.	Resistor (10k 330ohm)	4	10.00
3.	Battery	1	50.00
4.	Servo Motor	2	260.00
5.	Wire	2 set	80.00
6.	Pvc sheet	-	200.00
7.	LDR	4	80.00
8.	Other	-	500
9.	TOTAL		= 1630/-

3.9 Conclusion

Five main part& some tools area unit utilized in this technique to makes it .This Project is employed to save lots of power and gain voltage. Our all part area unit terribly straightforward in our country market.

CHAPTER 4

SOFTWARE ANALYSIS & HARDWARE IMPLEMENTATION

4.1 Introduction

Proton IDE could be a skilled and power visual Development atmosphere (IDE).which has been designed specifically for the nucleon and compiler .Proton IDE accelerates development in a very comfy user atmosphere while not compromising performance, flexibility or management.

4.2 Description of our code


The ASCII text file Arduino atmosphere makes it simple to write down code and transfer it to the I/O board. It runs on Windows, Mac OS X, and Linux. The atmosphere is written in Java and supported process, avr-gcc, and different open supply code. The screen shot of Arduino one.6.8 is shown below



Fig4.1: Arduino Compiler.

It is in addition capable of assembling and uploading programs to the board with one click. there's generally no requisite to edit create files or run programs on a command-line interface. Albeit building on command-line is feasible if needed with some third-party implements like Ino. The Arduino IDE comes with a C/C++ library known as "Wiring" (from the project of an equivalent name), that makes several mundane input/output operations rather more facile. Arduino programs area unit indited in C/C++, albeit users solely would like outline 2 functions to create a runnable program.

The compiled window of my code is show.



```
FM8QPTGI6QD4IOC | Arduino 1.8.5
File Edit Sketch Tools Help
FM8QPTGI6QD4IOC
1
int lt = analogRead(ldr1t); // top left
int rt = analogRead(ldr1r); // top right
int ld = analogRead(ldr1l); // down left
int rd = analogRead(ldr1r); // down right

int dtime = 10;
int tol = 50;

int avt = (lt + rt) / 2;
int avd = (ld + rd) / 2;
int avl = (lt + ld) / 2;
int avr = (rt + rd) / 2;

int dvert = avt - avd;
int dhoriz = avl - avr;

Serial.print(avt);
Serial.print(" ");
Serial.print(avd);

Done compiling.
Sketch uses 3938 bytes (12%) of program storage
Global variables use 240 bytes (11%) of dynamic memory
```

Figure 4.1 Compiled Code ino.

4.3 Flow Chart Diagram

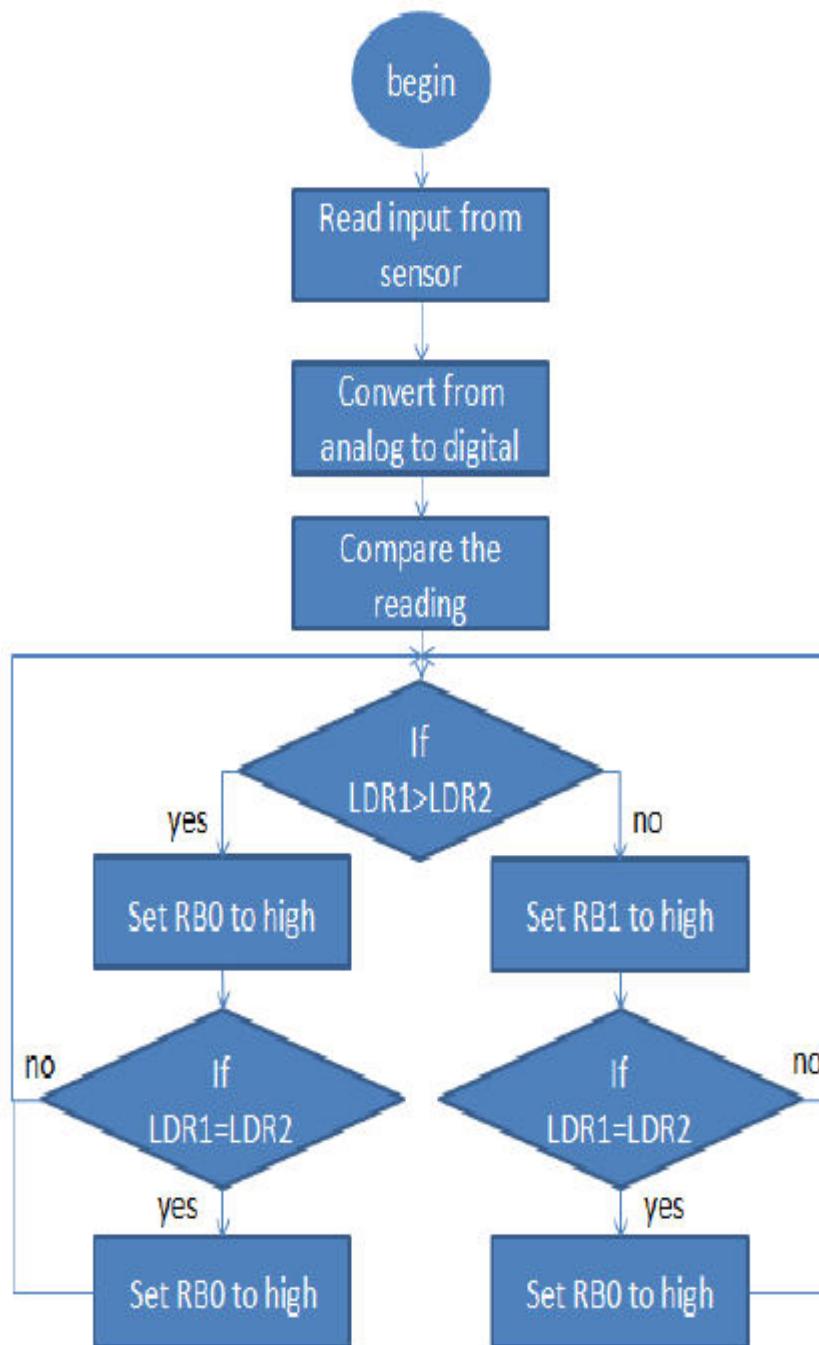


Fig. 4.3: Flow chart of our system

4.4 Calculated output:

Here we've got use dc in gear motor of ten R.P.M, 12V dc, to rotate the electrical device from east to west and invert direction. In general, the peregrinates from east to west i.e. 180degree in twelve hours (6am to 6pm) or 720mins. For 10degree displacement, the sun takes $720/180=$ forty minutes.

The circuit takes 24mA at 12V dc. So, the specified Power= $24\text{mA} \times 12\text{V} = 288\text{mW}/\text{sec}$. For 6 sec, the specified power= $288 \times 6 = 1728\text{mW} = 1.8\text{W}$. Here we've got use dc in gear motor of ten R.P.M, 12V dc, to rotate the electrical device from east to west and invert direction. In an exceedingly day the panel (or we will verbalize motor) moves east to west and back to east.

For ten rotations the motor takes one min/ sixty sec. Ergo, for one rotation (360 degree) the motor takes $(60/10) = 6$ sec. The circuit takes 24mA at 12V dc. So, the specified Power= $24\text{mA} \times 12\text{V} = 288\text{mW}/\text{sec}$. For 6 sec, the specified power= $288 \times 6 = 1728\text{mW} = 1.8\text{W}$. in an exceedingly day the panel (or we will verbalize motor) moves east to west and back to east.

To rotate from east to west (180 degree) the motor takes three sec. So, for ten degree displacement it takes $(3000\text{ms} \times 10\text{degree}) / 180\text{degree} = 167\text{msec}$. For 6 sec, the specified power= $288 \times 6 = 1728\text{mW} = 1.8\text{W}$. in an exceedingly day the panel (or we will verbalize motor) moves east to west and back to east

.In general, the peregrinates from east to west i.e. 180degree in twelve hours (6am to 6pm) or 720mins. For 10degree displacement, the sun takes $720/180=$ forty minutes. So, in a pair of hrs the sun peregrinates 30degree. to hide this 30degree displacement the panel takes $(167 \times 3) \text{ msec} = 501\text{msec}$. Here we've got use dc in gear motor of ten R.P.M, 12V dc, to rotate the electrical device from east to west and invert direction. In general, the peregrinates from east to west i.e. 180degree in twelve hours (6am to 6pm) or 720mins.

For 10degree displacement, the sun takes $720/180=$ forty minutes.

4.5 General output:

Time of day	Open circuit voltage(V)	Closed circuit voltage(V)	Current at fixed angle 0 degree(Amperes)
8.00 AM	19.7	15	0.59
9.00 AM	19.8	15	0.71
10.00 AM	18.74	15	0.65
11.00 AM	18.66	15	0.64
12.00	18.80	15	0.69
1.00 PM	18.78	15	0.60
2.00 PM	18.74	15	0.64
3.00 PM	18.54	15	0.63
4.00 PM	19.12	15	0.59
5.00 PM	18.97	15	0.44
Total			6.18

4	Time of day	Open circuit voltage(V)	Closed circuit voltage(V)	Maximum current at variable angle (Amperes)
7	8.00 AM	19.7	15	0.75
C	9.00 AM	19.8	15	0.73
o	10.00 AM	18.74	15	0.71
o	11.00 AM	18.66	15	0.70
m	1.00 PM	18.78	15	0.65
p	2.00 PM	18.74	15	0.64
a	3.00 PM	18.54	15	0.63
a	4.00 PM	19.12	15	0.60
r	5.00 PM	18.97	15	0.58
Total				6.66

4.6 Comparison of two outputs:

Time	Open Circuit Voltage	Closed Circuit Voltage	Current at fixed angle	Maximum current at variable angle
8.00 AM	19.7	15	0.59	0.75
9.00 AM	19.8	15	0.71	0.73
10.00 AM	18.74	15	0.65	0.71
11.00 AM	18.66	15	0.64	0.70
12.00 Noon	18.80	15	0.69	0.67
1.00 PM	18.78	15	0.60	0.65
2.00 PM	18.74	15	0.64	0.64
3.00 PM	18.54	15	0.63	0.63
4.00 PM	19.12	15	0.59	0.60
5.00 PM	18.97	15	0.44	0.58
12.00 Noon	18.80	15	0.69	0.67
Total			6.18	6.66

Table 4.3: Comparison of two outputs

$$\text{Efficiency} = \frac{(6.66 - 6.18) \times 100}{6.18} = 7.767\%$$

4.8 Proposed Design for Automatic Solar Tracker:

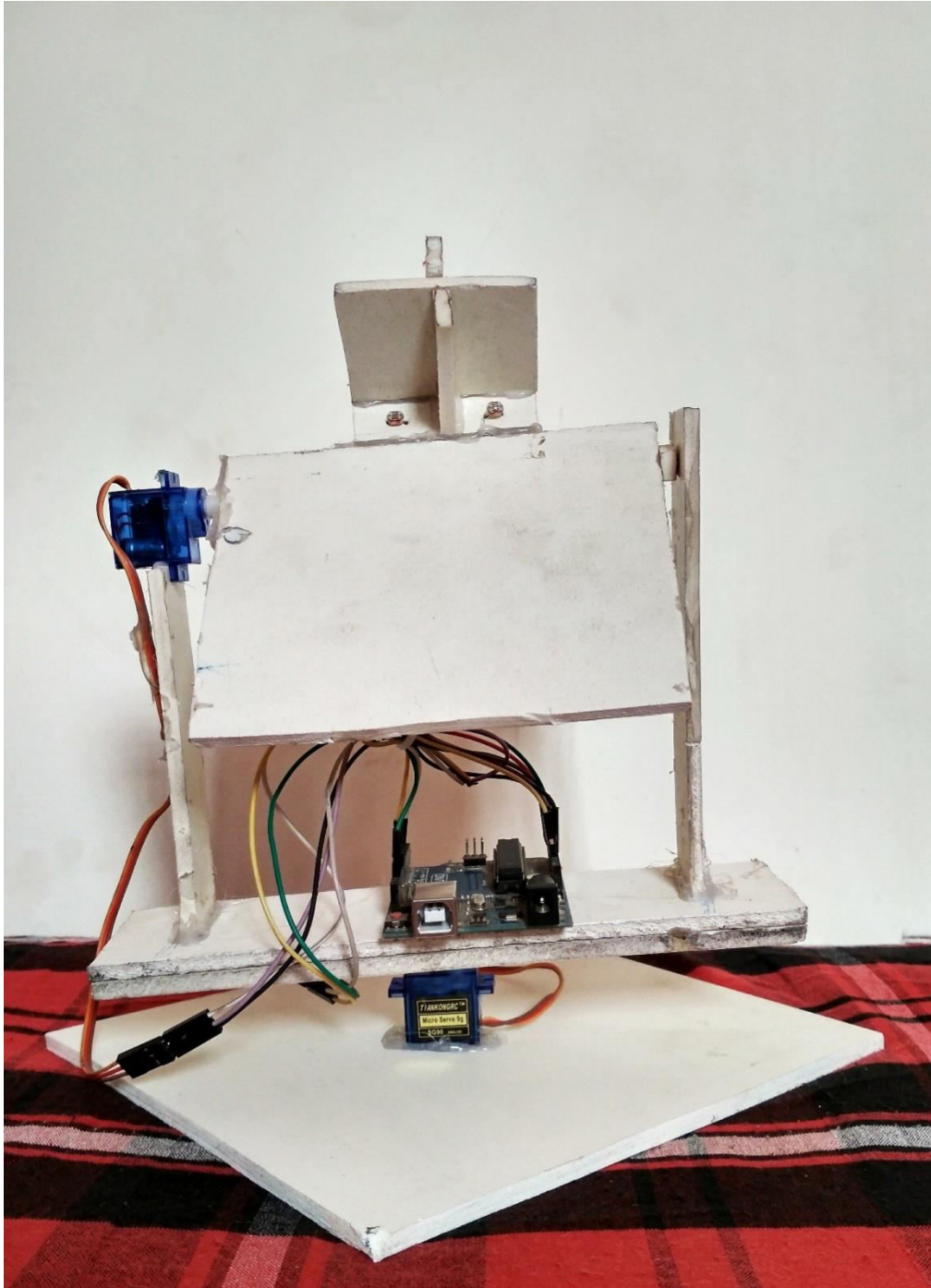


Figure 4.2: Proposed Design for the Automatic Solar Tracker.

CHAPTER 5

RESULT

5.1 Result:

Each and each project is rarely consummate as inchoate things area unit learned any modifications are often done. therefore we've endeavored to form an automatic star pursuit system which can increment the potency of the solar array system obtainable. Albeit there's higher initial price concerned we've endeavored to form the system price efficacious .This is simply the commencement, we will integrate totally different enhancements to form the system additional economical so it'll work around the year. The star panels utilizing this method compared with the system current at this time has several benefits. within the gift system, star panels used area unit stationary which provides less output and thence decrease the potency. however by creating utilization of hunter star panels we will increment potency of system. The operator interference is nominal since the system is automatic this will increase potency of the stationary system. every project can make a come back than anterior one as observe will create U.S.A. impeccable.

5.2 Advantages:

Trackers engender additional electricity than their stationary counterparts because of incremented direct exposure to star rays. This incrementation are often the maximum amount as ten to twenty fifth reckoning on the geographic location of the pursuit system. There area unit many alternative styles of star trackers, like single-axis and dual-axis trackers, all of which may be the impeccable acceptable a novel jobsite. Installation size, native weather, degree of latitude and electrical requisites area unit all preponderating concerns which will influence the sort of star hunter best fitted to a categorical star

installation. solar trackers engender additional electricity in roughly an equivalent quantity of house required for fine-tuned-tilt systems, creating them ideal for optimizing land utilization. In some states, some utilities provide Time of Use (TOU) rate plans for solar power, that denotes the utility can purchase the power engendered throughout the height time of the day at a better rate. During this case, it's good to engender an additional overriding quantity of electricity throughout these peak times of the day. Utilizing a pursuit system avails maximize the energy gains throughout these peak time periods. Advancements in technology and responsibility in natural philosophy and mechanics have drastically reduced long-run maintenance issues for pursuit systems.

5.3 Disadvantages:

Solar trackers are unit marginally additional luxurious than their stationary counterparts, because of the additional involute technology and moving elements indispensable for his or her operation. This is often conventionally around a 6–10Tk/W increase reckoning on the dimensions and placement of the project. Even with the advancements in responsibility, there's usually additional maintenance needed than a standard fine-tuned rack, though the standard of the solar hunter will play a job in what proportion and the way usually this maintenance is required. Trackers are unit an additional involute system than fine-tuned wrenching. This designates that usually additional web site preparation is required, as well as additional trenching for wiring and a few additional grading. Single-axis hunter comes nonetheless need additional site preparation on company stability and bankability. Once it involves obtaining comes supported, these systems are unit additional Byzantine and therefore are unit optically discerned as a better risk from a financier's viewpoint. Solar trackers are unit usually designed for climates with very little to no snow creating them an additional viable answer in hotter climates. Fine-tuned wrenching accommodates additional astringent environmental conditions additional facilely than pursuit systems. Fine-tuned pursuit systems provide additional field adjustability than single-axis pursuit systems. Fine-tuned systems will usually accommodate up to twenty slopes within the E/W direction whereas pursuit systems usually provide less of a slope accommodation usually around 100 percent within the N/S direction.

CHAPTER 6

CONCLUSION

6.1 Conclusion

My engineering project was to seek out what area unit the necessary variables contemplate to think about to contemplate after you area unit building a machine-controlled star pursuit system with pic microcontroller? to try to this we have a tendency to designed a star huntsman based mostly off one on instructables and tested and retested it till it had been accurately following the sun to seek out out what necessary variables you ought to consider once building one. My hypothesis was that i believe the necessary variables to think about once building star pursuit system are going to be the lights sensors, servo motors, the resistors and also the programming/programming code.

After making a star pursuit system and finding what variables our ought to take into account once building one, we have a tendency to discovered that our hypothesis was part correct, however incorrect as a result of we same additional the final concepts in our hypothesis like, the motors, LDRs, resistors and also the code area unit the necessary variables, however really it had been additional love it was the position of the servo motors and ensuring that the resistance price of the resistors weren't to high or too low. when making it these were the necessary variables you would like to consider:

- orthography things properly within the code
- having a powerful base
- having pots is useful
- for statements don't seem to be have to be compelled to management servo motors
- placement of the servo motors
- having robust solder joints
- not having too several sources of sunshine
- hot glue isn't the simplest thanks to stick things along
- declaring inputs and outputs

- adding ; at the tip of statements to separate them
- placement of the LDRs
- resistance price of the resistors
- checking the
- having long wires
- keeping the wires organized
- single pinhead connectors don't seem to be the simplest thanks to connect the servo motors wires to the bread board

I thought there was no errors during this project, aside from once we tested at Ernest Manning thanks to that there wasn't constant level of sunshine as a result of once we tested reception there was no lights on different then the electric lamp, however once I take a look at Ernest Manning there have been lights on which sort of disrupt our test as a result of it might generally track not the electric lamp however conjointly the lights within the area. For next time we'd undoubtedly add comments in my code to explain what's happening, draw a diagram of the star huntsman and a schematic of the circuit, perhaps add additional LDRs to create a touch additional correct, not use hot glue to attach the motors, not use single pin head connectors to attach the servo motors wires to the bread board and take a look at within the same testing atmosphere on every occasion. This info on what's necessary to think about once building a star huntsman and the way does one build one is extremely helpful within the trade of solar power and can undoubtedly be additional gift within the years to return thanks to that heating is increasing and fossil fuels and different unsustainable resources area unit running out. Since pollution/green homes gases area unit increasing several reformist and individual are attempting to work out ways that to reap property energy in economical ways that and solar power is one in all them. solar energy systems area unit economical, sturdy and a property thanks to convert energy from the sun into voltage we will use, however while not employing a star huntsman with the electrical device, you're not getting the maximized quantity of energy that the electrical device may harvest. The rationale why is that they rotate/turn them to reduce the angle of incidence with the sunshine and also the panel. this suggests that the star panels can forever be facing the sunshine supply, which suggests that the electrical device can forever be aggregation the maximum amount

lightweight because it will get throughout the day. Several corporations round the world area unit mistreatment this new star pursuit technology to extend the potency of their star panels and most star pursuit systems increase the potency of star panels by 20-40%. Even supposing this technology isn't excellent and will undoubtedly increase the potency even additional, it's still an extra step within the right direction into saving our Earth. Hopefully within the years to return nearly each company that generates electricity from star panels are going to be mistreatment this new technology. For my next steps i will be able to be adding a electrical device to the star huntsman and by making my very own code build the electrical device flip with the star huntsman and track the sun. conjointly harvest energy from the electrical device Associate in Nursing power an LED.

6.2 Scopes:

There area unit forever remains Associate in Nursing measureless scope of change to a system style. It's solely the time and money constraints that impose a restriction on the event. Following area unit the few enhancements that will integrate additional price to the system.

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Appendix

Programming Code for Whole System

```
#include <Servo.h>

Servo servohori;

intservoh = 0;

intservohLimitHigh = 160;

intservohLimitLow = 20;

Servo servoverti;

intservov = 0;

intservovLimitHigh = 160;

intservovLimitLow = 20;

//Assigning LDRs

intldrtopl = A0; //top left LDR green

intldrtopr = A1; //top right LDR yellow

intldrbotl = A2; // bottom left LDR blue

intldrbotr = A3; // bottom right LDR orange

void setup ()

{

Serial.begin(9600);

servohori.attach(10);
```

```
servohori.write(0);  
servoverti.attach(9);  
servoverti.write(0);  
delay(100);  
}
```

```
void loop()
```

```
{  
servoh = servohori.read();  
servov = servoverti.read();
```

```
inttopl = analogRead(ldrtopl);  
Serial.println (topl);  
delay(200);  
inttopr = analogRead(ldrtopr);  
Serial.println (topr);  
delay(200);
```

```
intbotl = analogRead(ldrbotl);  
Serial.print (botl);  
delay(300);  
intbotr = analogRead(ldrbotr);  
Serial.print (botr);  
delay(300);  
// calculating average
```

```
intavgtop = (topl + topr) / 2
intavgbot = (botl + botr) / 2
intavgleft = (topl + botl) / 2
intavgright = (topr + botr) / 2;
```

```
if (avgtop<avgbot)
{
servoverti.write(servov +7);
if (servov>servovLimitHigh)
{
servov = servovLimitHigh;
}
delay(10);
}
else if (avgbot<avgtop)
{
servoverti.write(servov -6);
if (servov<servovLimitLow)
{
servov = servovLimitLow;
}
delay(10);
}
else
{
```

```
servoverti.write(servov);  
}  
  
if (avgleft>avgright)  
{  
servohori.write(servoh +8);  
if (servoh>servohLimitHigh)  
{  
servoh = servohLimitHigh;  
}  
delay(10);  
}  
else if (avgright>avgleft)  
{  
servohori.write(servoh -7);  
if (servoh<servohLimitLow)  
{  
servoh = servohLimitLow;  
}  
delay(10);  
}  
else  
{  
servohori.write(servoh);  
}
```

```

delay(50);
}
intavgtop = (topl + topr) / 2
intavgbot = (botl + botr) / 2
intavgleft = (topl + botl) / 2
intavgright = (topr + botr) / 2;

if (avgtop<avgbot)
{
servoverti.write(servov +7);
if (servov>servovLimitHigh)
{
servov = servovLimitHigh;
}
delay(10);
}
else if (avgbot<avgtop)
{
servoverti.write(servov -6);
if (servov<servovLimitLow)
{
servov = servovLimitLow;
}
delay(10);
}

```