

DIGITAL SUN TRACKING SOLAR PANEL USING MICROCONTROLLER

**A Project 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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CERTIFICATION

This is to certify that this project paper that is entitled “**DIGITAL SUN TRACKING SOLAR PANEL USING MICROCONTROLLER**” is done by the following student under my direct supervision and this work has been carried out by him 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 in December 2021.

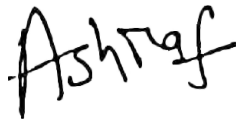
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DECLARATION

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LIST OF ABBREVIATIONS

LDR	Light Dependent Resister
PV	Photovoltaic
MPPT	Maximum power Point Tracker
PIC	Programmable interfacing Controller
GVD	Group Velocity Dispersion
LED	Light Emitting Diodes

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ABSTRACT

In the present time, the solar energy is extremely useful for the existence of humankind. Energy is used in a lot of different ways specially in houses, for appliances, vehicles ,industries etc. The name of this project paper "**digital Sun tracking solar panel using microcontroller**". in straight forward the main reason for doing this project is to make a solar panel that can track the sun and rotate consequently so that it can receive the sunlight at its fullest form of energy. we can achieve this phenomenon by putting in one or two of servo motors with the solar battery that can change the direction in step with Sun's position. the area unit primary three major components of of making the project microcontrollers , servo motors, arduino are functionalized for the project. it can take the sensing element sign and use it to control the motors in step with the program that has been done in the arduino. one of the servo motor is is employed horizontally to maneuver the solar panel up and down. the opposite employed vertically to move the left right direction. the battery that has been used in this project is connected with the servo motor and the position of solar battery is exactly as the servo motor. when the the sun's ray falls on the panel the module accepts the power and reserves in the battery.

Chapter 1

An Overview of Renewable Energy

the energy that is generated from nature and can have unlimited supply are identified as renewable energy. the examples can be geothermal heat wind power tides power water energy different types of biomass and most importantly sunlight. it has no limit and can be renewed constantly. this type of energy are responsible for operating the civilizations of the modern area. energy at the reasons to fulfill people's desire and ambition. day to day of our lives every single step of our day to day movement are associated with energy. the supply of energy must be inlis if you want to to survive the entire population. in the world humans are the greatest creation who who does everything in their power to make the best use of energy. energy is decreasing everyday as everything has his own limit. so conserving energy in order to make a better world should be on Moto.

1.1 Types of Renewable Energy

there are various types of energy mainly biomass solar wind geothermal and water. Green power is a word that amazes us while hearing as it indicates the type of power that can be restored by itself. as the fossil energy sources has his own limit but the green energy can generally generate unlimited li for example the solar energy e can be found as long as the sun lives on. it can be without doubt that wind energy Sun energy limitless and they will be sound as long as the solar system exist. and they don't have any negative effect on the nature as well.

the different kinds of resources that can be identified as green power happens to be e the following ones :-

solar photovoltaic energy, hydro electric power, wind power, biomass energy, thermal energy of the solar, geothermal power, power of the Waves, and the power of the tides, etc. according to the observation the actual power off the green sources has different type of uses for different sections. for instance we use the solar and wind energy also the geothermal energy to provide electricity e for civilized houses. it can be seen that many houses have solar plant, wind power plant and geothermal plant for electricity and heating purposes, instead of having numerous uses the main use of the green energy source is to generate electricity. the most typical kind of wind power source is hydroelectric energy source. it uses the potential energy of water to generate electricity. the wave and tidal are also so have the same ability to in case of generating electricity. geothermal it is to use the heat energy to convert them into electricity.

The different kinds of green power resources tend to be:

- i) Solar Photovoltaic Energy
- ii) Hydro electrical power
- iii) Wind Power
- iv) Bioenergy
- v) Solar Thermal Energy
- vi) Geothermal Power
- vii) Wave Power
- viii) Tidal Power

As potential observe, the particular sorts of green power that you'll be able to use square measure very varied. of these varied inexperienced power kinds; alternative energy, processing wind energy still as energy power is also used one by one to produce energy for the house. you'll be able to observe varied homes that have alternative energy panels to {make|to form} power still as heat water and you may to boot observe homes that make use of energy sends with respect to heating.

Nevertheless, the particular answer regarding the worldwide size depends upon utilizing these varieties of power resources to form power together with different varieties of power on the substantial size. thus to own this explicit, there ar various sorts of inexperienced power vegetation everywhere the world. the foremost typical quite inexperienced power vegetation ar possibly electricity energy programs that ar place along on the brink of streams together with different moving physiquess related to drink.

Furthermore, processing wind generation vegetation will be obtaining well-liked everywhere the world. processing wind farming tend to be designed to make sure that twenty or maybe a lot of processing wind generators tend to be designed conjointly to be able to increase the particular electrical result from the Blowing wind energy grow.

Obviously, different designs related to inexperienced power will be utilised. you'll notice geothermic submission vegetation in bound areas of the world yet as periodic event power and additionally the flow power tends to be utilised in bound ocean shorelines everywhere the planet.

1.2 Objective of this Project

The main purpose of making this project paper are the followings

- to track the sun's position and rotate the panel according to the sun's position and receive the sunlight at its fullest potential during the daytime.
- optimising the full solar energy using audino.

- observing the technical feasibility of mppt as well as the viability and giving details of the different methods that relates to mppt.
- uses of arduino in any system
- designing DC 2ac converter so that we can connect the solar panel with the grid powerline.

1.3 Methodology

For making this project, first we are gonna built a base on the ground where different iron rods in different shaping manner will be attached where different elements will be connected to operate the system. the solar tracking system is divisioned in 3 sections. the first one includes two LDR module death are connected like voltage divider circuit. the arduino Ide are programmed in the system which works as the microcontroller and lastly e there would be a DC motor which will rotate the solar panel. the motor driver will be e divided into three terminals where there would be e2 input motor and output motor respectively and the third one would be e the power which is inputted. the power of the motor is connected to the the two pinpoint of the the 14 arduino input output pins. the output terminal will be attached to DC motor. The resistors operated by light will be attached along the length at any side of the solar panel.

1.4 Block Diagram

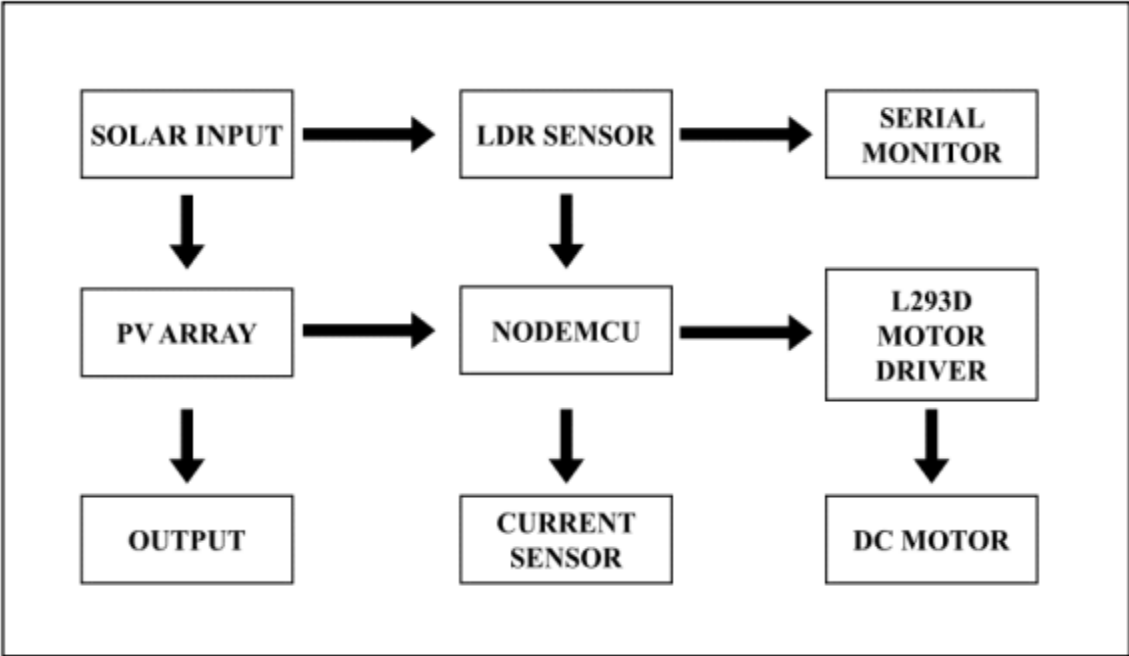


Fig: 1.1 Block Diagram of Automatic Solar Tracking System

there are three stages design with independent abilities. the programming of the module is is accurately and logically approved which anyone can understand very quickly. if any errors are found they will be freely considered and rightly done. in the following chapters we will describe about the solar energy mppt its history working principle the explanation of PV cell PO method advantage disadvantage of mppt.

we will also discuss about microcontroller ardeno no how to program in arduino is structural design the pin diagram the definition of servo motor is controlling LDR definition is working principle and construction setting up a photocell characteristics of LDR the circuit simulation and the making of the project lastly in chapter 5 there will be conclusion and further project prospects and at the end there will be e reference and the code which is used for arduino programming

Chapter 2

Literature Review

2.1 Maximum Power Point Tracing

photovoltaic cell also known as PV cell or solar cell has a strong bond with the environment it is set up into. this strong bond helps them to generate the maximum power. there is a tendency for solar cell which is not linear that helps them to generate maximum power with the product of open circuit voltage along with current that is short circuited this factor is define as fill factor. in what environment it is situated can be described by the base on three individual factor there fill factor open circuit voltage and short circuit current. depending on certain load and resistance and using the ohm's law or we can detect the the certain amount of voltage and also the current value that is correlated at a certain point where the PV cell is established. the voltage current carb line can n be used as the current constant source of every area. the full power supply changes the voltage current curve in an inverse manner and sources the relationship between them. so by using the theory that is named as elementary circuit theorem we can describe the power that has been obtained their magnitude can you show us the maximum power point ratio of a a certain area. so in every area you need there is a certain point where we can find the maximum power generation by using the given time and space co-ordinate. the methodology of my project is also to find that maximum power point or track them in order to ensure maximum power generation of the PV cell set up by me. there is a connection point given between the generation voltage and the voltage of the battery which will be defined as the output voltage. first the voltage is taken from the PV cell and converted into lower voltage point and collected in a smaller battery then it is converted into 2 best voltage possible to obtain the current at its maximum level.

Favorable conditions for max wall plug pursuit

MPPT also defined as maximum power point tracking needs some certain condition to work which also requires more power so that

-for drawing out the the full power from mppt gastly weather which is cloudy and cold is is strongly recommended. photo boltic panel can have greater walking ability at the time of this type of weather situation.

-at the time of the the charging level of battery being at its lowest point the mppt would be at its greatest point. the the greatest amount of current is acquired by the the maximum power point tracking system in the lower battery situations.

MPPT solar charge controller

The the maximum power point tracking system algorithm shown in the following shows as how the charge controls are made and the how the current is supplied from the solar panel to the batteries the step procedure includes DC voltage supply from solar panel then turned them into high frequency AC then used in lower DC voltage for the battery.

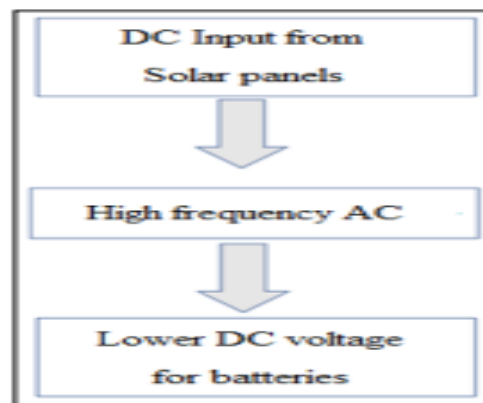


Fig: 2.1 Conversions taking place inside the Solar charge controller

2.2 Features of MPPT solar charge controllers

-if there is a PV module used like an energy supplier then m PPT solar charge controllers can sense the the ups and downs in the characteristics of the voltage current curve.

-the solar charge controller of mppt can generate the greatest level power from solar panel they used the PV cell to do a searching for the maximum power point place .

-this control system gives allowance to its user to drive the solar panel generating the output voltage higher then the voltage of the battery.

-the advanced highly efficient controlling systems output is also supported by mppt system. as the system output of the solar panel is converted into DC to DC converter it can be so that we can use the system with other energy sources as well.

-the mppt system cannot only be capitalised by solar panel but also other renewable energy sources can be connected to it for instance we can use water turbine or wind turbine using this controller system.

2.2.MPPT Trackers placement

eventually the MPP tracking system can generate greater power from identifying the certain area unit. the system is made in a way that can supply current from all the models surrounding to it single certain point where the current is reserved. these models are associated in in series connection with one another. Due to the construction process of different generating modules are different then each other importance of manufacturing and sharing the characteristics of the voltage current curve and the output of these systems will differ accordingly. onto the supply of of energy source is same in the whole area due to this for they cannot generate the maximum level of power from each and every module there would be. for that the efficiency label will be lesser then it should be. at this present time all the companies in this world related to making energy generation device uses mppt system in their device so that we can generate the maximum level of power by identifying the certain point so that their device works with its best level of efficiency

Chapter 3

Microcontroller and Algorithm

3.1 Equipment's List & Algorithm

Project equipment is showing table 3.1

Table 3.1 project equipment

NO	Name
1	Driving or Servo Motor
2	Atmega328
3	LDR
4	5V Voltage regulator (LM2596)
5	Capacitors (3x1000uf,2x220uf, 2x100nf, 2x22pf)
6	Resistor (5x10K,
7	330ohm, Pot-10K
8	Diode (N5822Schotkey)
9	Male Header
10	12 Volt Power Supply
11	Bread Board (For testing purpose)
12	Soldering iron, Soldering led
13	Solar penal
14	Multi-meter (For Measurement)
15	Oscillator 16 Mhz
16	28 Pin IC socket

Algorithm:

Step1: we are going to connect the LDR one pin to five potential unit of every LDR and another pin of LDR will go to the four analog pin of the microcontroller. Step2: The microcontroller can calculate the typical voltage to LDR of every section such top to Bottom to left and Right .

Step3: From there microcontroller can commit to rotate the servo in step with the difference of 2 averages such prime and bottom average distinction and left right average distinction.

Step4: in step with the difference the position of servo are going to be

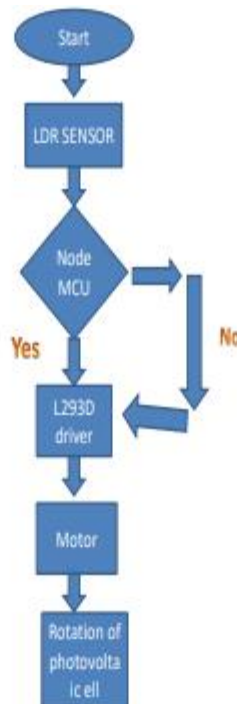


Fig 3.1 Project chart

3.2 Definition of microcontroller

The fundamental internal styles of microcontrollers square measure pretty practically identical. Figure 1.4 shows the diagram of an ordinary microcontroller. All parts square measure related through an inside transport and square measure all joined on one chip. The modules square measure related with the surface world through I/O pins

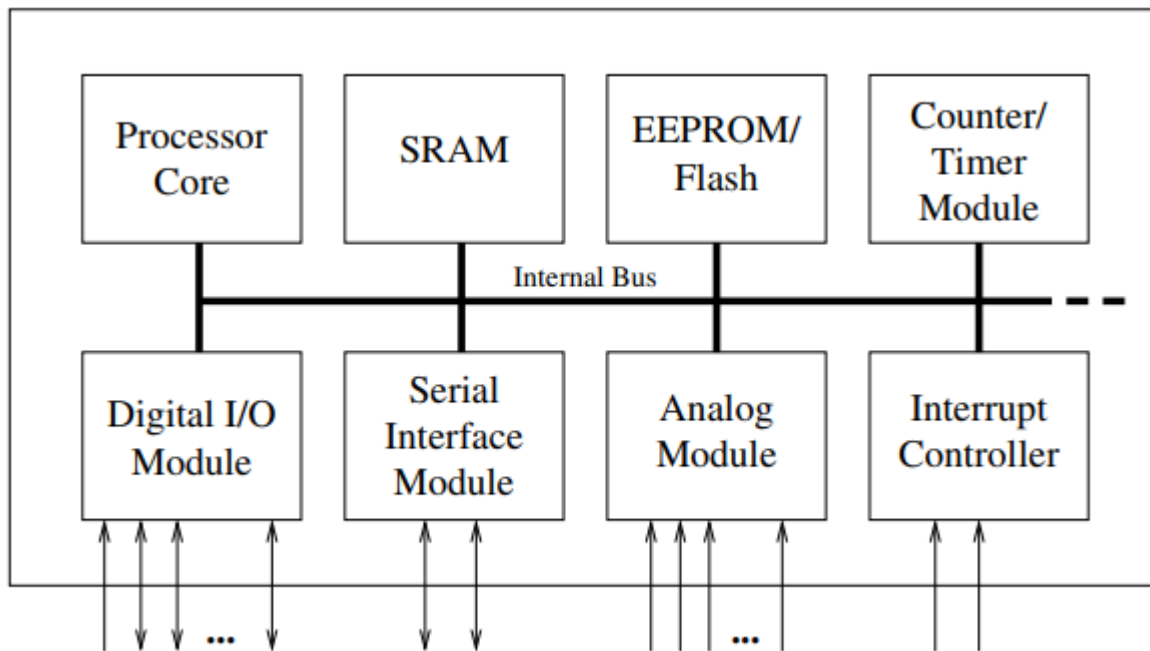


Fig: 3.2 Basic layout of a microcontroller

in the below the list we have contains different types of models we can find in a microcontroller more detail explanation of these components are given in the following

core processor: it is the central processing unit of the microcontroller. contents all the units like logic management and registers. the registers includes stack pointer program counter file register etc.

memory: memory usually divided into two parts program and knowledge. for bigger controllers the DMA controls knowledge transfer between in the the elements of the processor

Interrupt controller: this unit helps to interrupt the flow of the program during many internal and external incidents. resolving power is also one of its function.

Timer/counter: at least in all the controllers we had this unit minimum 2-3 times. they are responsible to area every single intervals count events output control they are also responsible to drive the motors stop them when it is needed control the pwm output filtering the external output and having convert the digital analogue supplies.

Digital i/o: the number of pins in the input output section where is from 3 to 4 receive all the data that is been provided in the controller

Analogue I/O: this unit is present in most of the the controller's this helps work as a comparator converse the digital data into to analogue so that the machine can understand the commands that has been given by the program. the pin numbers are 8-12 along with 2to 16 channels.

Interface: in order to make a communication with other computers every controllers usually have minimum of One serial interface de can communicate with external peripheral device supply and very other interfaces like SPI and SCI additional contents the the common buses. bigger interfaces can carry PC USB and LAN as an interface ports.

Watchdog timer: this unit is used only e when the program crashes it heals to reset the program if any unusual activity e is Caught during the running of the program that has been installed in the arduino.

Debugging unit: a lot of controllers are are made carrying remote debugging cheap in the the unit to control the installed application. ne can be used for managing all the task and collecting all the the instructions that is given to the memory the interface controllers are the timers interrupt controllers the digital input output pins and the analogue pins embraces with the the operations to run the microcontroller function smoothly and correctly.

3.2.1 Embedded Systems

one of the most important applications in microcontroller is embedded system. these are the system that helps in managing integrated circuits in the system. IIT can be found in many devices specially in mobile phones it is also witnessed in standard laptops. it is equipped with the built-in software package that helped utilise the system properly and in correct order.

3.2.2 Program Assembly Language Programming

this unit of the system provides the knowledge the ideas and the information required by the the system processes to drive them according to instruction programs. the data sheet and manuals that has been provided by the program of my opposite of instructions is given by this language. in this generation of language it is usually view ana chronic. After all, everything you'll kill assembly, you'll kill insert the artificial language of your alternative, henceforward stated as PLi. PL is just

the it is a little slow and few memory economic but in certain times a lot safer and convenient. if you use the c language we need to to purchase more highly structured hardware and supply a lot power and we also need is a huge memory with other aapse programming and we need a lot of skills according to the program instructions speed and size. we can n.b. computer program using assembly other languages. it is possible for everyone to write primary compiler and interpreter using high level languages. but there are some people who uses all the higher languages at once that create the problem. c n c plus plus programming needs has kill people and they also charges a lot. in order to make a c program we need a at least memory of 256 KB including SRAM and other elements. as we can see that this program is and lot of communion and the development time is short so we need to be very updated in order to program things using c. Indeed, it does, but not the greatest sum in show would conceivably assume. tragically, microcode improvement will in general be closer to a definitive cutoff times than, say, equipment advancement or examination. Notwithstanding, postpones because of issues in equipment improvement, hardwaresoftware communication, showcasing, or the executives could all work with to push microcode advancement directly into and on the far side the point on schedule. Along these lines, in the event that the product isn't on schedule, which oftentimes hopes to result to the bundle half. . In short: microcode advancement is anyway one a piece of improvement, and lessening microcode improvement time by five hundredth doesn't at all scale back an ideal opportunity to plug by five hundredth. Also regardless you'll have the option to stand to foster your microcode in PL whenever you're utilized closed enough to hardware,Also, you would conceivably utilize a general language on a top of the line regulator for the confirmation of-idea embodiment and change to programing language on a low-end regulator for creation, covering microcode advancement with various exercises you'll see that you just as a rule must be constrained to check what your compiler thinks about your inventory. For that, a fundamental knowledge of programing language is required. Mindful that any program code written in a very issue situated language like C++ should be converted into code before it are not unexpected dead by a processor. At last, a program in machine language is just an arrangement of numbers. Whenever envisioned inside the right base (as a rule base two will the stunt), the inside design of an order is some of the time perceptible. for example, there's an order inside the AVR guidance set1 to rehash the substance of 1 register (the source) into another register (objective).

using the modes currently I would like to make a load that will price into to a registering device I have a tendency to make use on the top of command however provided that Berry sim price is already out there in another register which is able to type 1 l e in the other unit. it is obvious that I want some ways that the load associated in in a a capricious unit in the register programs. I might want some other command just like the the targeted on top of copying apprise into other registering device. the distinction that we have between the instructions within supposed to be used inmod integration. this you need alternative lines are used tu to target the operand of the commandments.

3.3Driving Motor

this phase of the prototype is to be blame for or converting the the solar and the trailing it in the the face of the Sun. the face includes a module of the driver l293d, a servomotor, this unit of the device is enforced for making two directional moves in the same exist that is connected to the the array of the solar. this unit module charges the servo motor to make the rotation part the module additional e is is attached to the server power provided in the unit of 9 volts.

3.3.1ServoMotorTheory

servo motors is used in electrical energy for equipping movement of rotation. basically there are two principles that area unit accustomed produce motion in electrical motors the force and magnetic force. we can see that DC voltage is used in servo motor which is actually the direct current tu to attain the rotating motion they require. they have two pins with that to manage the the speeding and the movement of the motion the the structural construct principal: we can witness two basic styles of DC motors one of them has brass and the other does not have it . the mechanical device is producers a type of electric field the roto is pused by the magnetic force the rotor is usually entangled with copper wires in a looping manner. whatever the case is the movement direction of the the roto should be modified each each accordingly to our requirement

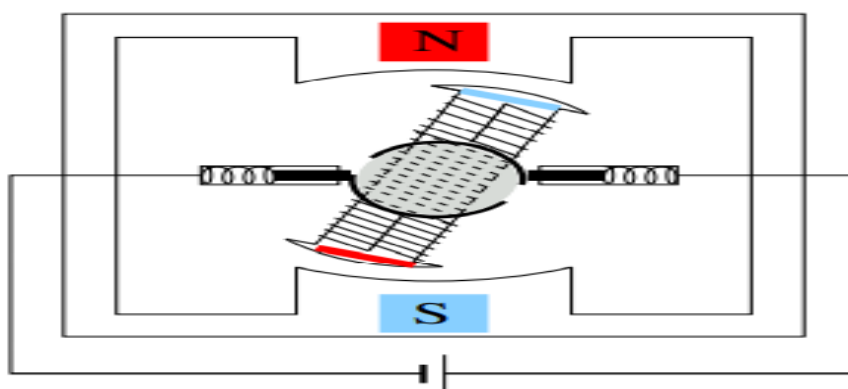


Figure 3.3: Servo motor with brushes

figure 3.3 that has been shown in the the upper identifiers that the operative procedure of a servo motor that contains brass the mechanical device produces a continuing electromagnetic flux either using a magnet or ore associated magnet. here you can see e rota is associate magnet that has been attached to a electric switch additional 22 guide collectors that are han han gapped and attached to the both end of the rotor supply also continuing voltage distinction .there are two branches of carbon brass pretending mechanical device b collecting a supply eye of continuous v distinction which has been rotated by the coil. once rota start to move the brushes that is been attached to the metal band it keeps moving over the gas once the rotor reaches its approximately spread. now the router dance to become an energized so rota cal izeone rotating movements until the brass that has been contacted with the router is chorused. it actually creates a 180 degree rotation flip of the connected device the motor is actually alot complicated functional then the one in figure 3.4 inches away motor with solli two collectors rotates so a practical servo motor may have minimum of three collector's alongside with coils also known as the coil that has been shown in figure scenes MS treatment solli sui causes a non uniform force even a lot of coils are typically accustomed smoothen the movement

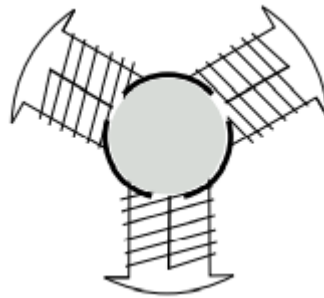


Fig 3.4 Rotor with three armature coils

that contains brushes have a definite problems the brushes are skin attached with the rotor ultimately resulting an an healthy condition. due to this reason the motors that wear used to develop have been failed to to be dependent on the brushes. scenes walnut some mechanical attachments have no other option to get current to the rotor. brushless servo motors have a static magnet that is used as rotor and other state appears that is square measure contains in the opposite to come with a rotational magnetism fielding. so it can be set without a doubt that a brushless servo motor is very complicated in using and caused a lot higher comparing with motor with brushes. however brushless motors happens to be possesses an extended anticipation

3.3.2 Servo Motor Control

here we have mentioned earlier that DC motors carries two pins that are accustomed managed ment there operations. enough Baltic distinction that exist between the connectors can cause the rotation of the motor to be slow. the motor speed rotation v_M is actually e proportional to the distinction voltage u_m that has been applied in the pins

$$v_M \propto U_M$$

in use of terribly tiny UN the friction that is made in the motor can be prevail over the force therefore some particular little UN should be given in the form off the motor flip.

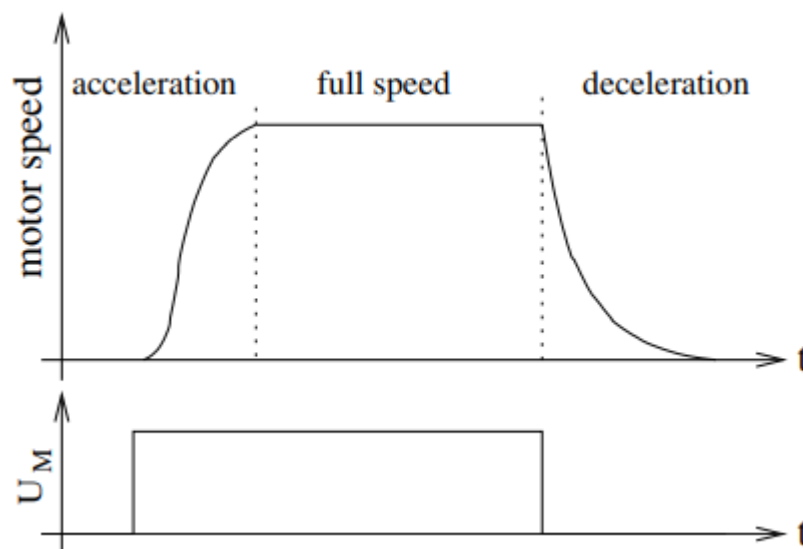


Figure 4.5 Simplified speed curve of a servo motor

figure in the upward signifies the simplest Karbonn the speed of the the used servo motor. once IT accomplishes it's peripheral speed. desktme it maintains the speed in between the boundaries exhibit by the construct. until it is turned off. once it goes inside a slowing section before stops throughout.

3.3.3 Continuous Rotation Servo Motors

in order for controlling the rotation direction of a DC motor is extremely easy. the movement direction is decided using the distinction of the voltage sign u_m in between the pins of the motor. if we reverse the polarity of UN then we can reversely rotate the direction of the motor.

3.3.4 Servo Motor Characteristics

the data provided by the motor can contain all the the useful information in order to operate the motor. the least information that I need would like ok that 8A personal voltage can change according to the supplies this voltage where is inside the motor can operate accordingly. as I have recognise the determined voltage is responsible for speed. if we give lower voltage supply then the needed voltage the operation I will not continue and the motor MI not work. and if you exceed the voltage then the given supplier it will get hotter and the operation will be e finished and the motor will stop working. the Moto aur ko jointly includes labelled voltage which is also so the operational voltage. moreover the data information States that the Moto or once each for or or loaded and unloaded operation are separated. a DC motor atarax lesser current supply then loaded one. other vital character is that the rotation that is done for permanent that is state how how smooth Lee the Moto will this type of parameters is usually e makes the labelled voltage work according to our basic needs. the characters that the motor has can be shown buy a speed torque curve that supplies the link between motari speed also the torsion it will use for manufacturing a load. it works just like the thumb rule The higher the speed of servo motor the smaller is it's torsion.

3.4 Light Dependent Resistor or a Photo Resistor

the registers dependent on the light or LDR also known as photo register is actually a device that is is operated using electromagnetic radiation. so there our kind of a device that works on light sensitivity

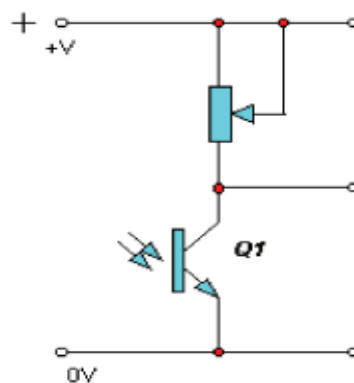


Fig. 3.6 Photo Resistor

they are jointly known as picture that has conductive sales conductors photo cells high resistivity saying conductors are used in making this device their area unit many various symbols want to tu direct an elder which is amongst for most usually used image from within in the below figure the arrow showing indicates lightweight that has been falling there on.

Types of light Dependent Resistors:

Light dependent resistors are classified based on the materials used.

***Intrinsic exposure Resistors**

These resistors are unit pure semiconductor devices like element or germanium. once the sunshine falls on the LDR, when the sunshine falls on the LDR, electrons get energy which helps them to jump from the valence to the conductivity band and the charge carrying will increase.

***Extrinsic exposure Resistors**

These devices are unit doped with impurities and these impurities produce a brand new energy bands higher than the valence band. These bands are unit stuffed with electrons. thus this decrease the band gap and little quantity of energy is needed in moving them. These resistors are unit in the main used for long wavelengths.

3.4.1 Construction of a Photocell

The construction of a detector may be done by Associate in Nursing exhausted glass tube which has 2 electrodes like collector and electrode. the form of the electrode terminal may be within the type of a semi-hollow cylinder. it's continually organized at a negative potential. the form of the collector terminal may be within the type of a metal which may be organized at the axis of the part cylindrical electrode. this may be perpetually unbroken at a positive terminal. The exhausted glass tube may be mounted over a nonmetal base & c base & pins area unit offered at the bottom for base for exterior affiliation



Fig. 3.7 Construction of a Photocell

3.4.2 Circuit Diagram of a LDR

the device that is called LDR will be simply connected with Arduino. The sunshine device is wired to analogue input of the Arduino. The pins of the LDR are attached at the bottom where the opposite is attached at least in one of the five analogue pins. Counting the operation of the LDR is going to want another resistor connected there to. Say as an example when LDR is dominant in light emitting diode or LED. The current inside it causes the LED diode to increase. It has been often explained in additional resistors which is required. The circuit diagram is pictured below.

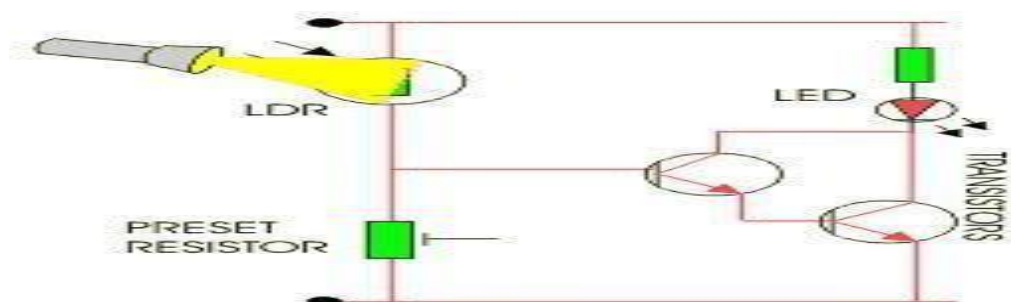


Fig. 3.8 Light Dependent Resistor

3.4.3 Working Principle of LDR

Light dependent electrical device additionally understands as a LDR photoconductor or transducer could be an electrical device whose resistance will increase or it will get lesser depending on the quantity of the sunshine intensity. The square measure of a light dependent resistor awfully grid tool during that light circuit. Light dependent registers will spread its functions accordingly. For instance the LDR may be accustomed activate lightweight once the LDR is taking in light. It will not work in the opposite method truly does once when the LDR is exposed in light it activates and the circuit once is taking in resistance increases interrupts the circuits the method associated on the LDR are fabricated from several materials of high resistance they need high resistance square measure only a few electrons that is square measure free and ready to move as a result of command during an unexpected phenomenon when the line falls on semiconducting material takes in the sunlight photons which the energy is converted into electrons that permits them to interact conductance electricity and the LDR resistance.

Chapter 4

Circuit Simulation & Construction

4.1 Voltage Regulator Circuit Using LM2596

Voltage regulator may be a device that's accustomed build a voltage constant/ linear. Here this can be a 3-30 potential unit adjustable transformer circuit diagram victimisation IC LM2596 ADJ. LM2596 ADJ is specially style for prime quantity of current output of 3A. This LM2596 transformer circuit can give adjustable output. we are going to regulate our output to five.5 potential unit as a result of our microcontroller and servo motor each work on five-6 potential unit. It the schematic circuit you see that we have a tendency to use four electrical device accustomed stable the input and output voltage as as a result of it improve the regulation of voltage.

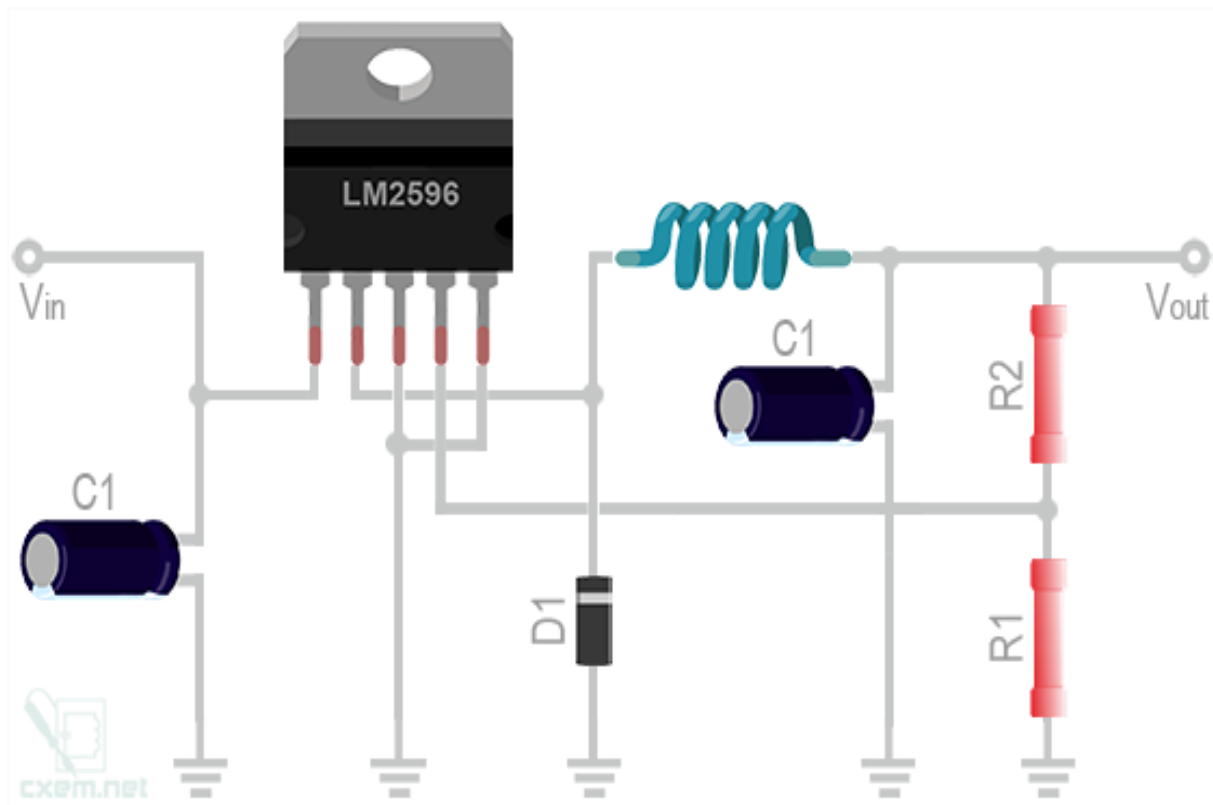


Fig. 4.1: Voltage Regulator

4.1.1 Description of transformer Circuit

It is solely rated for voltages on any of the pot connections that area unit capable (max) or at intervals the vary Vdd to GND. i believe that the circuit diagram for the LM2596 module are going to be one thing like this:

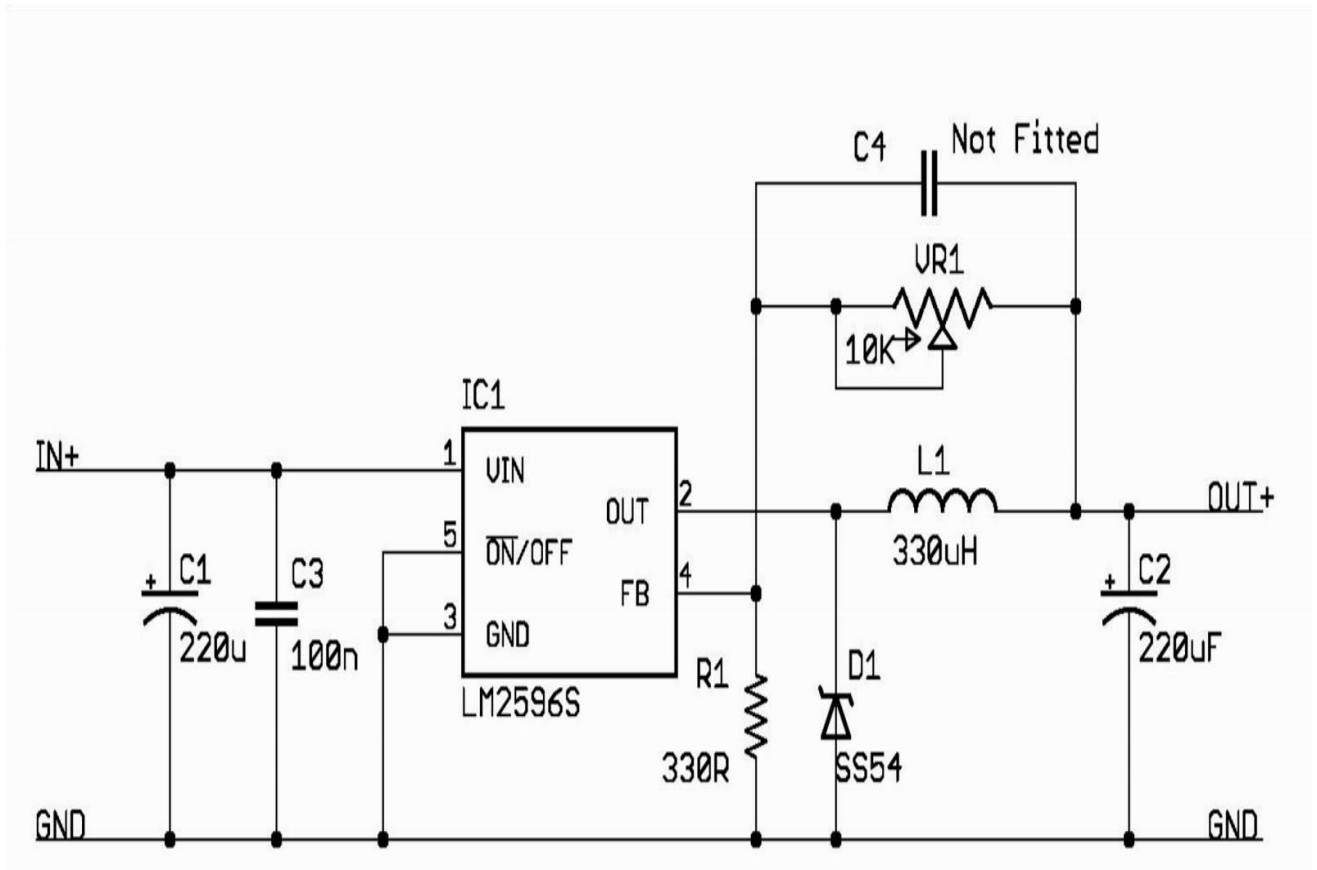


Fig. 4.2: Voltage Regulator Circuit

Note the position of the 10k POT within the circuit. primarily it's connected to the output terminal and though you indicate 330R nonparallel with it, if you "dial-up" AN output voltage that's too high the pot terminals could transcend absolutely the most ratings laid out in the information sheet.

If you'll guarantee that the POT will not transcend Vdd to ground you then have the matter of the POT's capacitance to ground. If you browse the information sheet there's generally 60pF from every wiper to ground (internal) and this might cause all kinds of issues with stability on the regulator (and noise of course).

What i might suggest is that you just strive the circuit with AN external regular pot and add the parasitic elements laid out in the POT's knowledge sheet and see if the circuit goes unstable.

4.2 Block Diagram

Block Diagram of solar tracker using MPPT system with an Arduino is showing figure 4.3:

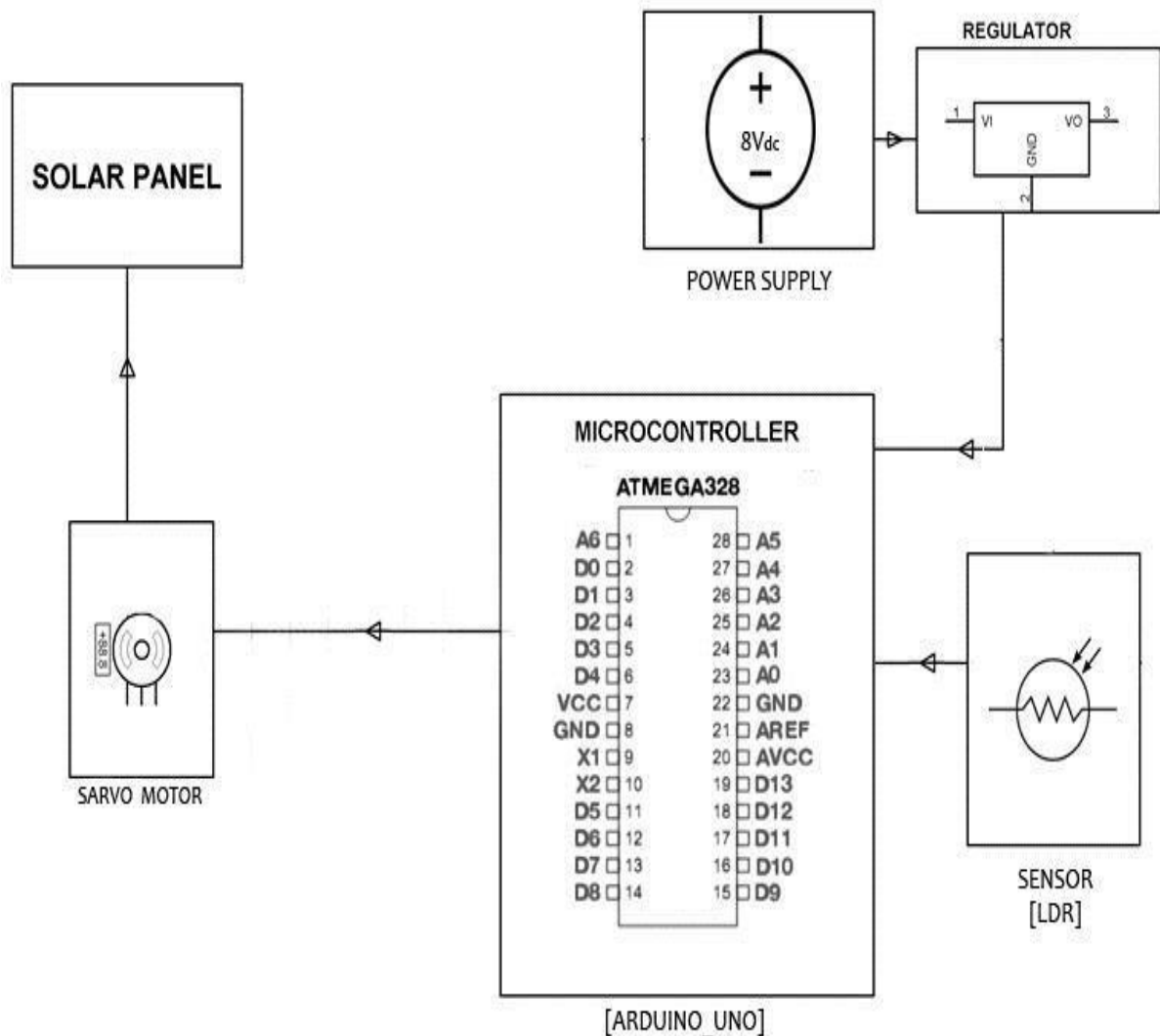


Fig.4.3: Block Diagram of solar tracker using MPPT system with an Arduino

4.3 The Controlling Circuit

the circuit that is used in controlling intendant with a controller that is micro. it is is described with some algorithmic program tu oo to be matched and discover the way of sunshine where is the most. the the data information given from the photograph sensor is carried out the result once it has been compiled in the count calling module. the device that we use in the controller is called nodemcu that is an internet of things device platform also known as iot platform device.

the device that we use in the controller is called nodemcu that is an internet of things device platform also known as iot platform device.

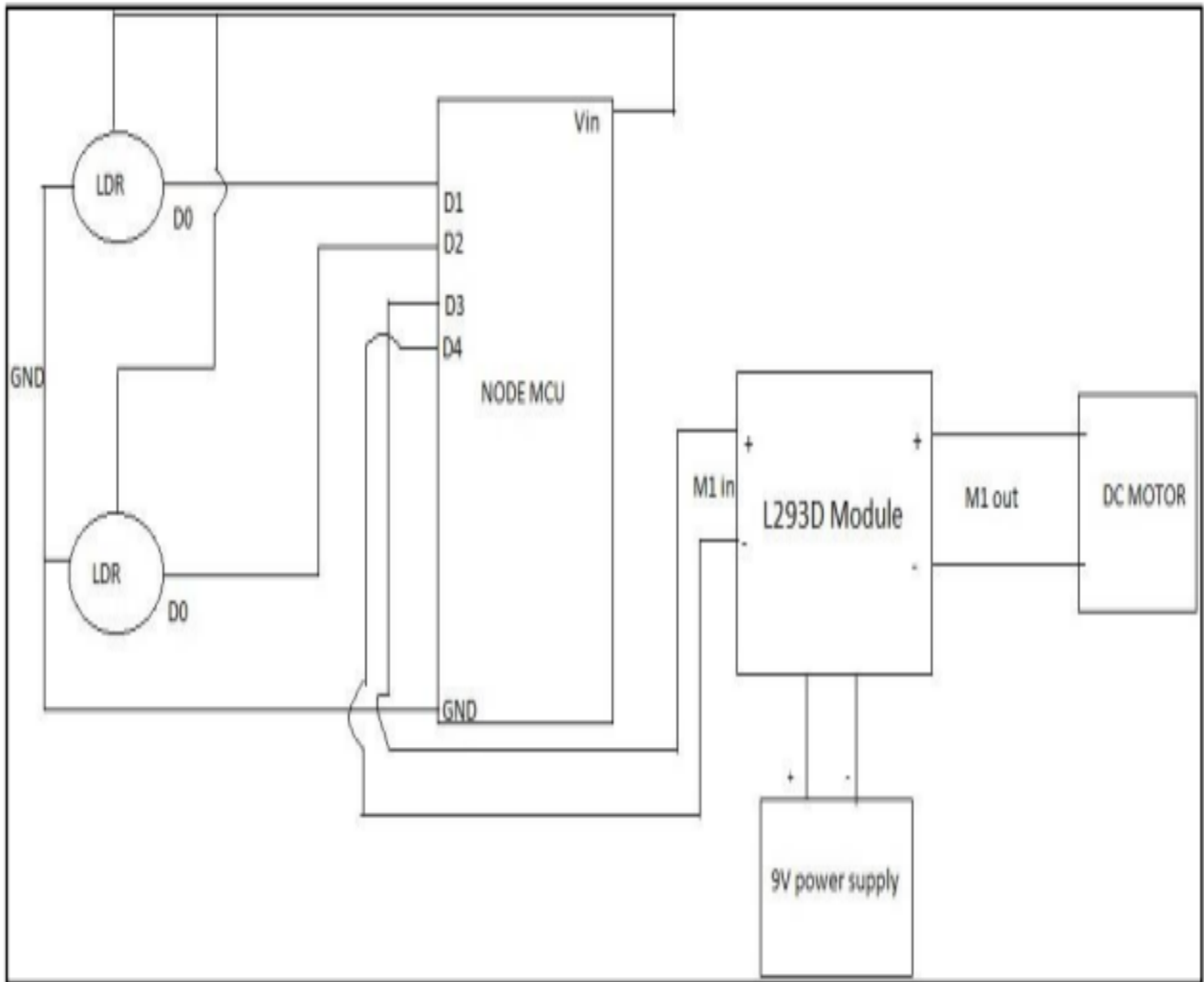


Fig.4.4: Circuit Diagram

4.3.1 Current Sensor

party chual signal that is made once in the present device detects the current that is passing throughout the connectors. This signal is made mainly dawai in three shots analogue current and voltage or digital output. here the leading signal main main have any utilised for the mensuration in the current flowing by associated meter. Haider can be keeping for the coming endorsement with in the field of information acquired or maybe in forced in dominant functions

4.3.2 Simulation

Above circuit the servo is rotating consistent with the quantity of sunshine falling on every LDR consequently we have a tendency to set the position of these LDR to achieve our goal. With the quantity of sunshine the voltage across LDR

will vary and per the position off every LDR we tend to set the rotating position of the servo motor. one amongst the motor can manage the horizontal rotation and another can manage the vertical rotation.

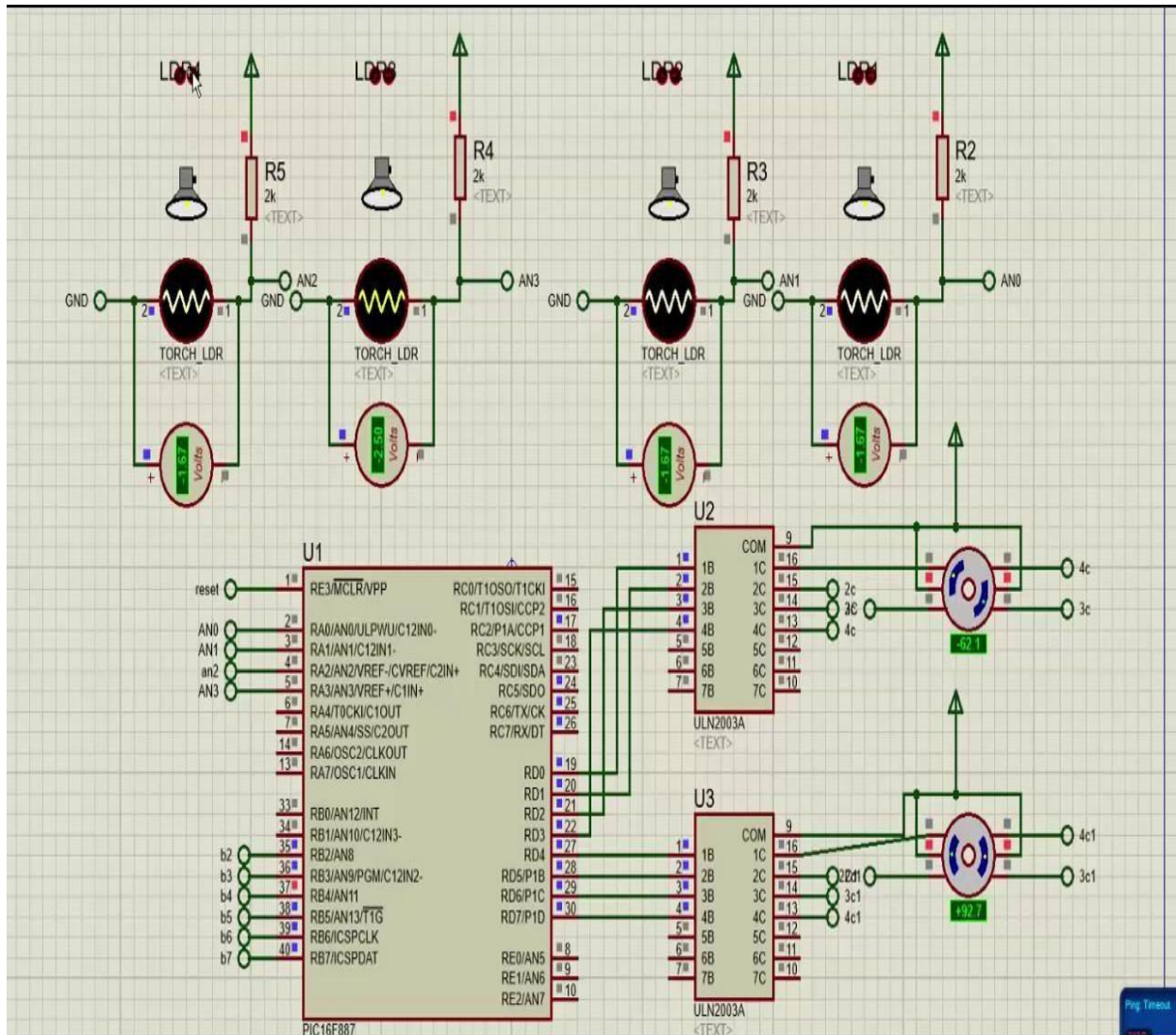


Fig.4.5: Proteus Simulation

4.4 Mechanical Structure

the perspective structure uses steel rod pillars so that it can hold on the solar battery. 30cm rods are used for making those pillars it is the the actual rate. where the other couple of rods steel rods are used have the length of 46 CM. the motility axis is structured using another rod what is the length of 40cm. the base of the structure is constructed using wood that has the measurement of 39*5*22cm . the battery that I have used in my project also known as solar battery has the the length of 29cm and width of 19 CM.

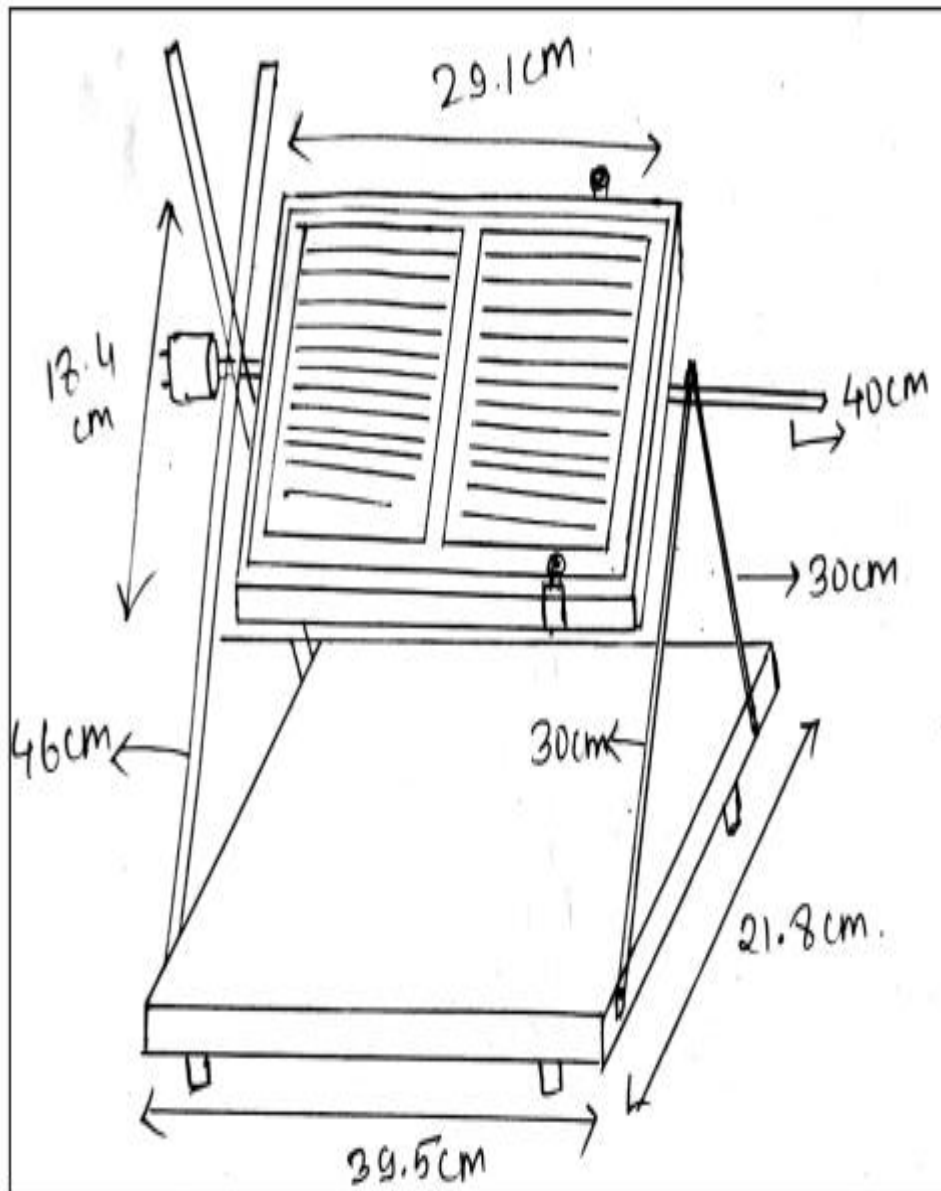


Fig.4.6 Mechanical structure of single axis Digital sun tracking solar panel

4.5 Final Project View

The first image was taken once i used to be testing my simulated circuit on sensible using AN Arduino board. And once success I build my very own atmega328 runnable version on bread board and using LM2596 Buck device module and take a look at my circuit again after success i made a decision to style an entire board and take additional steps.

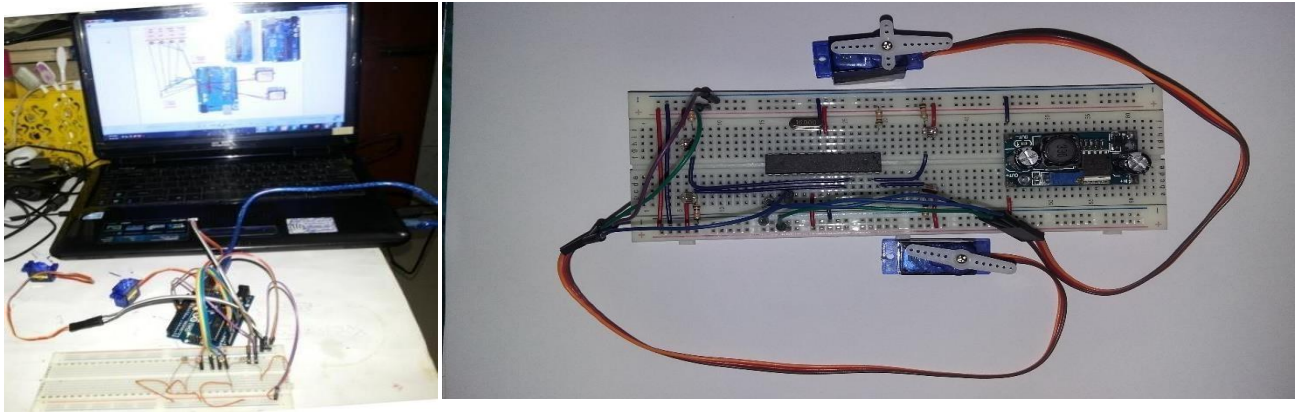


Fig.4.7 Working On Project Shots

4.6 Software Design

The microcontroller employed in our system, is code uses an IoT base platform. The formula is meant in an exceedingly Arduino Integrate Development surroundings (IDE). The transfer speed of the setup is ready to 9600 and therefore the setup id connected to COM5, ESP8266 board.

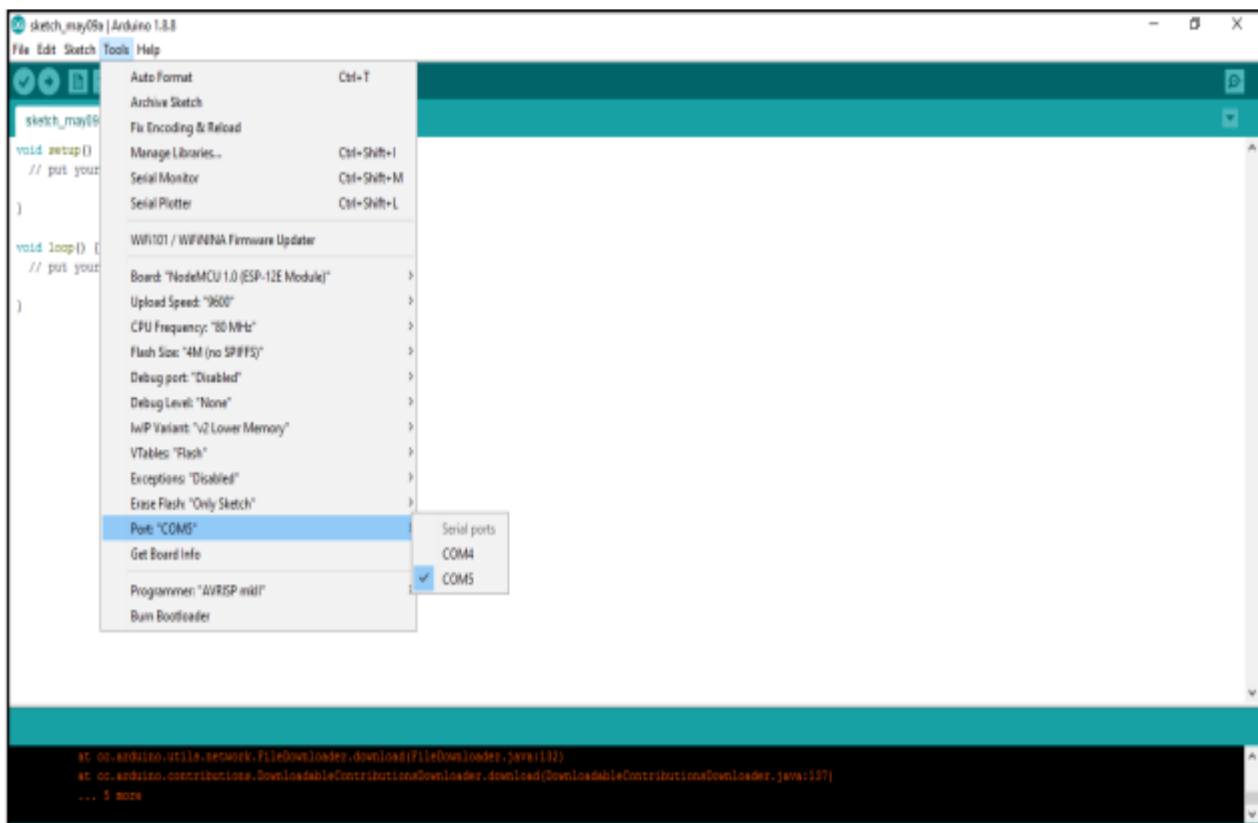


Fig 4.8 Setting up NodeMcu- Port connection

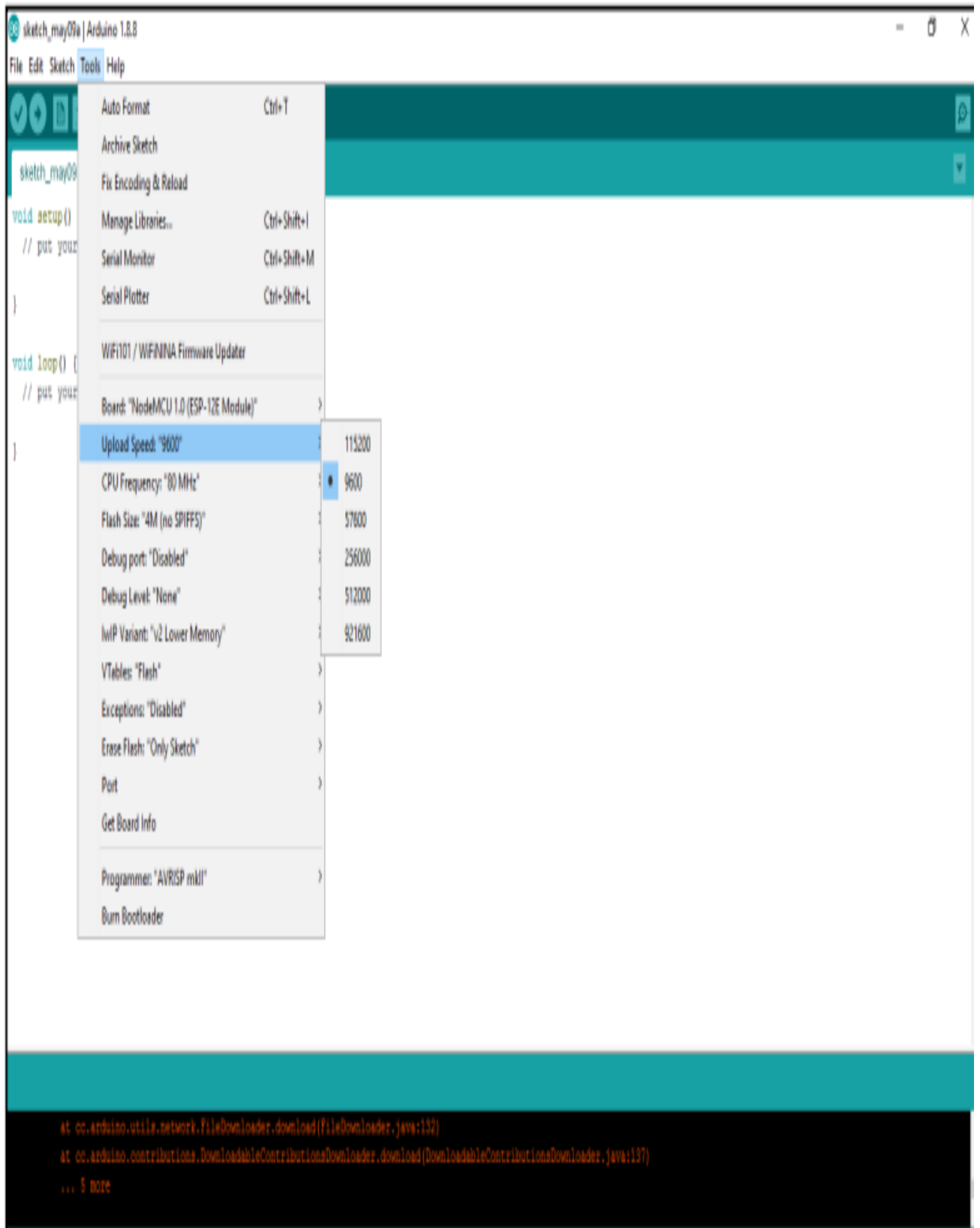


Fig 4.9 Setting up NodeMcu- Upload speed

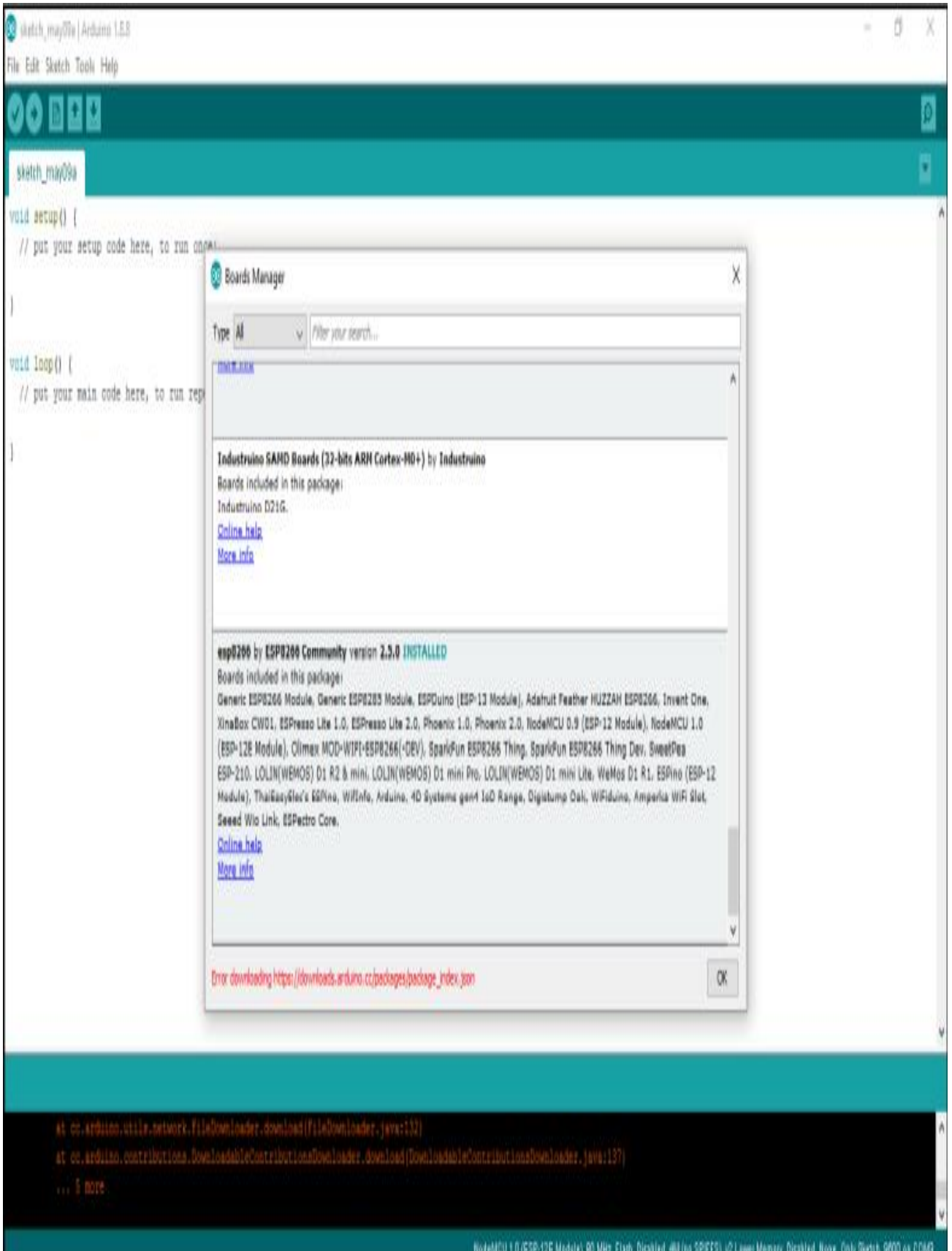


Fig 4.10 Setting up NodeMcu- Installing Library

Thus image was taken once I was testing my simulated circuit on sensible victimisation associate Arduino board .And when success I build my very own atmega 328 runnable version on board and victimisation LM2596

Buck convertor module and check my circuit once more when success i made a decision to style a whole circuit card and take more steps.

Chapter 5

Result and Conclusion

The results for the project were gotten from LDRs for the star trailing system and also the panel that features a fastened position. It took four days to record the result along with tabulating it. The outputting its most potential power all of the time, this happens once track the sun and rotate the electrical device consequently, to receive daylight to the fullest extent invariably throughout the day time.

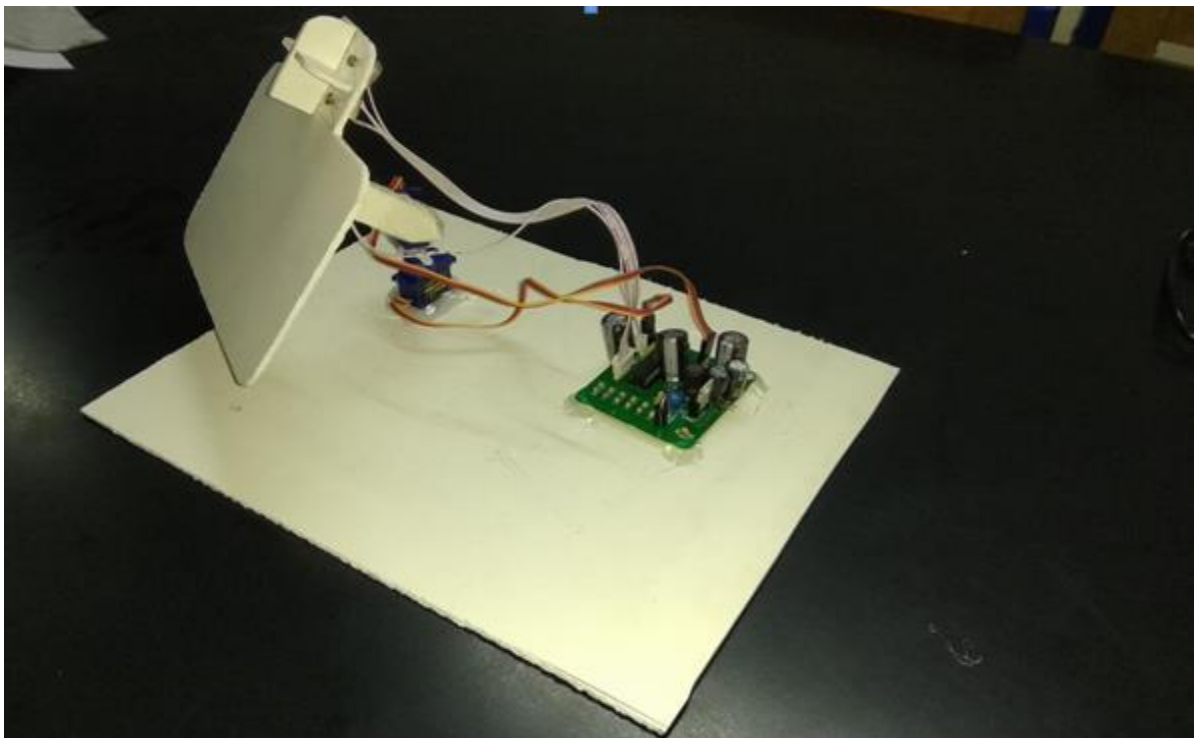


Fig 5.1 Digital sun tracking model

In this project we tend to learned concerning parameters influencing energy conversion of electrical phenomenon (PV) arrays. conjointly Learned concerning the final construct of most electric outlet chase (MPPT) and the way to program burn associate degree microcontroller.

Conclusion :

at this present world discovery uses of fundamental energy source that has been found in this world such as fossil fuel coals water another shots of things have a certain limitations. the constant growing of the population it would be impossible for the human generation tu to cope with the desire of energies using the things that we have in this world .

so using renewable energy source is the only option that can be used to supply enough energy to everyone. that is why people are engaging themselves to make more efficient more powerful more more necessary energy generating models using the renewable energy sources. so in order to make the maximum use for the greatest efficient use of renewable energy we need to create the device with extra care and extra hi tech with the least amount of elements possible so that everyone can use afford the product they discover. in my project paper I have tried to create something which can use the entire or the maximum level of solar energy by determining the point where the energy level is the most. now using this device in countries like h which is an underdeveloped one it would be very efficient not only for the people who is using it we can even supply this electricity that we are generating from the panel to the the grid point also . so so my device can help the people in a way that everyone can use the full extent amount of electricity generate the maximum amount of electricity using the simplest technique in the history. I think my device has the best chance that was all the persons or humans will be able to use the maximum amount of electricity just because of this creation it will not only develop a certain area analytically but also economically as well. most of the development are dependent of electricity so so our country e a government should allow us to use this system on every solar panel they establish and they should fund us so that people can use this system at the lowest cost possible.

5.1 The specific work we have finished are as follows

*I tested and optimized the event board and check the electrical affiliation between Micro-Controller and servo motor that was used to management the motors smoothly.

*After attaching the device, we have a tendency to properly develop the program to notice the signaling to manage the dc servo motors with Micro-Controller.

5.2Advantages

*A lot of electricity is generated by trackers comparing to its counterparts thanks to hyperbolic direct exposure to solar rays. This increase are often the maximum amount as ten to twenty fifth looking on the geographic location of the following system.

*There unit of measurement many different types of solar trackers, like single-axis and dual-axis trackers, all of which could be the correct work a novel jobsite. Installation size, native weather, degree of latitude and electrical needs area unit all necessary issues which will influence the sort of star hunter best fitted to a selected solar installation.

- Solar trackers generate additional electricity in roughly an equivalent quantity of area required for fixed-tilt systems, creating them ideal for optimizing land usage.
- In some states, some utilities supply Time of Use (TOU) rate plans for alternative energy, which implies the utility can purchase the ability generated throughout the height time of the day at a better rate. during this case, it's useful to get a larger quantity of electricity throughout these peak times of the day. employing a pursuit system helps 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.

5.2 Future Prospects

The very embodiment through that the artistic movement problem be put aside, is that the project known as “Digital sun following solar array victimization microcontroller”. A trailblazer by its spirit, this method works in its utmost potency, whether or not that be in terms of its monetary ability or in terms of its accessibility. within the smoke of the darkness wherever pollution engulfing each spheres of advancement as associate degree outcome of producibility , this device in its terribly potency work towards solely advancement and development by flushing out the pollution at giant.

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ARDUINO OPERATING CODE

```
Appendix A
#include <Servo.h> // include Servo
library Servo horizontal; // horizontal
servo intservoh = 90; // stand horizontal
servo
//
Servo vertical; // vertical servo
intservov = 90; // stand vertical
servo

// LDR pin connections
//name = analogpin;
intldr1t = A5; //LDR top
left intldr2t = A4;
//LDR top rightintldr1d =
A2; //LDR down left
intldr2d = A3; //LDR
down rightintledFisso =
13; int led = 8; void
setup()
{
Serial.begin(9600);
// servo connections
//name.attach(pin);
horizontal.attach(11);
vertical.attach(6);
pinMode(ledFisso, OUTPUT);
pinMode(led, OUTPUT);
}
void
loop()
{
digitalWrite(ledFisso, LOW);
digitalWrite(led, LOW);
int1t = analogRead(ldr1t);
// top left intrt =
analogRead(ldr2t); // top right
int1d = analogRead(ldr1d); // down
left intrd = analogRead(ldr2d);
// down right

//intdtime = analogRead(4)/20; // read potentiometers
inttol = analogRead(5)/4;
```

```

    //inttol = 20;
// inttol = 40;
intavt = (lt + rt) / 2; // average value top
intavd = (ld + rd) / 2; // average value down
intavl = (lt + ld) / 2; // average value left
intavr = (rt + rd) / 2; // average value right

intdvert = avt - avd; // check the diffirence of up and down
intdhoriz = avl - avr; // check the diffirenceog left and rigt

if (-1>tol>dvert || dvert>tol) // check if the diffirence is in the
tolerance else change vertical angle
{
    if
    (avt>avd){
        servov
        =
        ++servov;
//    digitalWrite(led, HIGH);
//    delay(1000); // attende un seconso (1000
millisecondi)
//    digitalWrite(led, LOW); // spegneil led
//    delay(1000);
//    digitalWrite(led, HIGH);
if (servov> 180){
servov = 180;
    }
    } else if
    (avt<avd){
//    digitalWrite(led, HIGH);
//    delay(100); // attende un seconso (1000 millisecondi)
//    digitalWrite(led, LOW); // spegneil led
//    delay(100);
//    digitalWrite(led,
HIGH); servov= --servov; if
(servov< 0){ servov = 0;
    }
    }
    vertical.write(servov);
//delay(15);
}

if (-1 tol>dhoriz || dhoriz>tol) // check if the diffirence
is in the tolerance else change horizontal angle
{
    if
    (avl>avr
    ){

```

```

//  digitalWrite(ledFisso, HIGH);
//  delay(1000);    // attende un secondo
(1000 millisecondi)
//          digitalWrite(ledFisso, LOW);    // spegne il led
//          delay(1000);
//          digitalWrite(ledFisso, HIGH);
servoh = --servoh;
if (servoh <
0){ servoh
= 0;
}
}
else if
(avl < avr){
//  digitalWrite(ledFisso, HIGH);
//  delay(100);    // attende un secondo
(1000 millisecondi)
//          digitalWrite(ledFisso, LOW);    // spegne il led
//          delay(100);
//          digitalWrite(ledFisso, HIGH);
servoh =
++servoh; if
(servoh > 169){
servoh = 169;
}
} else if (avl
== avr){
// nothing
}
horizontal.write(servoh);
//delay();
}
delay(50
);
}

```