A MINI PROJECT REPORT ON

"Agro-Bot"

SUBMITTED TOWARDS THE
PARTIAL FULFILMENT OF THE REQUIRMENTS OF

THIRD YEAR OF ENGINEERING
(Electronics and Telecommunication)

BY

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ACADEMIC YEAR: 2019-20

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Certificate

This is to certify that Mini Project Entitled

"AGRO-BOT"

Submitted by

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MINI PROJECT APPROVAL SHEET

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Project Members –

Pranoti Kasture

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Abstract

About 60% of Indian population is engaged in agriculture activities. It also helps in building the strong GDP of Indian economy. In total expenditure a large amount is spent by a farmer on weed cutting. All the weed cutting activities are currently manual based. Weeder, cutter, hoe are some of the manual weed cutting tools. Our objective is to produce low cost solution for weed removal which is fully automatic and IoT based.

We are trying to design a project which can be used in all types of farms, with any crop cultivated. It has a unique LS mechanism in order to remove the weed which is controlled by a controller and gives 80% accuracy on the field. It consists of a sensing system, signal conditioning electronic circuit and advance microcontroller hardware for middle level complication.

HCSR04 ultrasonic distance measurement sensors are used to align the bot in center with DHT11 temperature and humidity sensor to get control of temperature and humidity. This bot can sustain any physical climate changes like storm, heat, rain as it has a hard body material which helps itself to sustain in tough condition and give a long term life.

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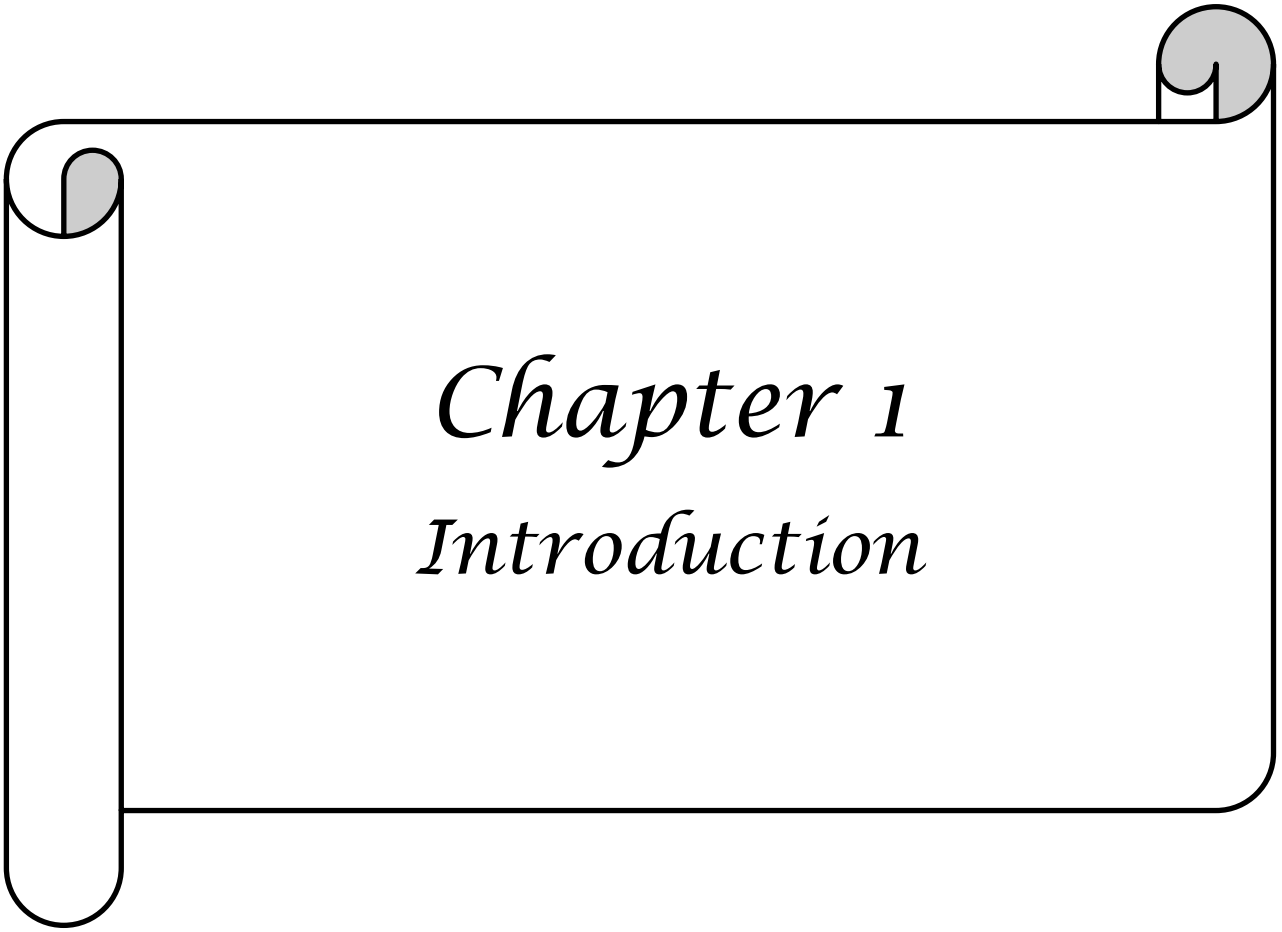


Chapter 1

Introduction

1. INTRODUCTION

In Indian economy Agriculture sector is one of the most important sectors. Agriculture sector contributes 17% to the Indian GDP at the current state. Agriculture sector provides jobs to over 53% of Indian population. So, agriculture is one of the most important businesses in India. Farmers get ample amount of money in this sector, but not in all case. Most of the money by Indian farmer is spent on the cropping and cultivating the weeds.

A weed is a plant considered undesirable in a particular situation, "a plant in the wrong place". Examples commonly are plants unwanted in human-controlled settings, such as farm fields, gardens, lawns, and parks. Lots of amount of money is spent to remove this grass and weed by farmers.

The removal of weed is a manual work. Kurpi, hoe, grass cutter are some of the weed cutting tools. Our aim is to make this task a little easy and cost efficient. The solution from our team is **"AGRO-BOT".**

It is a fully automatic four wheel controller based robot having LS mechanism driven by powerful DC motor. It also has the HCSR-04 ultrasonic sensor which can be used to sens the weed or grass. The main objective of this project is to make a low cost fully automated robot which will work in all weather conditions and by using which the cost of cutting can be reduced.

1.1. Need of Project

A study was conducted to estimate the yield and economic losses due to weeds by On-Farm Research. Trials conducted by All India Coordinated Research Project on Weed Management between 2003 and 18 in major field crops in different districts of 18 states of India. The study revealed that potential yield losses were high in case of soybean (50–76%) and groundnut (45–71%).

Greater variability in potential yield losses were observed among the different locations (states) in case of direct-seeded rice it was (15–66%) and in case of maize it was (18–65%).

Total actual economic loss of about USD 11 billion was estimated due to weeds alone in 10 major crops of India viz. groundnut (35.8%), soybean (31.4%), green-gram (30.8%), pearlmillet (27.6%), maize (25.3%), sorghum (25.1%), sesame (23.7%), mustard (21.4%), direct-seeded rice (21.4%), wheat (18.6%) and transplanted rice (13.8%). For 1 Acre of crop cultivating any crop required a 3 times weed harvesting for a time period of 6 months which may required around 3 to 4 labors to accomplish this task which costs 600 to 900 INR after one person for one time.

Mathematical Model:-

- 3 to 4 labours for 800 each
  4 * 800 = 3200 Rupees for one time

- Three times for 6 months
  6 * 3200 = 19200Rupees

- As one crop is cultivated for around 5 years on an average
  6 * 19200 = 96000Rupees

Approximately 96000 INR which is nearly 1 lakh rupees is spent by the farmer on weed management.

Our aim is to reduce the cost and increase the profit for farmers, and to reduce the expenditure on weed harvesting using controller based weed management robot.

1.2. **Motivation:-**

It important to get rid of weeds because weeds such as nut grass actually reduce crop yields on farms because their roots release chemicals that are harmful to surrounding plants. So the impulse of our project is to give the solution to the farmers which will reduce their efforts and they can afford it financially also.

1.3. **Objectives:-**

- In this project, we are designing a robot which is capable of doing the weed cutting work on the field.
- We are using an advance microcontroller which will help us in middle level complications.
- This robot is fully automated type of robot so there will be no need of manual work for this.
- The main objective of this project is to make a low cost fully automated robot which will work in all weather conditions and by using which the cost of cultivating can be reduced.

1.4. **Application:-**

Application of the project is to cut the weeds which are harmful and not useful grown between the crops

1.5. Advantage:

- Cultivation of the crops can be possible at affordable cost.
- With the use of this LS mechanism removal of the weeds can be easily done.
- Weeds of any size any type can remove without harming the main product.
- The robot can work in any weather specially when it is cloudy and stormy weather as the material used is very strong as well as water and dust proof.
- The robot can work on any type of field as its wheels are tooth-shaped wheels which are capable of any type of land weather it is normal or having mud.

1.6. Organization of Project Report:

- In this project report, in first chapter there is information about project topic, introduction, necessity, motivation, objectives, application and advantages.
- In second chapter proposed work of the project is given which contains systems concept, all the block diagrams and their explation is given.
- Third chapter gives analysis and design approach of main circuit and PCB layout of the circuit.
- In fourth chapter we introduce about the implementation of system software design and collection of data information is given.
- In fifth chapter result of simulation of main circuit.

Chapter 2

Proposed Work

2.1. System Concept

The solution proposed is a Bot which is made up of durable and highly sustanaible body material which help it to face any environmental factors affecting it .

The bot contineously monitors the temperature and the humidity in air using the DHT 22/ DHT 11 temperature and humidity sensor and changes the calculation according to it ,Three sonar sensor present are use to calclate the distance between two object's , the first sonar will fire up sound waves and get the response back , at the same time the second sonar also fire and get the response back from the surface on which the sound waves are rebounced back, the bot calculate the difference between the both responses and act accoordinglly , if the left distance is more then the right one then the controller will start to rotate the left motor in order to make the bot aligned at the center if the lane, if the right distance is greter then the left one then the controller will start the right motor to roatate and aligned the bot in center of the lane.

As the bot is moving In forward direction at same time it fires up its third sonar which is the weed detection process , if the response get by the sonar states that any obstacal is present in front of he Bot then it will try to remove the obstacal using the LP Mechansim which consist of a screw and a bolt attcah to a motor ,as the obstacle is detected the controller commands and the motor is ON start to rotate which make the bolt to rotate and the length of the cylinder increases and thus the claw present in front of the cylindrical shape rod digg out the weed from the roots this heps to prevent the further growth of the weeds in the field, the waste removed can be collected into a sepearte moving container and the process goes on.

2.2. Block Diagram

Block diagram shows the working model of the Bot

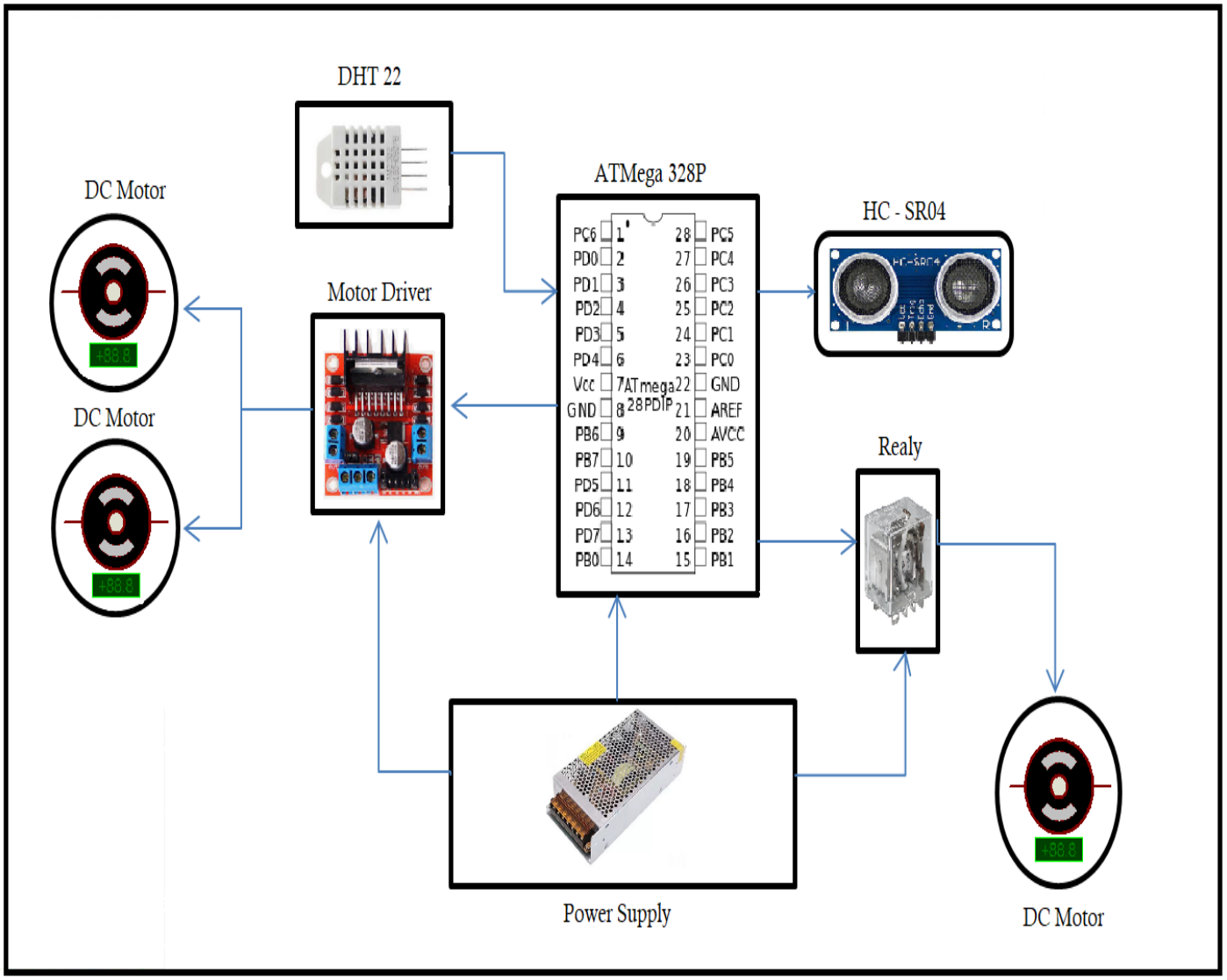


Figure 2.1 : System Block Diagram

2.3. Explanatation Of Block Diagram

The above block diagram give a pictorial view of the system and its explaintation is as follow.

2.3.1 Power Supply

The Power supply designed so to get a output voltage of 1Amp and 12V, with less distoration and get a output 10 % ripple .

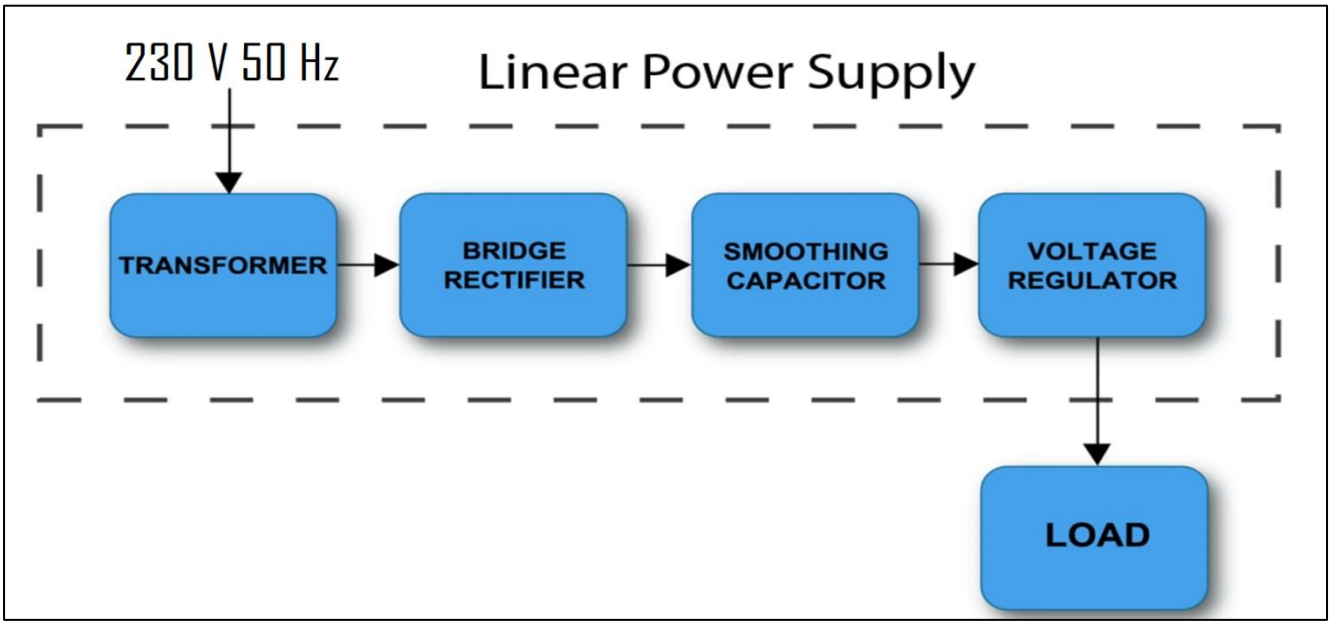
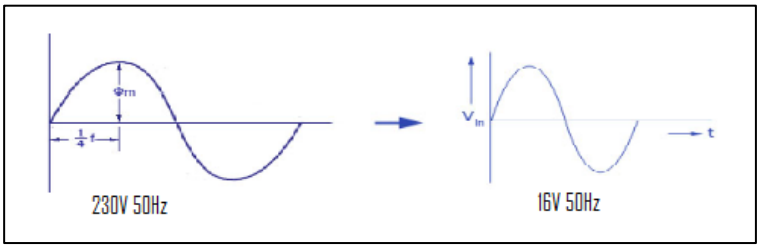


Figure 2.2: Power suppply block diagram

1. Transformer :

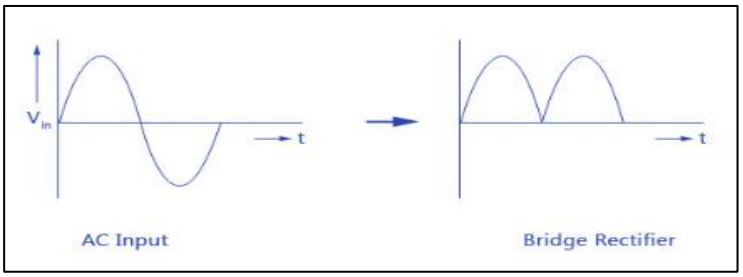
A *step down transformer* is used to step down the voltage from the input AC to the required voltage of the electronic device. This output voltage of the transformer is customized by changing the turn's ratio of the transformer according the electronic device specs. The input of the transformer being 230 Volts AC mains, the output is provided to a full bridge rectifier circuit.



Transformer output wavefrom

2. Bridge Rectifier :

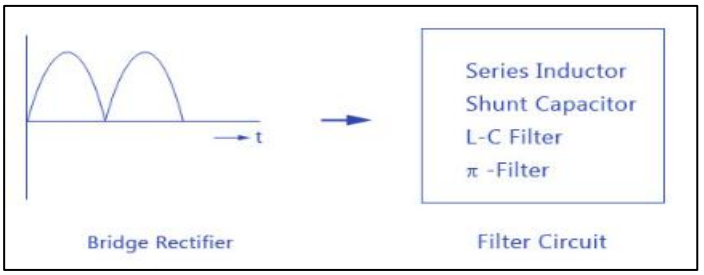
The *Full wave rectifier* consists of four diodes which rectify the output AC voltage or current from the transistor to its equivalent DC quantity. As the name implies the *Full wave rectifier* rectifies both half's of the AC input. The rectified DC output is given as input to the filter circuit.



Rectifier Output

3. Filter (Smoothing Capacitor) :

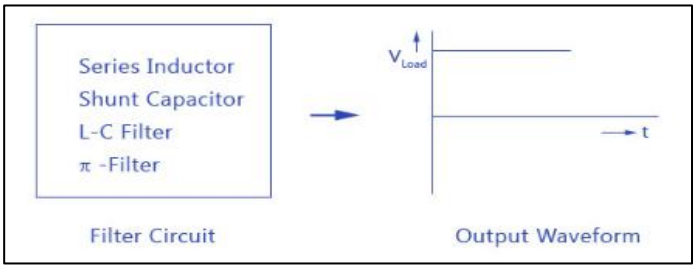
The filter circuit is used to convert the high rippled DC output of the FWR to ripple free DC content. A ∏ filter is used to make the waveforms ripple free.



Filtered output

4. Voltage Regulator :

The voltage regulator receives the signal from the filter and delivers a constant voltage regardless of the variations on the load or the voltage supply. Voltage regulator can be implemented in several ways. It can be a transistorized voltage regulator or a monolithic voltage regulator.



Voltage regulator ouput

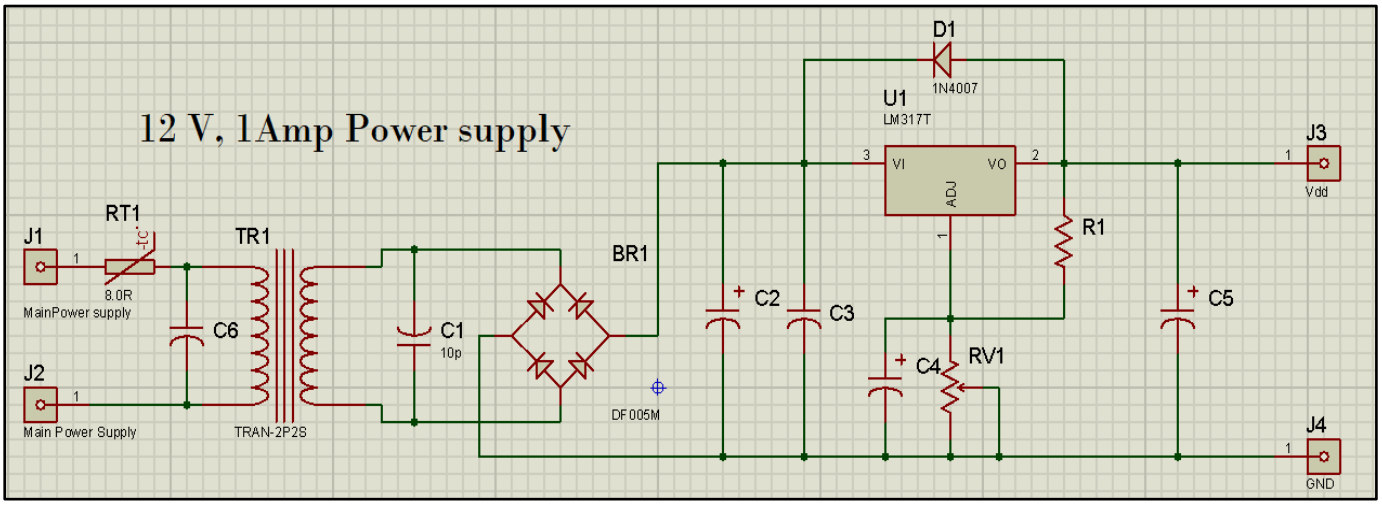


Figure 2.3: Power supply schemetic diagram

Explanation:

Transformer step down the input voltage of 230 V_{rms} to 16 V_{rms} which is passed t the bridge rectifier inorder to get a sinusoidial pulsating wave with a voltage drop of around 1.2v, which is addition of the two silicon diode placed back to back. The rectified signal is to be filtered thus a electrolytic capacitor is used of 2.5 m henry which filtered out the unwanted noise and we get a pulsating output. This wave is transferred to regulator which is a variable regulator LM317, whose value of resistor is set as to get a out put voltage of 10v DC. A bypass capitor is connected at the output as a bipass capacitor.

An Output we get a 10V 1 Amp DC output. Extra components inorder to protect circuit.

Power supply design calculation:

1. Selection of Transformer :

Transformer ouput voltage should be 12v as requirenment, let consider we get 9v at output winding of transformer thus, the peak voltage will be

We know that,

$$\boldsymbol{V_{peak} = V_{rms} * 1.414}$$

$$V_{peak} = 9 * 1.414$$

$$V_{peak} = 12.69\ V$$

Now the, the transformer with secondary winding output AC voltage should be of 12V as there will be voltage drop after some components.

Thus, new value will be

$$V_{peak} = 12 * 1.414$$

$$V_{peak} = 16.92\ V$$

2. Selection of Smoothning capacitor :

Across each diode we observe a voltage drop of 0.7V as in each cycle two diode are in "ON State" thus we get a total voltage drop of around 1.4V.

Thus for smoothing capacitor

$$C = \frac{5\ I_o}{V_p\ f}$$

Where,

I_o = Load current
V_p = Peak Voltage
f = frequency

Thus,

$$C = \frac{5 * 1}{16.92 * 100}$$

$$C = 2.95\ mH$$

Also,

$$V_{ripple} = \frac{V_p}{R_l * C}\overrightarrow{\Delta t}$$

Where,

C = Capacitance
V_p = Peak Voltage
R_L = Load Resistance
Δt = Time period between output waweform

3. Selection of Voltage regulator :

As we have chosen LM317 which is a variable voltage regulator thus its output voltage can be set as,

$$V_{out} = 1.25\left(1 + \frac{R_1}{R_2}\right) + I_{adj} * R_2$$

Where,

V_{out} = Output voltage
R_1 = fixed resistor
R_2 = Variable resistor
I_{adj} =Regulating current

Let $V_1 = 240\ \Omega$

$$R_2 = R_1 \left(\frac{V_{out} - 1.25}{1.25}\right)$$

$$= 240 \left(\frac{12 - 1.25}{1.25}\right)$$

$$R_2 = 2K\ \Omega$$

Thus,

$$V_{out} = 1.25\left(1 + \frac{2000}{240}\right)$$

$$V_{out} = 12.007\ V$$

4. **Selection of Bypass capacitor :**

Without bypass capacitor connected, the regulator will act as an oscillator and also it improves transient response of circuit , its value depend on the capcito type we select as like

Capcitor Values	Capacitor Type
0.01 µf	Ceraminc Capcitor
1 µf	Tantalum Capcitor
22 µf	Electrolitic Capacitor

Table 2.1: Bypass capacitor type and values

2.3.2 ATMega-328P Microcontroller

Arduino Uno is a wonderful device. With a generous helping of digital I/O ports, 8 analog-to-digital converters, I2C, Serial and SPI interfaces and on board voltage regulation it is suitable for powering a wide variety of devices. It has a built-in USB port and onboard LEDs and can provide both 5-volt and 3.3-volt low-current power supplies for peripheral devices. But it take a lot of aspect thus we decided to use the controller i.e ATMega-328P

The ATmega328 is a single-chip microcontroller with the following features:

- 8-bit RISC (Reduced Instruction Set Computer) processor core.
- Runs at clock speeds from 1MHz to 20MHz.
- 32 Kb Flash Memories.
- 2Kb SRAM (Static Random Access Memory).
- 1Kb EEPROM (Electrically Erasable Read Only Memory).
- 23 GPIO (General Purpose Input-Output) lines.
- 32 general purpose registers.
- I2C, SPI, and Serial interfaces.
- 10-bit Analog to Digital converters – 6 in DIP package, 8 in surface-mount package.
- Internal and External Interrupts.
- Available in DIP and Surface Mount packages.

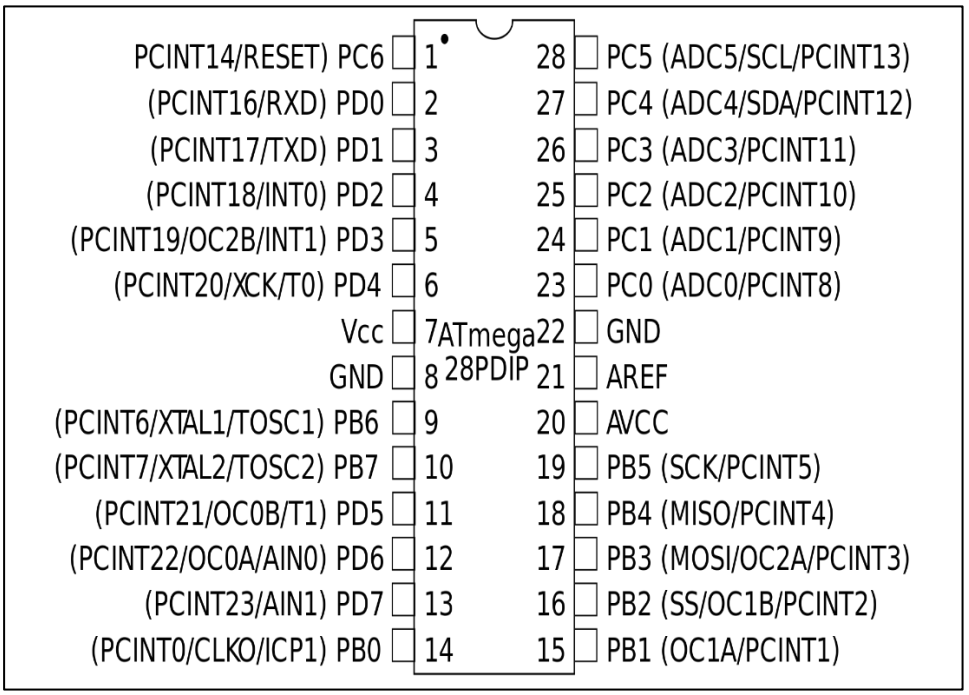


Figure 2.4: Pinout of ATmega 48A/PA/88A/PA/168A/PA/328/P in 28-PDIP

1. Basic configuration:

Assuming that ATmega328 has bootloader burned onto it, then we can upload the code.We need a few extra components for this basic configuration.

- ☐ A 16MHz crystal.
- ☐ A 10K resistor.
- ☐ Two 22pf capacitors
- ☐ A 10uf capacitor

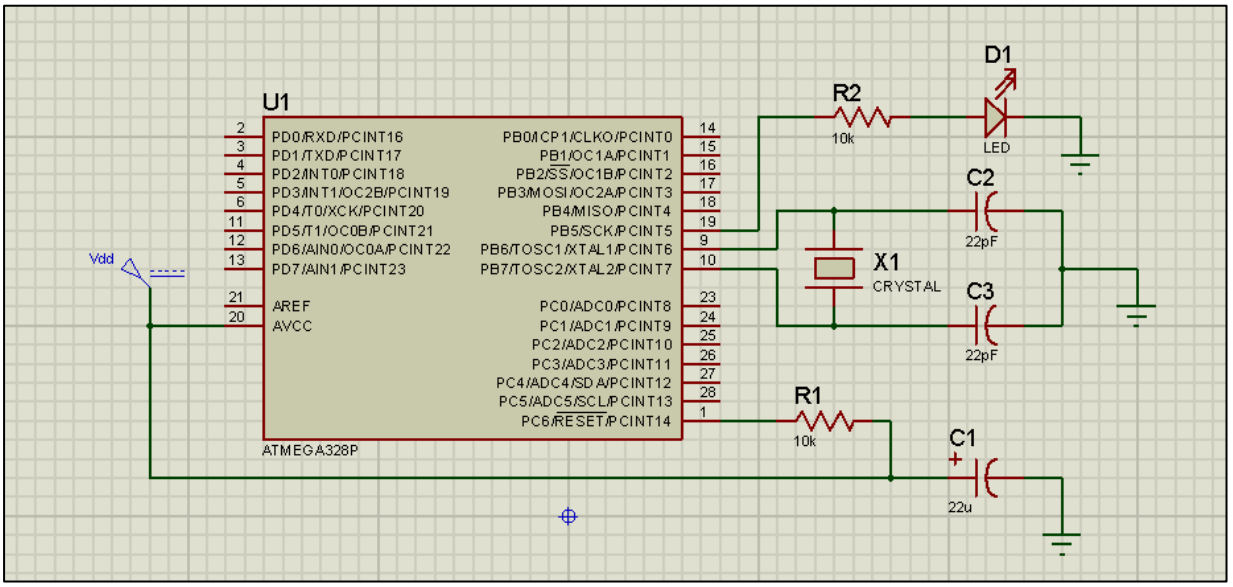


Figure 2.5: Basic configuration of ATMega-328P

2. Burning the program

If the controller has pre installed booth loader then we can directly upload the code on it using various methods known if not then we first have to upload the bootloader then we can burn the code. There are several different technique to burn the controller here are some.

➢ Using arduino board

Using serial communication ports of the board which are connected to the serial communication pin out of the controller.

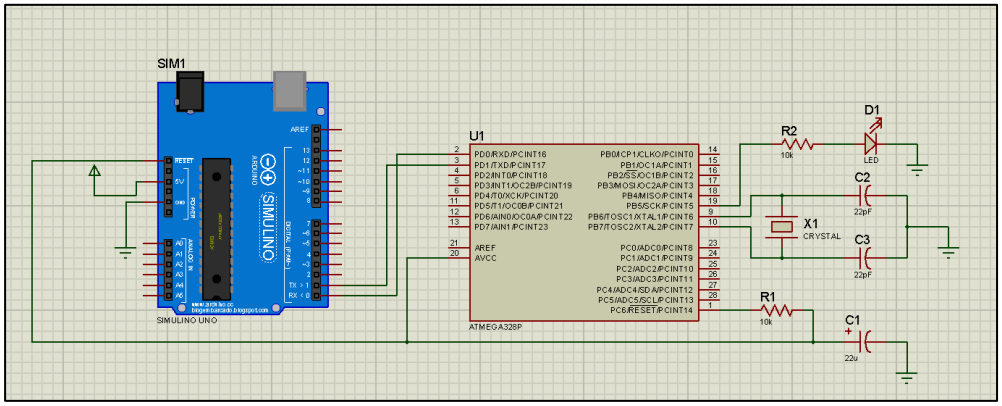


Figure 2.6 : Using serial communication pin

- Without arduino board

We can use the serial to bus converter circuit i.e FTDI converter inorder to burn the code into the controller.

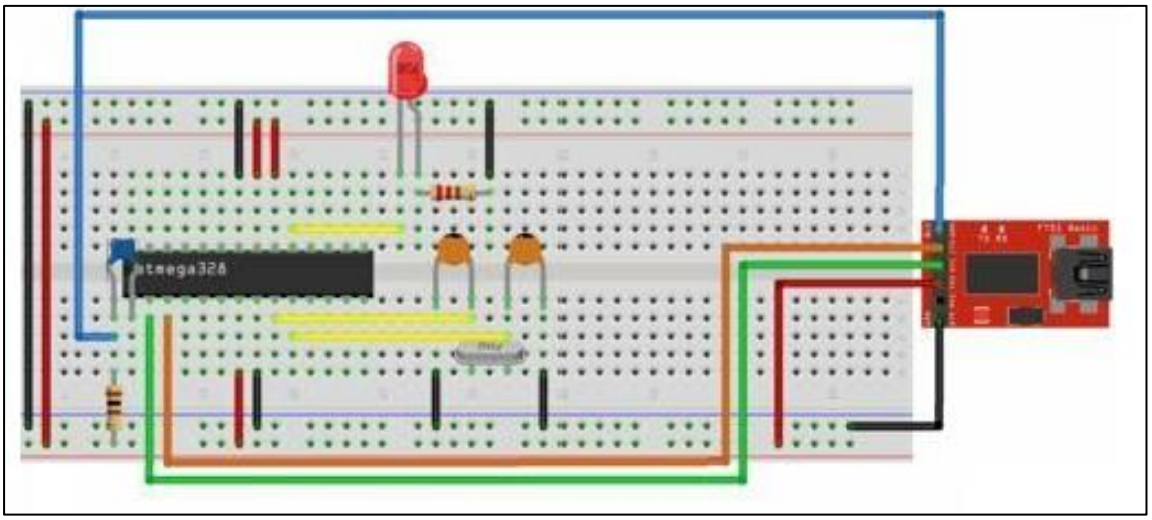


Figure 2.7: Using FTDI Serisl to USB converter

2.3.3 HC-SR04 Ultrasonic Distance Sensor

1. Discription:

HC-SR04 Ultrasonic Distance sensor consist of two transducers one as a receiver and other as transmitter its range is from 2 cm to 400 cm.

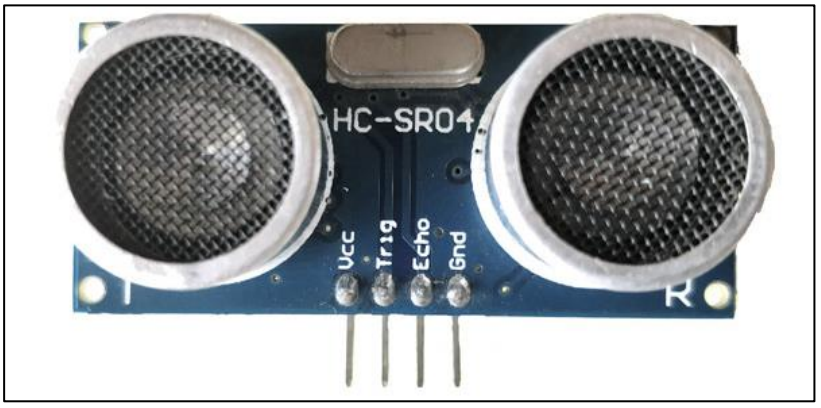


Figure 2.8: HC-SR04

2. Pin Out:

- VCC: +5VDC
- Trig : Trigger (INPUT)
- Echo: Echo (OUTPUT)
- GND: GND

3. Working :

It sense the distance between the object and the sensor by calculating the difference between tile delay occurred between the transmitted wave and the receiver wave. Longer time delay i.e the object is at longer distance, else object is near. For each transmission there are eight pulse each of 40 KHz.

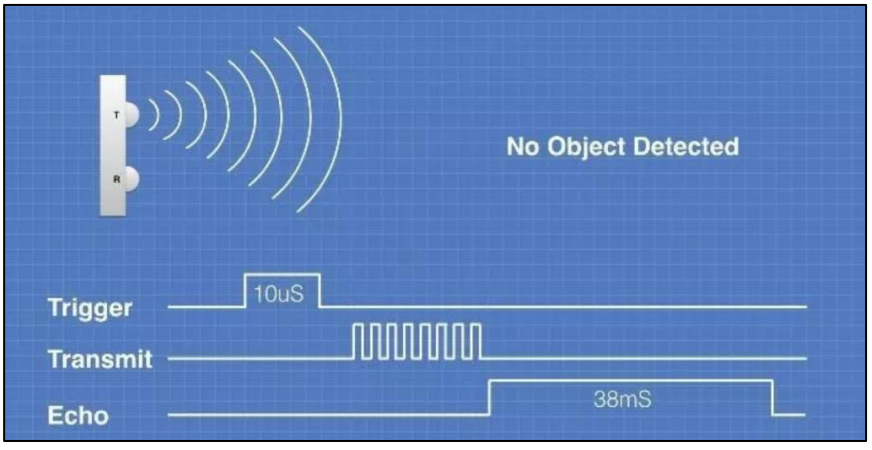


Figure 2.9: No object detected

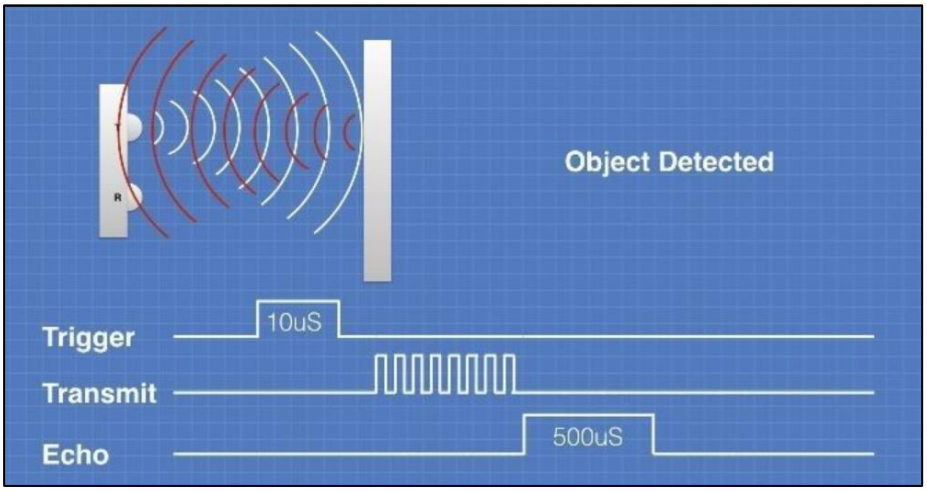


Figure 2.10: Object detected

Distance can be calculated by

$$D = \left(\frac{\Delta t}{2}\right) v$$

Where D = Distance
Δt = Change in time
v = Velocity of air

As ultrasonic sensor has same speed as air, but it also depends on other environmetal factors like temperature, humidity, air pressure, etc. thus to increase its accuracy we have connected DHT22/ 11 Temperature and humidity sensor.

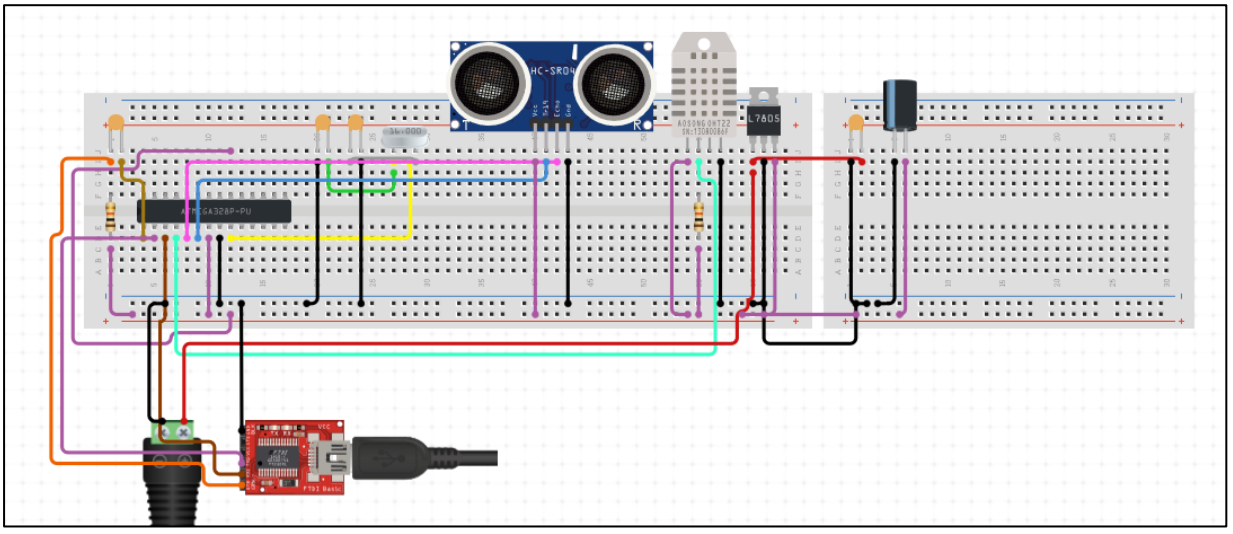


Figure 2.11: Connect DHT22 and HC-SR04

Now distance can be calculated by

$$D = 331.4 + (0.0606 * T) + (0.0124 * H)$$

Where D = Distance
T = Temperature of air
H = Humidity of air

2.3.4 DC Motor Driver

In order to control the working of motor we are using motor driver i. e L298N H bridge module, we also can use for transistors in place of that, in order to reduce the cost, L298N handles up to 3Amp of current and 38Volt of DC voltage.

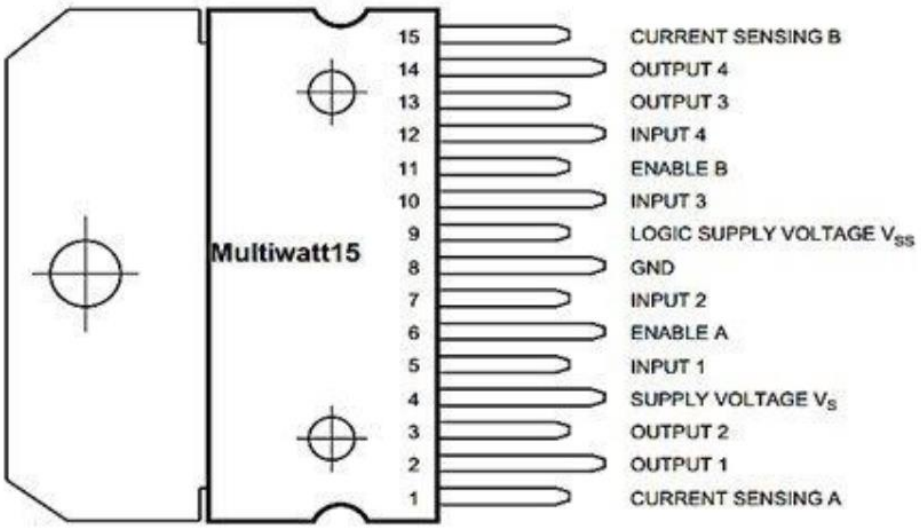


Figure 2.12:L298N pinout diagram

- **INPUT** – Input for Motor
- **OUTPUT** – Output for Motor
- **ENABLE** – Enable line for Motor
- **V_{ss}** – Logic voltage(5V)
- **V_s** – Input voltage for Motor

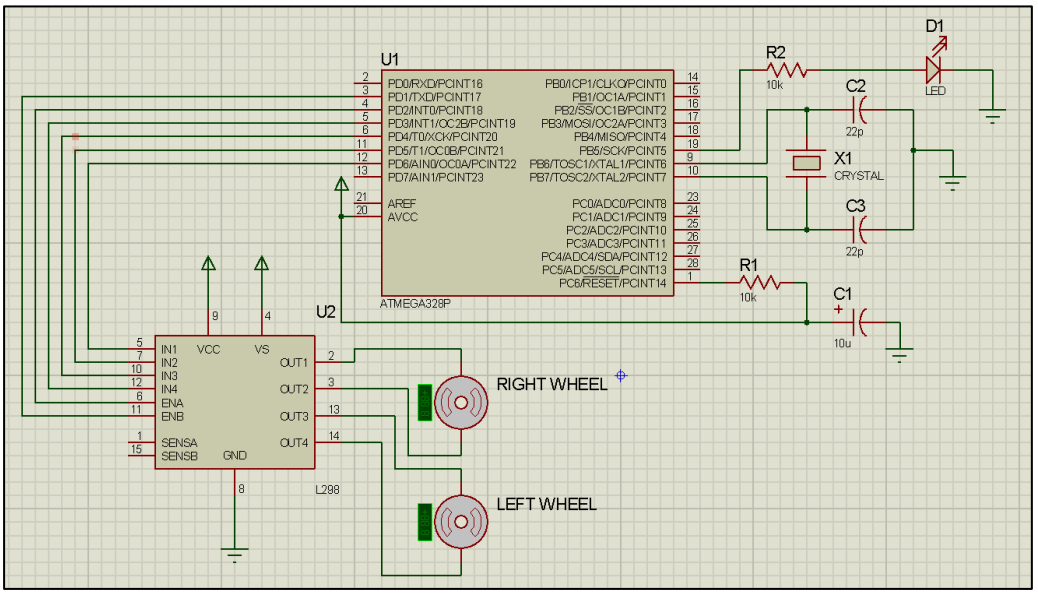


Figure 2.13: DC Motor control using L2

Chapter 3

Analysis and Design Approach

3.1. Circuit Diagram

Figure shown below is he circuit diagram of the system which is being proposed by. Here three ultrasonic sensors are in which two aer to align the bot in center and one for removal of the weed, with a relay attach to it. A motor driver IC is used in order to control the movement of bot, And temperature and humidity sensor is connect in order to get high accuracy for calculation.

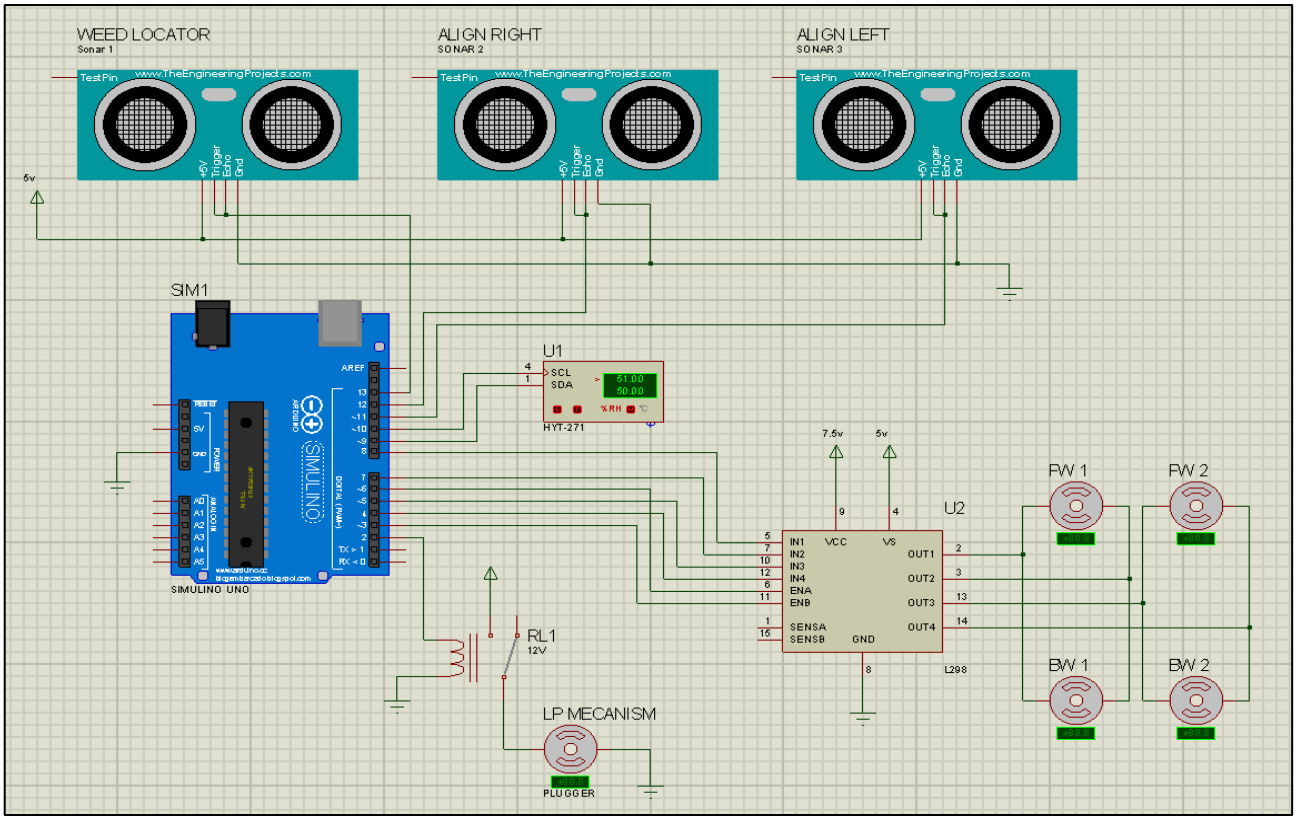


Figure 3.1: Circuit diagram of system

The below circuit diagram shown gives us internal connection of arduino borad used in the solution we proposed, we can see,

- Five analog I/O pin
- Thirteen Digital I/O pin
- Sixteen kilo hertz of crystal
- 5v and 3.3 v power supply
- A reset button
- ISP pinout
- Serial connection pinout in order to connect the board with system

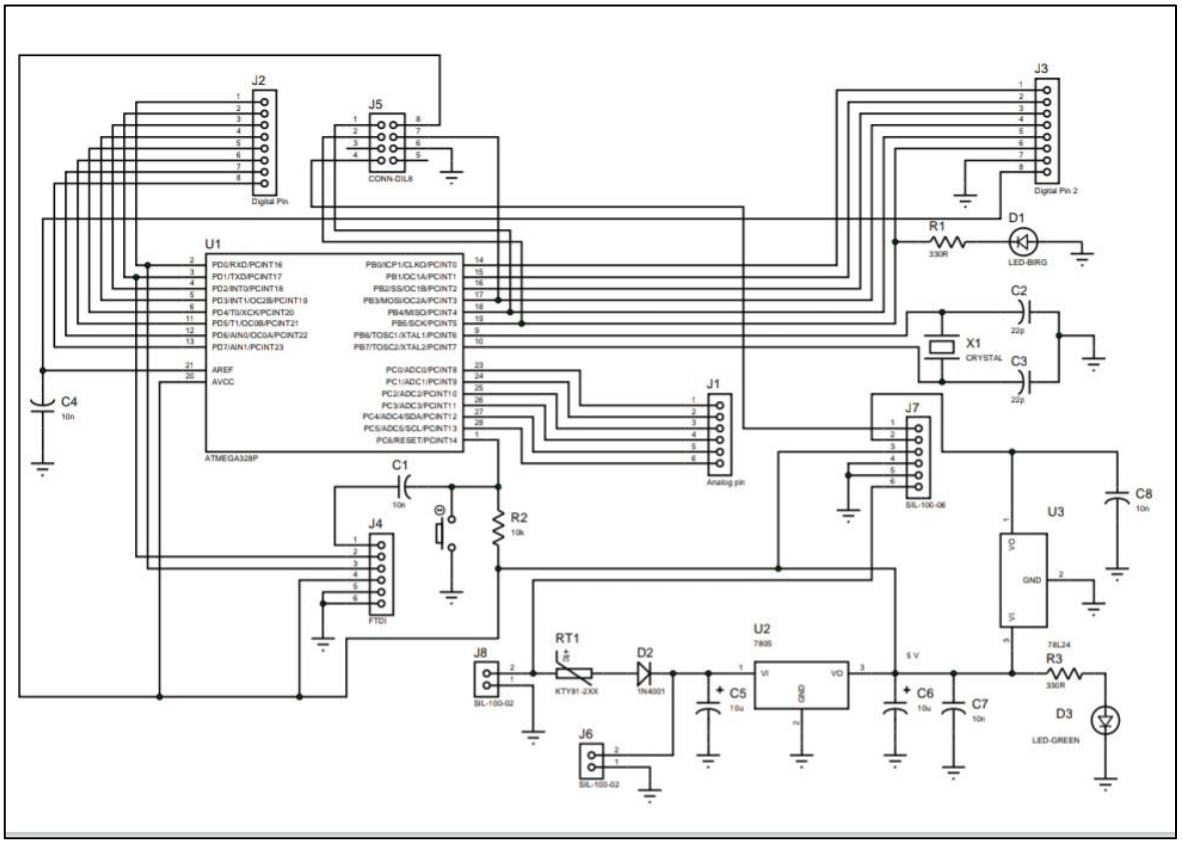


Figure 3.2: ATMega 328p controller connection diagram

3.2. PCB Layout Circuit

PCB Layout is designed in Proteus and Eagle, below layout is of the arduino board used in the project.

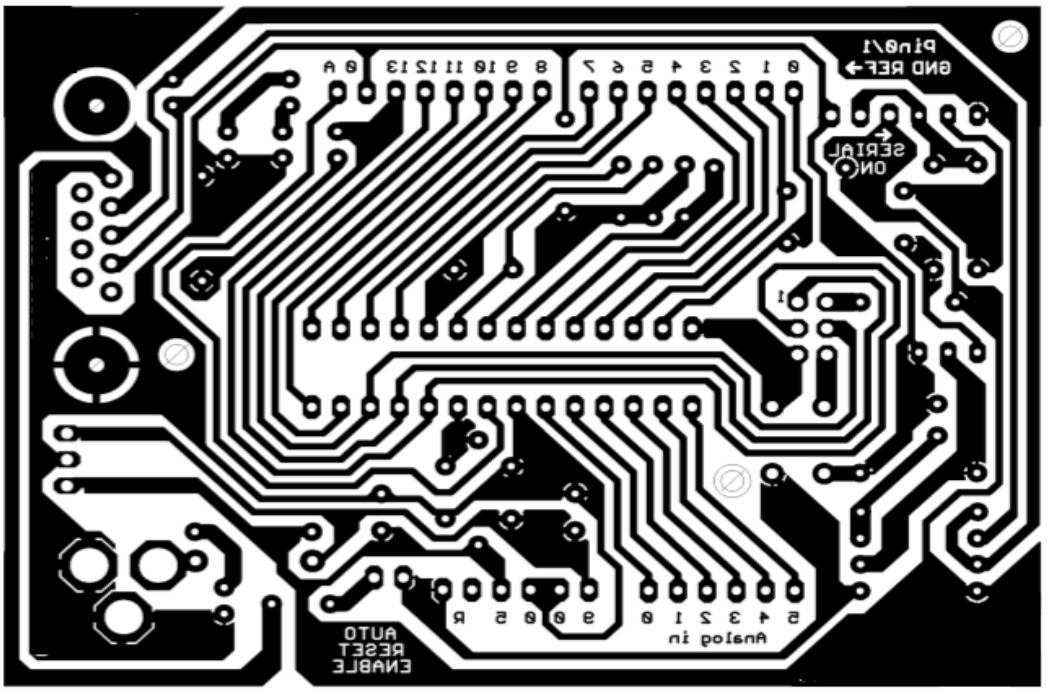


Figure 3.3: PCB Layout

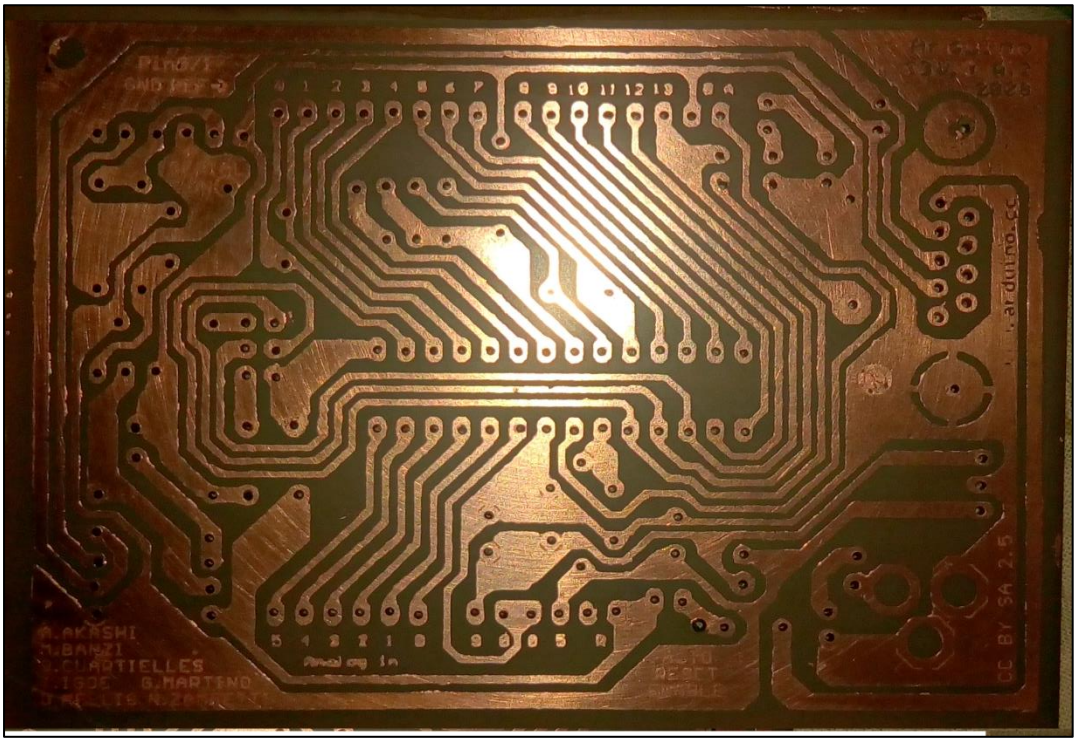
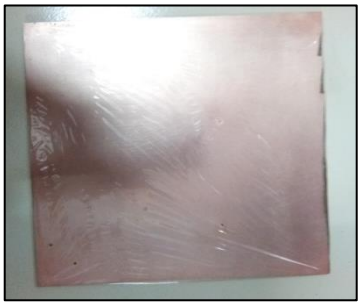
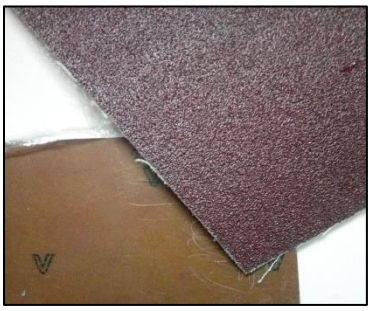


Figure 3.4: Actual PCB Lyout

3.3. PCB Layout printing

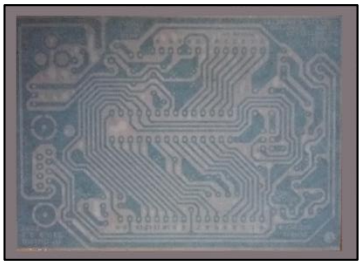


Copper plated epoxy sheet

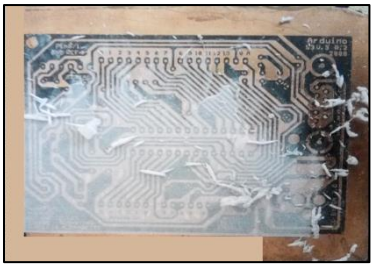


Scrubbing Copper plated epoxy sheet

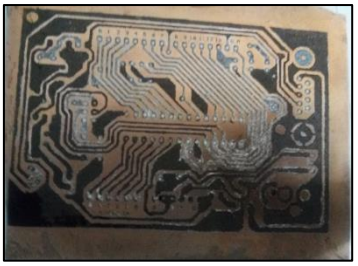
Scrubbed Copper plated epoxy sheet



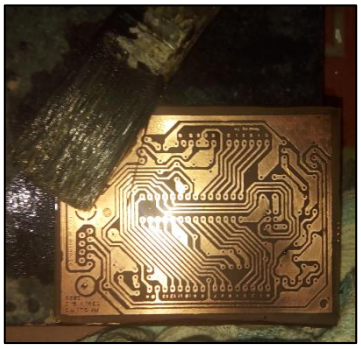
Printing layout



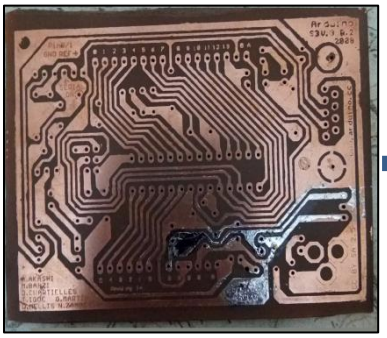
Removing paper



Paper removed



Removing ink form the sheet



TinningProcess

Final PCB

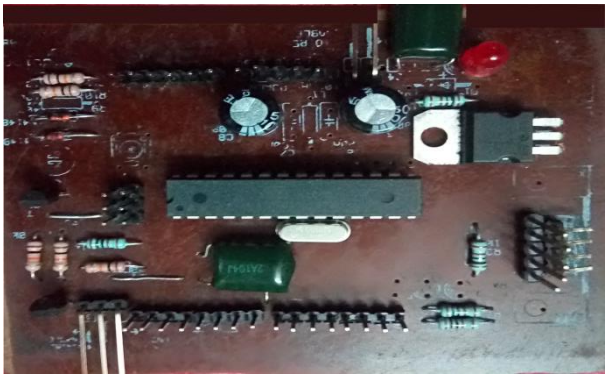


Figure 3.5 : Actual PCB

Chapter 4

Software Implementation

4.1. Program Algorithm

- **Step 1:** Store temperature value and sir humidity value and store in variable
- **Step 2:** Check distance from the first sonar
- **Step 3**: If distance is less then the minimum distance ON the relay.
- **Step 4:** Store if not check the bot is in center aligned position
- **Step 5:** if not then calculate the time delay and then find the distance with help of the temperature and humidity
- **Step 6:** If left time delay is more then rotate the bot to left directioin using the motor driver.
- **Step 7:** If right time delay is more then rotate bot to right direction using the motor driver.

4.2. Program Flow Chart

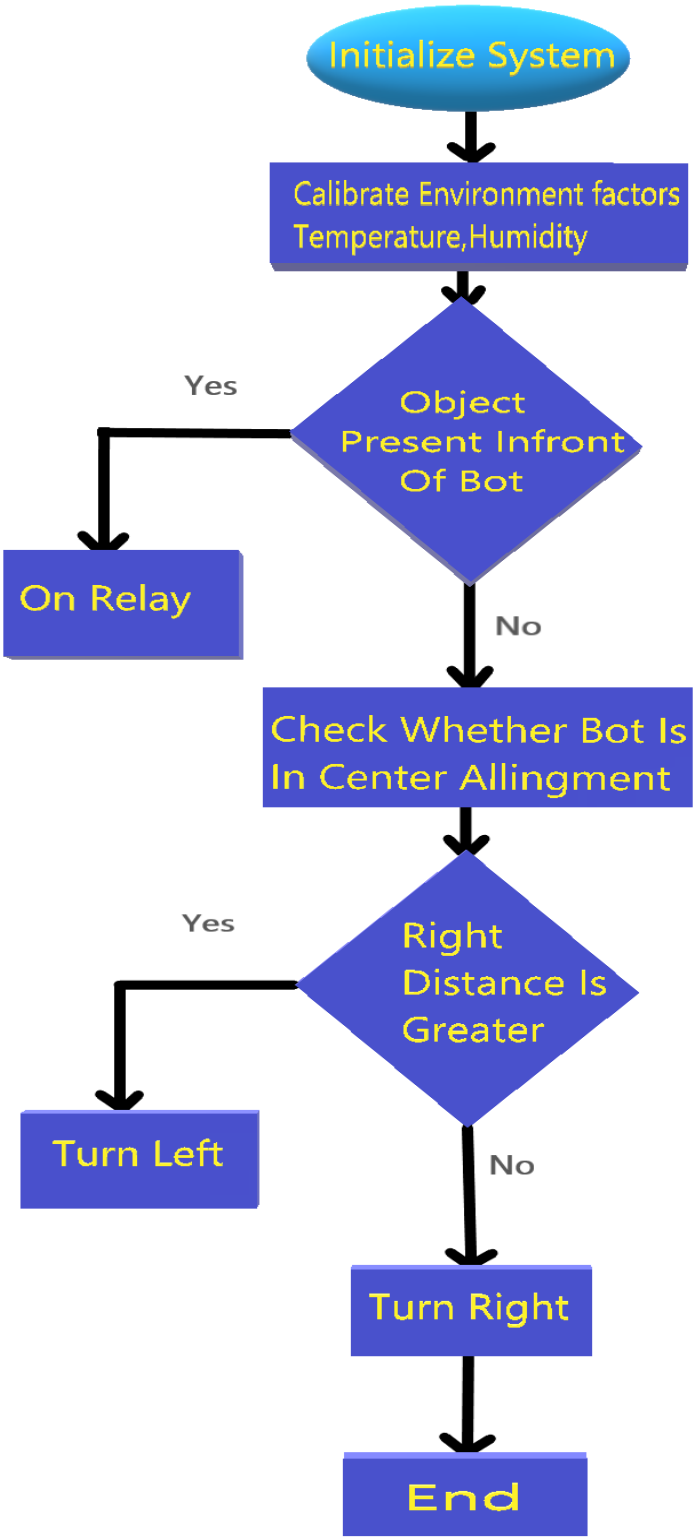


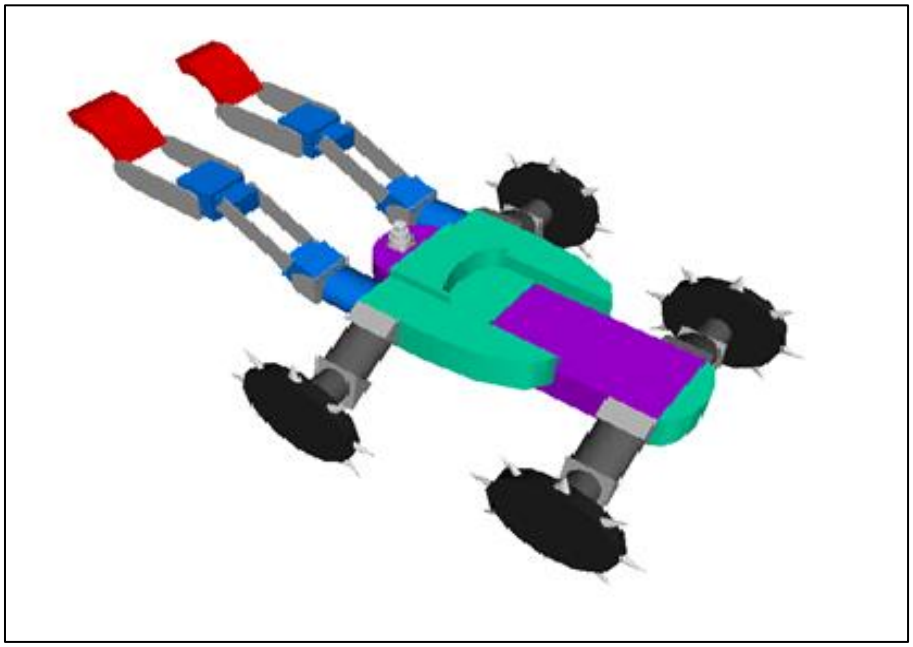
Figure 4.1: Flow chart

Chapter 5

Result

5.1. **Result**

The following pictures are the result of the project we made some of them are CAD images some are realistic PCB images.



5.1 CAD software image of BOT

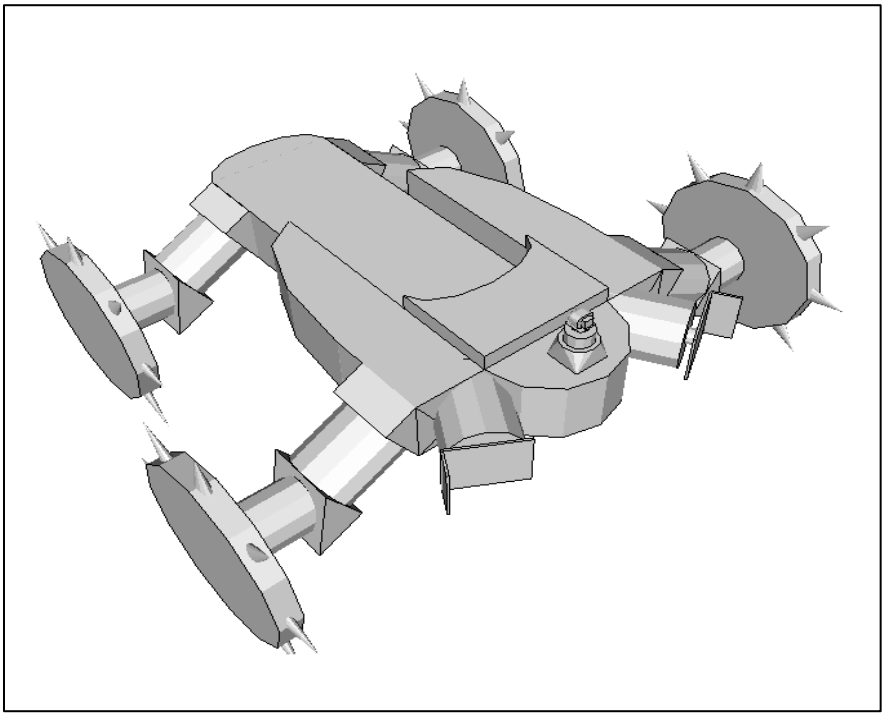


Figure 5.2: CAD software image of BOT

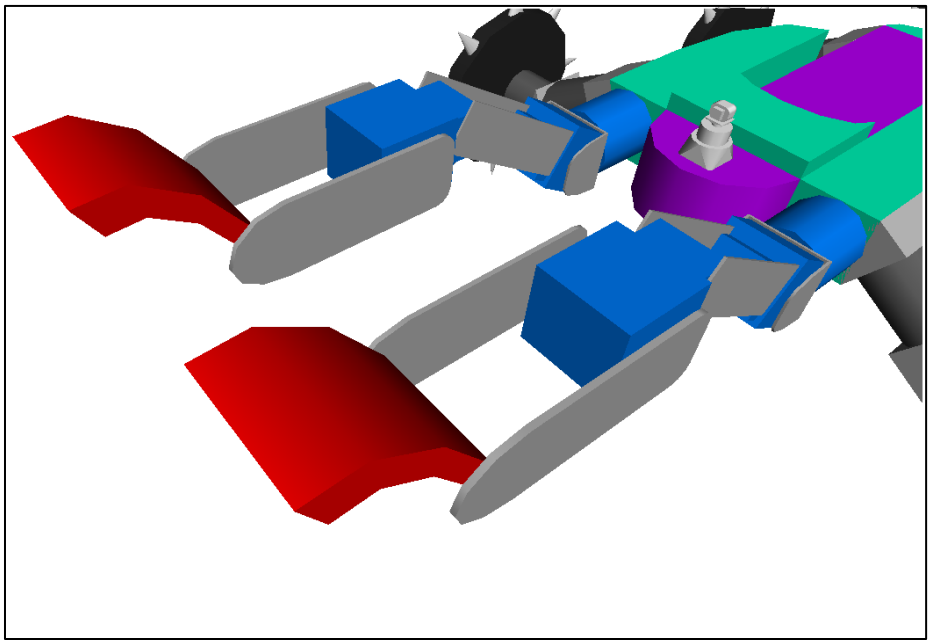
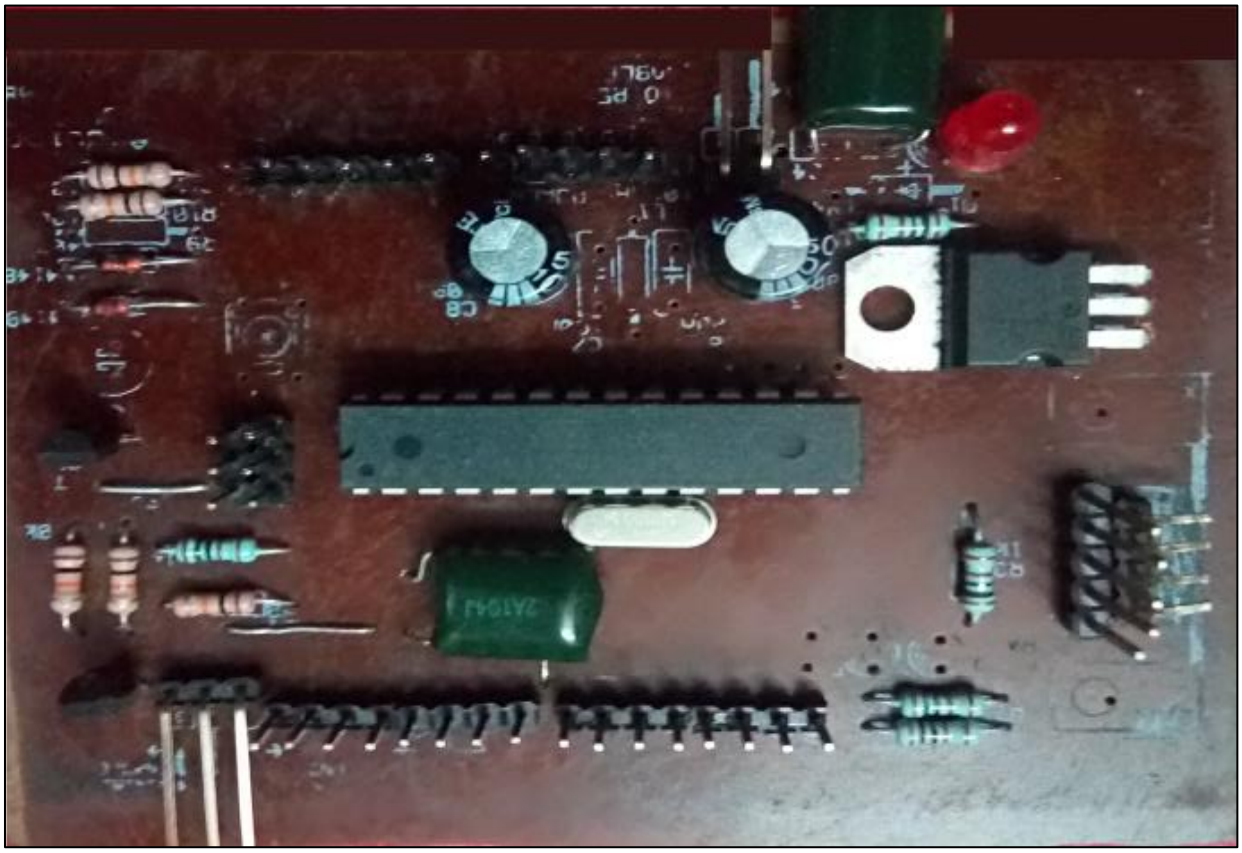


Figure 5.3: CAD Software images



5.3 All components mounted on the PCB

Chapter 6

List of the Components Used

6.1 List Of Components Used:-

Components Name	Quantity	Price
Through holes PCB	1 Unit	20 rs
ATMega328 with Opti boot bootloader	1 Unit	90 rs
5mm LED	4 Unit	10 rs
330Ohm Resistor	3 Unit	10 rs
10kOhm Resistor	4 Unit	10 rs
16MHz Crystal	1 Unit	10 rs
22pF Ceramic Capacitors	2 Unit	10 rs
0.1uF Ceramic Capacitors	2 Unit	10 rs
10uF Electrolytic Capacitors	2 Unit	10 rs
LM7805 5V Regulator	1 Unit	20 rs
Diode 1N4001	4 Unit	15 rs
Resettable Fuse PTC (300mA)	1 Unit	10 rs
28-Pin DIP Socket	1 Unit	40 rs
Push Button Reset Switch	1 Unit	10 rs
6-Pin Female Headers	1 Unit	30 rs
8-Pin Female Headers	1 Unit	30 rs
6-Pin Right Angle Header	1 Unit	30 rs
6-Pin Right Angle Header	1 Unit	20 rs
0.1uF Capacitor	1 Unit	5 rs
DC Barrel Jack	1 Unit	20 rs
2-pin screw terminal	1 Unit	20 rs
HCSR04	3 Unit	300 rs

Chapter 7

Reference

References:-

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- https://components101.com/ultrasonic-sensor-working-pinout-datasheet
- https://www.electronics-tutorials.ws/diode/diode_6.html?nab=0&utm_referrer=https%3A%2F%2Fwww.google.com%2F
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- https://www.instructables.com/id/How-to-make-PCB-at-Home/
- https://www.youtube.com/watch?v=mv7Y0A9YeUc
- https://drive.google.com/file/d/1i4frlqyrInMca0IAhmkJgQqYZyERIWiV/view
- https://www.latex-tutorial.com/installation/
- https://www.youtube.com/watch?v=SoDv0qhyysQ