# ACKNOWLEDGEMENT

We feel privileged to acknowledge the contribution of several people for the successful completion of our project.

At this occasion for successful completion of our project we would like to thank our course coordinator Mr.R.AYYAPPAN for his valuable guidance, technical support and motivation.

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We thank all our colleagues and all others who helped us directly or indirectly during the project.

# CHAPTER-01

## INTRODUCTION

Foam PVC Cutting is a very important process in many Industry segments. Fast growing industry segments like automotive have full the growth opportunities of foam PVC sheet working. Foam PVC sheet can be cut into a circular shape finding numerous applications in airplane wings, medical tables, and roofs for buildings, circular cutting tool, edible plates and many other things. Quality of cut is usually poor, depending highly on worker's expertise and mood. Also, tracks come only in different circular shape, so circular shapes can be cut depends upon the requirements.

Such a machine would enable medium and small-scale firms to increase their production capacity and produce high quality products at much cheaper rates, helping them to survive in today's competitive global market. This paper circularizes in detail the design and implementation of such a low-cost foam PVC sheet cutting machine.

# CHAPTER-02

# PROJECT BRIEF

## AIM

The aim of the project is to build foam PVC cutting machine using ATmega328P microcontroller

## OBJECTIVES

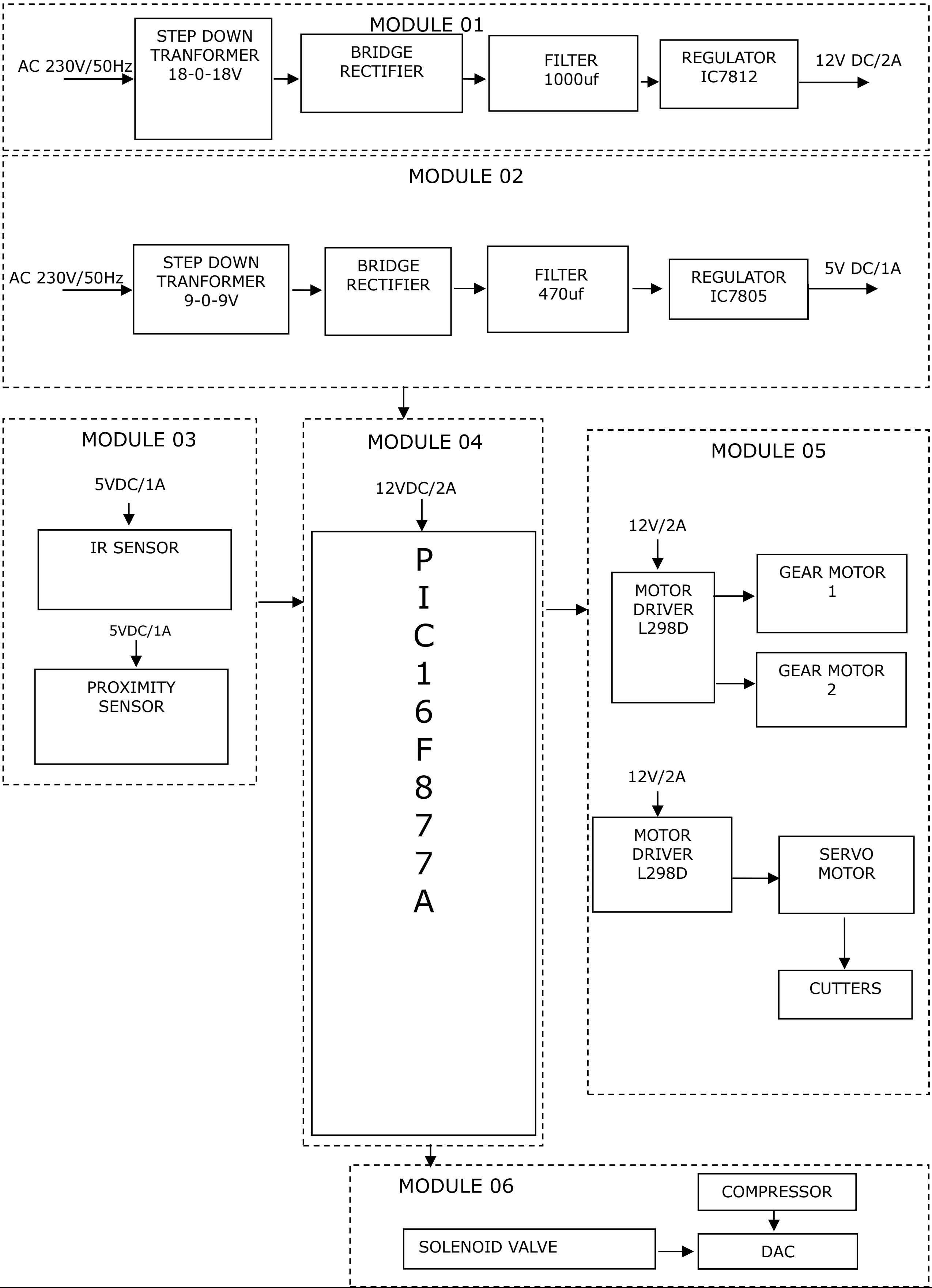
- In older days manual power is required to cut any object for industry purpose to overcome that automatic circular cutting machine is helpful.
- It reduces time usage.
- It has more accuracy.

## PROJECT TARGET

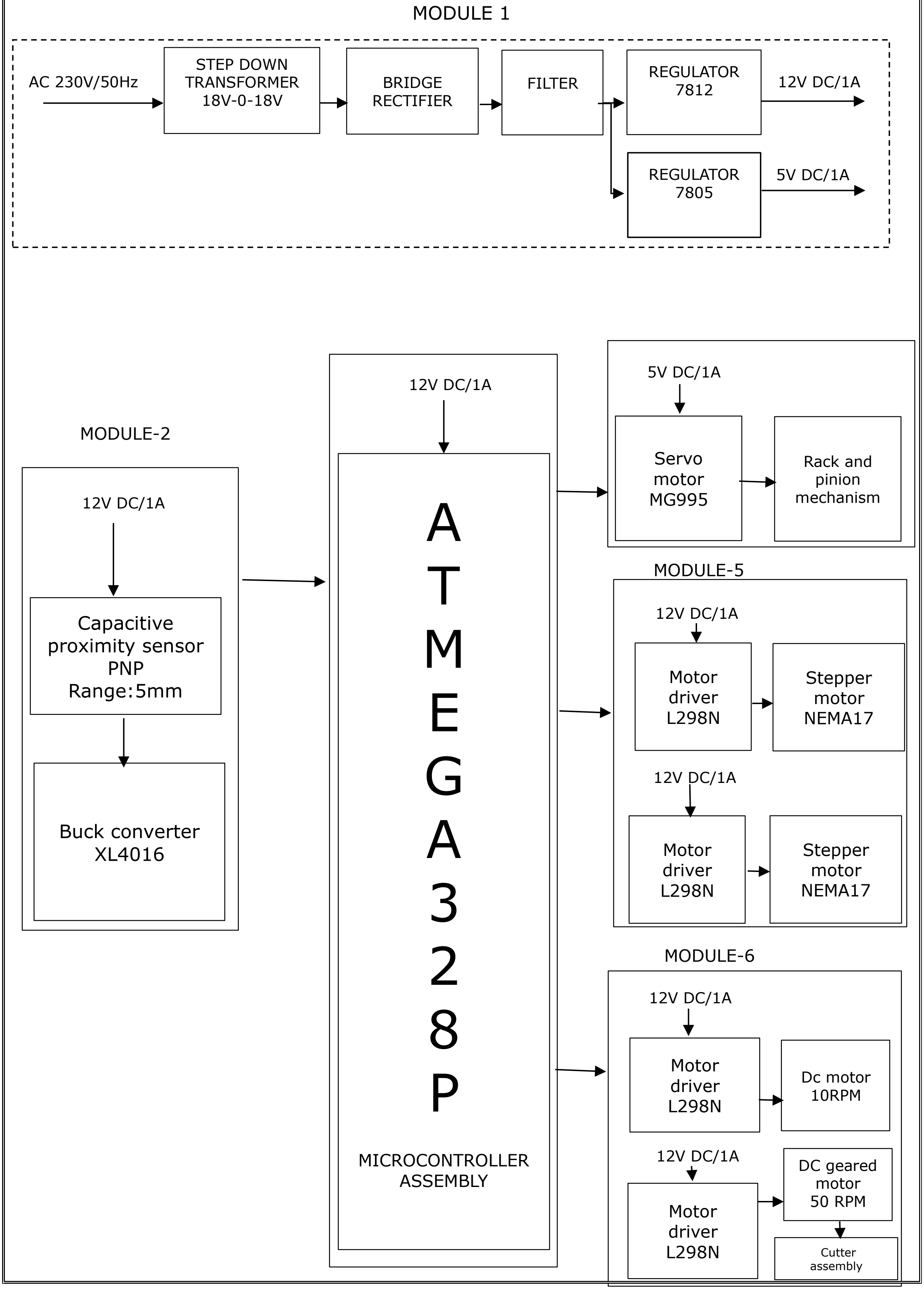
- The target of the project is to reduce the human effort and to increase mass production and for better accuracy.

# CHAPTER-03

## EXISTING BLOCK DIAGRAM



# 3.1.IMPROIVISED MODULAR BLOCK DIAGRAM0-



# 3.2.COMPARISON OF EXISTING AND IMPROVISED BLOCK DIAGRAM

| EXISTING | IMPROVISED |
|---|---|
| 1.In this module we are using the IR sensor and proximity sensor for sensing the cutter and the sheet | 1. In this module we are using only the proximity sensor for sensing the sheet. |
| 2. In this module we used PIC16F877a as a controller because of less outputs. | 2.In this we are using ATMEGA328P as a controller. Because it is less cost and it is easy to program compared to PIC controller |
| 3.In this module we used conveyor system for pushing the sheet . | 3.In this module we are using the rollers to push the sheet. |
| 4.In this module we uses DAC as a linear actuator. | 4.In this module we used 2 Vslot linear actuator for linear motion. |

# CHAPTER-04
# BLOCK DIAGRAM DESCRIPTION

## MODULE-01
## POWER SUPPLY (12V DC/1A AND 5V DC/1A)

This module consists of both 12V and 5V power supply. We are converting 230V AC to 18V AC by using transformer. We are converting AC to DC by using bridge rectifier. We are getting 12V DC output by connecting LM7812 regulator,we are getting 5volts from LM7805 Which gives 12V DC and 5V DC.

12V DC/1A is given to the sensor, Micro controller assembly, and motor drivers. 5v DC/1A is given to the servo motor.

## MODULE-02
## CAPACITIVE PROXIMTY SENSOR (PNP,12V DC/1A)

Capacitive proximity sensor is used to sense/check the arrival of foam PVC. When the foam PVC came to the sensor, the sensor will sense and become high, then the output of the sensor is given to the buck converter.

Buck converter is used to reduce the voltage to 5v,1A. The output of the buck converter is given to the arduino.

## MODULE-03
## MICROCONTROLLER (ATMEGA328P,12V DC/1A)

We are using Arduino for controlling the actions of Vslot actuators, cutter assembly, rollers and the rack and pinion mechanism.

## MODULE-04

## SERVO MOTOR (MG995,5V DC/1A)

Servo motor is used to set the position of the rack and pinion. After completion of cutting operation conveyor moves to the rack and pinion placement. Through rack and pinion process we are giving some mechanical pressure to the workpiece to come out from the PVC sheet and make it place in a box or a tray.

## MODULE-05

## STEPPER MOTOR (NEMA17,12V/1A)

Stepper motors are used to control the position of the lead screw. For step angle rotations of the stepper motors the lead screw helps the cutters to move up and down.

## MODULE-06

## DC MOTORS (12V DC/1A)

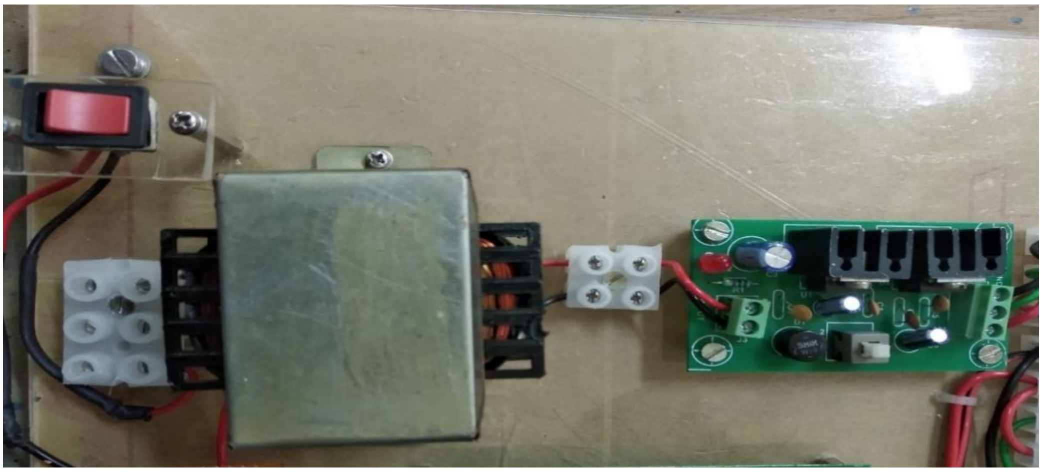
- There are 2 DC motors in the project
- DC motor (10RPM) is connected to the roller. To move the PVC sheet to the desired position.
- DC motor 2 is connected to the cutter assembly to cut the work piece.

# MODULE-01

POWER SUPPLY
12V/1A AND 5V /1A

**CONTENTS**

- Description
- Block diagram
- Schematic diagram
- Design
- Bill of materials



# CHAPTER-05

## 5.1. DESCRIPTION

### POWER SUPPLY MODULE (12V DC/ 1A)

Step down transformer gives 12v/2A.Bridge rectifier converts AC to DC. Capacitor is introduced to filter the ripples of converted DC, so it is used as filter as well as backup capacitor. To remove the ripple voltage.

The rectifier is connected to the capacitors for filtering the signal as pulsating DC voltage to pure DC voltage and they are connected regulator LM7812 for regulating the voltage.

## INPUT

The input 230V/50Hz is given to the transformer.

## STEP DOWN TRANSFORMER

Most of the logic and digital circuit will work only a voltage less than 230V.That is why are using step-down transformer in a power supply.

18-0-18 2A Step Down Transformer is a general purpose chassis mounting mains transformer. Transformer has 230V primary winding and center tapped secondary winding. The transformer has flying colored insulated connecting leads ( Approx 100 mm long ). The Transformer act as step down transformer reducing AC - 230V to AC - 18V.

The Transformer gives outputs of 18V, 18V and 0V. The Transformer's construction is written below with details of Solid Core and Winding.

` The transformer is a static electrical device that transfers energy by inductive coupling between its winding circuits. A varying current in the primary winding creates a varying magnetic flux in the transformer's core and thus a varying magnetic flux through the secondary winding. This varying magnetic flux induces a varying electromotive force (E.M.F) or voltage in the secondary winding. The transformer has cores made of high permeability silicon steel. The steel has a permeability many times that of free space and the core thus serves to greatly reduce the magnetizing current and confine the flux to a path which closely couples the winding.

**Specifications of 18-0-18 2 Ampere Tapped Transformer:**

- Input Voltage: 230V AC
- Output Voltage: 18V, 18V or 0V
- Output Current: 2Amp

## BRIDGE RECTIFIER

To convert an AC signal into a DC signal we are using rectifier circuit. Which is build-up of diodes and the circuit may contain ripples.

A bridge wave rectifier is a rectifier that rectifies mains AC input to DC output. Bridge Rectifiers are widely used in power supplies that provide necessary DC voltage for the electronic components or devices.

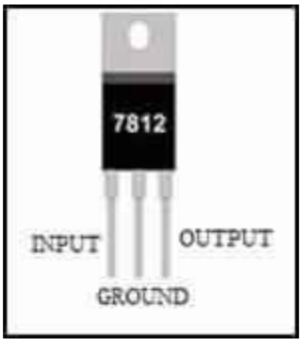
They can be constructed with four or more diodes or any other controlled solid state devices depending on the load current requirements, a proper bridge rectifier is selected. Components' ratings and specifications, breakdown voltage, temperature ranges, transient current rating, forward current rating, mounting requirements and other considerations are taken into account while selecting a rectifier power supply for an appropriate electronic circuit's application.

## FILTER CIRCUIT

To remove the ripples, we are using filter circuit which is built up of capacitors.

## REGULATOR

We are using regulator ICs to maintain a constant output voltage in a power supply circuit. We are using regulator IC 7812 for getting 12v respectively.




The IC 7812 is simple to use. Connect the positive lead to the common pin and then turn on power, a 12-volt supply from the output pin will be obtained.

## OUTPUT

The output of power supply is 12v DC/1A.

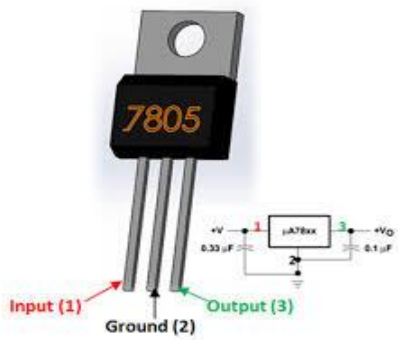
## 5V DC/1A POWER SUPPLY

Step down transformer gives 5v/2A.Bridge rectifier converts AC to DC. Capacitor is introduced to filter the ripples of converted DC, so it is used as filter as well as backup capacitor. To remove the ripple voltage.

The rectifier is connected to the capacitors for filter pulsating DC voltage to pure DC voltage and they are connected regulator LM7805 for regulating the voltage.

## REGULATOR

We are using regulator ICs to maintain a constant output voltage in a power supply circuit. We are using regulator IC 7805 for getting 5v respectively.



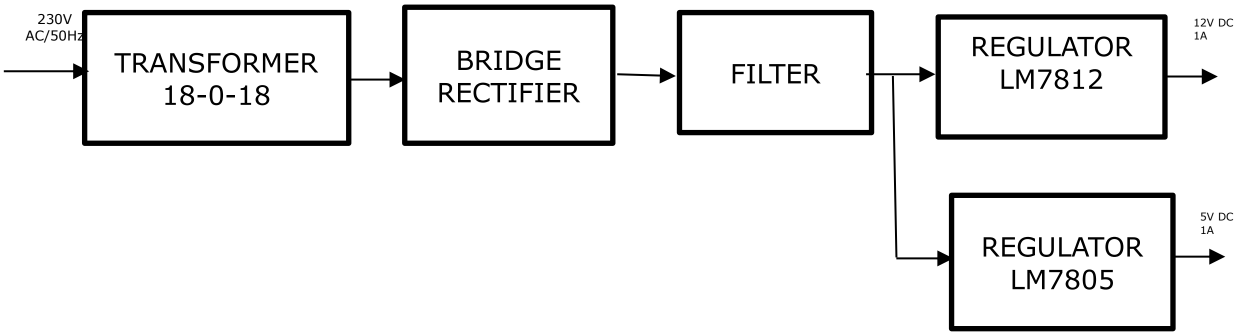

The IC 7805 is simple to use. Connect the positive lead to the common pin and then turn on power, a

5-volt supply from the output pin will be obtained.

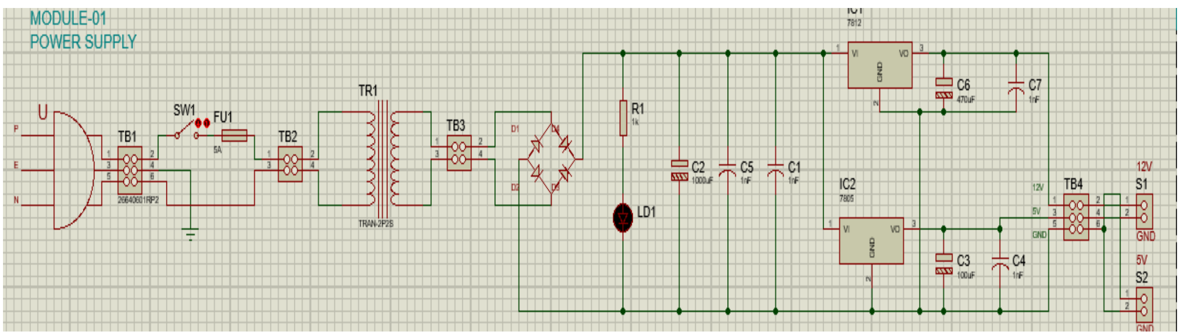
## OUTPUT

The output of power supply is 5V DC/1A.

## 5.2 BLOCK DIAGRAM




## 5.3 SCHEMATIC DIAGRAM




## Design:

## 5.4.1. 12V POWER SUPPLY DESIGN:

1. A design should start from output to input.
2. Our required design is 12V/1A.
3. Terminal (S1)

 2 way terminal/5A

4. LED (LD1) Radial red color LED Φ3mm

5. Resistor(R1)

Formula:

V=IR

R=v/I

Given:

I = 10mA

I/p volt = 12v

Drop across LED = 2

Voltage = Input voltage-drop across LED voltage

= 12V-2V

= 10V

Solution:

**R=V/I**

**=** $10 / (10\times10^{-3})$

$= 1000\Omega = 1K\Omega$

**R1 = carbon resistor/ axial lead/ 1KΩ/ ¼W**

6. A) Electrolytic capacitor (C2 & C3)

Formula:

T = R×C

C = T/R

Given:

T = 10ms

R = ?

R = V/I

R = 12 / 2

= 6

R = 10Ω (approx.)

Solution:

C2 & C3 = T/R

$= (10\times10^{-3}) / 10$

$= 10^{-3}$Mf

=1000µF (approx.)

**C2 & C3 = 1000µ/50v radial type, 25V, aluminum electrolytic Capacitor.**

B) Ceramic capacitor (C1 & C5)

C2 & C4 =0.1µf

*(Due to overshoot and undershoot we have to use low pass filter because it will filter high frequency.)

## So, select least value capacitor 0.1µf/30V

7.Transformer (TR1)

Minimum voltage drops across regulator = 3V

Regulated voltage output =12V

Unregulated (VDC) = 3+12

= 15V

Vdc = 0.9×Vrms

Vrms = 15/0.9

= 16.6

*(10% 0f 16.6 is 1.6)

= 16.6+1.6

= 18.2V

## TR1 = 18V (approx.) /1A

8.Regulator (IC1)

P = V×I

= drop voltage × I

$= 3.8 \times 2$

$= 7.6W$

$P = 10W$ (approx.)

**Regulator 12V/1A/10w/T0220/LM7812**

9.Diode (D1-D4)

Vrms = 18V

$PIV = 2\sqrt{2} \times Vrms$

$= 2 \times 1.414 \times 18$

$= 50.904V$

$= 50V$

**Diode (D1-D4) = 1N4007 (1000V/1A)**

## 5.4.2. 5V DC POWER SUPPLY DESIGN

1. A design should start from output to input.
2. Our required design is 5V/1A.
3. Terminal (S2)
  2-way terminal/5A
4. LED (LD1)
Radial red color LED Φ3mm
5. Resistor(R1)
Formula:
V=IR
R=v/I
Given:
I = 10mA
I/p volt = 5v
Drop across LED = 2v

Voltage = Input voltage-drop across LED voltage

=5V-2V

=3V

Solution:

**R = V/I**

$= 3 / (10\times10^{-3})$

= 300Ω

= 330Ω (approx.)

**R2 = carbon resistor/ axial lead/ 330Ω/ ¼w.**

## 6. A) Electrolytic capacitor (C6)

Formula:

$$T = R\times C$$

C = T/R

Given:

$$T = 10ms$$

R =?

R = V/I

R = 5 / 1A

$= 5 / (500\times10^{-3})$

R = 10Ω

Solution:

$$C6 = T/R$$

$= (10\times10^{-2}) / 10$

$=10^{-2}\mu F$

=100µF (approx.)

C6 = 100µF /50v radial type

## B) Ceramic capacitor (C7 & C4)

C7 &C4 =0.1µf

*(Due to overshoot and undershoot we have to use low pass filter because it will filter high frequency.)

**So, select least value capacitor 0.1µf/30V**

Transformer (TR2)

Minimum voltage drops across regulator = 3V

Regulated voltage output = 5V

Unregulated (Vdc) = 3+5

= 8V

Vdc = 0.9×Vrms

Vrms = 8/0.9 *(10% of 8.8 is 0.8) = 8.8+0.8

= 9.6V

**Regulator 5V/1A/3w/T0220/LM7805**

9. Diode (D6-D8)

Vrms = 10V

PIV = 2√2×Vrms

= 2×1.414×10

= 28.28 V

**Diode = 1N4007 (1000V/1A)**

## 5.5 BILL OF MATERIALS

| SL. NO | ITEM DESCRIPTION | SYMBOL | QUANTITY | PRICE(INR) |
|---|---|---|---|---|
| 1. | 3 PIN POWER CORD AC 230V/50Hz 230V/10mA | U | 1 | 30 |
| 2. | Terminal2 Way /5A | TB1-TB5 | 5 | 15 |
| 3. | GLASS TYPE CYLINDER CARTRIDGE FUSE 5*20mm | FU1 | 1 | 5 |
| 4. | FUSE BLOCK 5*25mm | FU1 | 1 | 5 |
| 5. | STEP DOWN CENTER TAP TRANSFORMER 18-0-18/2A | TR1 | 1 | 280 |

| | | | | |
|---|---|---|---|---|
| 6. | Molded Plastic P-N Junction Diode; 1N4007,1000V/3A, Package: Bulk DO201AD | D1-D4 | 4 | 5 |
| 7. | DC Electrolytic Capacitor, DC 63V,1000µF, -55° to 120°c | C2<br>C3<br>C6 | 1<br>1<br>1 | 15 |
| 8. | DC Ceramic Capacitor 0.1µF/ 3V, -55˚C to +125˚C | C1, C4, C5<br>C7 | Each1 | 10 |
| 9. | SWITCH<br>230V,5A<br>SPST | SW1 | 1 | 10 |
| 10. | Fixed Positive Regulator LM7812-up to 150◦C | IC1 | 1 | 10 |
| 11. | Fixed Positive Regulator LM7805-up to 150◦C | IC2 | 1 | 10 |
| 12. | Carbon Resistor, Axial lead CFR 1KΩ / ¼w, -55˚C to +150˚C,<br>±5% to ±20% tolerance | R1 | 1 | 5 |
| 13. | Radial LED Φ 3mm, Red color | LD1 | 1 | 5 |
| | | | **TOTAL** | 510 |

# MODULE-02

# CAPACITIVE PROXIMTY SENSOR
# PNP
# RANGE:5mm
# SUPPLY VOLTAGE:12V DC/1A

CONTENTS

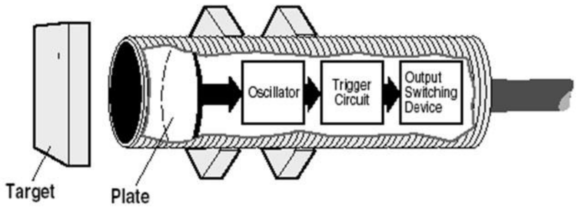



**CHAPTER-06**

## 6.1 DESCRIPTION

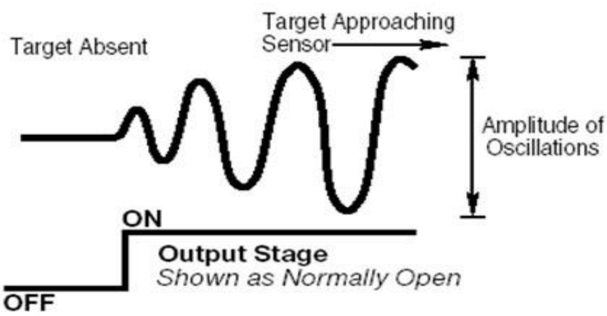
Capacitive proximity sensors are non-contact devices that can detect the presence or absence of virtually any object regardless of material. They utilize the electrical property of capacitance and the change of capacitance based on a change in the electrical field around the active face of the sensor.

## Principle of operation




A capacitive sensor acts like a simple capacitor. A metal plate in the sensing face of the sensor is electrically connected to an internal oscillator circuit and the target to be sensed acts as the second plate of the capacitor. Unlike an inductive sensor that produces an electromagnetic field a capacitive sensor produces an electrostatic field.

The external capacitance between the target and the internal sensor plate forms a part of the feedback capacitance in the oscillator circuit. As the target approaches the sensors face the oscillations increase until they reach a threshold level and activate the output.



Capacitive sensors have the ability to adjust the sensitivity or the threshold level of the oscillator. The sensitivity adjustment can be made by adjusting a potentiometer, using an integral teach pushbutton or remotely by using a teach wire. If the sensor does not have an

adjustment method then the sensor must physically be moved for sensing the target correctly. Increasing the sensitivity causes a greater operating distance to the target. Large increases in sensitivity can cause the sensor to be influenced by temperature, humidity, and dirt.

There are two categories of targets that capacitive sensors can detect the first being conductive and the second is non-conductive. Conductive targets include metal, water, blood, acids, bases, and salt water. These targets have a greater capacitance and a targets dielectric strength is immaterial. Unlike an inductive proximity sensor, reduction factors for various metals are not a factor in the sensors sensing distance.

Rated or nominal sensing distance $S_{n}$ is a theoretical value that does not take into account manufacturing tolerances, operating temperatures and supply voltages. This is typically the sensing

The non-conductive target category acts like an insulator to the sensors electrode. A targets dielectric constant also sometimes referred to as dielectric constant is the measure of the insulation properties used to determine the reduction factor of the sensing distance. Solids and liquids have a dielectric constant that is greater than vacuum (1.00000) or air (1.00059). Materials with a high dielectric constant will have a longer sensing distance. Therefore, materials with high water content, for example wood, grain, dirt and paper will affect the sensing distance.

When dealing with non-conductive targets there are three factors that determine the sensing distance.

- The size of the active surface of the sensor – the larger the sensing face the longer the sensing distance
- The capacitive material properties of the target object, also referred to as the dielectric constant – the higher the constant the longer the sensing distance

- The surface area of the target object to be sensed – the larger the surface area the longer the sensing distance Other factors that have minimal effect Temperature.

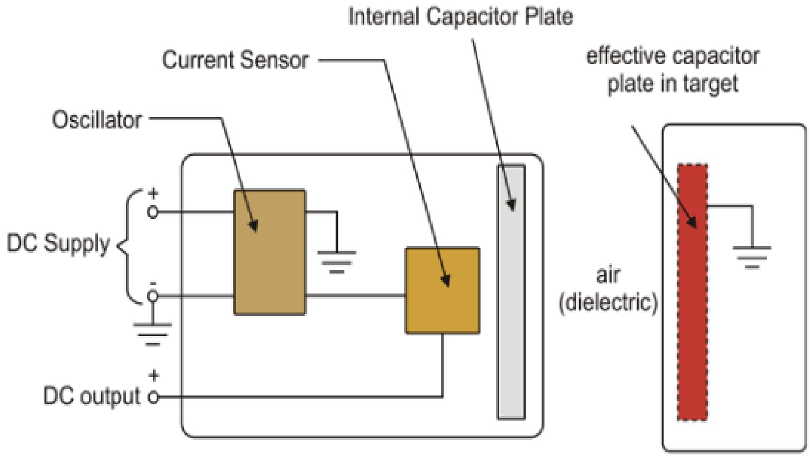
There are two types of capacitive sensing system: mutual capacitance, where the object (finger, conductive stylus) alters the mutual coupling between row and column electrodes, which are scanned sequentially; and self- or absolute capacitance where the object (such as a finger) loads the sensor or increases the parasitic capacitance to ground. In both cases, the difference of a preceding absolute position from the present absolute position yields the relative motion of the object or finger during that time.

## Sensing range

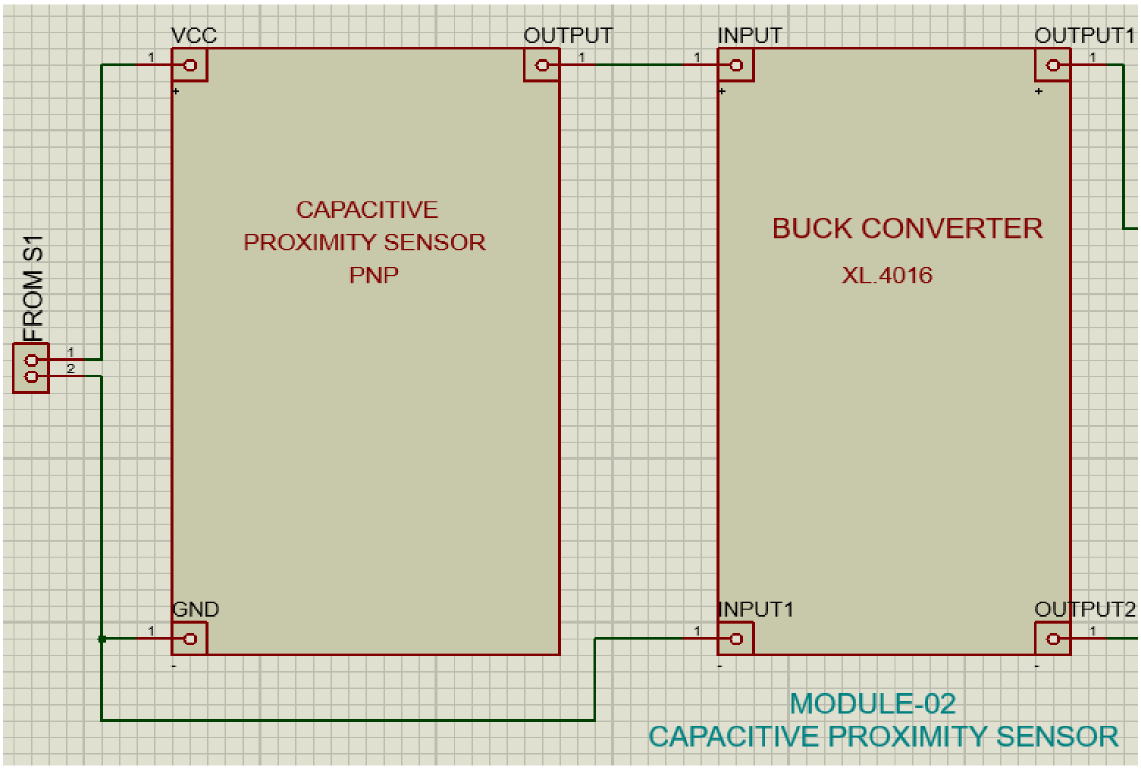
A capacitive sensor's maximum published sensing distance is based on a standard target that is a grounded square metal plate (Fe 360) that is 1mm thick. The standard target must have a side length that is the diameter of the registered circle of the sensing surface or three times the rated sensing distance if the sensing distance is greater than the diameter. Objects being detected that are not metal will have a reduction factor based on the dielectric constant of that object material. This reduction factor must be measured to determine the actual sensing distance however there are some tables that will provide an approximation of the reduction factor. distance listed in various manufactures catalogs and marketing material.

Effective sensing distance $S_r$ is the switching distance of the sensor measured under specified conditions such as flush mounting, rated operating voltage $U_e$, temperature $T_a$ = 23°C +/- 5°C. The effective sensing range of capacitive sensors can be adjusted by the potentiometer, teach pushbutton or remote teach wire.

## INTERNAL DIAGRAM OF PROXIMITY SENSOR




## 6.2. SCHEMATIC DIAGRAM




## 6.3. BILL OF MATERIALS

| SL.NO | ITEM DESCRIPTION | SYMBOL | QUANTITY | PRICE(INR) |
|---|---|---|---|---|
| 11. | CAPACITIVE PROXIMTY SENSOR<br>PNP<br>12V DC/1A<br>RANGE:5mm | S1 | 1 | 250 |
| 12. | BUCK CONVERTER<br>XL4017 | B1 | 1 | 75 |
| | | | **TOTAL** | 325 |

# MODULE-03

MICROCONTROLLER ASSEMBLY
(ATMEGA328P)

CONTENTS



# CHAPTER-07

## 7.1 DESCRIPTION

The Arduino Uno is an OPENSOURCE MICROCONTROLLER BOARD BASED ON THE MICROCHIP ATMEGA328P AND MICROCONTROLLER DEVELOPED BY ARDUINO.CC. The board is equipped with sets of digital and analog INPUT/OUTPUT pins that may be interfaced to various extension boards and other circuits. The board has 14 digital i/o pins ,6 analog i/o pins and is programmable with the Arduino IDE ,via a type B USB cable It can be powered by the USB cable or by an external 9v battery, through it accepts voltages between 7 and 20 volts .Its also similar to the Arduino nano and Leonardo. The hardware reference design is distributed under a creative commons attribution share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available.

The word “uno” means “one” in Italian and was chosen to mark the initial release of Arduino service of USB -based aurdino boards ;it is a version 1.0 of the Arduino IDE were the reference versions of Arduino, which have now evolved to newer releases. he ATmega328 on the board comes preprogrammed with a bootloader that allows uploading new code to it without the use of an external hardware programmer.

While the Uno communicates using the original STK500 protocol it differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it uses the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB to serial converter.

## HISTORY

The Arduino project started at the Interaction design institute Ivrea ,Italy. At that time, the students used a BASIC STAMP microcontroller, at a cost that was a considerable expense for many students In 2003, Hernando Barragán created the development platform wiring as a Master's thesis project at IDII, under the supervision of Massimo Banzi and Casey Reas, who are known for work on the processing language . The project goal was to create simple, low-cost tools for creating digital projects by non-engineers. The Wiring platform consisted of a printed circuit board (PCB) with an Atmega 168 microcontroller ,an IDE based on Processing, and library functions to easily program the microcontroller. In 2003, Massimo Banzi, with David Mellis, another IDII student, and David Cuartielles, added support for the cheaper ATmega8 microcontroller to Wiring. But instead of continuing the work on Wiring, they forked the project and renamed it *Arduino*. Early Arduino boards used the FTDI USB-to-serial driver chip and an ATmega168.The Uno differed from all preceding boards by featuring the ATmega328P microcontroller and an ATmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

## TECHNICAL SPECIFICATIONS:

- Microcontroller-Microchip ATmega328P
- Operating voltage:5V
- Input voltage-7 to 20 volts
- Digital i/o pins:14 (of which 6 can provide PWM output)
- UART: 1
- I2c:1
- SPPI:1
- Analog input pins:6
- DC Current per I/O Pin: 20 mA
- DC Current for 3.3V Pin: 50 mA
- Flash memory: 32 KB of which 0.5 KB used by a boot loader
- SRAM :2kb
- EEPROM:1Kb
- Clockspeed:16MHz

- Length: 68.6 mm
- Width: 53.4 mm
- Weight: 25 g

## Pins:

General pin functions

- **LED**: There is a built-in LED driven by digital pin 13. When the pin is high value, the LED is on, when the pin is low, it is off.
- **VIN**: The input voltage to the Arduino/Genuino board when it is using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- **5V**: This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 20V), the USB connector (5V), or the VIN pin of the board (7-20V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage the board.
- **3V3**: A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- **GND**: Ground pins.
- **IOREF**: This pin on the Arduino/Genuino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source, or enable voltage translators on the outputs to work with the 5V or 3.3V.
- **Reset**: Typically used to add a reset button to shields that block the one on the board.

Special pin functions

Each of the 14 digital pins and 6 analog pins on the Uno can be used as an input or output, under software control (using pinMode(), digitalWrite(), and digitalRead() functions). They operate at 5 volts. Each pin can provide or receive 20 mA as the recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50K ohm. A maximum of 40mA must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller. The Uno has 6 analog inputs, labeled A0 through A5; each provides 10 bits of resolution (i.e. 1024 different values). By default, they measure from ground to 5 volts, though it is possible to change the upper end of the range using the AREF pin and the analogReference() function.

In addition, some pins have specialized functions:

- **Serial** /UART: pins 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL serial chip.
- **External interrupts**: pins 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
- PWM : Pins 3, 5, 6, 9, 10, and 11. Can provide 8-bit PWM output with the analogWrite() function.
- SPI: pins 10 (SS), 11 (MOSI), 12 (MISO), and 13 (SCK). These pins support SPI communication using the SPI library.
- **TWI** (two-wire interface) /I2C: pin SDA (A4) and pin SCL (A5). Support TWI communication using the Wire library.
- **AREF** (analog reference): Reference voltage for the analog inputs.

**COMMUNICATION:**

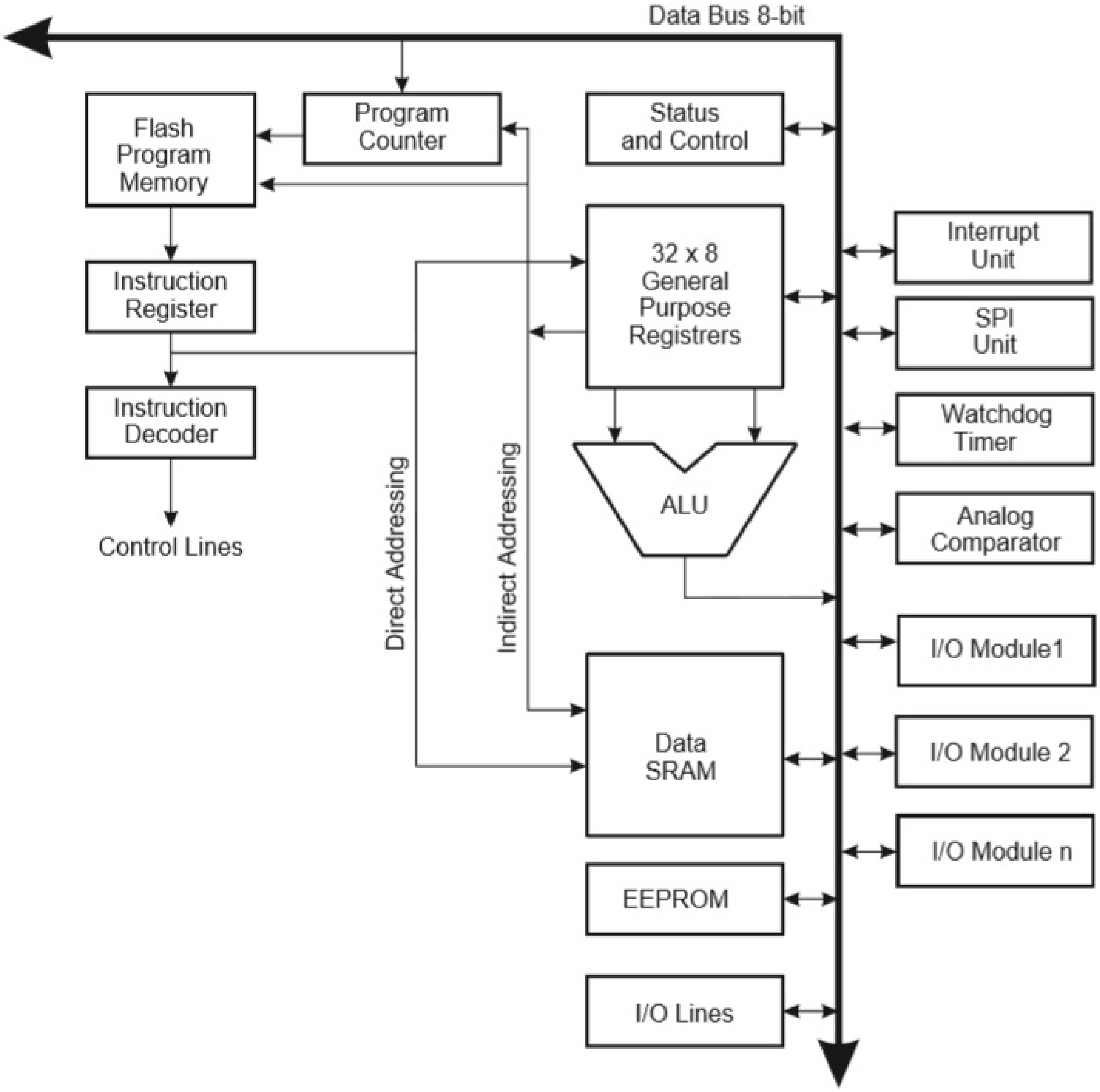
The Arduino/Genuino Uno has a number of facilities for communicating with a computer, another Arduino/Genuino board, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The 16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a .inf file is required. Arduino Software (IDE) includes a serial monitor which allows simple textual data to be sent to and from the board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1). A SoftwareSerial library allows serial communication on any of the Uno's digital pins.

## Automatic (software) reset

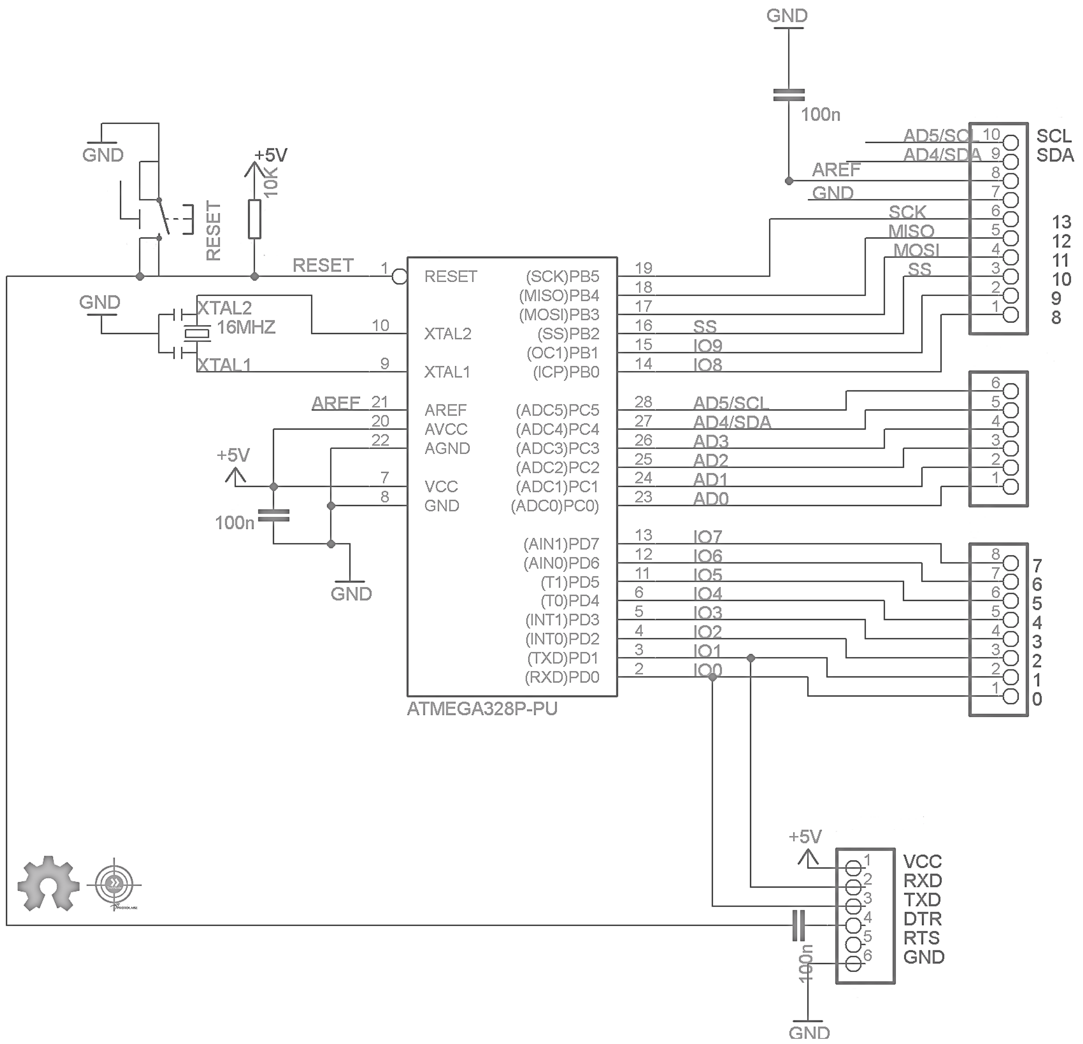
Rather than requiring a physical press of the reset button before an upload, the Arduino/Genuino Uno board is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the ATmega8U2/16U2 is connected to the reset line of the ATmega328 via a 100 nanofarad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip.

This setup has other implications. When the Uno is connected to a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the bootloader is running on the Uno. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened.

## 7.2.ARCHITECTURE OF ATMEGA 328P



# 7.3.CIRCUIT DIAGRAM OF ARDUINO UNO



## 7.4 BILL OF MATERIALS

| SL.NO | ITEM DESCRIPTION | QUANTITY | PRICE(INR) |
|---|---|---|---|
| 1. | ATMega 328P, 5V, 500mA | 1 | 200 |
| 2. | Disc Capacitor 0.1uF, 103. | 1 | |
| | Disc Capacitor, 33uF, 33uF. | 2 | 10 |
| 3. | Carbon Resistor, Axial lead CFR 330Ω / ¼w, -55˚C to +150˚C, ±5% to ±20% tolerance | 1 | 5 |
| 4. | Crystal oscillator 8MHz | 1 | 35 |
| 5. | Molded Plastic P-N Junction Diode; 1N4007,1000V/ 1A, Glass package-2 | 1 | 5 |
| 6. | Micro Push Button 1.5A 28v DC. | 1 | 10 |
| 7. | SIL Connectors | 4 | 10 |
| | TOTAL | | 275 |

# MODULE-04

SERVO MOTOR
MG995
SUPPLY VOLTAGE:5V DC/1A

CONTENTS



# CHAPTER-08

## 8.1 DESCRIPTION

A servo motor is an electrical device which can push or rotate an object with great precision. If you want to rotate and object at some specific angles or distance, then you use servo motor. It is just made up of simple motor which run through servo mechanism. If motor is used is DC powered then it is called DC servo motor, and if it is AC powered motor then it is called AC servo motor. We can get a very high torque servo motor in a small and light weight packages. Doe to these features they are being used in many applications like toy car, RC helicopters and planes, Robotics, Machine etc.

### Servo Mechanism

It consists of three parts:

1. Controlled device
2. Output sensor
3. Feedback system

It is a closed loop system where it uses positive feedback system to control motion and final position of the shaft. Here the device is controlled by a feedback signal generated by comparing output signal and reference input signal.

Here reference input signal is compared to reference output signal and the third signal is produces by feedback system. And this third signal acts as input signal to control device. This signal is present as long as feedback signal is generated or there is difference between reference input signal and reference output signal. So, the main task of servomechanism is to maintain output of a system at desired value at presence of noises.

## Working principle of Servo Motors

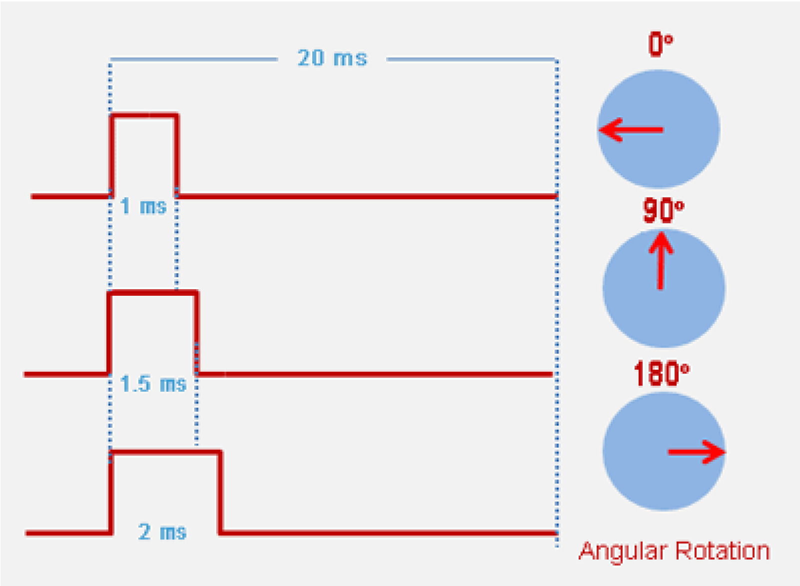
A servo consists of a Motor (DC or AC), a potentiometer, gear assembly and a controlling circuit. First of all, we use gear assembly to reduce RPM and to increase torque of motor. Say at initial position of servo motor 7the potentiometer and it will generate a signal. So, as the potentiometer's angular position changes, its output feedback signal changes. After sometime the position of potentiometer reaches at a position that the output of potentiometer is same as external signal provided. At this condition, there will be no output signal from the amplifier to the motor input as there is no difference between external applied signal and the signal generated at potentiometer, and in this situation motor stops rotating.

## Controlling Servo Motor:

All motors have three wires coming out of them. Out of which two will be used for Supply (positive and negative) and one will be used for the signal that is to be sent from the MCU.

Servo motor is controlled by PWM (Pulse with Modulation) which is provided by the control wires. There is a minimum pulse, a maximum pulse and a repetition rate. Servo motor can turn 90 degree from either direction form its neutral position. The servo motor expects to see a pulse every 20 milliseconds (ms) and the length of the pulse will determine how far the motor turns. For example, a 1.5ms pulse will make the motor turn to the 90° position, such as if pulse is shorter than 1.5ms shaft moves to 0° and if it is longer than 1.5ms than it will turn the servo to 180°.

Servo motor works on PWM (Pulse width modulation) principle, means its angle of rotation is controlled by the duration of applied pulse to its Control PIN. Basically, servo motor is made up of DC motor which is controlled by a variable resistor (potentiometer) and some gears**.** High speed force of DC motor is converted into torque by Gears. We know that WORK= FORCE X DISTANCE, in DC motor Force is less and distance (speed) is high and in Servo, force is High and distance is less. Potentiometer is connected to the output shaft of the Servo, to calculate the angle and stop the DC motor on required angle.



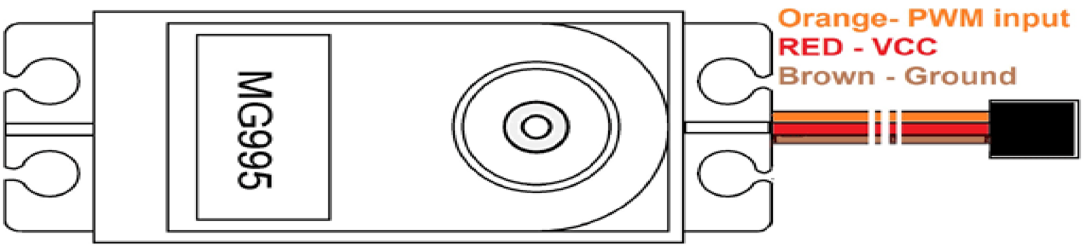

Servo motor can be rotated from 0 to 180 degree, but it can go up to 210 degree, depending on the manufacturing. This degree of rotation can be controlled by applying the Electrical Pulse of proper width, to its Control pin. Servo checks the pulse in every 20 milliseconds. Pulse of 1 ms (1 millisecond) width can rotate servo to 0 degree, 1.5ms can rotate to 90 degree (neutral position) and 2 MS pulse can rotate it to 180 degree.

As the encoder type, gearhead ratio and overall system dynamics are application specific, it is more difficult to produce the overall controller as an off-the-shelf module and so these are often implemented as part of the main controller.

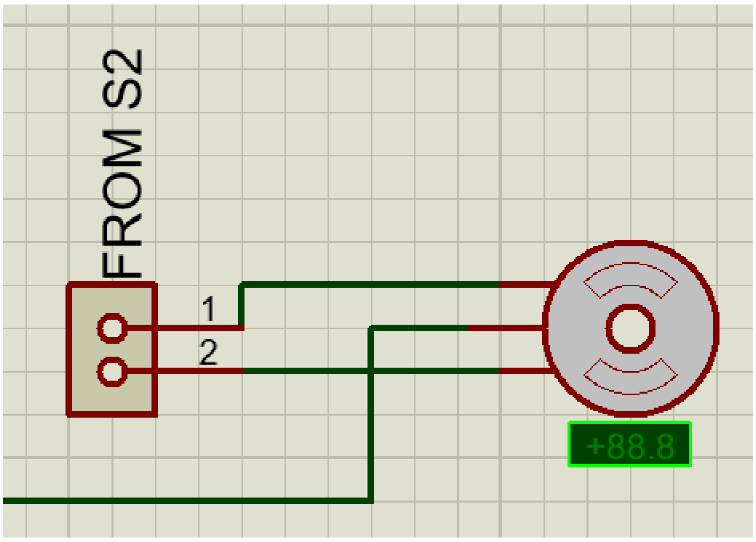
## SPECIFCATIONS

- Stall torque: 8.5 kgf·cm (4.8 V), 10 kgf·cm (6 V)
- Operating speed: 0.2 s/60◦ (4.8 V), 0.16 s/60◦ (6 V)
- Operating voltage: 4.8 V To 7.2 V
- Stable and shock proof double ball bearing design

- Temperature range: 0◦C to 55◦C.




## 8.2 SCHEMATIC DIAGRAM



## 8.3 BILL OF MATERIALS

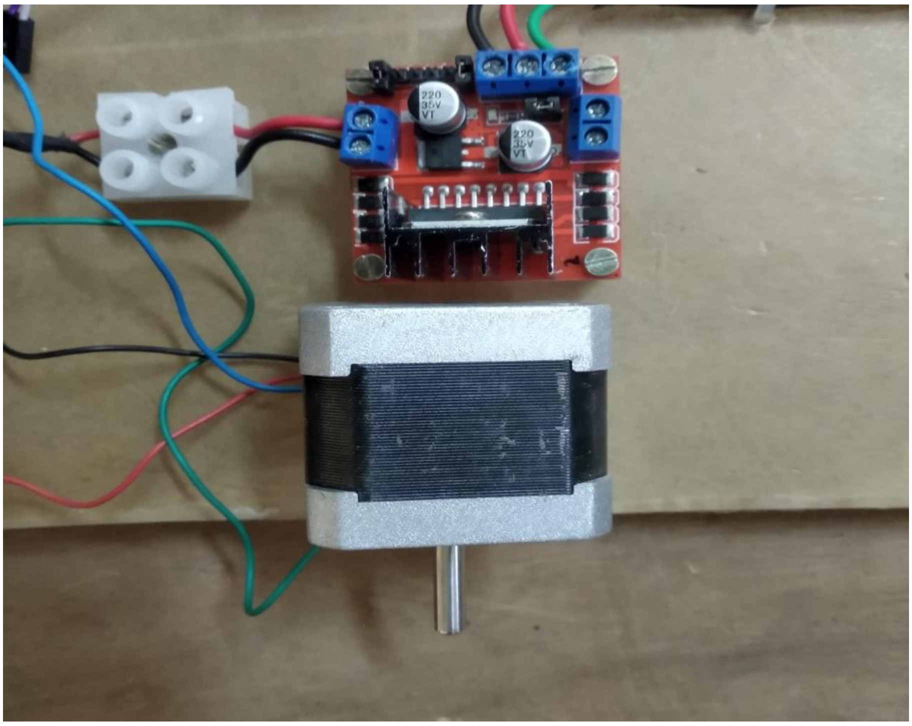
| SL.NO | ITEM DESCRIPTION | SYMBOL | QUANTITY | PRICE(INR) |
|---|---|---|---|---|
| 1. | SERVO MOTOR<br>MG995<br>4.8V-7.2V<br>0◦C to 55◦C. | - | 1 | 80 |
| 2. | SIL CONNECTORS/5A | - | 2 | 10 |
| | | | **TOTAL** | 90 |

# MODULE-05

STEPPER MOTOR
17HS4401
SUPPLY VOLTAGE 12V/1A

CONTENTS





# CHAPTER-09

## 9.1 DESCRIPTION

L298 is a dual H bridge motor driver IC controls the rotation of two motors in both clockwise and anticlockwise directions. Maximum output current per channel is1A. So, it can drive the gear motors. It is an integrated monolithic circuit in a 15 lead multi watt and power S020 packages and it's a high voltage high current dual full bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays solenoids DC and stepping motors. The DC motor driver is used as the output from the ATmega which is connected to the motor. It works using the H-bridge principle to drive two motors simultaneously. The motor driver used in this project is the L298 motor driver which can operate at 1A of current and 5v voltage.

## FEATURES, MODULE PINOUTS, H BRIDGE CONCEPT

## PWM FEATURES

1) High operating voltage, which can be up to 40 volts;
2) Large output current, the instantaneous peak current can be up to
3) With 25W rated power.
4) Two built in H-bridge, high voltage, large current, full bridge driver, which can be used to drive DC motors, stepper motors, relay coils and other inductive loads.
5) Using standard logic level signal to control.
6) Able to drive a two-phase stepper motor or four-phase stepper motor, and two-phase DC motors.
7)Adopt a high-capacity filter capacitor and a freewheeling diode that protects devices in the circuit from being damaged by the reverse current of an inductive load, enhancing reliability.
8) The module can utilize the built-in stable volt tube 78M05 to obtain 5v from the power supply. But to protect the chip of the 78M05 from damage, when the drive voltage is greater than 12v, an external 5v logic

supply should be used.

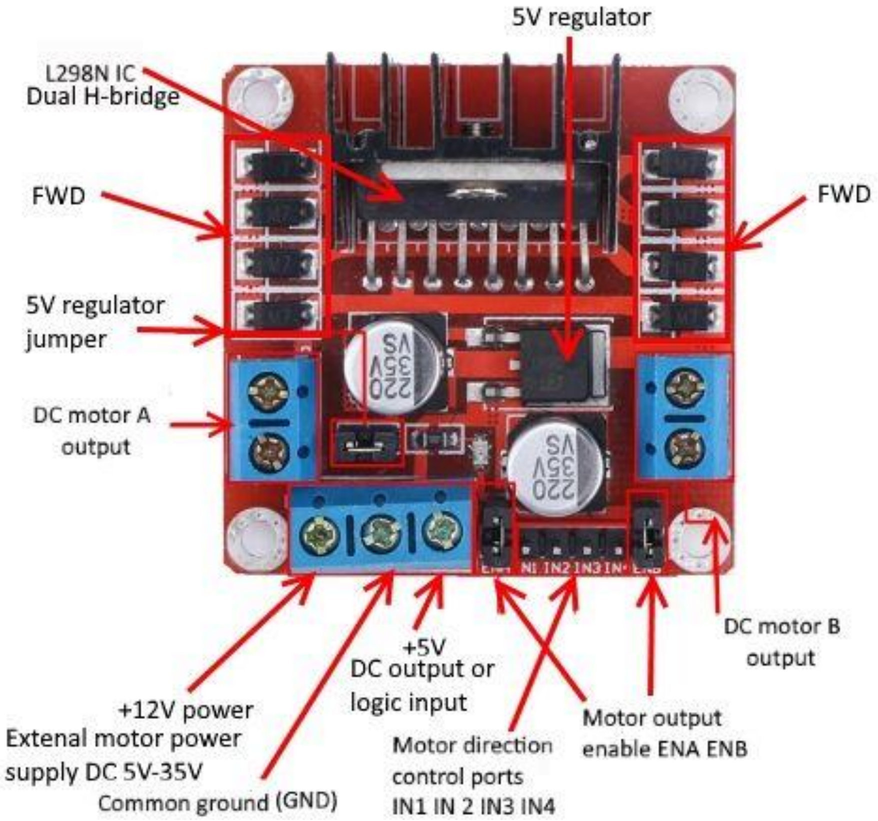
9) Drive voltage: 5-35V; logic voltage: 5V.

10) PCB size: 4.2 x 4.2 cm.

L298N Module Pin out

The board contains an L298N mounted on a heatsink, a 5 volt voltage regulator to “optionally) provide power for logic circuits, supporting diodes and capacitors and connectors as follows:

- Logic inputs for each H-Bridge circuit.
- Power supply inputs for
- the motor power supply.
- An optional 5 Volt power input for the logic circuits.
- Outputs for each DC motor



- CSA – This is the "current sensing" function for Motor A. If the jumper is in this function is ignored.
- CSB – The "current sensing" function for Motor B. Again, you'll usually just leave this in place to disable this function.
- U1 – Input 1 pull-up resistor. You will usually leave this in place, which enables a 10k pull-up resistor for the input.
  - U2 – Input 2 pull-up resistor.
  - U3 – Input 3 pull-up resistor.
  - U4 – Input 4 pull-up resistor.

**5V-EN**

This is the only jumper that you need to really pay attention to. When this jumper is in place it enables the boards internal 78M05 5 Volt regulator, supplying logic power from the motor power supply. When this jumper is enabled you will NOT supply 5 volts to the 5 Volt input terminal. When the jumper is removed you will need to supply 5 Volts to the 5 Volt input terminal. If we do not use the internal voltage regulator, we have to supply the motor power supply with at least 7.5 volts.

The motor power supply it needs to be a bit higher voltage than the actual motor requirements. This is due to the internal voltage drop in the transistors that form the H-Bridge circuit. The combined voltage drop is 1.4 volts, so if we are using 6 Volt motors, we have to give the board 7.4 volts, if we have 12-volt motors then the motor supply voltage needs to be 13.4 volts.

The board has four input terminals plus two enable terminals. These terminals are used to control both direction and speed or each motor.

- They are as follows:
- IN1 – Input 1 for Motor A
- IN2 – Input 2 for Motor A
- IN3 – Input 3 for Motor B
- IN4 – Input 4 for Motor B
- EN1 – Enable line for Motor A

EN2 – Enable Line for Motor B In order to simplify things a bit I'll just discuss the inputs and enable for Motor A, Motor B functions identically. The two Input lines control the direction that the motor rotates. We can call, one direction "forward" and the other one "reverse", if it makes more sense to we can just substitute "clockwise" and "counter clock-wise". Motor direction by applying either a Logic 1 (5 Volts) or Logic 0 (Ground) to the inputs. This chart illustrates how this is done.

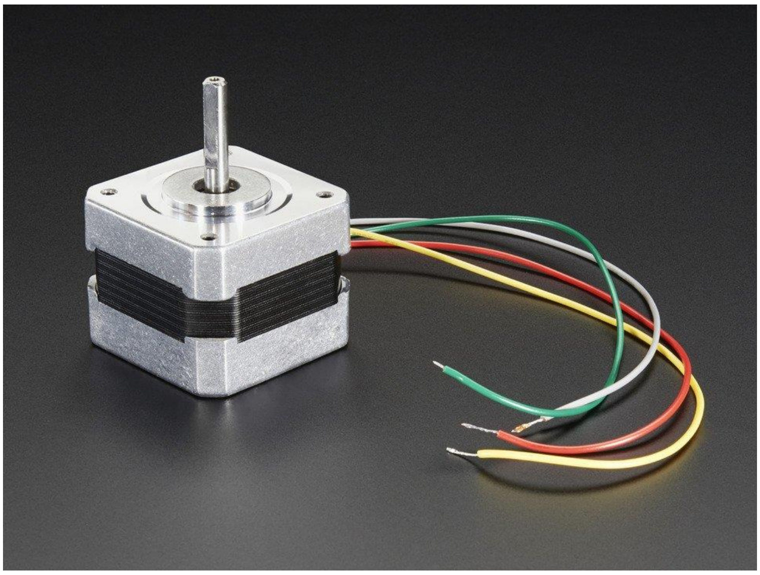
As we see only two combinations are actually used to control the direction of the motor's rotation. The Enable line can be used to turn the motor on, to turn it off and to control its speed. When the Enable line is at 5 Volts (1) the motor will be on. Grounding the Enable line (0) will turn the motor off. To control the speed of the motor you apply a Pulse Width Modulation (PWM) signal to the Enable line. The shorter the pulse width, the slower the motor will spin.

## H-Bridge

We can reverse their direction by changing polarity and we can change their speed using pulse width modulation, let's examine an easy way to do this using a very common circuit configuration called an "H-Bridge".

An "H-Bridge" is simply an arrangement of switching the polarity of the voltage applied to a DC motor, thus controlling its direction of rotation. H-Bridge is usually built using transistors. Using transistors also allows to control the motor speed with PWM, as described above. Close (i.e. turn on) two of the switches you can see how the voltage is applied to the motor, causing it to turn clockwise.

**Stepper Motor: Bipolar, 200 Steps/Rev, 42×38mm, 2.8V, 1.7 A/Phase**



**DESCRIPTION:** This NEMA 17-size hybrid bipolar stepping motor has a 1.8° step angle (200 steps/revolution). Each phase draws 1.7 A at 2.8 V, allowing for a holding torque of 3.7 kg-cm (51 oz-in). This hybrid bipolar stepping motor has a 1.8° step angle (200 steps/revolution). Each phase draws 1.7 A at 2.8 V, allowing for a holding torque of 3.7 kg-cm (51 oz-in). The motor has four color-coded wires terminated with bare leads: black and green connect to one coil; red and blue connect to the other. It can be controlled by a pair of suitable H-bridges (one for each coil), but we recommend using a one of our stepper motor. In particular, the Tics make control easy because they support six different interfaces (USB, TTL serial, I²C, RC, analog voltages, and quadrature encoder) and are configurable over USB with our free configuration utility. Our can be used to mount objects on the stepper motor's 5 mm-diameter output shaft, and our product offers a variety of options for mounting this stepper motor in your project. This NEMA17 stepper motor is also available with threaded rod output shafts in lengths of product,and that convert its rotations into linear motion of the included traveling nut.

**NEMA 17 Stepper Motor Technical Specifications:**

- Size: 42.3 mm square × 38 mm, not including the shaft (NEMA 17)
- Weight: 285 g (10 oz)
- Shaft diameter: 5 mm “D”
- Steps per revolution: 200
- Current rating: 1.68 A per coil
- Voltage rating: 2.8 V
- Resistance: 1.65 Ω per coil
- Holding torque: 3.7 kg-cm (51 oz-in)
- Inductance: 3.2 mH per coil
- Lead length: 30 cm (12″)
- Output shaft supported by two ball bearings

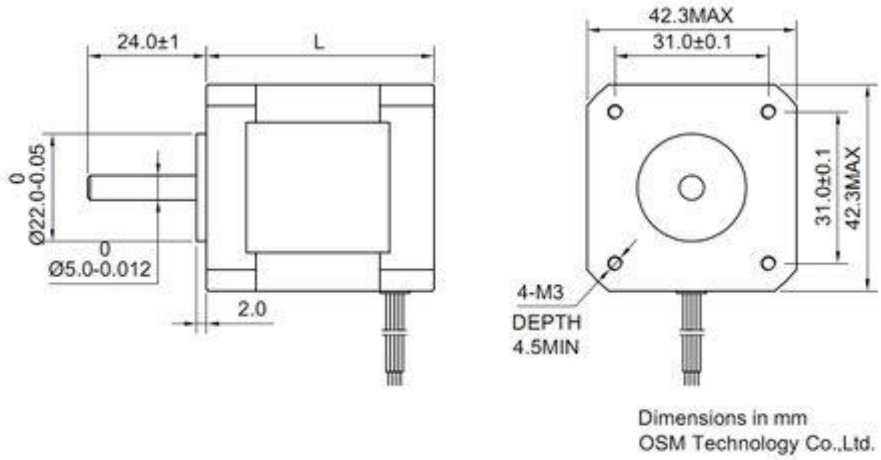
**Stepper Motor Applications**

Stepper motors are generally used in a variety of applications where precise position control is desirable and the cost or complexity of a feedback control system is unwarranted. Here are a few applications where stepper motors are often found:

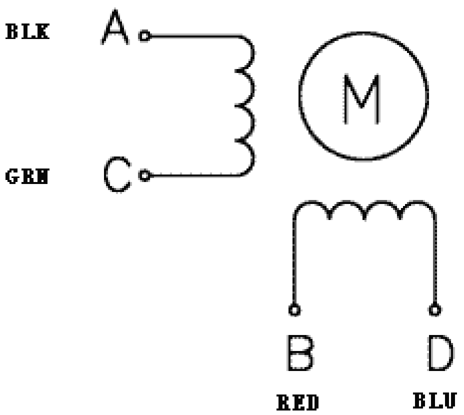
- Printers
- CNC machines
- 3D printer/prototyping machines (e.g. RepRap)
- Laser cutters
- Pick and place machines
- Linear actuators
- Hard drives

**Dimensions:**

The following diagram shows the stepper motor dimensions in mm. The dimension labeled “length” is 38 mm. The output D-shaft has a 5 mm diameter with a section that is flattened by 0.5 mm. This shaft works with our motor.




**CONSTRUCTION:**

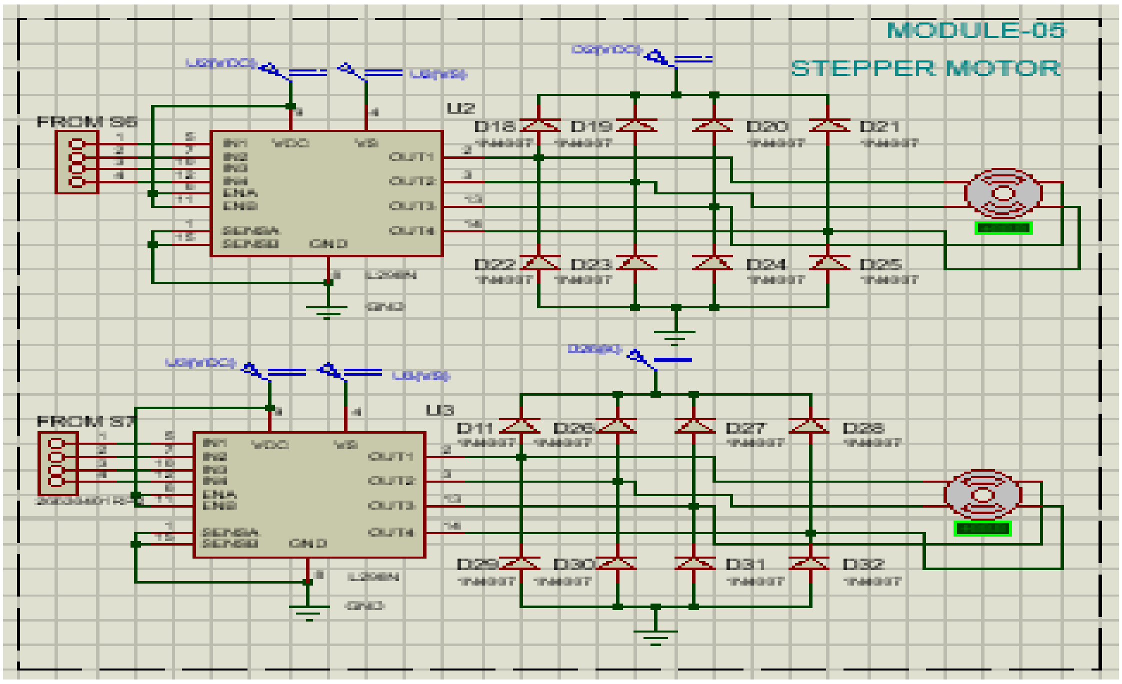



Advantages of Stepper Motor:

1. The rotation angle of the motor is proportional to the input pulse.
2. The motor has full torque at standstill.
3. Precise positioning and repeatability of movement since good stepper motors have an accuracy of 3 – 5% of a step and this error is noncumulative from one step to the next.
4. Excellent response to starting, stopping, and reversing.
5. Very reliable since there are no contact brushes in the motor. Therefore the life of the motor is simply dependant on the life of the bearing.
6. The motor’s response to digital input pulses provides open-loop control, making the motor simpler and less costly to control.
7. It is possible to achieve very low-speed synchronous rotation with a load that is directly coupled to the shaft.

8. A wide range of rotational speeds can be realized as the speed is proportional to the frequency of the input pulses.

## 9.2 SCHEMATIC DIAGRAM




## 9.3 BILL OF MATERIALS

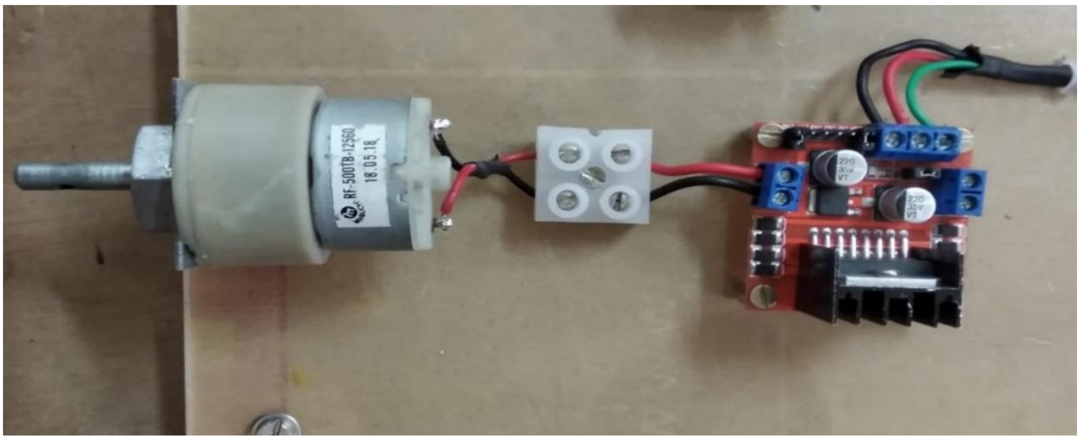
| SL.NO | ITEM DESCRIPTION | SYMBOL | QNTY | PRICE |
|---|---|---|---|---|
| 1. | MOTOR DRIVER (L298N,12V,1A) | U3,U4 | 2 | 300 |
| 2. | STEPPER MOTOR NEMA17 | - | 2 | 1000 |
| 3. | Molded Plastic P-N Junction Diode; 1N4007,1000V/3A, Package: Bulk DO201AD | D18-D31 | 16 | 30 |
| | | | **TOTAL** | 1330 |

# MODULE-06

DC MOTOR 1&2
30 RPM
SUPPLY VOLTAGE :12V DC/1A

DC MOTOR :3
IG32-800RPM
SUPPLY VOLYAGE:12V DC/1A

CONTENT
- Description
- Schematic diagram
- Bill of materials



# CHAPTER-10

## 10.1 DESCRIPTION

### GEAR MOTOR

Geared DC motors can be defined as an extension of DC motor. A geared DC Motor has a gear assembly attached to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as RPM. The gear assembly helps in increasing the torque and reducing the speed. Using the correct combination of gears in a gear motor, its speed can be reduced to any desirable figure. This concept where gears reduce the speed of the vehicle but increase its torque is known as gear reduction. This Insight will explore all the minor and major details that make the gear head and hence the working of geared DC motor.

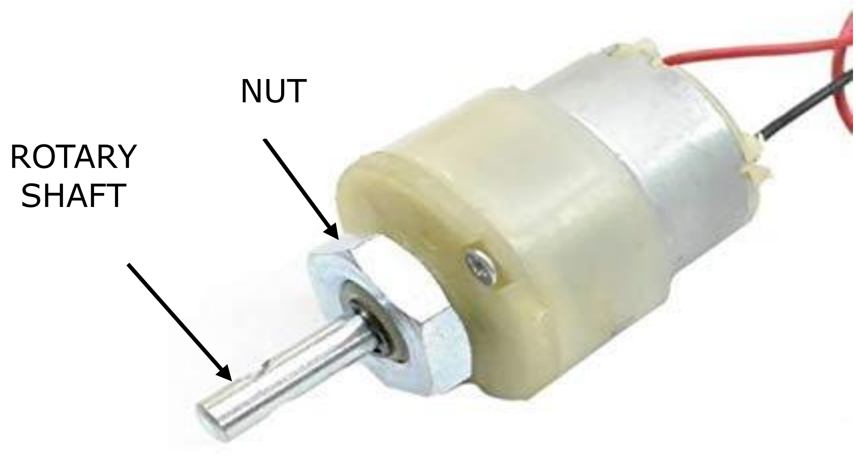
### WORKING PRINCIPLE OF A DC MOTOR

A motor is an electrical machine which converts electrical energy into mechanical energy. The principle of working of a DC motor is that "whenever a current carrying conductor is placed in a magnetic field, it experiences a mechanical force". This DC or direct current motor works on the principal, when a current carrying conductor is placed in a magnetic field, it experiences a torque and has a tendency to move. This is known as motoring action.

If the direction of current in the wire is reversed, the direction of rotation also reverses. When magnetic field and electric field interact, they produce a mechanical force, and based on that the working principle of DC motor is established.

The direction of rotation of this motor is given by Fleming’s left hand rule, which states that if the index finger, middle finger and thumb of your left hand are extended mutually perpendicular to each other and if the index finger represents the direction of magnetic field, middle finger indicates the direction of current, then the thumb represents the direction in which force is experienced by the shaft of the DC motor. Structurally and construction wise a direct current motor is exactly similar to a DC generator, but electrically it is just the opposite. Here we unlike a generator we supply electrical energy to the input port and derive mechanical energy from the output port. We can represent it by the block diagram shown below.

| INPUT 1 | INPUT 2 | DIRECTION |
|---|---|---|
| Ground (0) | Ground (0) | Motor Off |
| 5 Volts (1) | Ground (0) | Forward |
| Ground (0) | 5 Volts (1) | Reverse |
| 5 Volts (1) | 5 Volts (1) | NOT USED |




**GEAR**

A gear or cogwheel is a rotating machine part having cut teeth, or cogs, which mesh with another toothed part to transmit torque. Geared devices can change the speed, torque, and direction of a power source. Gears almost always produce a change in torque, creating a mechanical advantage, through their gear ratio, and thus may be considered a simple machine. The teeth on the two meshing gears all have the same shape. Two or more meshing gears, working in a sequence, are called a gear train or a transmission. A gear can mesh with a linear toothed part, called a rack, thereby producing translation instead of rotation.

If we close (i.e. turn on) two of the switches you can see how the voltage is applied to the motor, causing it to turn clockwise as shown in fig 1.1

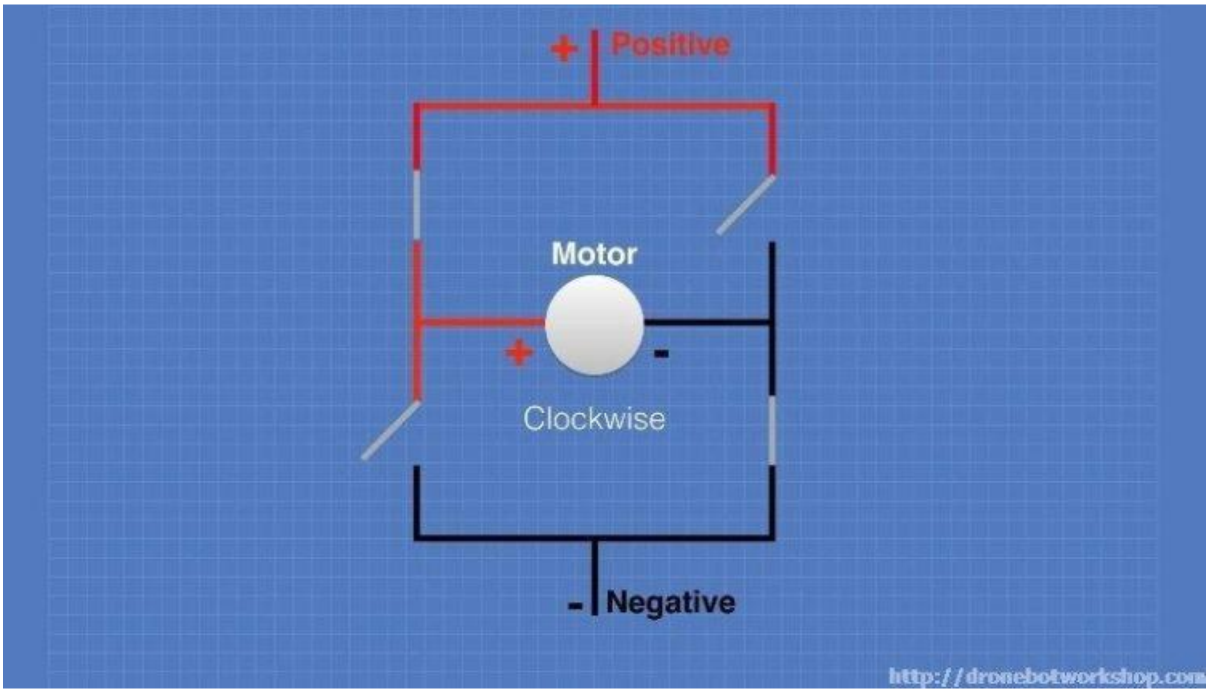



**Fig1.1 MOTOR RUNNING IN CLOCKWISE**

Now we'll open those switches and close the other two. As you can see this causes the polarity of the voltage applied to the motor to be reversed, resulting in our motor spinning counterclockwise.

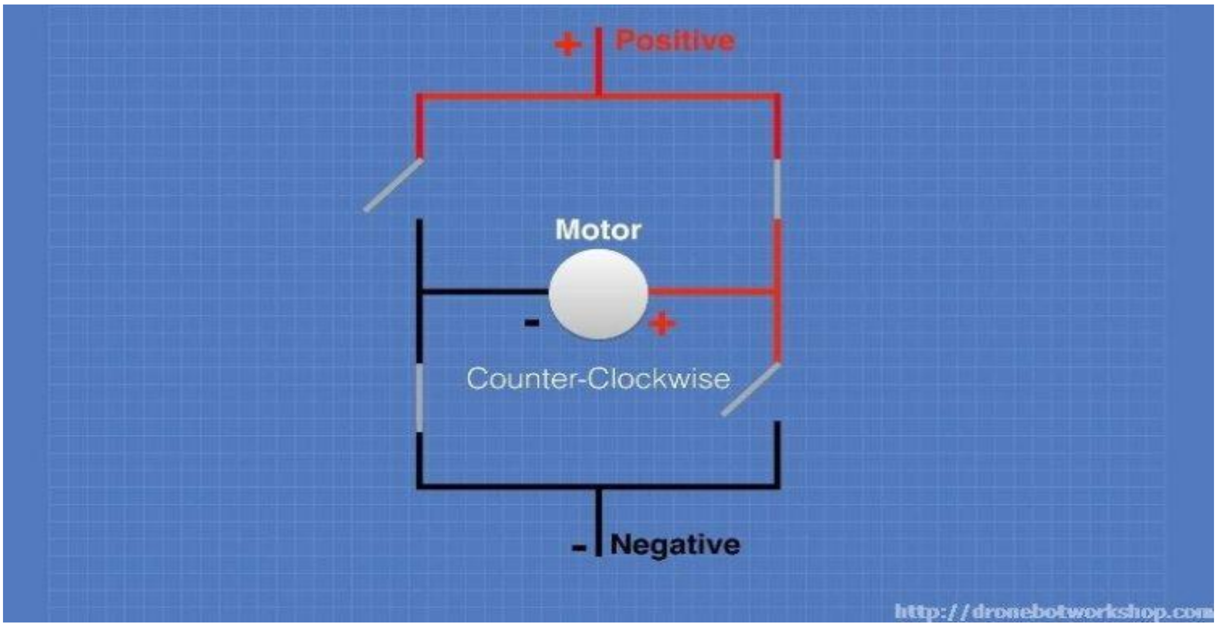
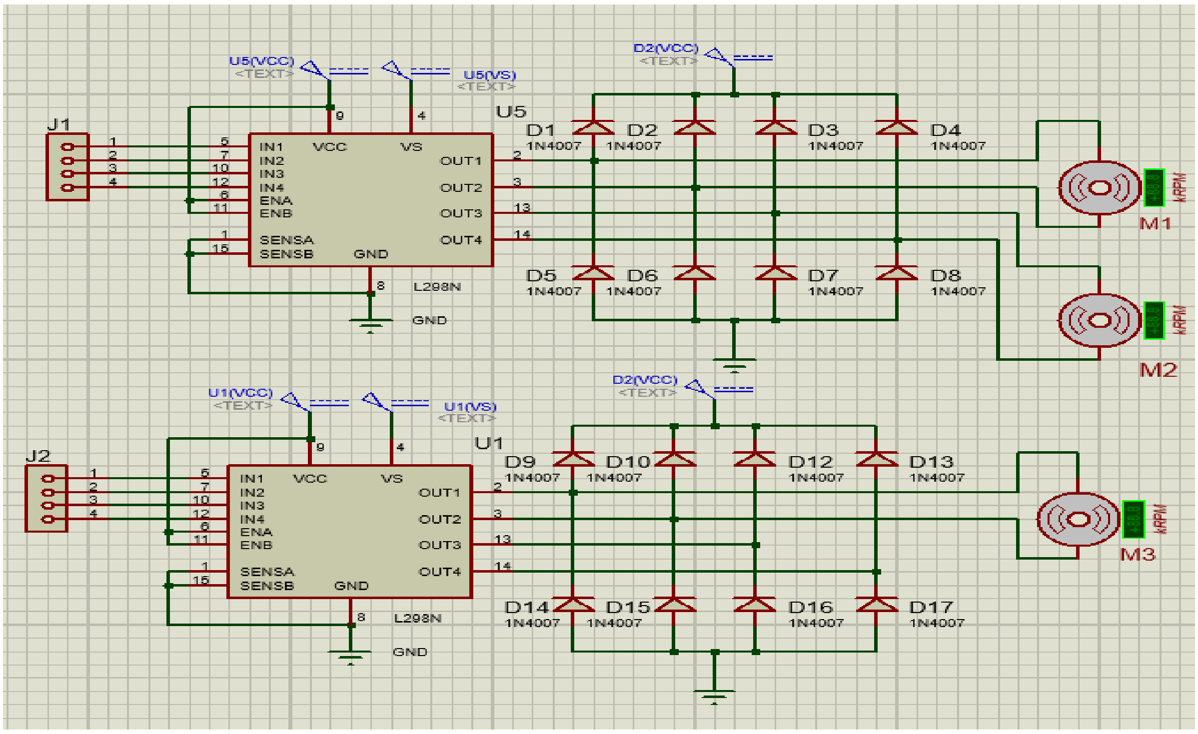



**Fig 1.2 MOTOR RUNNING IN COUNTER CLOCKWISE**

## 10.2 SCHEMATIC DIAGRAM

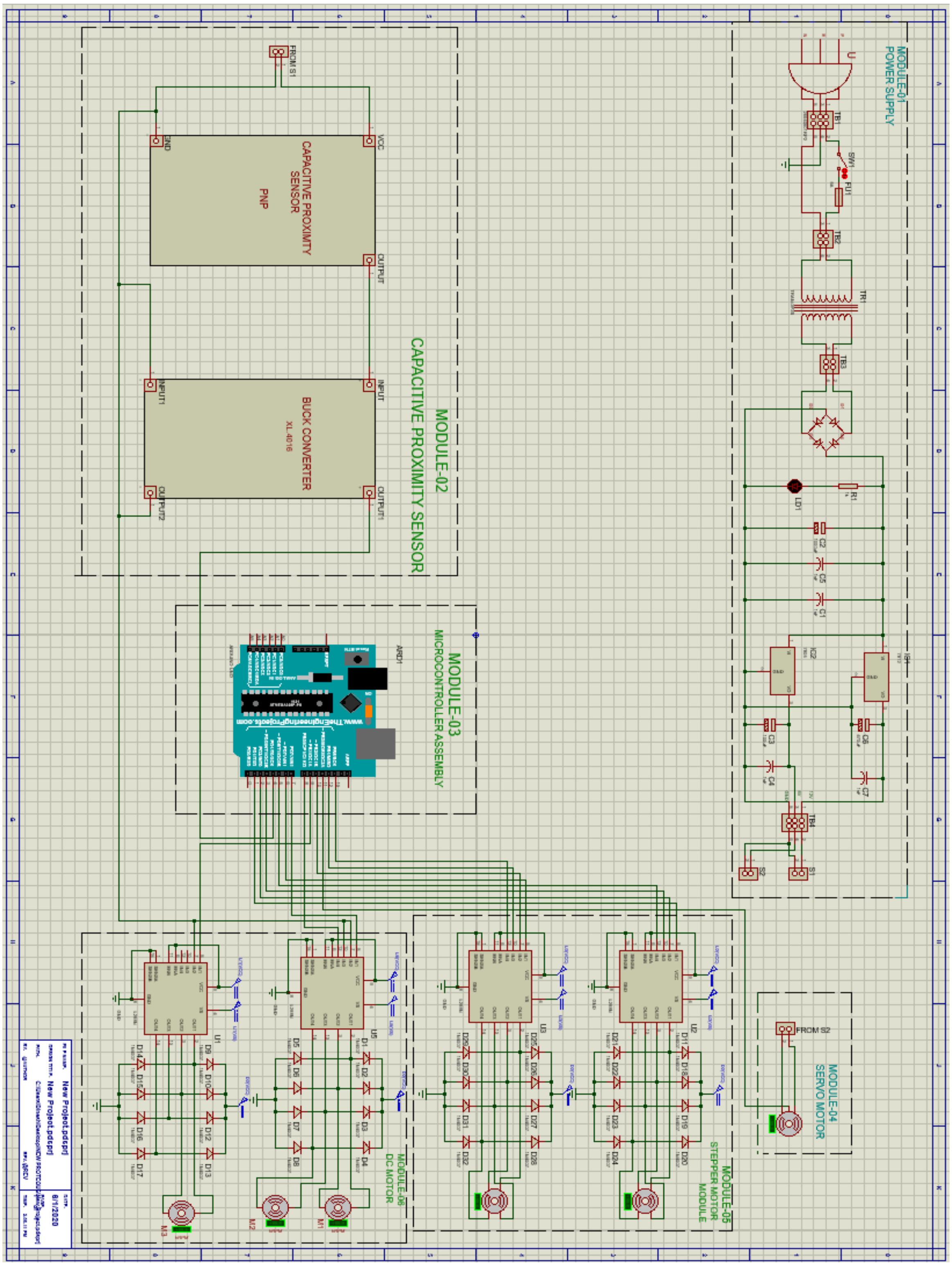



## 10.3 BILL OF MATERIAL

| SL.NO | ITEM DESCRIPTION | SYMBOL | QUANTNTY | PRICE (INR) |
|---|---|---|---|---|
| 1. | MOTOR DRIVER (L298N,12V,1A) | U1, U4 | 2 | 300 |
| 2. | DC MOTORS 30 RPM 12V/1A | M1, M2 | 2 | 250 |
| 3. | DC MOTOR IG32 800 RPM 12V/1A | M3 | 1 | 800 |
| 4. | Molded Plastic P-N Junction Diode; 1N4007,1000V/3A, Package: Bulk DO201AD | D1-D17 | 16 | 25 |
| | | | **TOTAL** | 1375 |

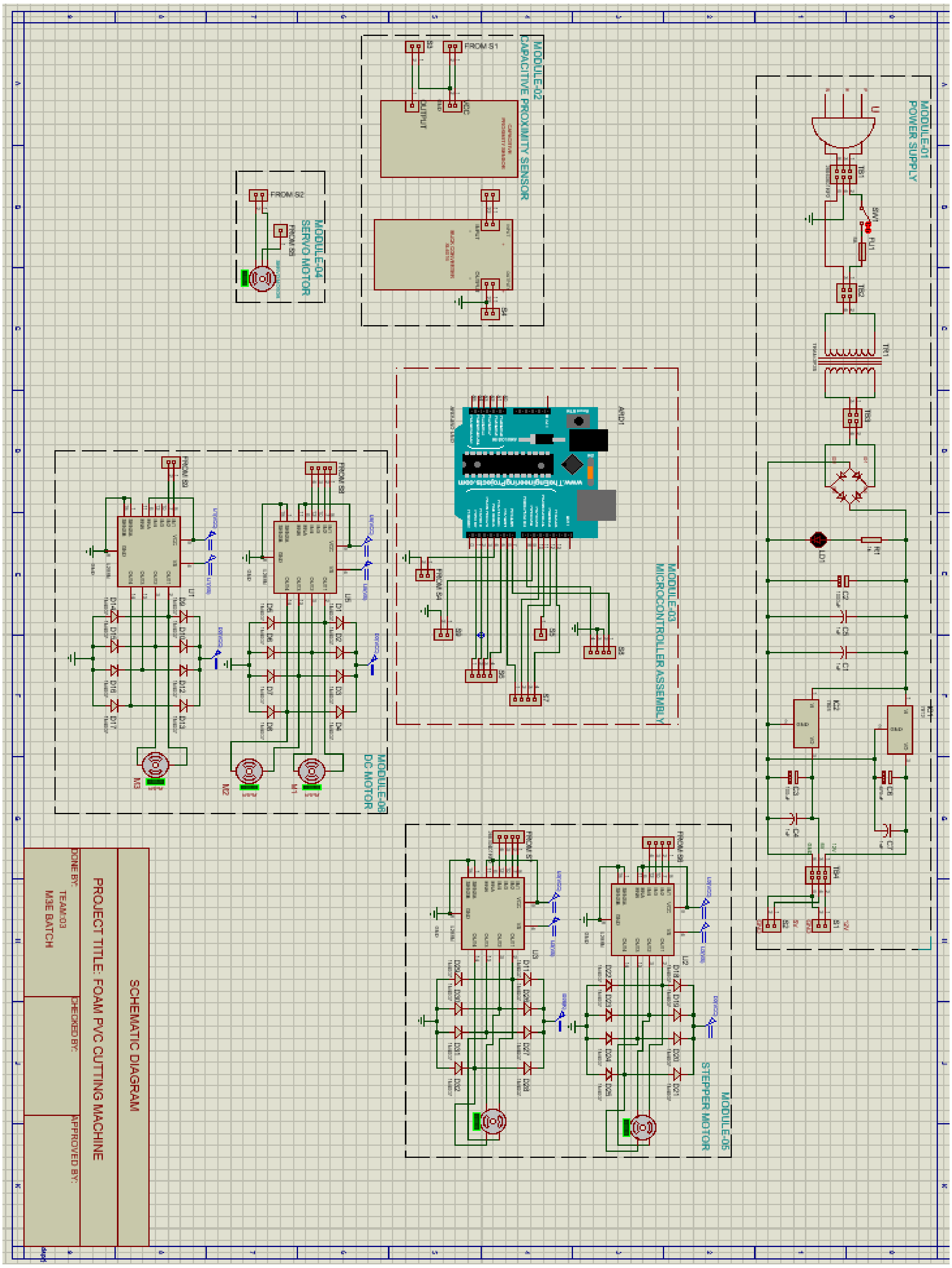
# CHAPTER-11

## CIRCUIT DIAGRAM WITH INTERCONNECTION



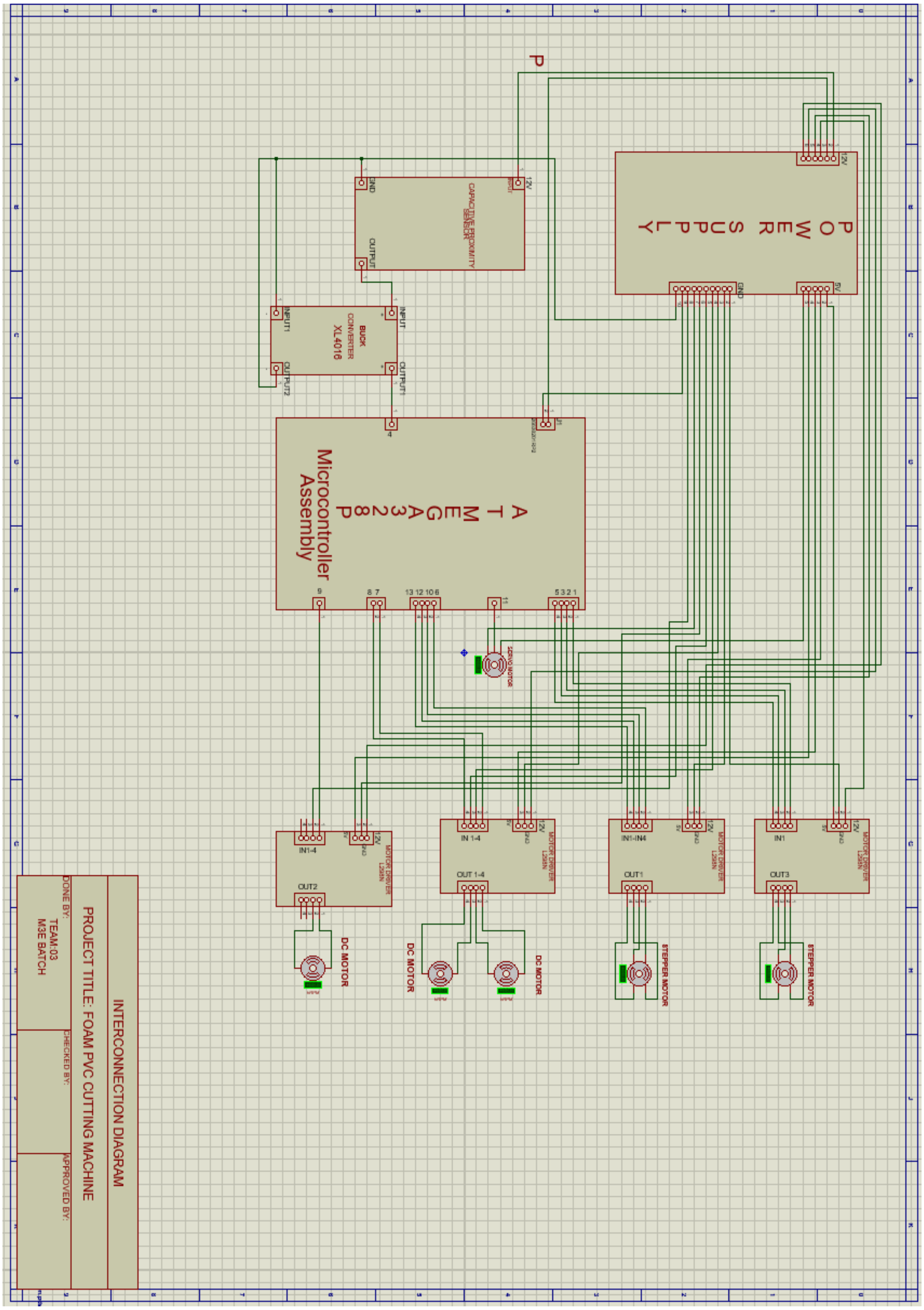
# CHAPTER-12

# SCHEMATIC DIAGRAM



# CHAPTER-13

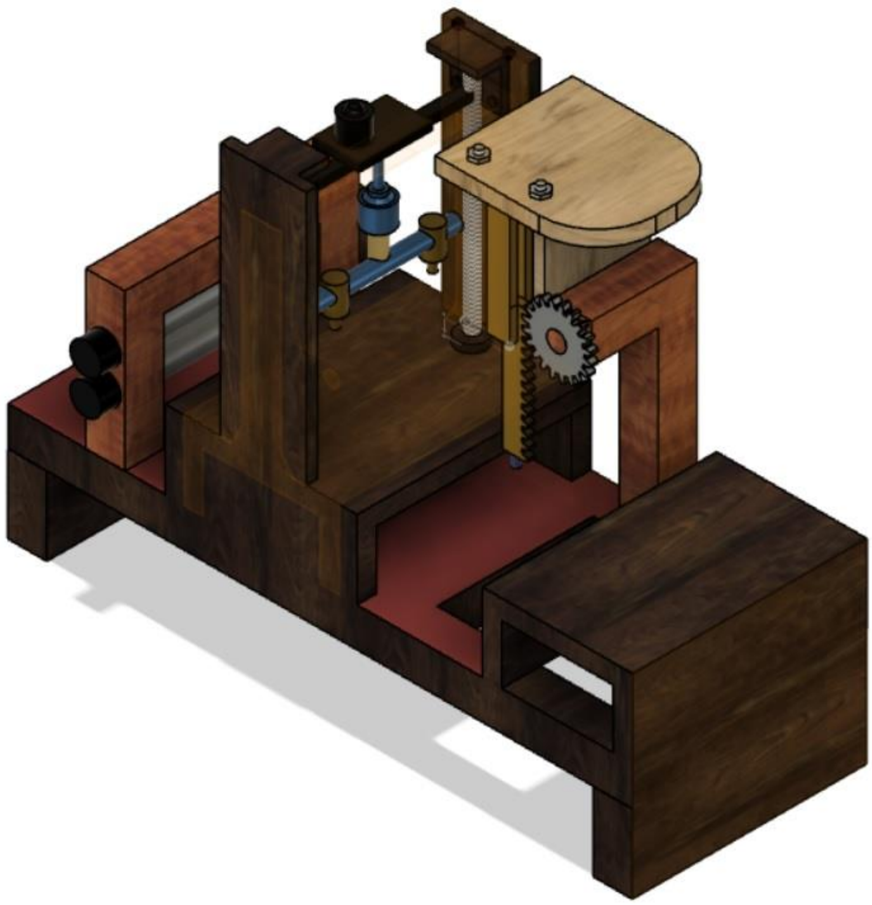
# INTERCONNECTION MODULEWISE



# CHAPTER-14

# MECHANICAL DIAGRAM

## ISOMETRIC VIEW



→ DC MOTOR

→ ROLLERS

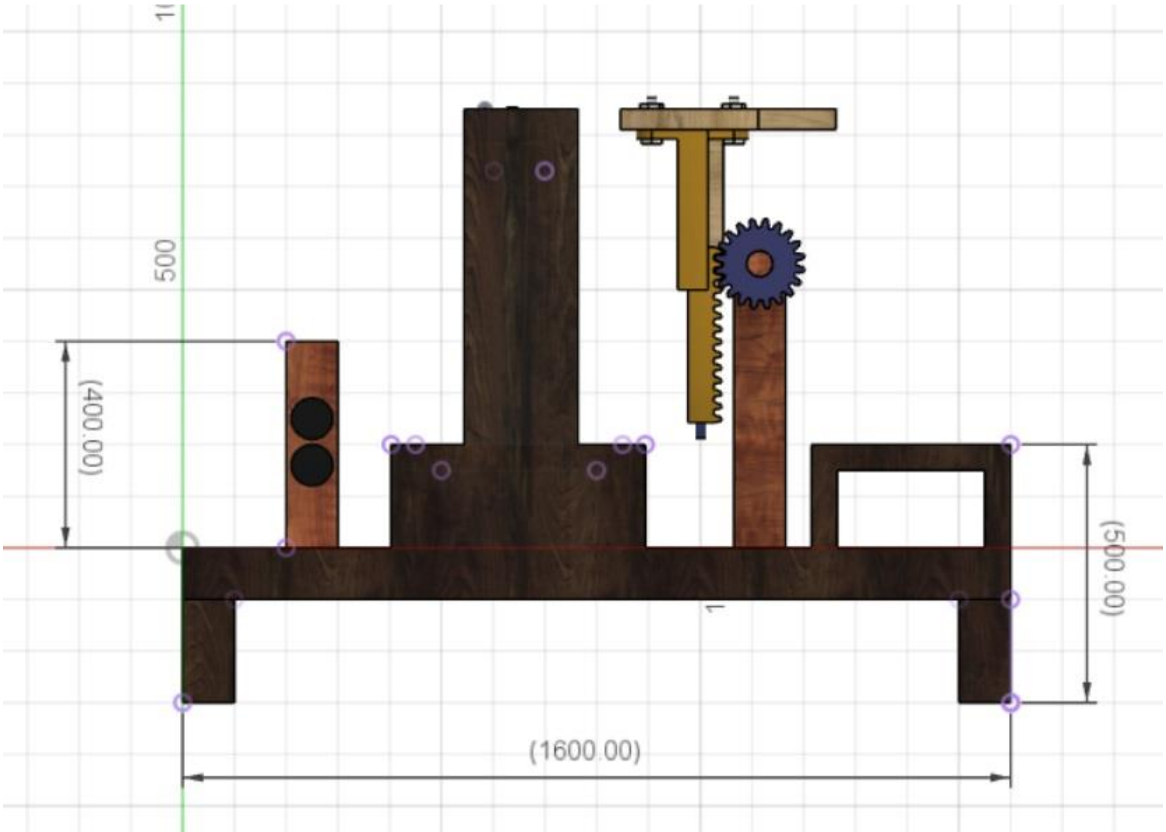
→ BENCH

→ RACK AND PINION

→ DC MOTOR CUTTER

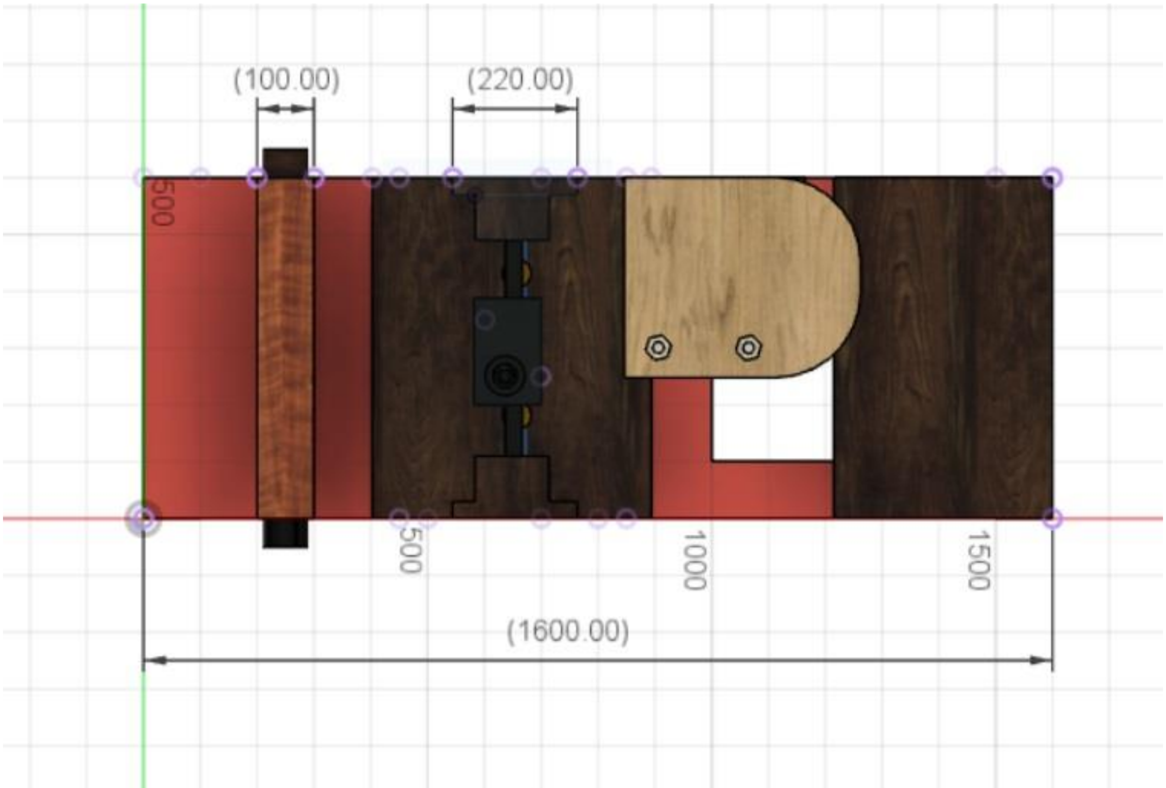
→ LEAD SCREW

## 14.0.FRONT VIEW



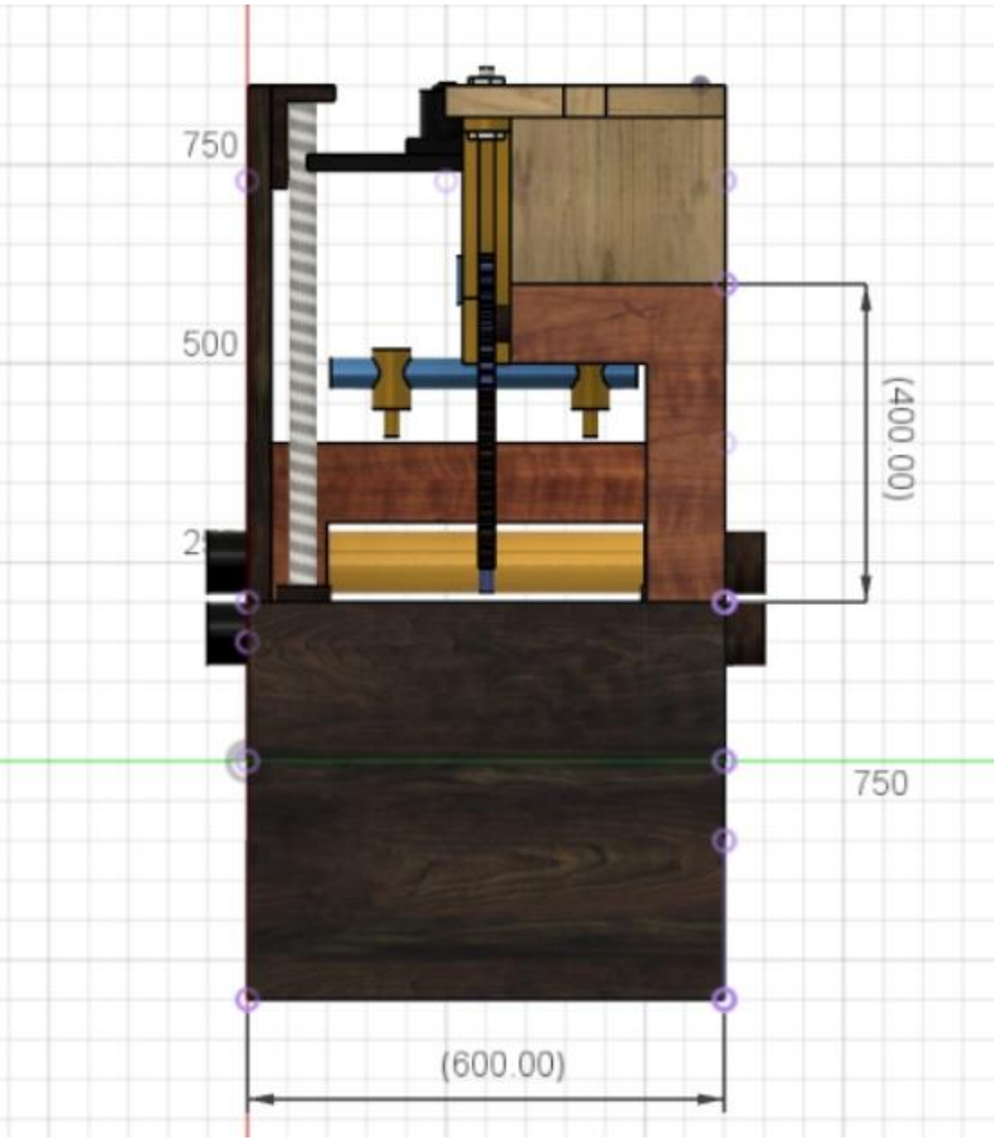

ALL DIMENSIONS ARE IN MM

## 14.2.TOP VIEW



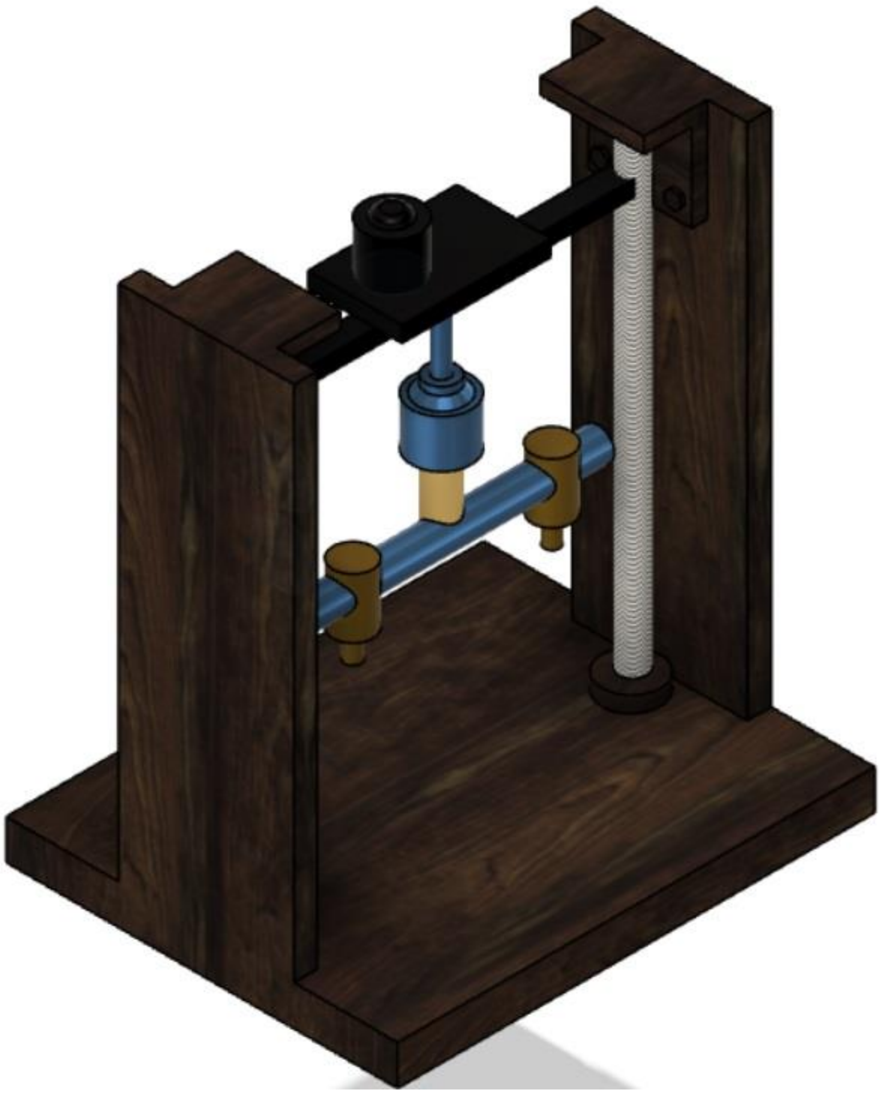

ALL DIMENSIONS ARE IN MM

## 14.3.SIDE VIEW




ALL DIMENSIONS ARE IN MM

## 14.4. MAIN BODY OF THE PROJECT



# CHAPTER-15

## OVERALL BILL OF MATERIALS

| SL.NO | MODULES | PRICE |
|---|---|---|
| 1. | POWER SUPPLY (12V DC/1A, 5V DC,1A) | 510 |
| 2. | CAPACITIVE PROXIMTY SENSOR(PNP,12V/1A) | 325 |
| 3. | MICROCONTROLLER ASSEMBLY (ATmega328P,12V DC/1A) | 275 |
| 4. | SERVO MOTOR (MG995,5V DC/1A) | 90 |
| 5. | STEPPER MOTOR (nema17,12V DC/1A) | 1330 |
| 6. | DC MOTORS (12V DC/1A) | 1375 |
| TOTAL | | 3905 |

## 15.1.MECHANICAL COMPONENTS

| SL.NO | ITEMS | SPECIFICATION | QUANTITY | PRICE |
|---|---|---|---|---|
| 1. | ROLLERS | 80mm DIA | 2 | 200 |
| 2. | NUTS | M3 | 10 | 30 |
| 3. | SCREWS | M3*15 | 10 | 30 |
| 4. | WASHERS | M3 | 10 | 30 |
| 5. | TUNGSTEN CARBIDE CUTTERS | 60mm DIA | 2 | 600 |
| 6 | FOAM PVC SHEET | 8*4 | 1 | 200 |
| 7 | RACK & PINION | - | 1 | 250 |
| | | | TOTAL | 1340 |

# CHAPTER -16
# SOFTWARES USED IN THE PROJECT DESIGN

## 16.1. FUSION 360

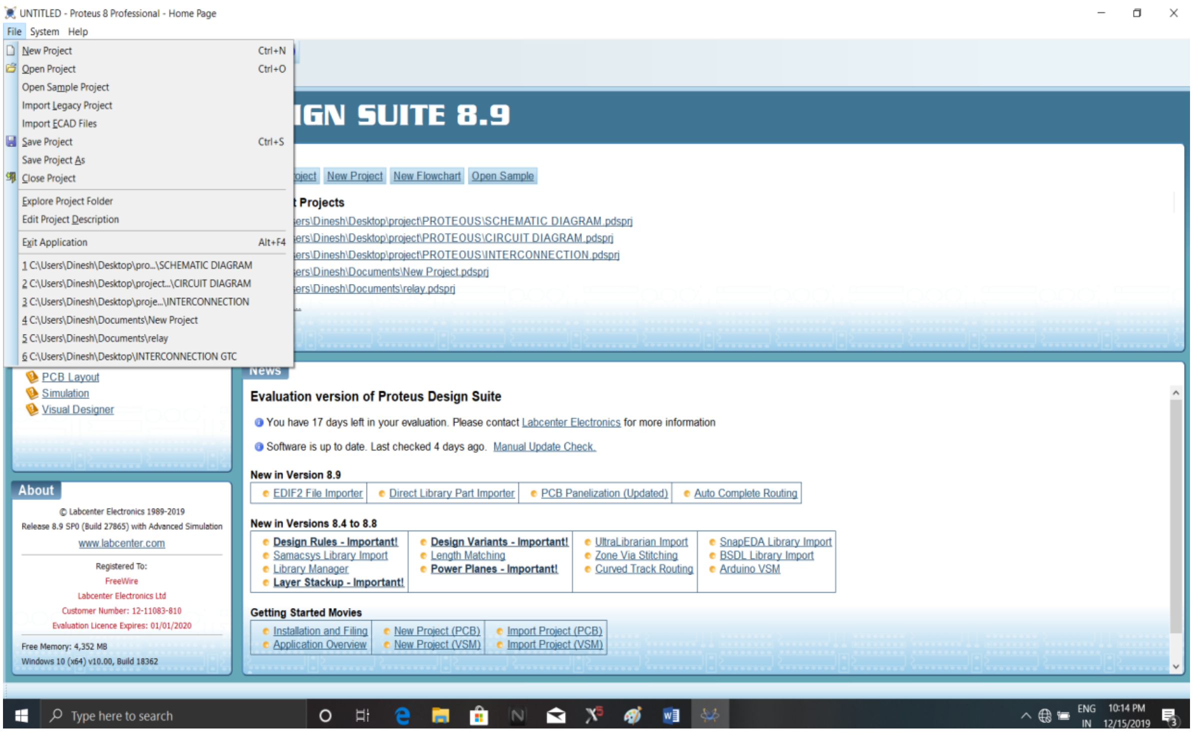
The mechanical design work was carried out using this software. The mechanical design could be drawn in 3 dimensions using this software.

## 14.1 PROTEUS 8 Professional

This software was used to draw the Schematic diagram, Circuit diagram and the interconnection diagram. It was also used to simulate and test certain programs.

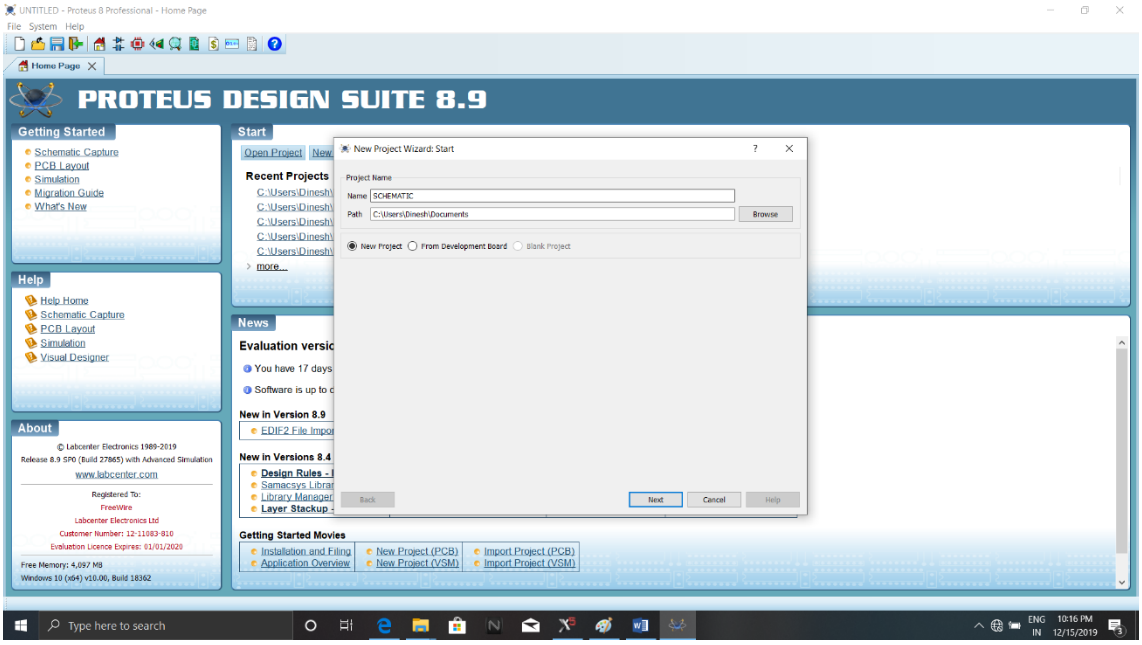
**STEP 1**: Creating new project

Click on new project in menu bar.



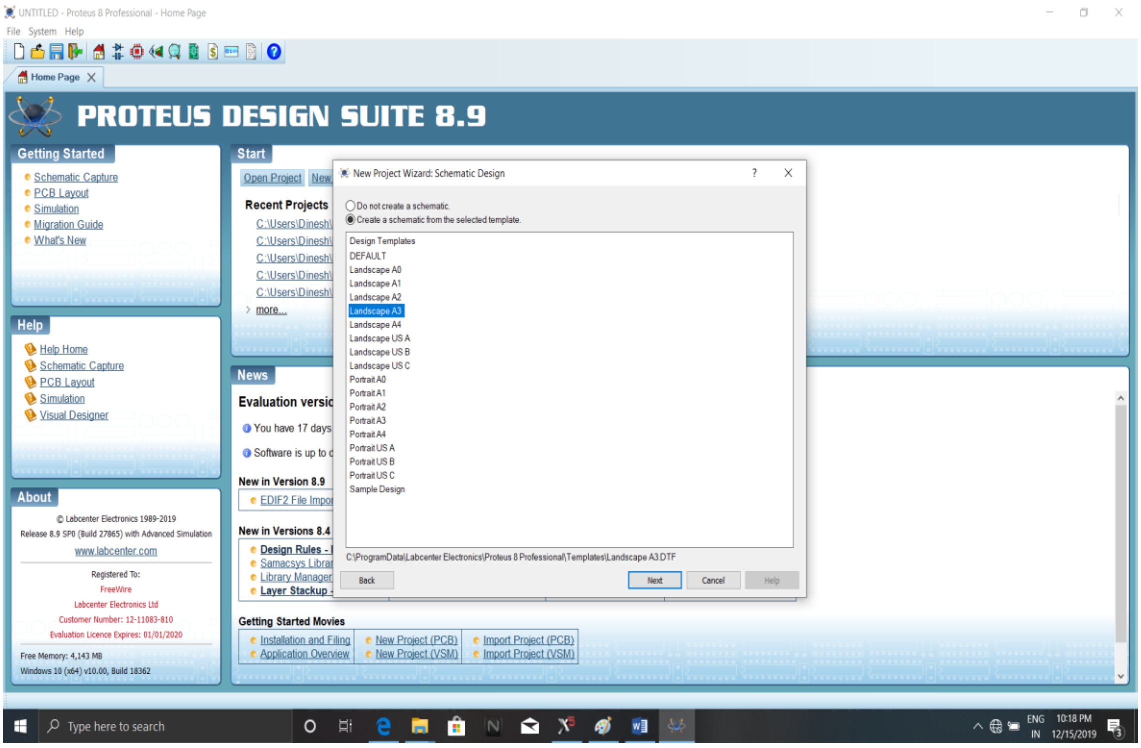

**STEP 2:**

On the next window type the project name and destination and click ok.



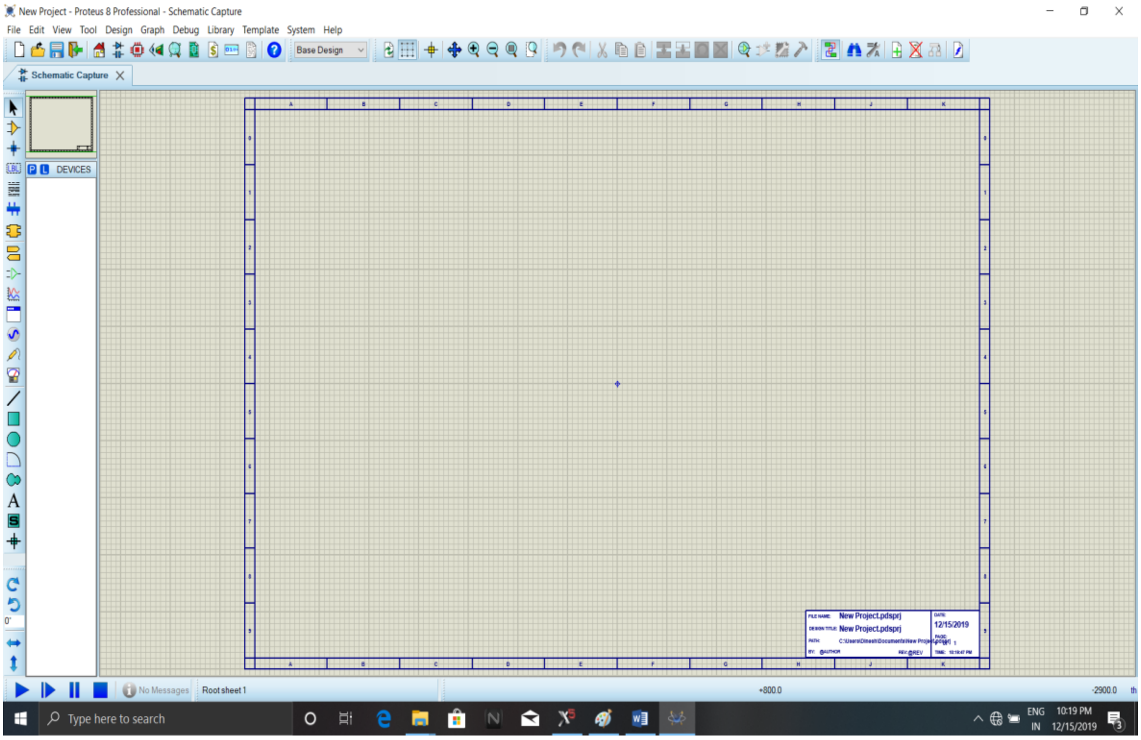

## STEP 3:

Select the required page format.



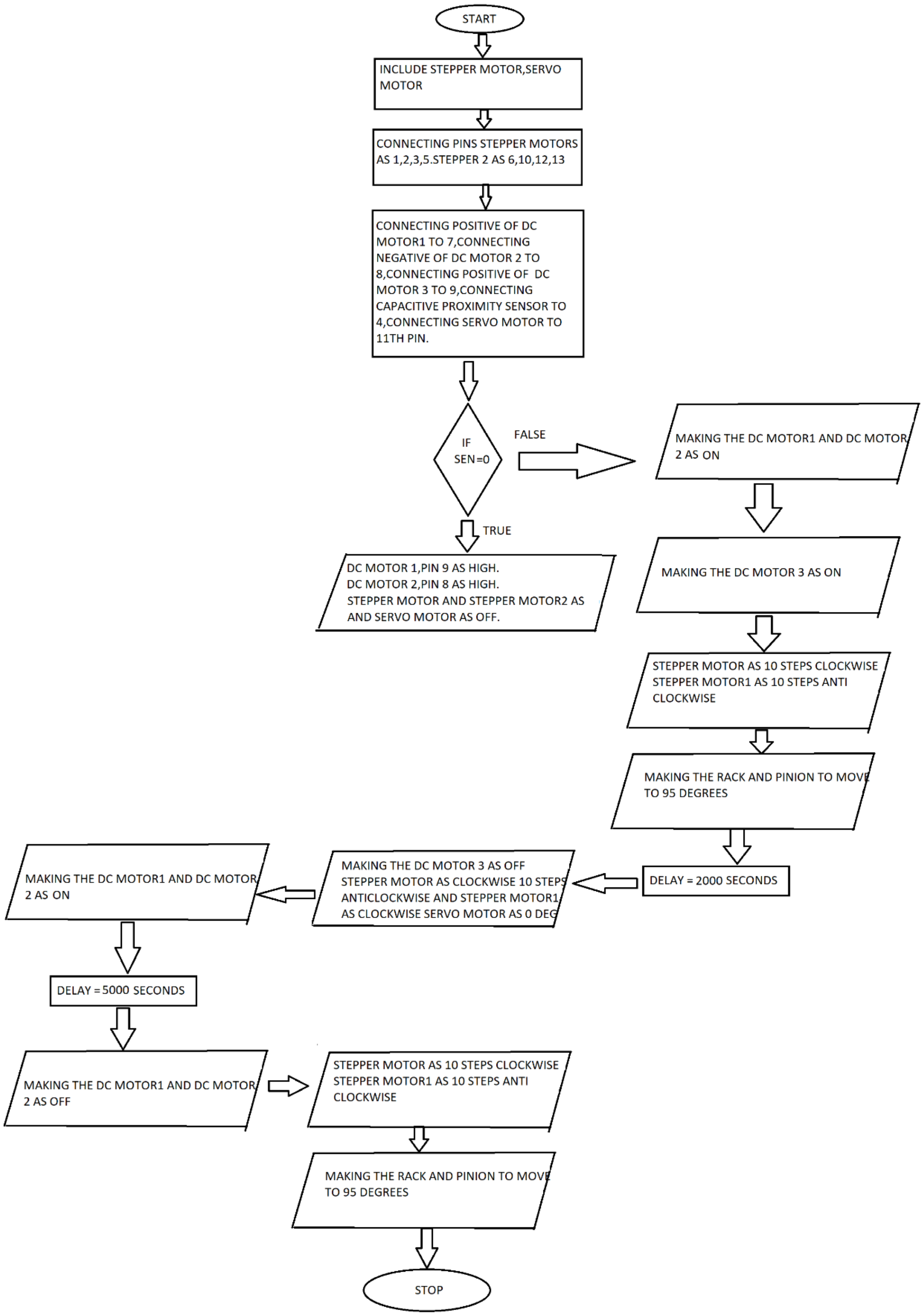
## STEP 4:

Draw the required diagram and save.



# CHAPTER-17

## 17.0 FLOW CHART



## 17.1 PROGRAM

```
#include <Stepper.h>//including the stepper motor librarary
#include<Servo.h>//including the servo motor library
Servo servo;//defining servo motor as servo
#define STEPS 200//nema17 having 1.8 degree of rotation so that for 360 degrees rotation it takes 200 steps
Stepper stepper(STEPS,1,2,3,5);//connecting the stepper motor for the shown pins
Stepper stepper1(STEPS,6,10,12,13);//connecting the stepper motor1 for the  shown pins
#define motorInterfaceType 1//while we are connnecting the stepper motor we have to use interface as type1
int i;//declaring i as integer for reading the sensor input
void setup()
{
  pinMode(7, OUTPUT); //positive of dc motor1
  pinMode(8, OUTPUT); //negative of dc motor2
  pinMode(9,OUTPUT),//positive of dc motor3 cutter motor
  pinMode(4, INPUT);//sensor input
  servo.attach(11);//connecting servo motor to 9th pin of arduino
   pinMode(1, OUTPUT); //setting stepper motor pin as output
   pinMode(2, OUTPUT); //setting stepper motor pin as output
   pinMode(3, OUTPUT); //setting stepper motor pin as output
   pinMode(5, OUTPUT); //setting stepper motor pin as output
   pinMode(6, OUTPUT); //setting stepper motor pin as output
   pinMode(10, OUTPUT);//setting stepper motor pin as output
   pinMode(12, OUTPUT);//setting stepper motor pin as output
   pinMode(13, OUTPUT);//setting stepper motor pin as output
}

void loop() {
  // put your main code here, to run repeatedly:
```

```
  i = digitalRead(4); //reading taking the value of the sensor



  if (i = 0)
  {
    digitalWrite(7, HIGH); //making the dc motor1 to run as clockwise
direction
    digitalWrite(8, HIGH); //making the dc motor2 to run as
anticlockwise direction
    stepper.step(0);//making the stepper motor1 off
    stepper1.step(0);//making the stepper motor2 off
    servo.write(0);//making the servo motor to move to 0 degrees
  }
  if (i = 1)
  {
    digitalWrite(7, LOW); //making the dc motor1 to stop
    digitalWrite(8, LOW); //making the dc motor2 to stop
    digitalWrite(9,HIGH);//making the dc motor 3 to run for cutting
    stepper.step(10),//rotating stepper motor to 10 steps clockwoise
    stepper1.step(-10);//rotating the stepper motor to 10 steps into
anticlockwise
    servo.write(95);//making the rack and pinion to move to 95 degrees
    delay(2000);
    digitalWrite(9,LOW);//making the dc motor to off
    stepper.step(-10);//taking stepper motor to 10 steps anti clockwise
    stepper1.step(10);//taking stepper motor1 to 10 steps clockwise
    digitalWrite(7,HIGH);//make dc motor1 to run in clockwise
    digitalWrite(8,HIGH);//make dc motor2 to run in anticlockwise
    delay(5000);
    digitalWrite(7,LOW);//make dc motor1 to OFF
    digitalWrite(8,LOW);//make dc motor2 to OFF
    stepper.step(12);//taking stepper motor to 12 steps to clockwise
```

```
    stepper1.step(-12);//taking stepper motor to 12 steps clockwise
    servo.write(95);//making the servo motor to run to 95 degrees

  }
}
```

# CHAPTER-18

## ADVANTAGES

- Easy to operate.
- Good finishing.
- Higher accuracy.

## LIMITATIONS

- Same thickness will cut.

## APPLICATIONS

- Foam PVC disc cutting machine is a machine that support the cutting process.
- Its used in different place like:
    - Manufacturing industries.
    - Carpenters etc.,

# CHAPTER-19

## CONCLUSION

By our project we made the circular shaped material by cutting the foam PVC sheet using foam PVC sheet cutting machine. By this project we did the interfacing of ATmega microcontroller.

# DATASHEETS