LINE FOLLOWER

Group Members:

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BE MECHATRONICS (Session F-21)

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FACULTY OF ENGINEERING

AIR UNIVERSITY, ISLAMABAD

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7.1 Everyone must write one page about how he executed his role in project

7.2 Comment individually about success /failure of your project

7.3 Give a word count how many words each member write in final report in their allocated color as assigned

7.4 Risk management that you learned

8 **Feedback for project and course**

9 **Detailed YouTube video explaining our work of each member**

Appendix-

References-

Chapter 1:Preliminaries

Proposal:

This project's primary goal was to design a line follower in accordance with the guidelines. A line follower robot essentially follows a given line as long as it is present. The line is usually drawn on the ground. Either black or white can be used. The line may either be an electric field, magnetic field, or typical visible color. The robot uses infrared (IR) sensors to follow the line. In our project, we are using three infrared sensors, but we could use as many as five. These sensors take a reading from the line, transmit it to Arduino, which uses it to regulate the robot's motion..

Initial feasibility:

The first stage was split into two sections;

The turtle robot simulation has to be understood and programmed first. Secondly, to design a simple line follower using an LCD, two motors, three infrared sensors, and an L3298 motor driver. The goal of this stimulation was to comprehend the fundamental mechanisms of the line follower .Everything said above outlines the fundamental direction in which the robot should go.

Specifications of deliverables :

1. For this project, you have to create your own bespoke ATMEL controller-based board.
2. Proteus is the best tool for simulation, and any software can be used to build a PCB.
3. Dual channel H bridges can be created and designed, or they can be utilized as modules.
4. It should run on a battery for at least 20 minutes (you can power the bot with your own power sources or, ideally, Li-Po/Li-Ion batteries with a capacity of at least 2000mAh).
5. The data for logging needs to be stored on a Micro SD card module.
6. Red-colored obstacles can be identified using IR, ultrasonic, and color sensors.
7. We need to employ I/O, ADC, Timers, Interrupts, and PWM on the embedded side.
8. Robot ought to transmit data

Team Roles & Details:

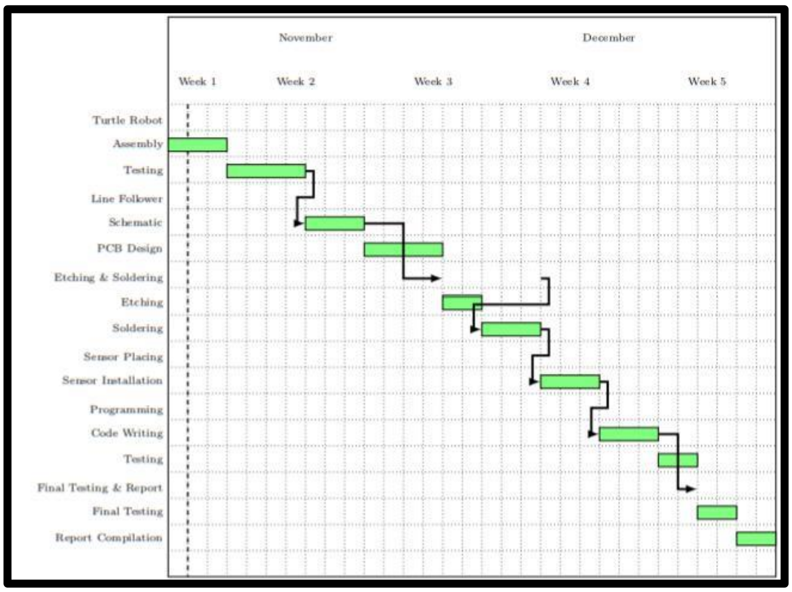
Team Member Name	Role	Word count that each has written in assigned color code in report	Signature
Azhar Ali	**Design Technical work**		**A**
Samiullah	**Design**		**S**
Rafay Ali	**Technical and Report**		**R**
Taha Khalid	**Code**		**T**

Work Break down structure

Members of the team have backgrounds in robotics, electronics, and programming. Individual strengths were taken into consideration while assigning roles, which promoted teamwork and effective project growth. Taha was tasked with programming and coding the entire robot. Rafay was given the responsibility of purchasing parts, producing reports, and etching. Sami was tasked with creating the PCB layout and schematic, and Azhar was tasked with etching and attaching the components. Then, with assistance from other members, He Soldered it, and collectively we were able to get it operating.

Gantt Chart

The project timeline was plotted on a Gantt chart, complete with checkpoints at each stage. This guarantees the project's timely completion and aids in visualizing its development. In essence, it was a schedule.



Estimated budget

A budget estimate was created, taking into account the price of parts, supplies, and any necessary equipment. This offers a financial planning guideline.

Components	Quantity	Cost/Item	Total
Battery	1	2700	2700
Arduino uno	1	2100	2100
PCB Board	4	450	1800
L2988	1	500	500
IR Sensor	2	120	240
Ultrasonic Sensor	1	120	120
Voltage Sensor	1	320	320
Current Sensor	1	320	320
SD-card Module	1	250	250
OLED display	1	500	500
Button	1	20	20
Color sensor	1	1250	1250
Print	13	70	910
HCL/H2SO4	1	400	400
Caster Wheel	1	100	100
Jumper Wires	3	140	420
Total	34	11950	11950

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Chapter 2 Project Conception:

Objective:

To create a basic, fully automatic line-following and obstacle-avoiding robot with a number of features. The main goal of this project is to create a simple line follower robot with comprehension that can serve as the foundation for any mobility vehicle created in the future for automated uses.

Abstract:

Our project, the Line Follower Robot, is the foundational design for all future mobility vehicles. It has the ability to recognize lines, follow them, and adjust its design when a turn presents itself. It continuously records and displays all of the data from the many sensors so that the user can understand how it behaves and modify the features as necessary. To enable the robot to travel in a certain direction, we employed infrared sensors, which recognize a line in front of them and transmit signals to the motors. We employed the voltage sensor and the current sensor (ACS-712) to track the robot's consumption in relation to the various behaviors brought on by the sensor inputs. We employ a color sensor, which is essentially a light.

Introduction:

A machine that can follow a path is called a line follower. It is possible to see the path as a black line on a white background. A straightforward but efficient system is formed by the robot sensing a line, moving to stay on course, and continuously correcting incorrect movements using the sensor's feedback. It can be applied to industrial automation, automotive automation, guiding, etc .An autonomous line-following robot is one that automatically moves along a predetermined path. It usually tracks a white line on a black background or a black line on a white surface. The following describes some of a line follower's fundamental functions: The robot's front-down side is equipped with an IR sensor array, which reads the pre-defined line and transmits

List of features and operational specification of our project:

Features:

The Proteus simulation was used to design the project, which includes the following elements.

• Using two infrared sensors, the project can precisely recognize white lines. • Using an ultrasonic sensor, it can also avoid obstructions.

• Two motors were installed on two wheels; • An SD card and two Arduino Uno were used to establish a data log; • A motor driver is used to measure the speed of motors.

Lastly, the LCD panel aids in showing the output voltage in addition to the input voltage and current.

Operation:

The following are the line follower's fundamental functions:

• Use optical sensors fixed to the robot's front end to record line position. An optical sensor—a hybrid of an IR-LED and a photodiode—has been employed for this purpose.

• As a result, the sensing method has excellent robustness and resolution.

• A steering mechanism is needed for the steer robot to track. To do this, two wheel motion-governing motors are employed.

• The LCD display screen on this system indicates the distance it covers.

• When a robot detects no black surface, it moves in a circle until it finds a line.

Components:

2x Arduino uno
- Color sensor
- 16x2 LCD Module
- 1x SD Card Module
- 2x IR Sensors
- 1x Ultrasonic Sensor
- 1x Voltage Sensor
- 1x Current Sensor
- 1x Robot Chassis
- 2x Motors 3V to 6V
- Jumper Wires
- Header Pins
- Resistors, Capacitors
- On/Off Button
- Screws and Nuts
- 1x Motor Driver LM298
- 3x Rechargeable Battery 3.7V Connecting We Made A 12V Battery

Project Development Process:

After a thorough examination of the information contained in books, periodicals, journals, magazines, and websites. The project's concept is well-defined.

The robot derives its reasoning for intelligence. It is burned to the Arduino and programmed using the Arduino software.

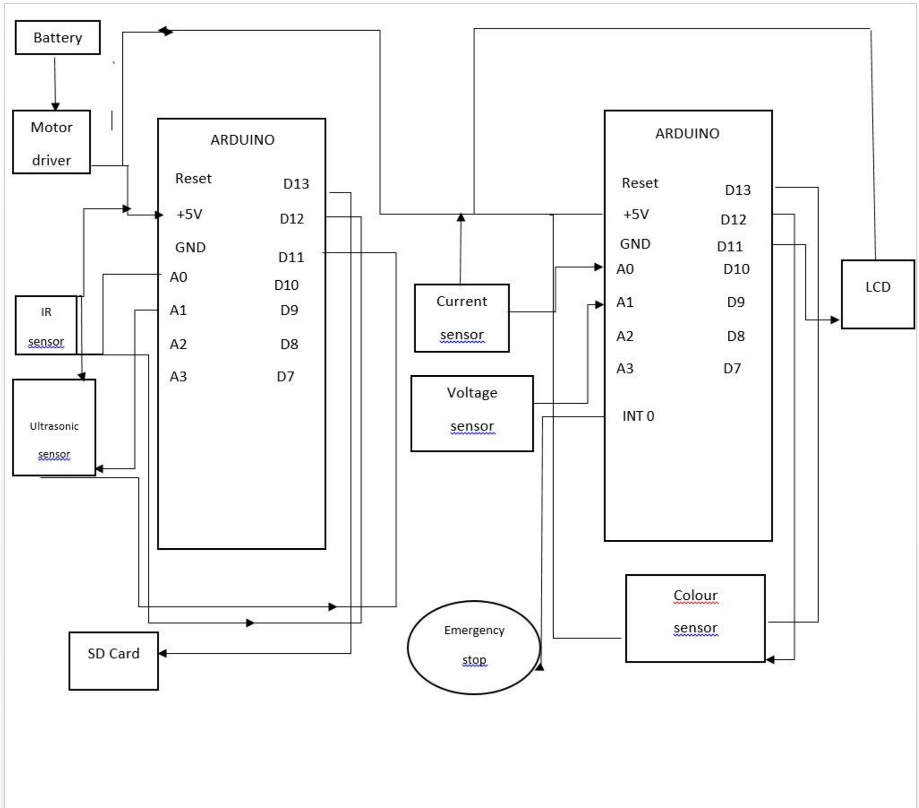
• The accuracy of the software and the viability of the electronic components are evaluated using the simulation tool Proteus.

• The hardware puts the simulation into practice after it is successful.

• We designed our PCB board with the hardware in mind, maintaining a more polished and realistic-looking robot. Following programming completion, electrical and electronic systems must be dependable and stable.

Basic block diagrams of whole system and subcomponents:

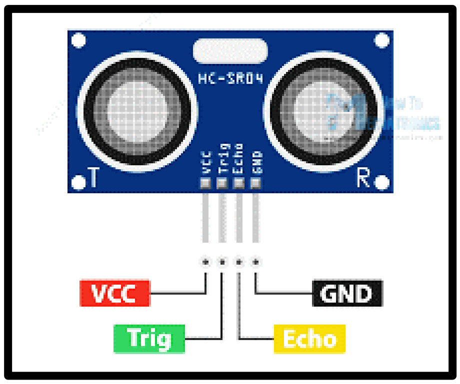
Here is a basic block diagram that illustrates the circuit design's key components and provides an overview of the project's planning and design process.



Literature Review:

Ultrasonic sensor:

Devices that produce or detect ultrasound radiation are known as ultrasonic transducers and ultrasonic sensors. A continuous sequence of high and low pulses, or signals, is sent by an ultrasonic sensor. These signals bounce back off of obstacles and are picked up by ultrasonic sensors. The distance between the obstruction and the sensor is determined by measuring how long it takes for the signals to return. These signals return more quickly the closer the obstruction is to the sensor.

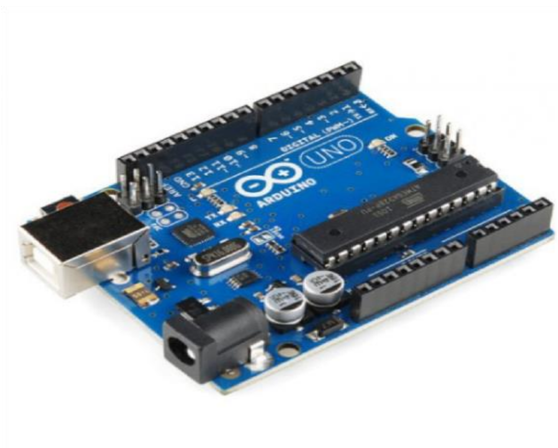


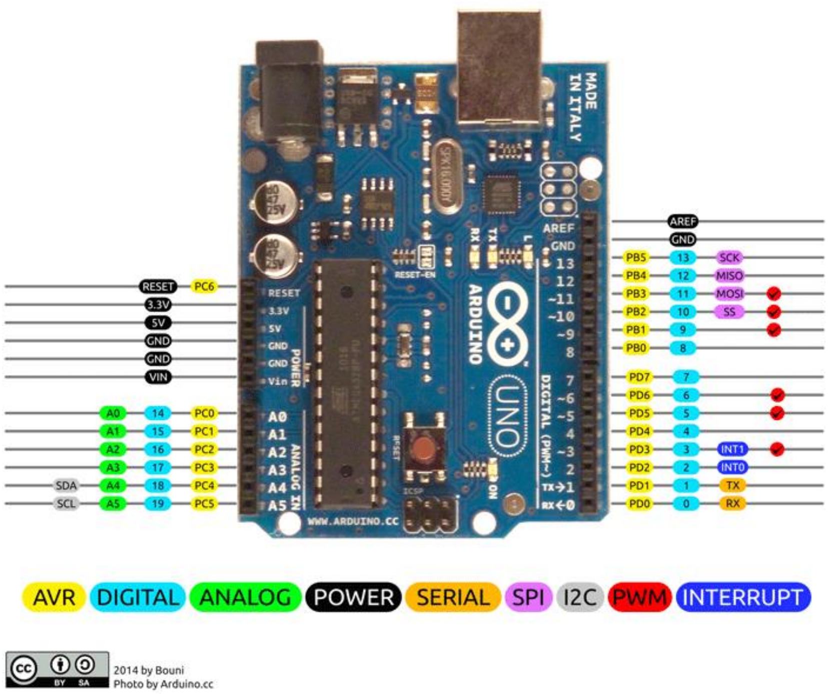
Pin Configuration:

Pin Number	Pin Name	Description
1	Vcc	The Vcc pin powers the sensor, typically with +5V
2	Trigger	Trigger pin is an Input pin. This pin has to be kept high for 10us to initialize measurement by sending US wave.
3	Echo	Echo pin is an Output pin. This pin goes high for a period of time which will be equal to the time taken for the US wave to return back to the sensor.
4	Ground	This pin is connected to the Ground of the system.

Arduino UNO:

The smallest-sized Arduino board, the UNO, is the company's traditional breadboard-friendly design. The Arduino Nano has a USB-B connector and pin headers that make it simple to attach it to a breadboard. The eldest board in the Arduino family is the traditional Uno





Robotic Chassis (2 Wheel with DC Motor):

This robotic chassis kit contains of an acrylic base with two gear motors, two compatible wheels, a ball caster, and other accessories.

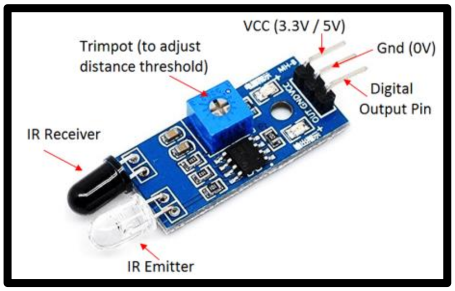
Package Contains:

1. 1 x Rubber wires
2. 1 x Deceleration motors
3. 1 x Aluminum fasteners
4. 1 x Nylon all-direction wheel
5. 1 x Chassis
6. 1 x Battery box (4 x AA batteries, not included)
7. 1 x Screwdriver.

IR sensor:

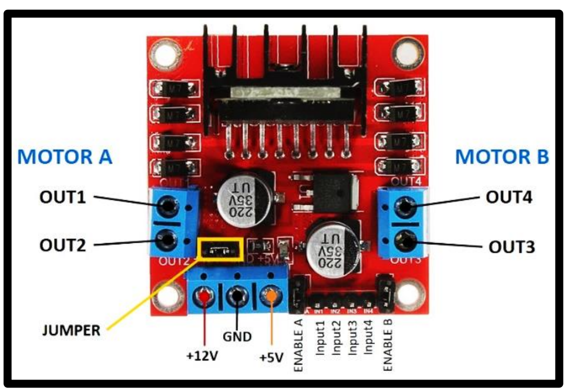
An infrared signal is normally transmitted by an IR transmitter or IR LED at a frequency that is compatible with an IR receiver found inside an IR sensor module. Infrared sensors are frequently used for obstacle detection and distance measurement.

The emitter is an infrared light emitting diode (LED), and the detector is an infrared photodiode that has the same wavelength as the IR LED. The resistances and these output voltages change in response to the photodiode's exposure to infrared light.



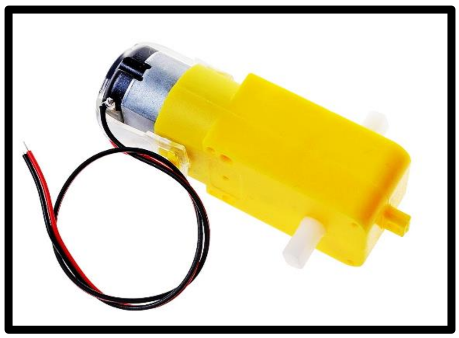
L298N Motor Driver

DC and stepper motors can be driven by this high power motor driver module, the L298N. An L298 motor driver integrated circuit and a 78M05 5V regulator make up this module. Up to four DC motors or two DC motors with directional and speed control can be operated by the L298N Module.



TT Gear Motor:

This DC motor is essentially controlled by the controller, or L298N. The l298N regulates both its direction and speed. DC motors are designed to run in a steady condition within a speed range that is rather near to their no-load speed. In order to lower its speed, we combine the DC motor with gearbox because, in general, this speed is too high for applications like the robot we are building. A current-carrying conductor receives mechanical force whenever it is placed in a magnetic field. This is the fundamental principle underlying the operation of a DC motor. Although the idea is still the same, combining them both into one part is quite useful for carrying out a number of tasks.

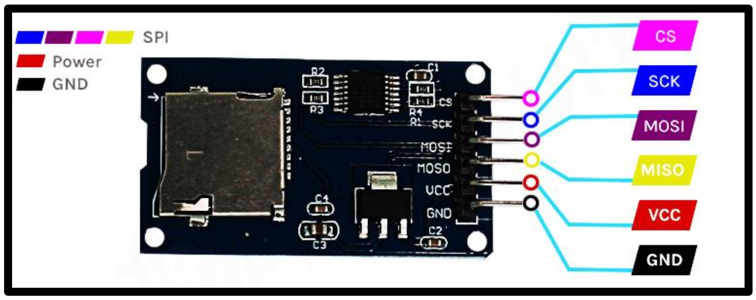


Color sensor:

A color sensor is a particular kind of "photoelectric sensor" that uses a receiver to detect light reflected back from a detecting object after light is emitted from a transmitter.

SD Card Module

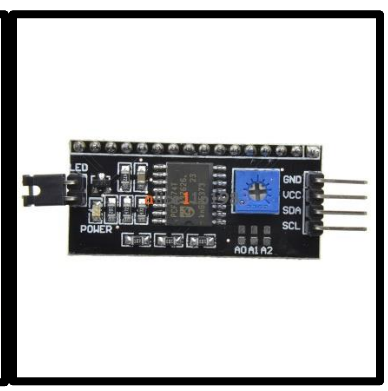
Micro SD cards and SD cards are widely utilized in many different applications, including data visualization and logging. We can access these SD cards more easily with the help of Micro SD Card Adapter modules. The Micro SD Card Adapter module is a user-friendly module that features an SPI interface and an integrated 3.3V voltage regulator to ensure that the SD card is properly supplied with power.



16 x 2 LCD Display with I2C module

A dot-matrix liquid crystal display module, the 16X4 CHARACTER LCD 1604 GREEN LCD DISPLAY is intended specifically for the display of characters, numbers, symbols, and other information. separated into data transmission techniques of 4 and 8 bits. Rich command settings are available on the 1604 Green Character LCD, including clear display, cursor return to origin, show on/off, display character ashes, move the cursor, display shift, and more. Any embedded system, industrial device, security system, medical device, or handheld gadget can use it.

Controlling an LCD display could be laborious because microcontrollers and microprocessors have limited pin resources. With just two pins, serial to parallel adapters like the I2C serial interface adapter module with PCF8574 chip simplify tasks. A 16x2 LCD can be linked to the serial interface adaptor, which also offers two signal outputs.

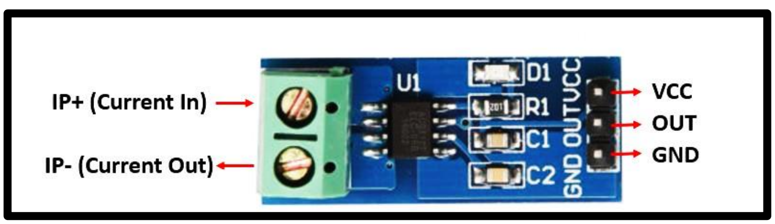


LCD Pin Configuration:

Pin No.	Symbol	Description
1	V_{SS}	Ground
2	V_{DD}	Power supply for logic
3	V_O	Contrast Adjustment
4	RS	Data/ Instruction select signal
5	R/W	Read/Write select signal
6	E	Enable signal
7~14	DB0~DB7	Data bus line
15	A	Power supply for B/L +
16	K	Power supply for B/L -

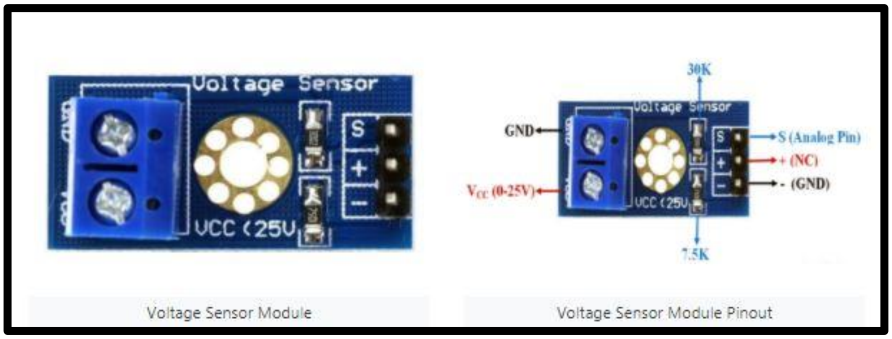
ACS712 Current Sensor

The ACS712 Module measures current utilizing the Hall Effect concept and the well-known ACS712 IC. The IC (ACS712) that the module uses gives the module its name; hence, for your final products, utilize the IC directly rather than the module.



VOLTAGE SENSOR

A precise, reasonably priced voltage sensor is the voltage sensor. Its foundation is the resistive voltage divider design concept. It can reduce the input voltage of the red terminal connector by five times.



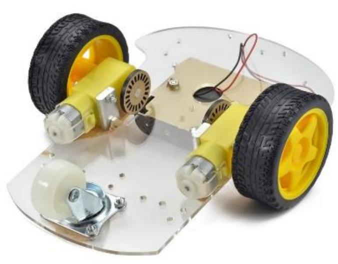
CHAPTER 3 MECHANICAL DESIGN

A crucial component of every engineering project is mechanical design. One engineering project that may be impacted by a subpar or flawed mechanical design model is our line-following robot. We can state that the robot's longevity, weight lifting, and sustainability are all due to its mechanical design. Therefore, the robot should be designed with as little external or internal constraints as possible on the material and design employed.

Mechanism selection and Platform Design

The robot chassis is straightforward and quick to assemble, allowing us to quickly build a mobile robotics platform. When you don't have the time or tools to fabricate your own robotic chassis, they are the ideal answer. Robot chassis typically feature numerous pre-drilled holes and slots for fast attachment of additional components, such as sensors.

Therefore, we utilized the robot chassis as our platform and mounted a PCB with all of our circuitry on it.



Actuators with speciation and datasheet

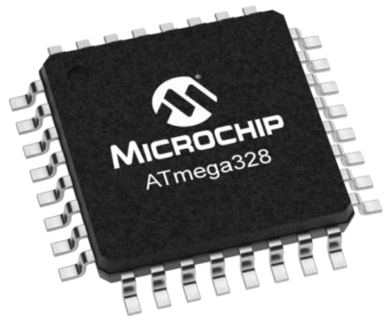
We employed gear motors with the following specifications as actuators

Size	21 x 14.7 cm approx
Voltage	3-6 V
Gear Motor Reduction Radio	148
Wheel Size	6.6 x 2.6 cm approx.
Tire Center Hole	5.3mm Long, 3.5mm wide
No Load Speed (6V)	200RPM +-10%
No Load Current (6V)	Less Than 200mA
No Load Speed (3V)	90RPM +-10%
No Load Current (3V)	Less Than 150mA

Chapter 4 Software Design:

Controller Selections with features

An ATmega328P-based microcontroller board is the Arduino UNO. It features a 16 MHz ceramic resonator, 6 analog inputs, 14 digital input/output pins (six of which can be used as PWM outputs), a USB port, a power jack, an ICSP header, and a reset button. It comes with everything needed to support the microcontroller; all you need to do is power it with a battery or an AC-to-DC adapter or connect it to a computer via a USB cable to get going. You can experiment with your UNO without too much fear of making a mistake; in the worst case, you can replace the chip and restart for a few bucks.



Parametrics:

Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328P) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 MHz
Length	68.6 mm
Width	53.4 mm
Weight	25 g

Technical specs of Arduino Uno Specifications Microcontroller ATmega328P

Advantages:

- Processors are easier to use since 8- and 16-bit versions are used instead of the more complicated 32- and 64-bit versions.
- With 23 programmable I/O lines and 32k bytes of onboard self-programmable flash program memory, it is easily used without the need for external computing components.
- The arithmetic logic unit (ALU) is directly coupled to all 31 registers, resulting in code efficiency and speed that is ten times faster than traditional CISC microcontrollers.
- AVR improved RISC instruction set optimized

Disadvantages:

Performs poorly in comparison to microcontrollers with more bits.

Software Design details & user Requirements

Components

Components that we used it the software design

- Ultrasonic sensor
- SD card module
- IR sensors
- L298 motor driver
- Color sensor
- 16x2 LCD display
- Motors
- Current sensor.
- Voltage sensor

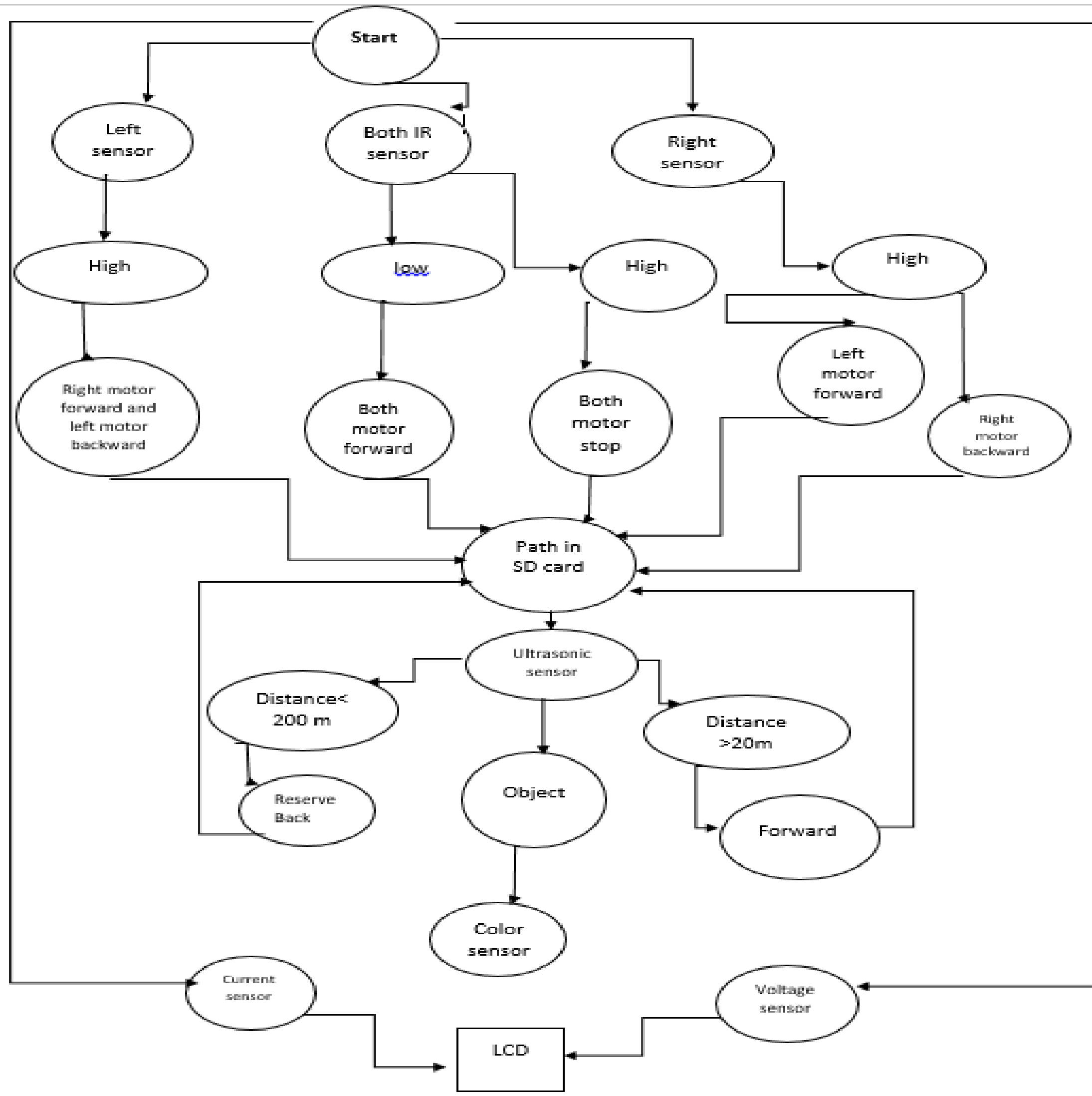
Inputs

- Left Sensor (LS)
- Right Sensor (RS)
- Right Centre Sensor (RC)
- Left Centre Sensor (LS)
- Centre Sensor (CS)
- Ultrasonic Sensor
- Voltage sensor
- Current sensor
- Color sensor

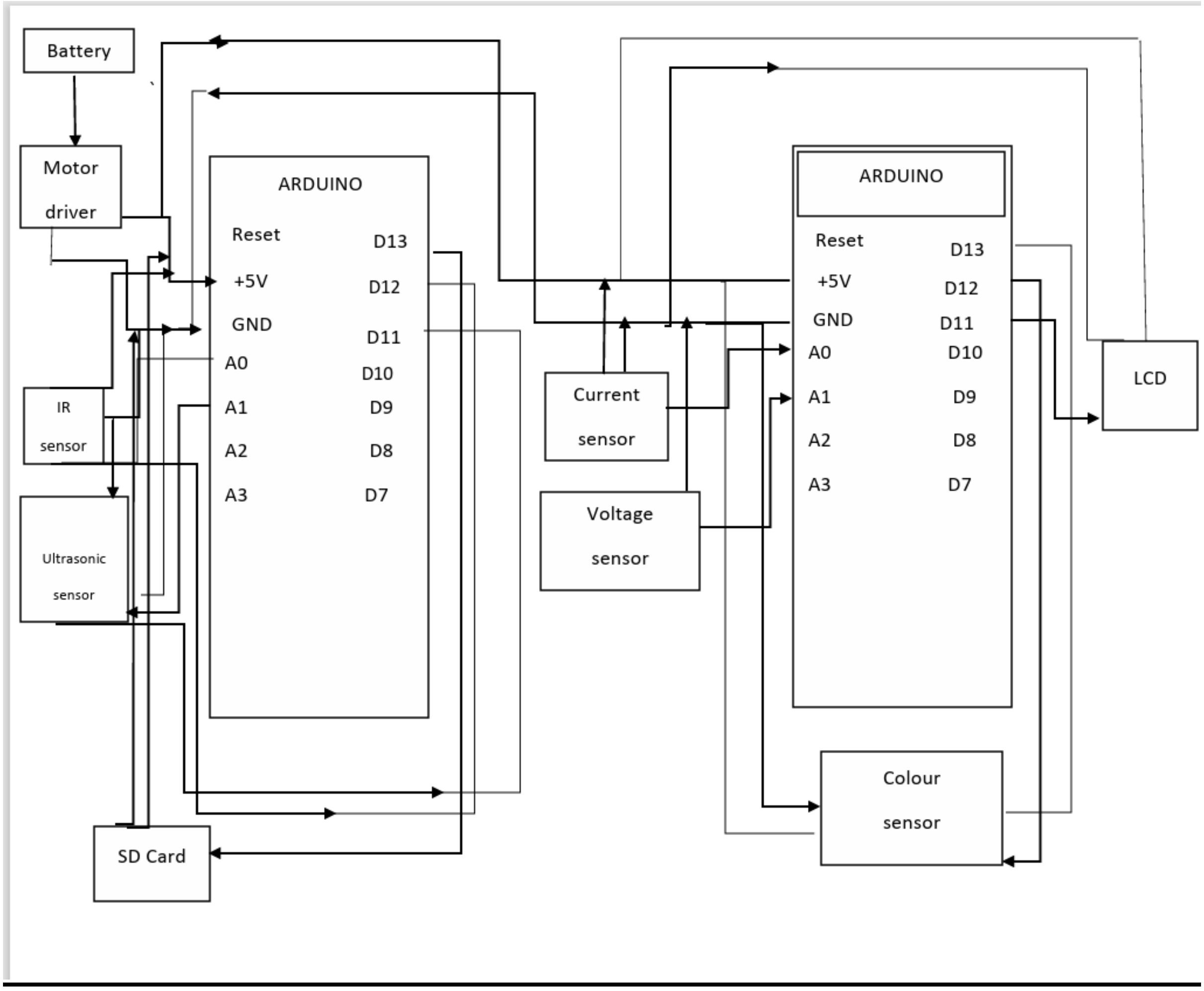
Outputs

- Left Motor
- Right Motor
- SD card
- 16 X 2 LCD

State Machine & System flow diagram



Block diagram



Chapter 5 SIMULATIONS AND FINAL INTEGRATIONS

Integrations and testing all hardware and software component separately

We started by reading each component's data sheet and making a note of the ideal voltage and current for each one. Next, each component was tested independently using a DMM. The majority of the parts were operating as intended. The parts that needed to be replaced were not functional. Following component inspection, we assembled the parts. We were very careful during integration to make sure that no component was shorted or inserted in the incorrect pin, as this could cause the component to burst.

Compiled Arduino code:

```
#include <Ultrasonic.h>
Ultrasonic ultrasonic(A2, A3);
int distance;
#define LS A1      // left sensor
#define RS A0      // right sensor
#define LM1 7       // left motor
#define LM2 6       // left motor
#define RM1 9       // right motor
#define RM2 8       // right motor
void setup() {
  Serial.begin(9600);
  pinMode(LS, INPUT);
  pinMode(RS, INPUT);
  pinMode(LM1, OUTPUT);
  pinMode(LM2, OUTPUT);
  pinMode(RM1, OUTPUT);
  pinMode(RM2, OUTPUT);
  pinMode(10, OUTPUT);
  pinMode(5, OUTPUT);
}void loop() {
  distance = ultrasonic.read();
  Serial.print("Distance in CM: ");
  Serial.println(distance);
  if(distance>=15){
  if((digitalRead(LS)==0)&&(digitalRead(RS)==0))
```

```
are on Black Surface Move Forward sesnor light off
  {
   digitalWrite(LM1,HIGH);
    digitalWrite(LM2, LOW);
    analogWrite(5,90);
    digitalWrite(RM1, HIGH);
    digitalWrite(RM2, LOW);
    analogWrite(10,90);
  }
  else if((digitalRead(LS)==1)&&(digitalRead(RS)==0))
  {
  digitalWrite(LM1, LOW);
    digitalWrite(LM2, HIGH);
    analogWrite(5,90);
    digitalWrite(RM1, HIGH);
    digitalWrite(RM2, LOW);
    analogWrite(10,90);
  } else if((digitalRead(LS)==0)&&(digitalRead(RS)==1))
  {
    digitalWrite(LM1, HIGH);
    digitalWrite(LM2, LOW);
    analogWrite(5,90);
    digitalWrite(RM1, LOW);
    digitalWrite(RM2, HIGH);
    analogWrite(10,90);
 }
else if((digitalRead(LS)==1)&&(digitalRead(RS)==1))
```

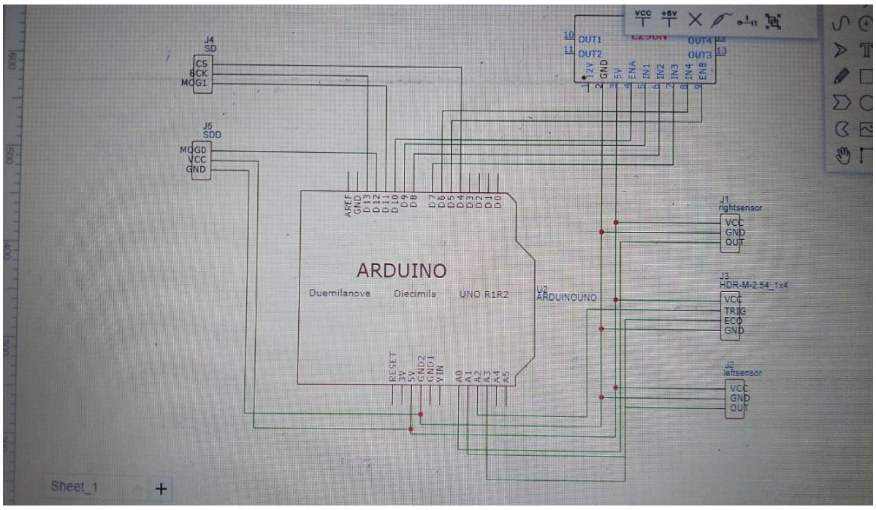
```
{
digitalWrite(LM1, LOW);
  digitalWrite(LM2, LOW);
  digitalWrite(RM1, LOW);
  digitalWrite(RM2, LOW);
}
}
else if(distance<15){
 digitalWrite(LM1, LOW);
  digitalWrite(LM2, LOW);
  analogWrite(5,85);
  digitalWrite(RM1, LOW);
  digitalWrite(RM2, LOW);
  analogWrite(10,85);
}}
```

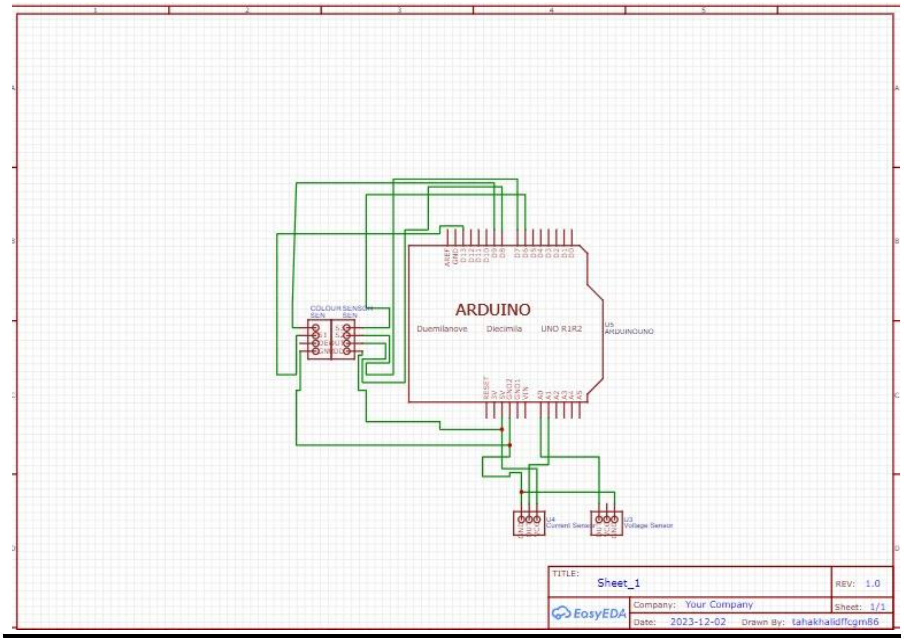
For Voltage sensor and LCD

```
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27, 16, 4);
const int sensorIn = A0;
int mVperAmp = 185; // 5A version SC712 – use 100 for 20A Module or 66 for 30A Module
float vOUT = 0.0;
float vIN = 0.0;
float R1 = 30000.0;
float R2 = 7500.0;
int Watt = 0;
double Voltage = 0;
double VRMS = 0;
double AmpsRMS = 0;
void setup() {
  Serial.begin(9600);
  lcd.init();
  lcd.backlight();
  lcd.setCursor(0, 0);
  lcd.print("Voltage :");
  lcd.setCursor(0, 1);
  lcd.print("Amps :");
}void loop() {
  int value = analogRead(sensorIn);
  vOUT = (value * 5.0) / 1024.0;
  vIN = vOUT / (R2 / (R1 + R2));
 Voltage = getVPP();
  VRMS = (Voltage / 2.0) * 0.707;
  AmpsRMS = (VRMS * 1000) / mVperAmp;
  Watt = (AmpsRMS * 240 / 1.2);
lcd.setCursor(9, 0);
  lcd.print(vIN, 2);
  lcd.print("v ");
lcd.setCursor(7, 1);
  lcd.print(AmpsRMS, 2);
  lcd.print("A ");
  Serial.print("Voltage: ");
  Serial.print(vIN);
Serial.print("v, Amps: ");
  Serial.print(AmpsRMS);
  Serial.println("A");
delay(1000);}
float getVPP() {
  float result;
  int readValue;
  int maxValue = 0;
  int minValue = 1024;
uint32_t start_time = millis();
  while ((millis() - start_time) < 1000) {
    readValue = analogRead(sensorIn);
    if (readValue > maxValue) {
      maxValue = readValue;  }
    if (readValue < minValue) {
      minValue = readValue;   } }
  result = ((maxValue - minValue) * 5.0) / 1024.0;
return result
}
```

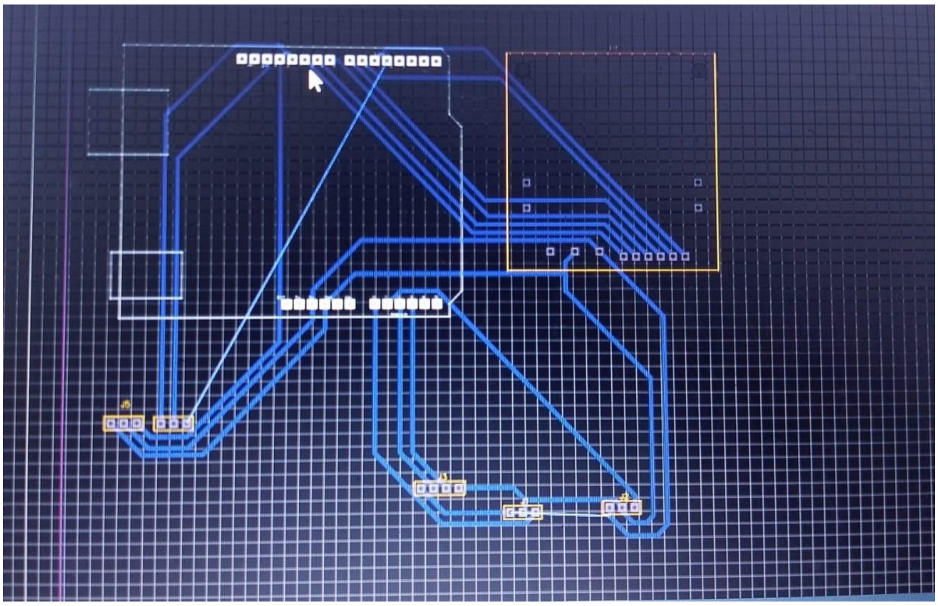
Simulations

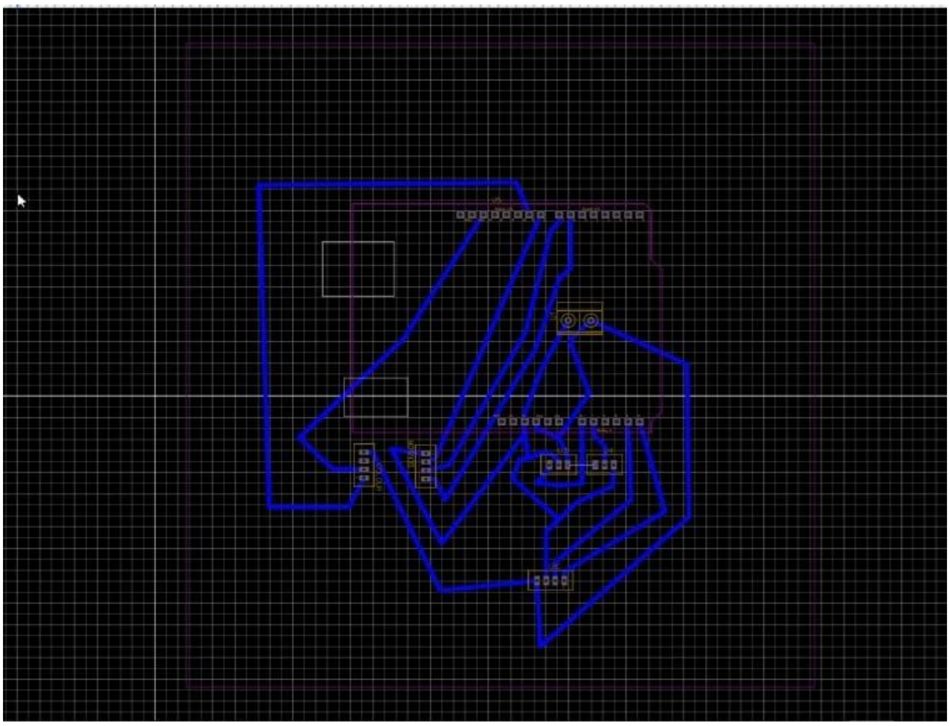
We used Proteus ISIS software to conduct our simulations. Many packages of microcontrollers and sensors were needed for our assignment, so we included the libraries first, then merged them all together in our simulation using the block diagram and pinouts that we decided upon. This is the schematic for our Proteus ISIS simulation.





Simulation PCB:





Chapter 6 System Testing :

Final testing

First stage

First, we examined each of our parts independently. A few of them required replacement because they were malfunctioning; for example, the first motor driver we bought burned and needed to be replaced. then we combined every element.

Second stage

We used a bread board to test every module in our second step. Every module we have was operating as it should. All of the values were shown correctly on our LCD as our robot was moving in line. For example, voltage, current, encoder value, etc. We also verified that our teacher was operating properly..

Third stage

Testing on a PCB board constituted the third step. While each component was operating as intended separately, we integrated them onto the PCB. Following soldering, we examined all of the PCB board's ports and pins, and they were all fine. All of our sensors were providing the correct value. LCD and other sensors were both operating as intended. However, even though our motor driver was receiving the voltage correctly, it was not being mapped to our motors.

Things that are questionable and get burned again and again

When troubleshooting the problem, we discovered that we were connecting the motor drivers' enable pins to the microcontroller's analogue pins rather than to PWM pins. This led to the true control speed being solved. Are motor components being questioned because the speed of the motor wasn't being controlled according to a requirement? Either it was too fast or it was too slow. The LCD panel's inappropriate behavior, which included turning it on but failing to display any output data that we wanted to see, was the second dubious aspect. When the light turns on, the screen stays dark, thus troubleshooting

We tested our components thoroughly before completing the design, so we didn't experience any component burning. However, there was a problem with how the components were placed in the design, we ended up compromising some space that the components needed to be placed correctly. To solve this, we used header pins to arrange the components in a neat and orderly manner. Last but not least, a significant modification we made to our design was to utilize an I2C module instead of directly connecting the LCD to the microcontroller. This was necessary because we lacked the spare pins necessary to connect the LCD directly to the controller, so we used an external module to connect the LCD instead.

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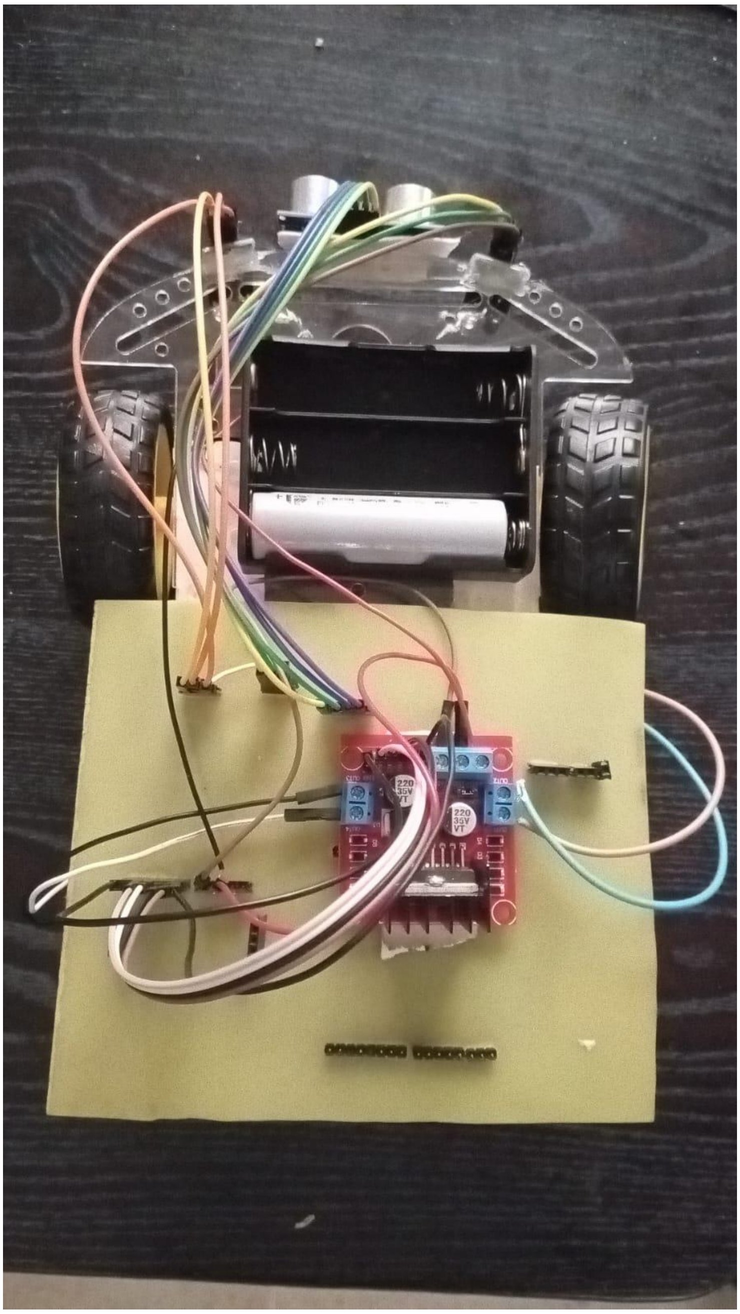
Project actual Picture



Chapter7 Project Management:

Everyone must write one page about how he executed his role in project

Sami created a schematic and PCB for the project with skill. Although Sir's recommendation to use the Proteus software was first made, there was a greater learning curve because of the large number of sensors needed. Seeing this, Sami chose EasyEDA and used YouTube lessons to become proficient with the program so that it could be used to construct the PCB and schematic. Despite the fact that early versions had incorrect component and wire spacing, which might have resulted in short circuits, [your name] worked with the other members of the group to come up with a fix and guarantee correct operation. To put it briefly, Sami was instrumental in the project's hardware design and assembly..

The Arduino IDE was used by Taha to write the project's code. They wrote the code in an extremely accessible style, making it understandable to people with a variety of technical backgrounds. This demonstrates their priority for accessibility and clarity. They were skilled with a wide range of sensors, including as infrared, ultrasonic, color, voltage, and current. Their ability to integrate and assemble hardware was also proficient, which further cemented their contributions to the project's fundamental development

The acquisition of required parts marked the beginning of the hardware assembly phase of the project. Sami kindly provided most of the needed items, following the schematic that was presented. Later on, further parts were purchased from Electrobes and College Road by Rafay . Working together with Sami, Taha, and Azhar was crucial to making the hardware design a reality. Their combined knowledge made the assembling process run smoothly.

Eventually, a thorough report detailing the project's evolution was created after the hardware was successfully completed

Under the direction of Azhar, the project succeeds. By carefully delegating tasks to each team member, they have skillfully led the group and ensured maximum efficiency and skill application. Acknowledging Sami's proficiency in design, Azhar offered significant support, with a particular emphasis on hardware. This concentrated effort consisted of carefully tracing and then soldering the complex parts of the PCB. Given the intricacy of the project, Azhar actively solicited team members' assistance, creating a cooperative atmosphere that strengthened the project's advancement. All in all, this group effort is what drives the project to its successful conclusion and truly represents the essence of collaboration.

Team lead

- Azhar is the team leader

Hardware handling

- Azhar and Rafay are on hardware

Sensor interfacing

- Sami and Taha are on sensor Interfacing

.

Project assembly

- All the Group members contributed on Project assembly

Comment individually about success /failure of your project

Our project is complete success as we learned many Important thing in project completion.   1-
1-Team working
2-Software
3-Hardware
Risk management that you learned:

It is the process of locating, assessing, and mitigating project risks that could jeopardize the intended results. Throughout the course of a project, project managers are usually in charge of supervising the risk management procedure.
This project had a number of hazards, such as PCB etching, which, if done incorrectly, would have required us to buy a new one from a store, which would have been inconvenient. Drilling and soldering holes on PCBs is another.
We faced significant difficulties with PCB alignment because our PCB was double-layered. We had to make several of the components ourselves because Proteus did not have them.
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This project had a number of hazards, such as PCB etching, which, if done incorrectly, would have required us to buy a new one from a store, which would have been inconvenient. Drilling and soldering PCB holes is another. We took all the necessary precautions to ensure that there would be no problems when employing acids.
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Chapter 8 Feedback For Project and Course:

Our task was highly instructive as well as a test of our past knowledge and skills. It also really helped us consider all of our options thoroughly and broadly. We learned new skills that we had only studied or seen on screens, including soldering. This project taught us time and money management techniques in addition to technical skills. Every one of us learned how to work together and as a team on an individual basis. We had a good experience all around.

Chapter 9 DETAILED YOUTUBE VIDEO EXPLAINING OUR WORK OF EACH MEMBER:

The comprehensive YouTube videos that each group member has created to explain the project report and the project will be linked in the GCR submission slot's comment section.

APPENDIX-

References-

studocu.com/in/document/dr-d-y-patil-vidyapeeth-pune/computer-engineering/line-following-robot-project-report/18183710

GitHub Link:

https://github.com/MTahaKhalid/MES-Project.git