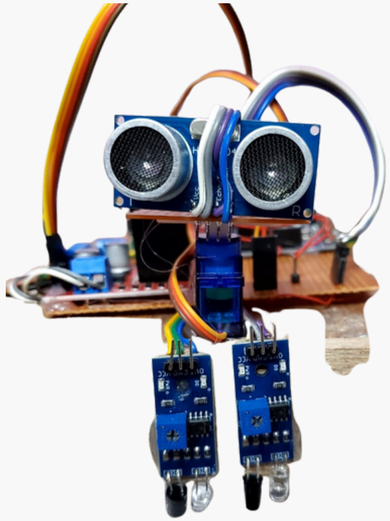
AUTOMATED GUIDED VEHICLE

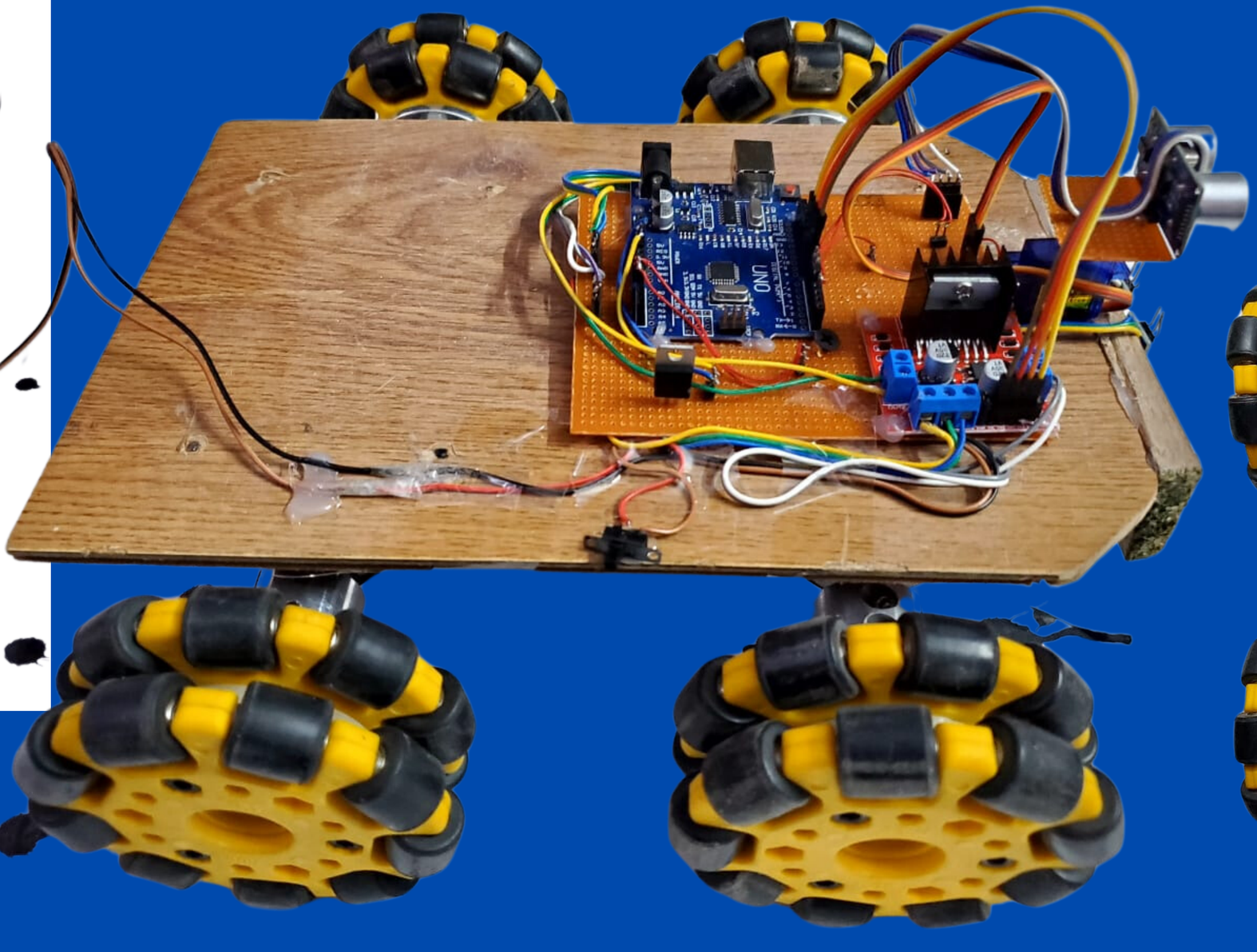


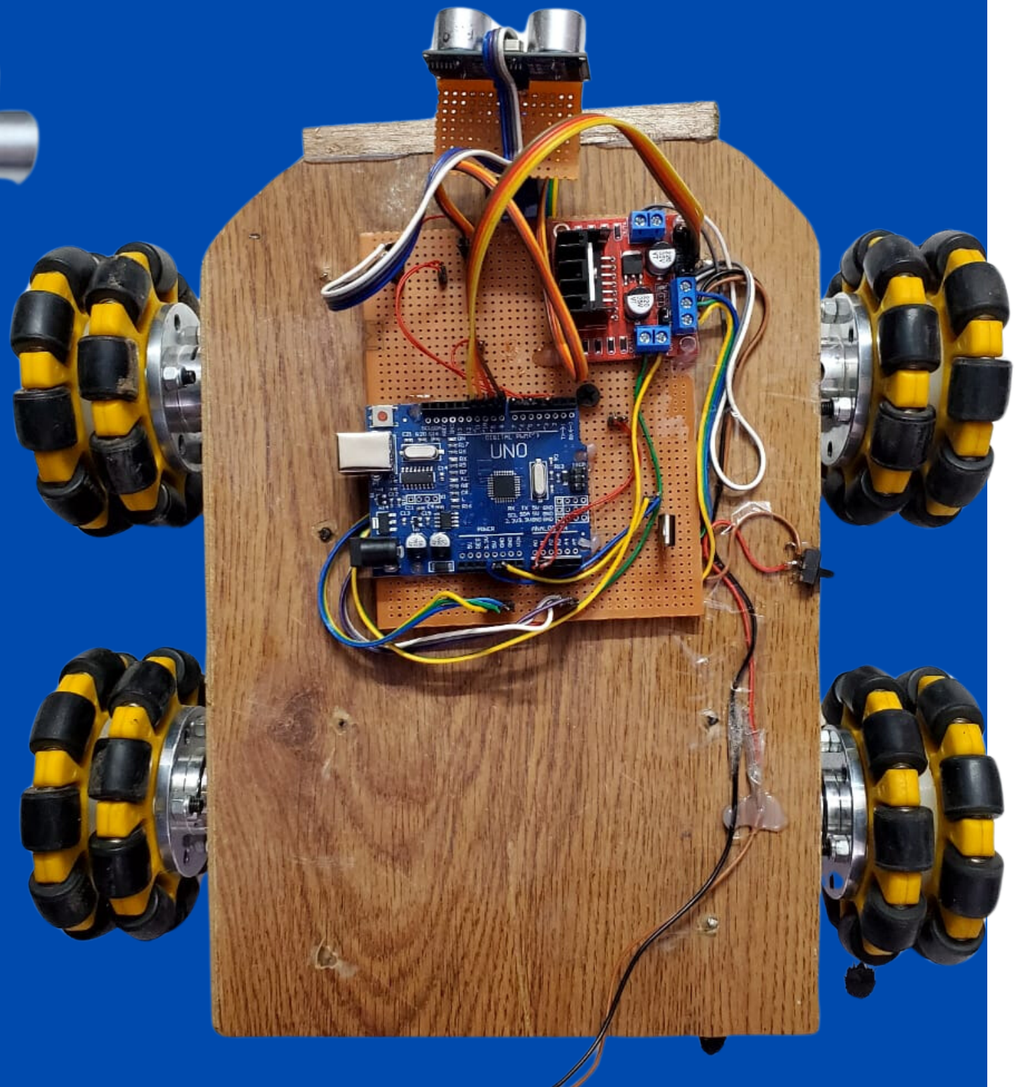
MECHATRONICS, Jury

B.F.TECH, SEM-7

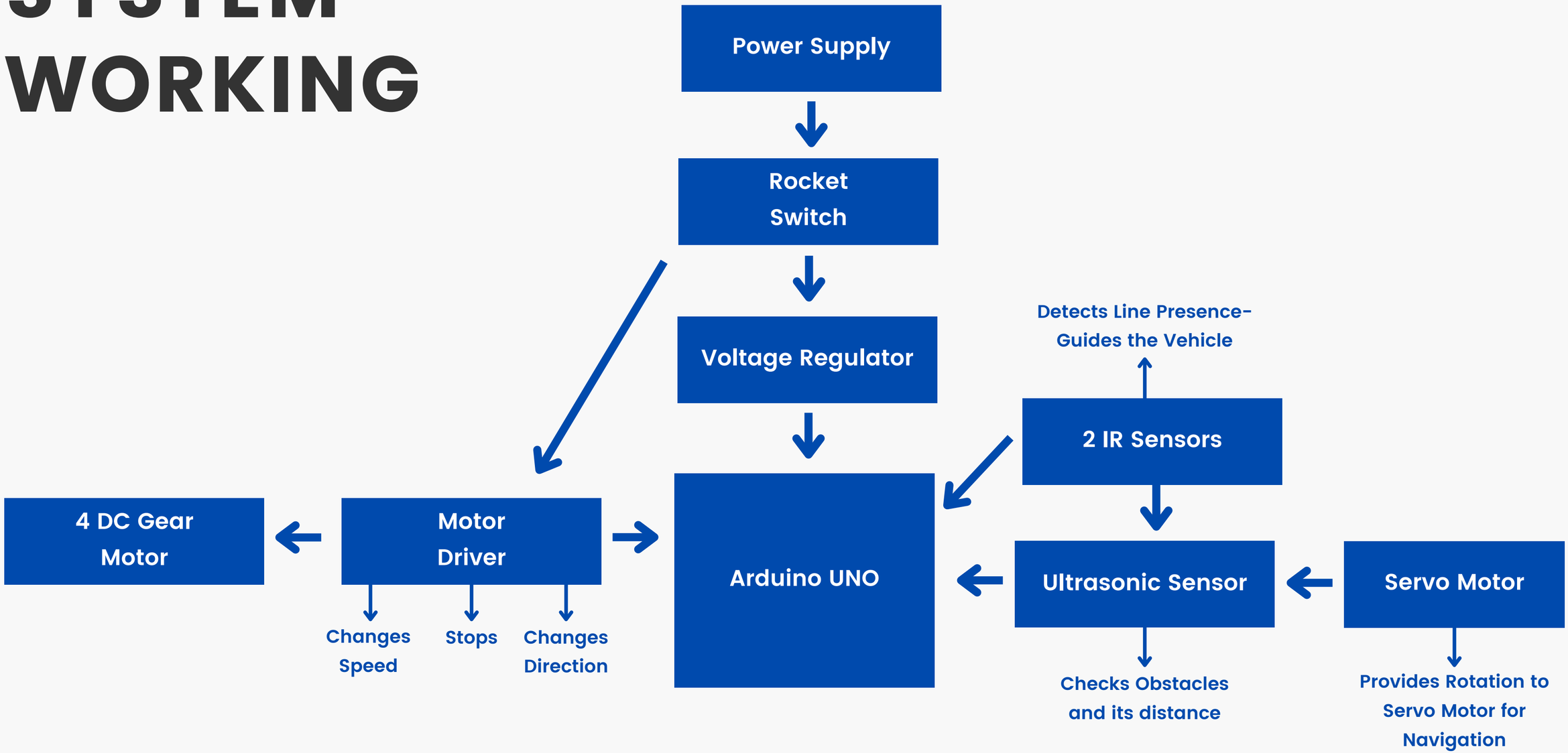
By:
Shreyash Ojha

PROTOTYPE

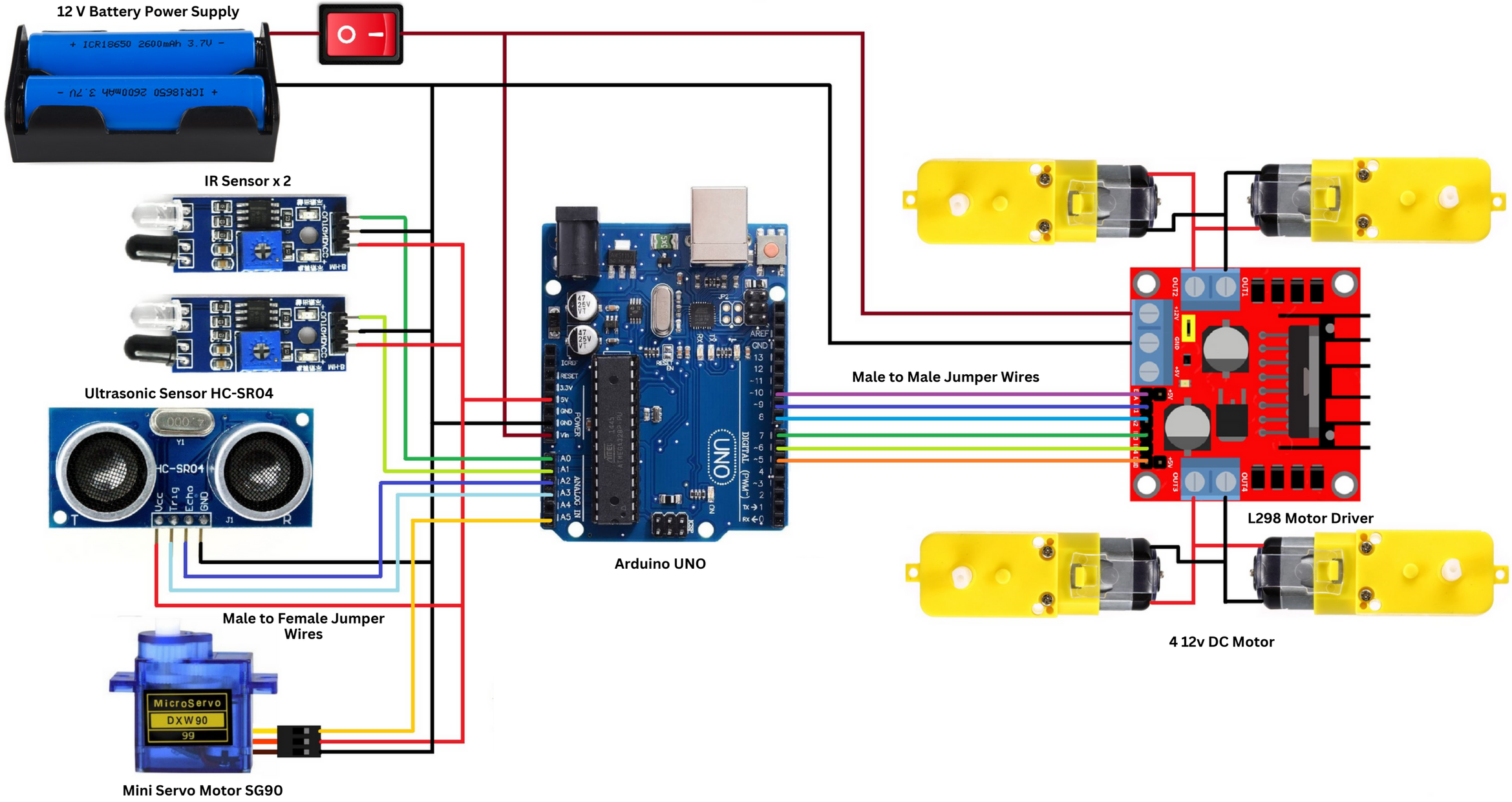




SYSTEM WORKING



Circuit Diagram

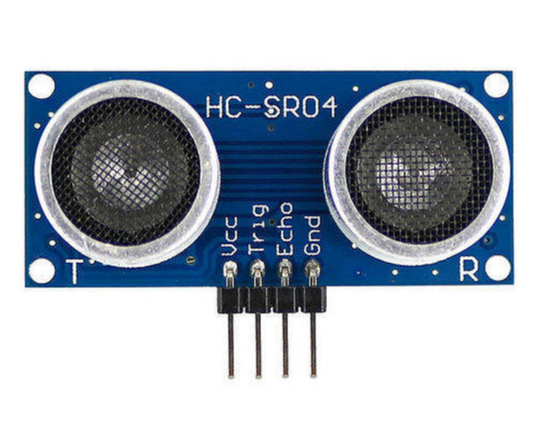

12 V Battery Power Supply
IR Sensor x 2
Ultrasonic Sensor HC-SR04
Male to Female Jumper Wires
Mini Servo Motor SG90
Arduino UNO
Male to Male Jumper Wires
L298 Motor Driver
4 12v DC Motor

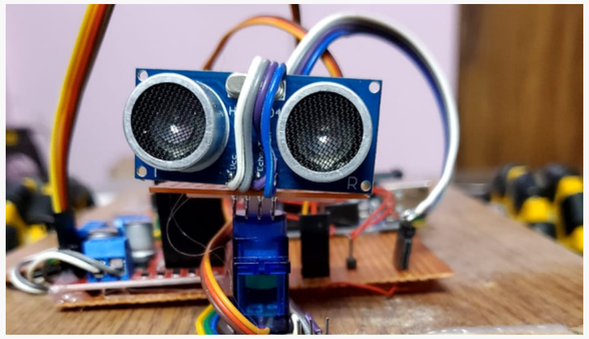
System Components

NAVIGATION SYSTEM

Ultrasound sensor

Operating Voltage: 5V DC
Operating Current: 15mA
Measure Angle: 15°
Ranging Distance: 2cm - 4m





Mini servo motor

Operating Voltage: 3-7.2 DC
Operating speed: 0.1 sec/60
Rotational Degree: 180°

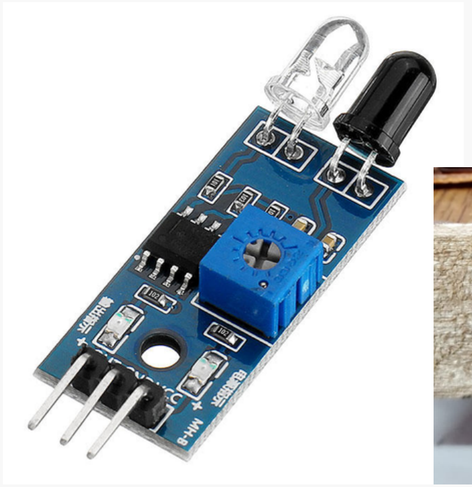
By rotating the sensor using the servo motor, the robot can scan its surroundings and create a map of obstacles. This information can be used by the Arduino UNO to plan the robot's path and avoid obstacles.

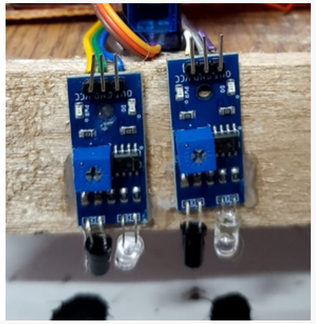
SAFETY and VEHICLE CONTROL

IR sensor

IR Infrared Obstacle Avoidance Sensor Module

- Range: 2-30cm
- Detection angle: 35°
- Operating Voltage: 3.6- 5V

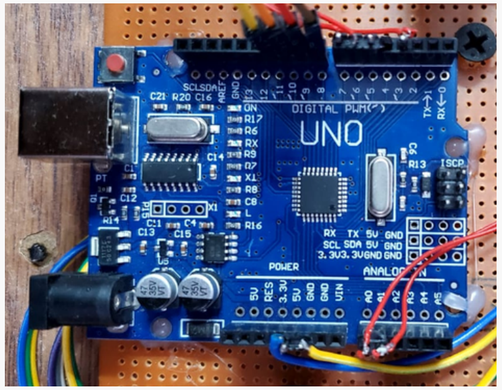




Ultrasonic Sensor

Arduino UNO

Operating Voltage : 5V.
Input Voltage (recommended) : 7-12V.
Analog Input Pins : 6
Digital I/O Pins : 14



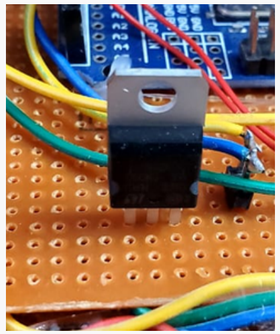
The IR sensors serve as the safety system by detecting obstacles in the robot car's path.
When an obstacle is detected, the Arduino UNO processes this information and triggers the necessary actions to avoid collisions, such as stopping the motors or steering the car away from the obstacle

POWER SYSTEM

12V Battery

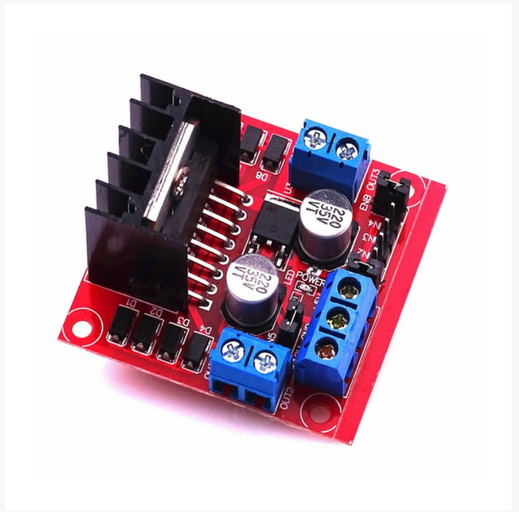
The Battery Provides 12 V of Power to each Motor.
And Voltage Regulator regulates 5V power to Arduino

7805
Voltage Regulator



L298 Motor Driver

The L298N Motor Driver module consists of an L298 Motor Driver IC, 78M05 Voltage Regulator, resistors, capacitor, Power LED, 5V jumper in an integrated circuit. L298N Module can control the rotation and speed of up to 4 DC motors

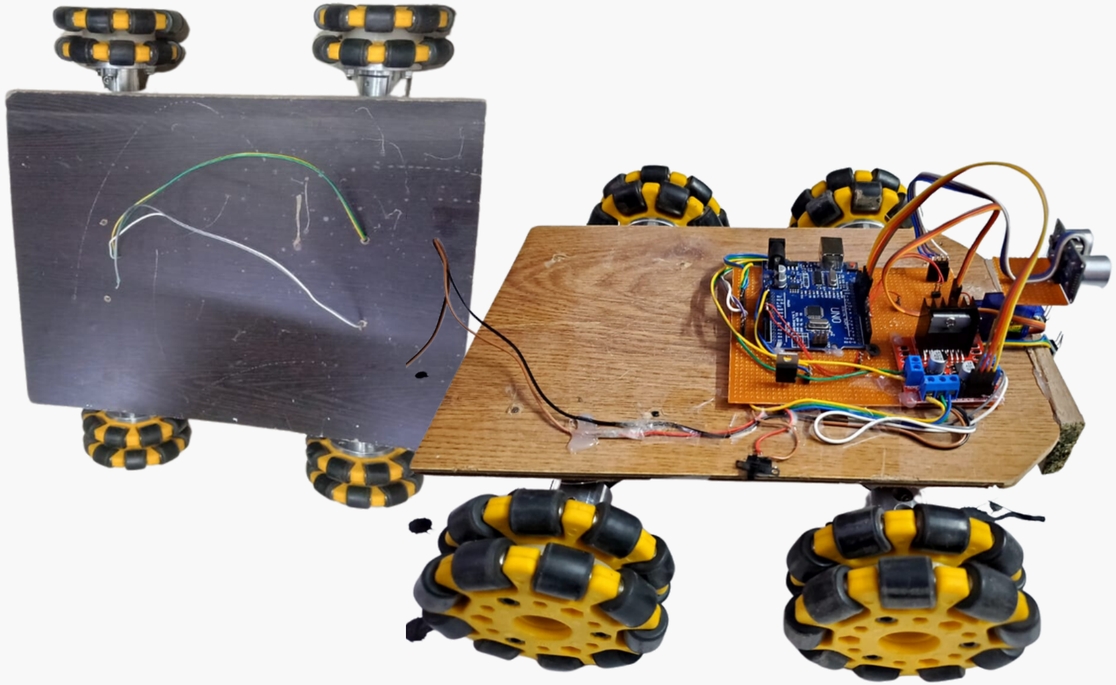


Operating Voltage: 5V
Supply Voltage: 5-35V
Driver Current:2A
Maximum Power (W): 25W

MOTION SYSTEM

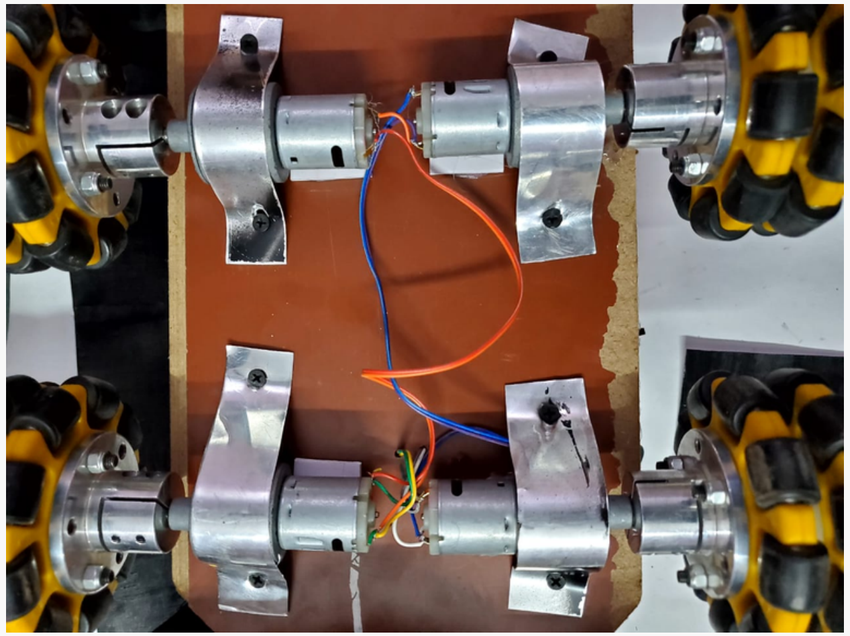
4 Wheel Robot Car

The 4 wheel robot car we made using wooden table, provides a stable platform for motion and can uphold 5kg load



DC Dual Gear Motor

30 RPM Motor
12 V per Motor Supply of Power



Power Transmission
&
Load Calculation

Power and Voltage

Component	Current (A)	Power Consumption (W)
DC Motors	4 * 2.4	9.6
IR sensors	2 * 0.02	0.04
Ultrasound sensor	1 * 0.015	0.015
Servo motor	1 * 0.7	0.7
Total		10.355

Assuming efficiency of 85% and operational time of 1 hour,

V = P/ I(efficiency) * Time
V = 10.35/0.85
V ≈ 12V

Load Calculation

Weight Distribution: To distribute the 6-kilogram load evenly across all four tires, we'll allocate 1.5 kilograms of weight to each tire. Adding the tire's own weight on this allocation, total weight n each tire is 2kgs.

Contact Area: We'll assume that each tire has a contact area of 2 square inches with the ground.

Now, let's calculate the pressure exerted on each tire due to the full load:

Force per tire = 2N

Pressure per tire = Weight on tire / Contact Area per tire

Pressure per tire = 2 N / (2 square inches * 6.45 sq cm per sq inch)

Pressure per tire ≈ 0.15 N/sq cm

Item	Weight
Payload	5 kg
IR sensor x 2 Ultrasonic sensor Servo motor Motor driver Arduino Uno Wires Fixtures Voltage regulator	Assuming a max weight of 500 g
Chassis	500 g
Weight of each tire	500 g

Code Explanation

1. Two libraries:

Servo for controlling the servo motor and NewPing for working with the ultrasonic sensor

```
#include <Servo.h>
#include <NewPing.h>
```

2. Variables

- Variables related to Motor Control: LeftMotorForward, LeftMotorBackward, RightMotorForward, RightMotorBackward
- Variables related to Ultrasonic Sensor: trig_pin, echo_pin, maximum_distance
- Variables for Analog Sensors (IR Sensors): lefts, rights
- goesForward: A boolean variable to track the direction of movement.
- distance: Variable to store the distance from the ultrasonic sensor.
- sonar: An instance of the NewPing class for ultrasonic sensor functionality.
- servo_motor: An instance of the Servo class for controlling the servo motor.

3. Main loop function

- The loop() function contains the main logic for the AGV. It continuously reads sensor values, checks for obstacles, and adjusts the AGV's movement accordingly.
- It first checks using ringPing() if the distance from the ultrasonic sensor is less than or equal to 20 cm. If true, it triggers obstacle avoidance maneuvers.
- If no obstacle is detected, the code reads analog values from left and right IR sensors.
- Based on the sensor readings, it determines whether to move forward, stop, turn left, or turn right.

4. Functions

- The lookRight() and lookLeft() functions control the movement of the servo motor to scan the environment.
- Functions like moveStop(), moveForward(), moveBackward(), turnRight(), turnLeft(), turn_Right(), and turn_Left() control the movement of the AGV motors.
- setup() function initializes the pins, attaches the servo motor, and reads initial distance values from the ultrasonic sensor

1. **If the distance is less than or equal to 20 cm:**

a. Stop the AGV (moveStop()).
b. Move backward (moveBackward()).
c. Stop the AGV again.
d. Use the servo motor to look right (lookRight()) and measure the distance.
e. Use the servo motor to look left (lookLeft()) and measure the distance.
f. Decide whether to turn right or left based on the available space:
    - If more space is available on the right, turn right.
    - If more space is available on the left, turn left.
g. Continue moving forward after turning.

2. **If no obstacle is detected:**

a. Read analog values from left and right IR sensors.
b. Based on the sensor readings, decide the movement:
    - If both sensors detect a line, move forward.
    - If only the left sensor detects a line, turn left.
    - If only the right sensor detects a line, turn right.
    - If neither sensor detects a line, stop.

THANK YOU! :)