PROTOTYPING AND SYSTEMS ENGINEERING PRESENTATION

TEAM MEMBERS :

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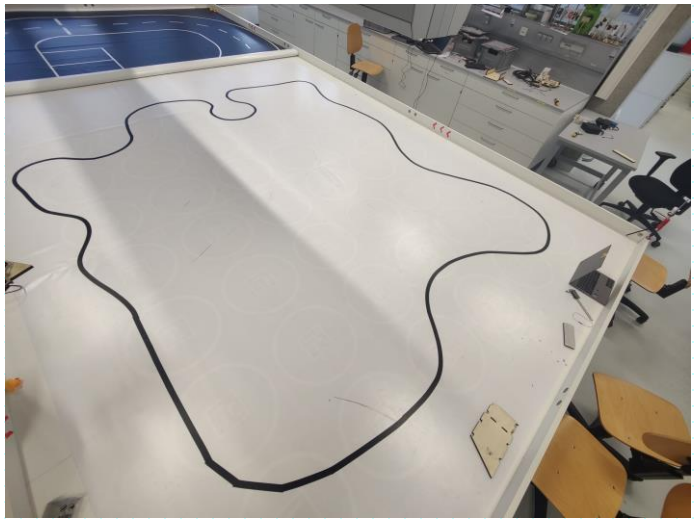
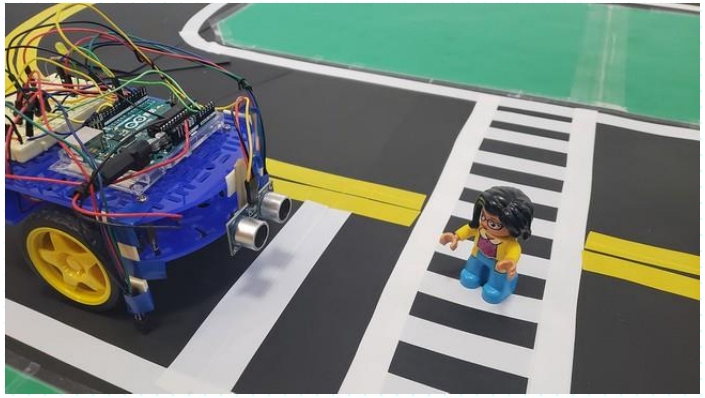
MOTIVATION



OVERVIEW

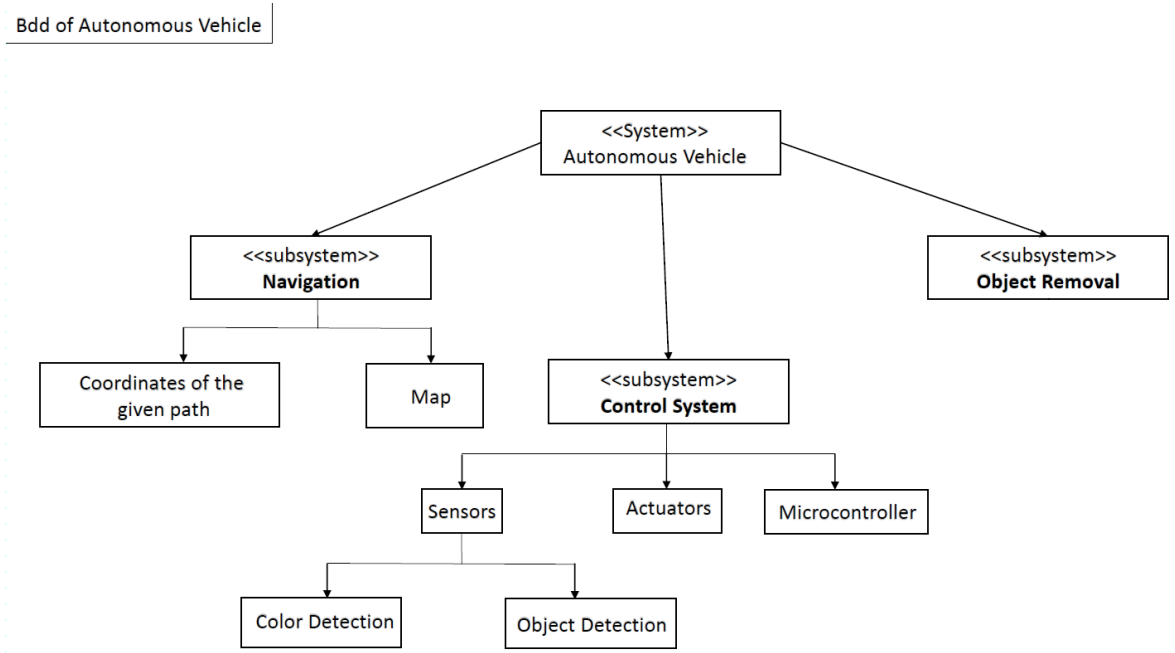
- Develop an autonomous vehicle that can drive autonomously on a given track.



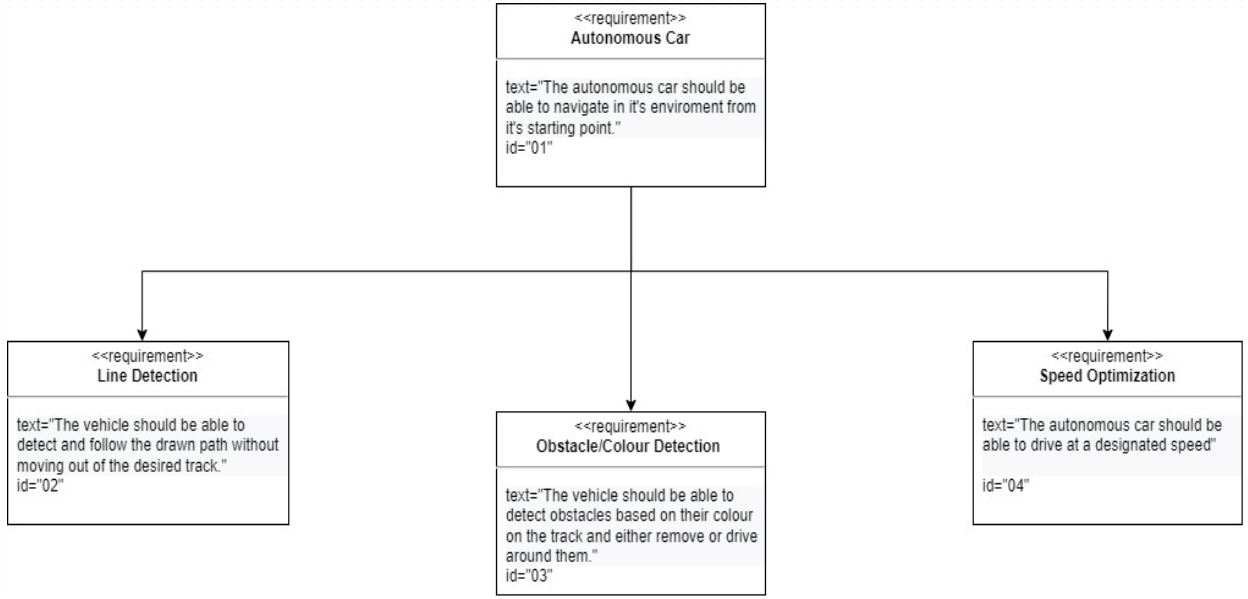
[1]

SYSML DIAGRAMS AND UPPAAL MODEL

- BLOCK DIAGRAM

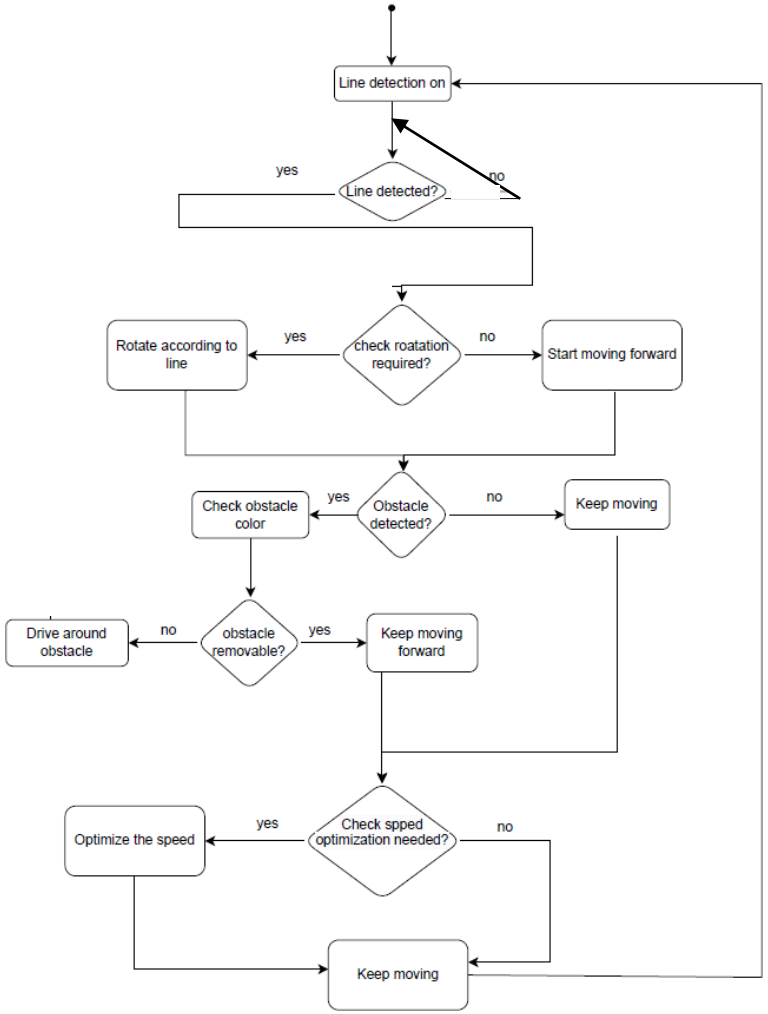


- REQUIRMENT DIAGRAM

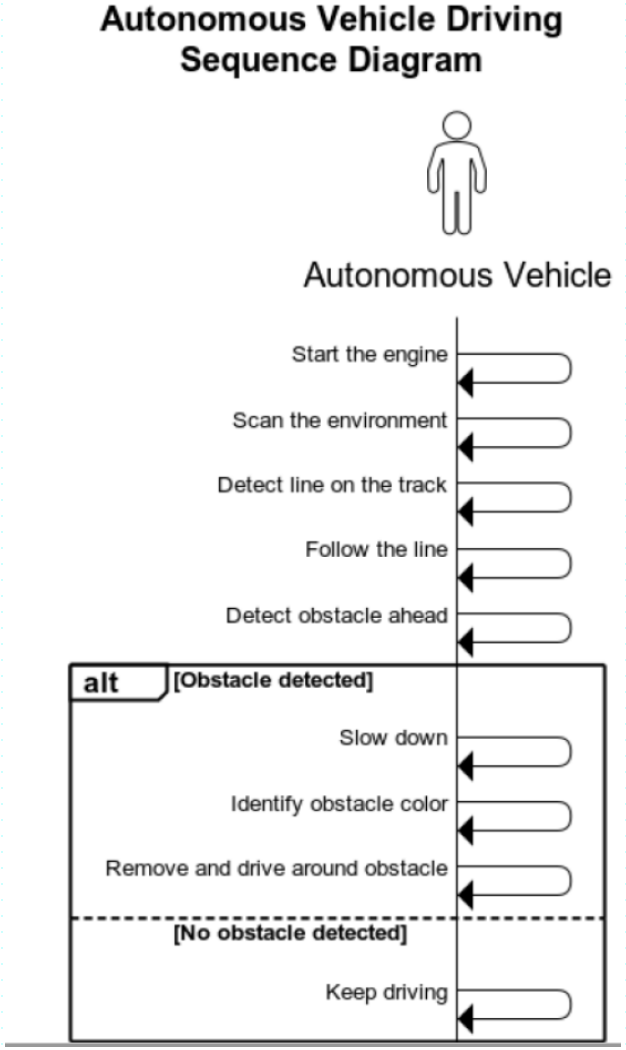


SYSML DIAGRAMS AND UPPAAL MODEL

- ACTIVITY DIAGRAM

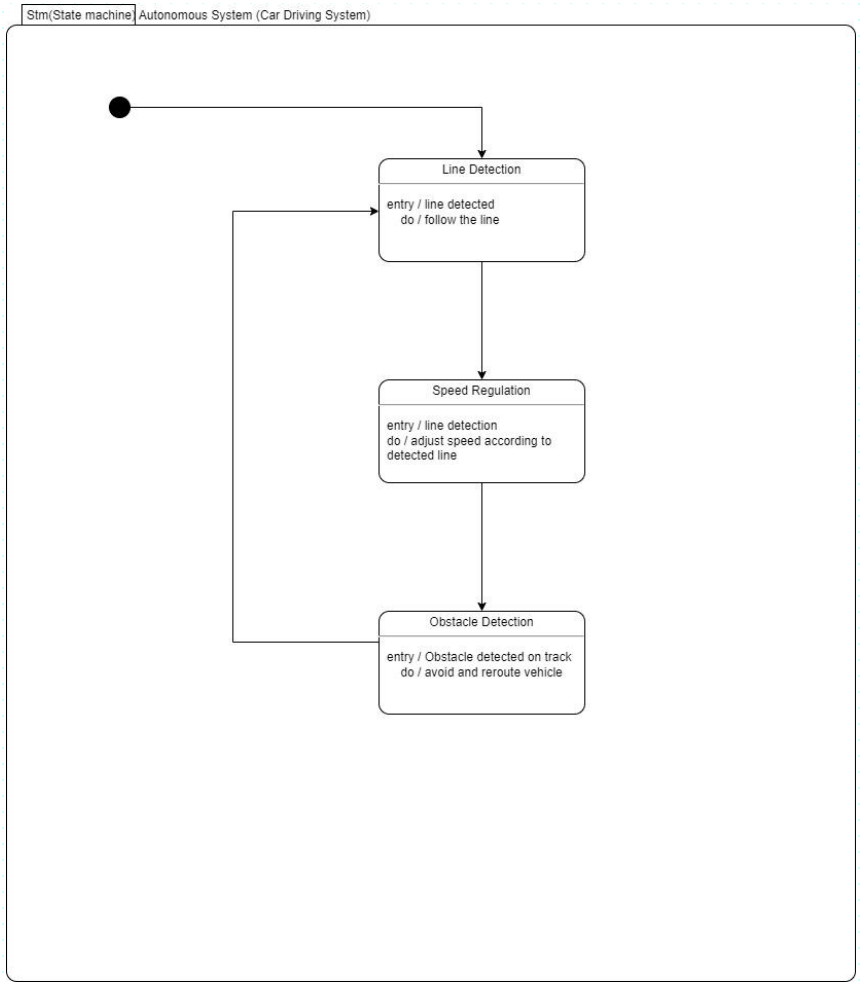


- SEQUENCE DIAGRAM

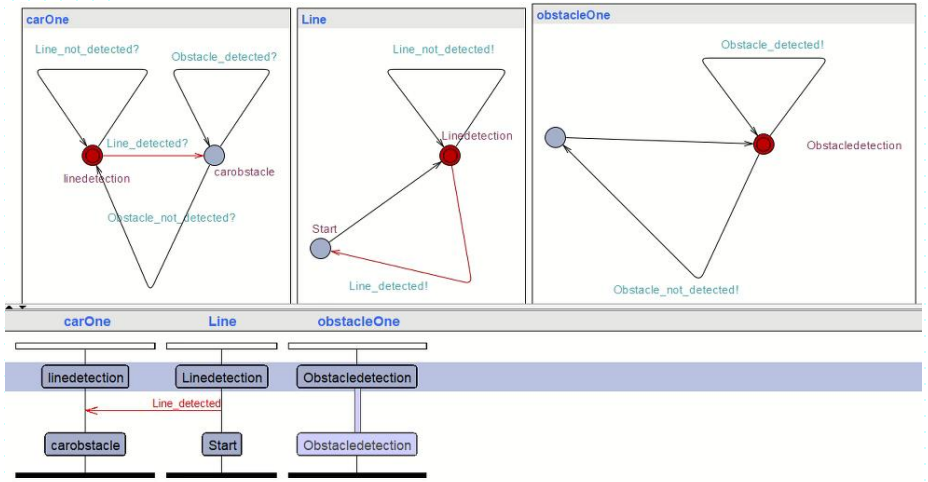


SYSML DIAGRAMS AND UPPAAL MODEL

- STATE MACHINE DIAGRAM



- UPPAAL MODEL



HARDWARE COMPONENTS

- Microcontroller - Arduino Uno

- Ultrasonic Sensor (HC-SR04)

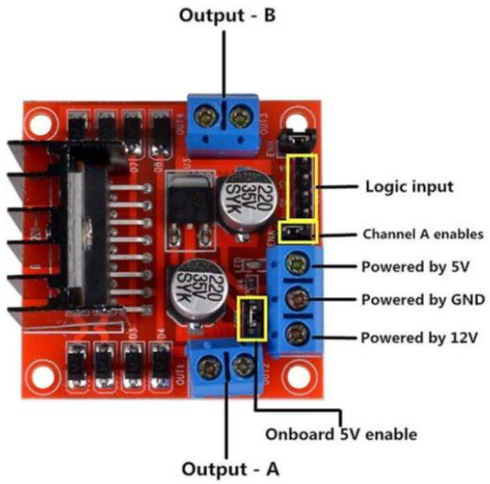
- Line sensor (IR Sensor,ST1140)

HARDWARE COMPONENETS

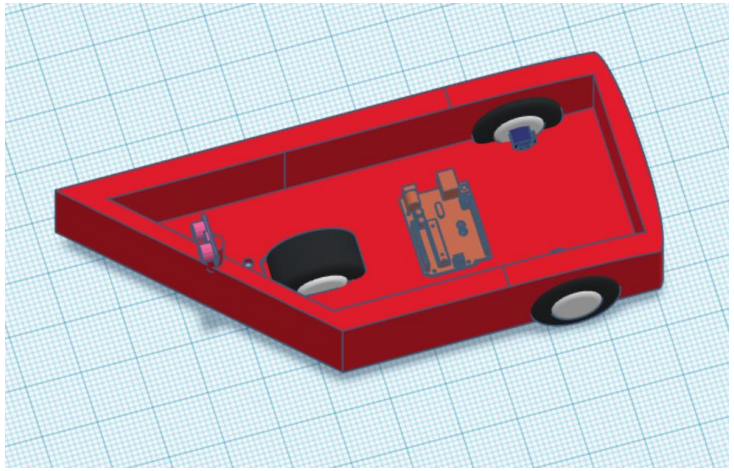
- Colour Sensor (TCS3200)

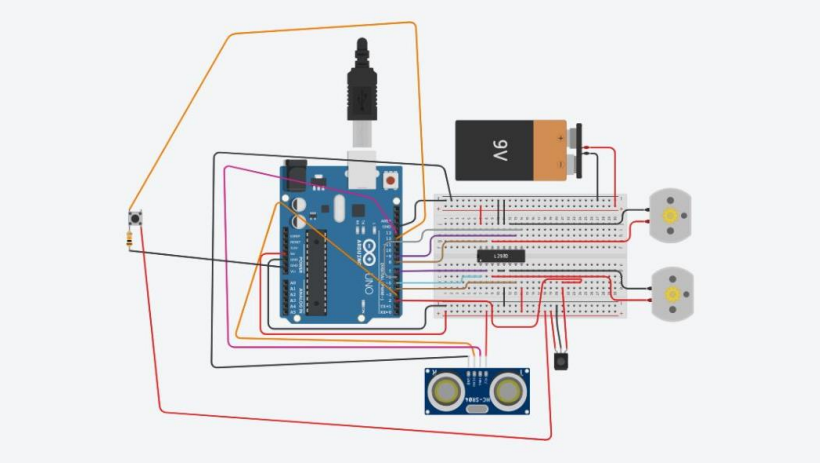
- 2 DC Motors

- Motor Driver



DESIGN & SCHEMATICS





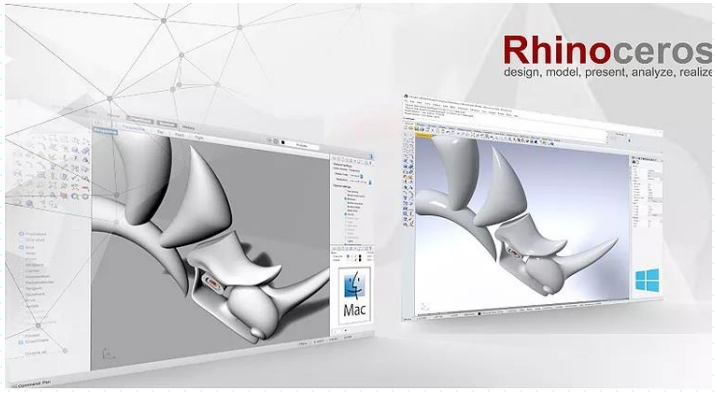
DESIGN & SCHEMATICS

TECHNOLOGIES USED

- TINKERCAD

AUTODESK® TINKERCAD® [2]

- Rhinoceros

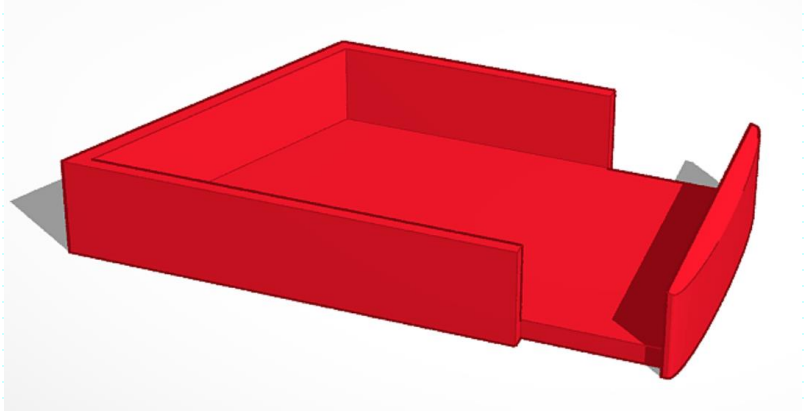


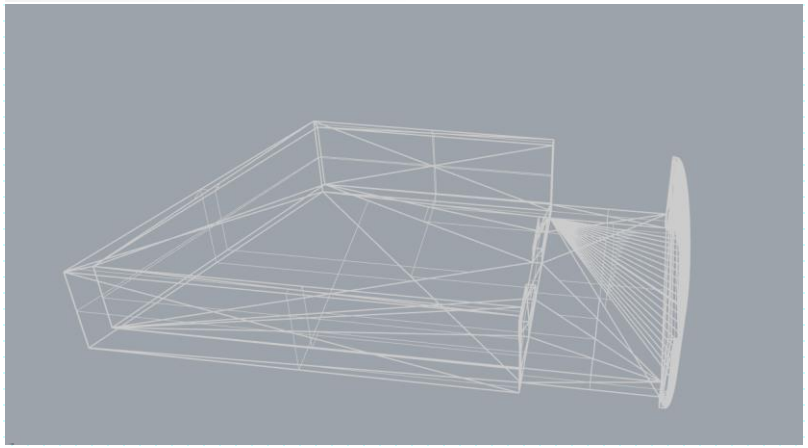
[3]

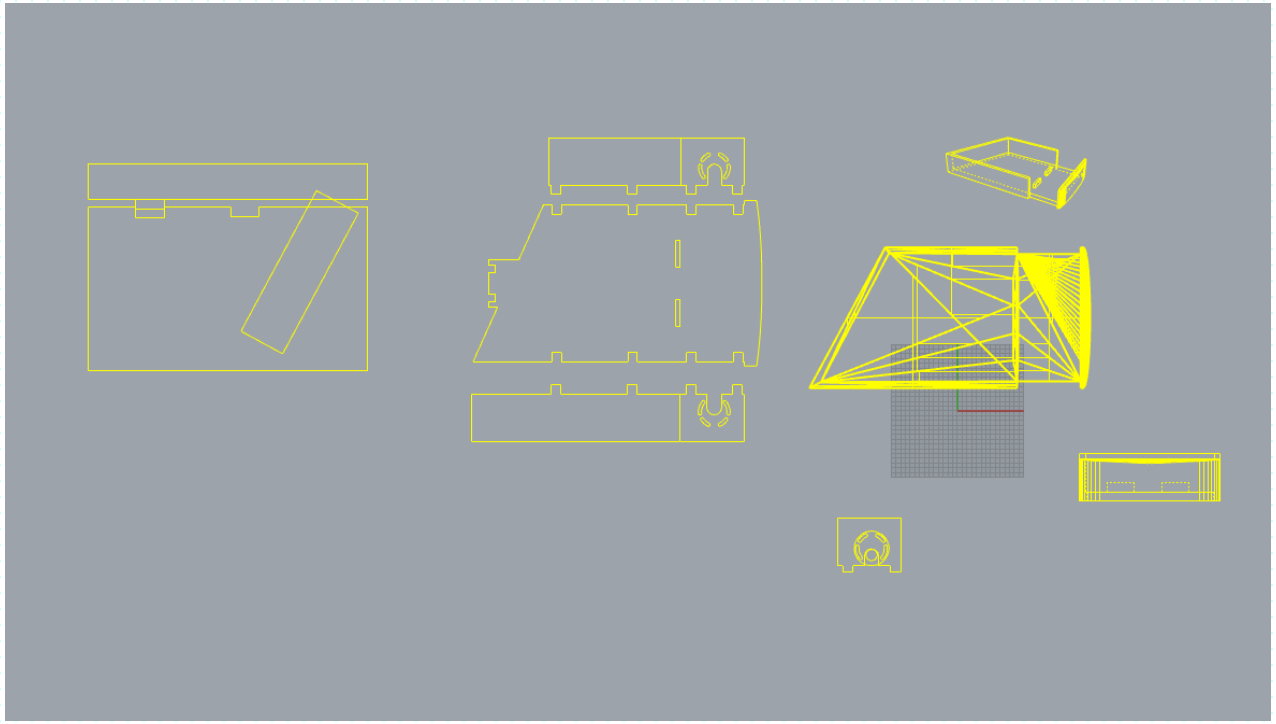
- Laser Cutting of Plywood

[4]

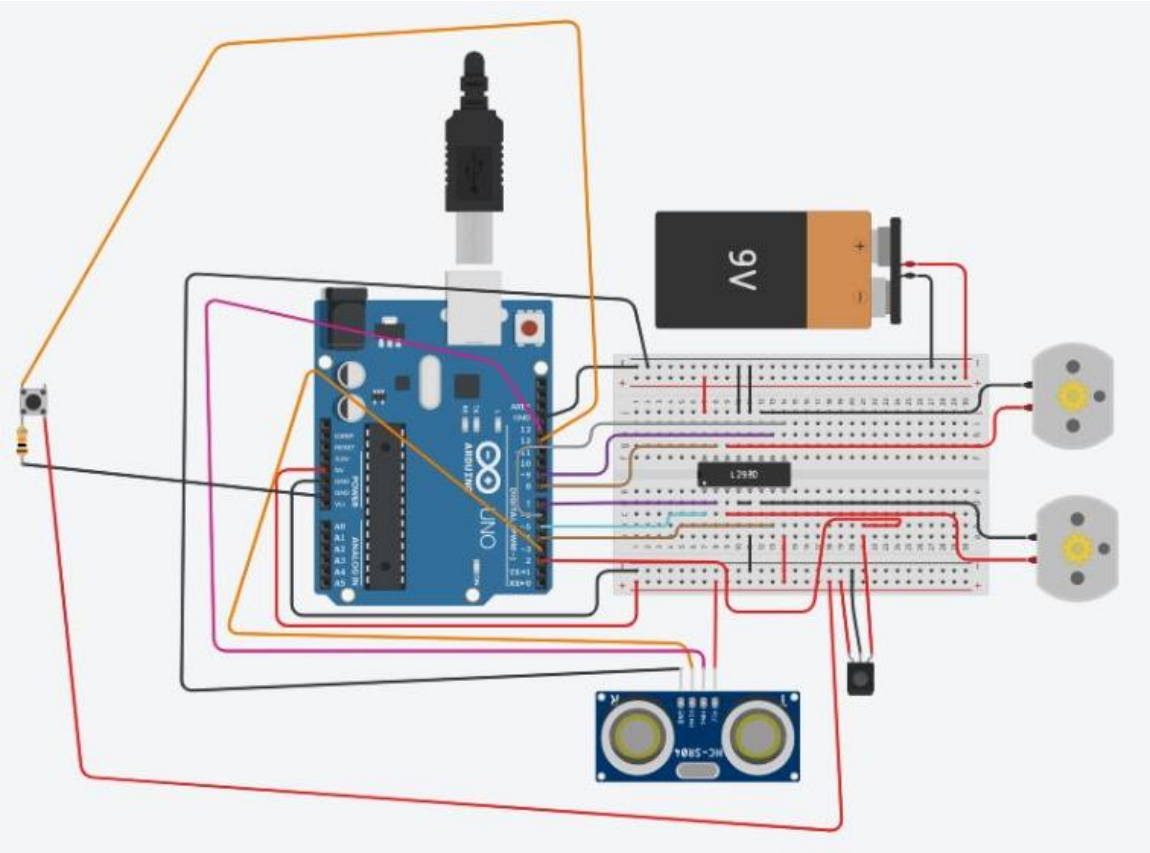
TINKERCAD & RHINOCEROS

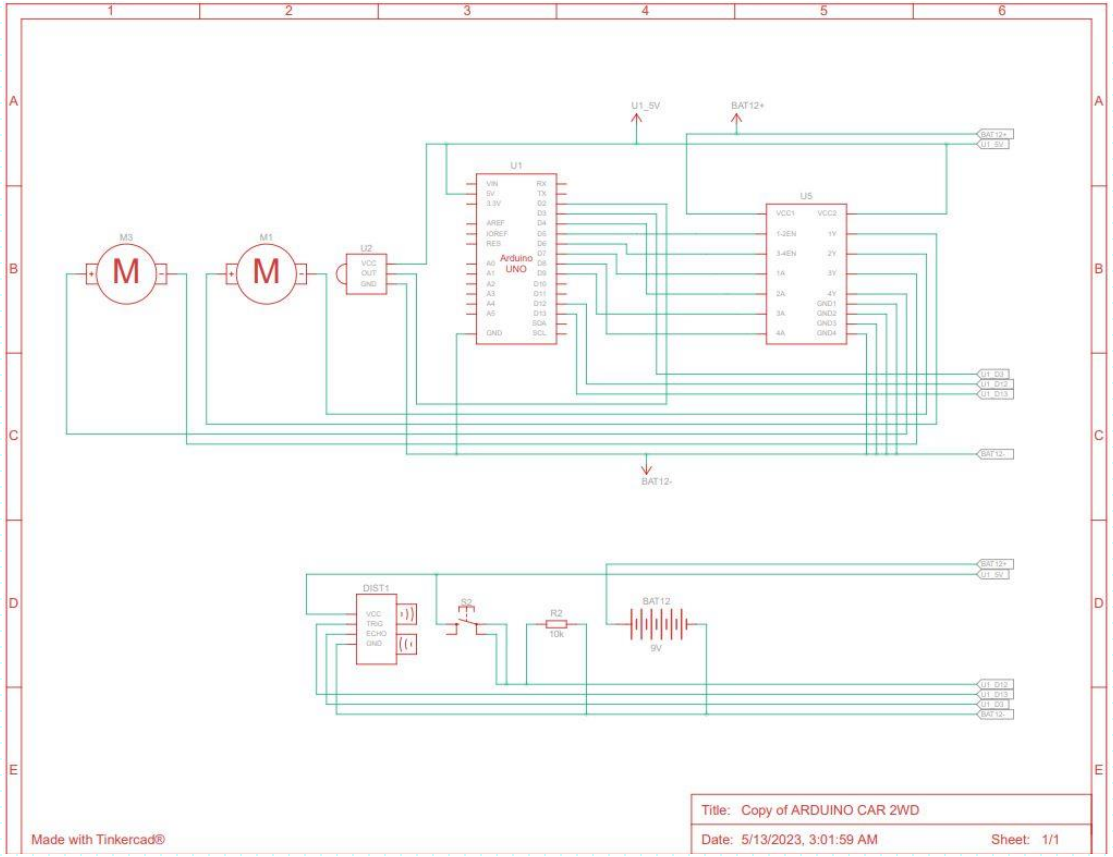


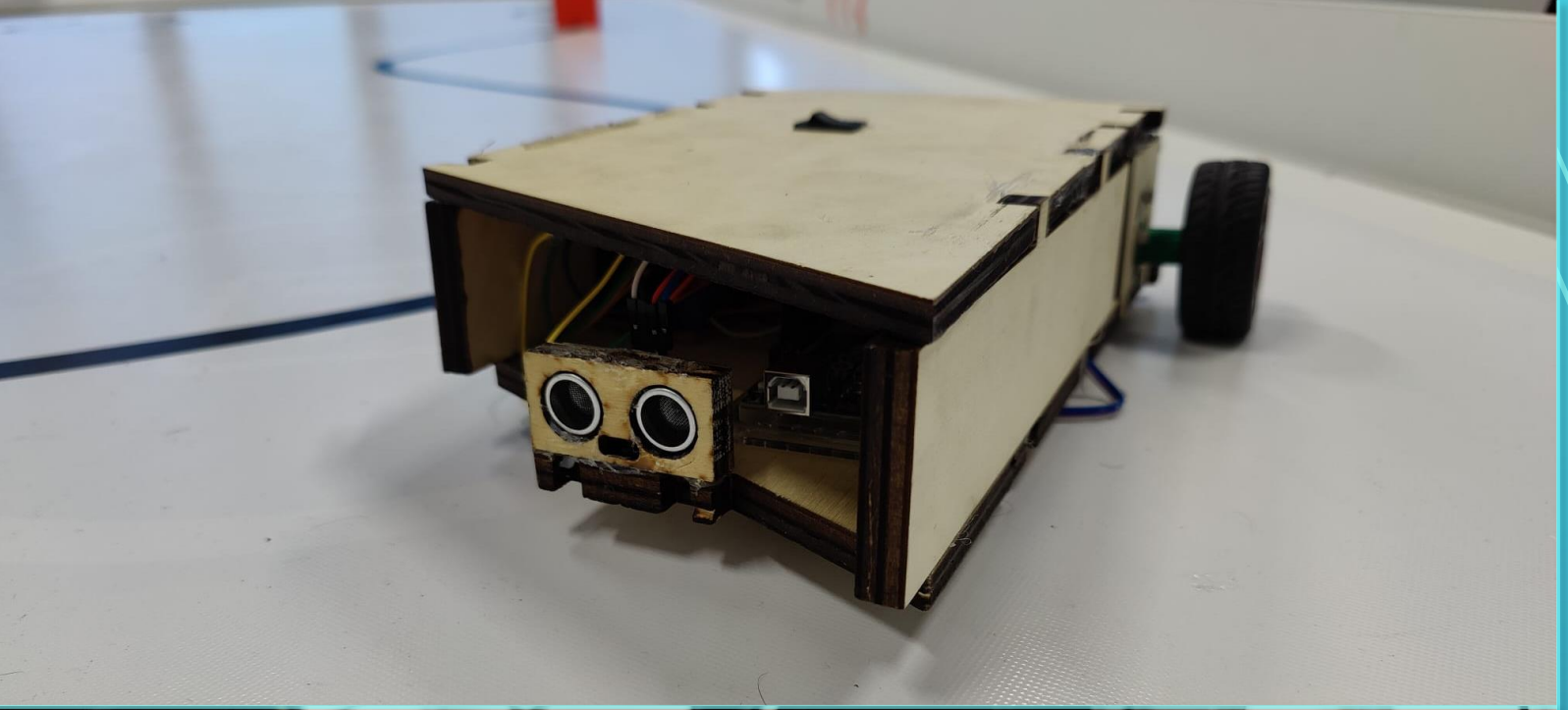


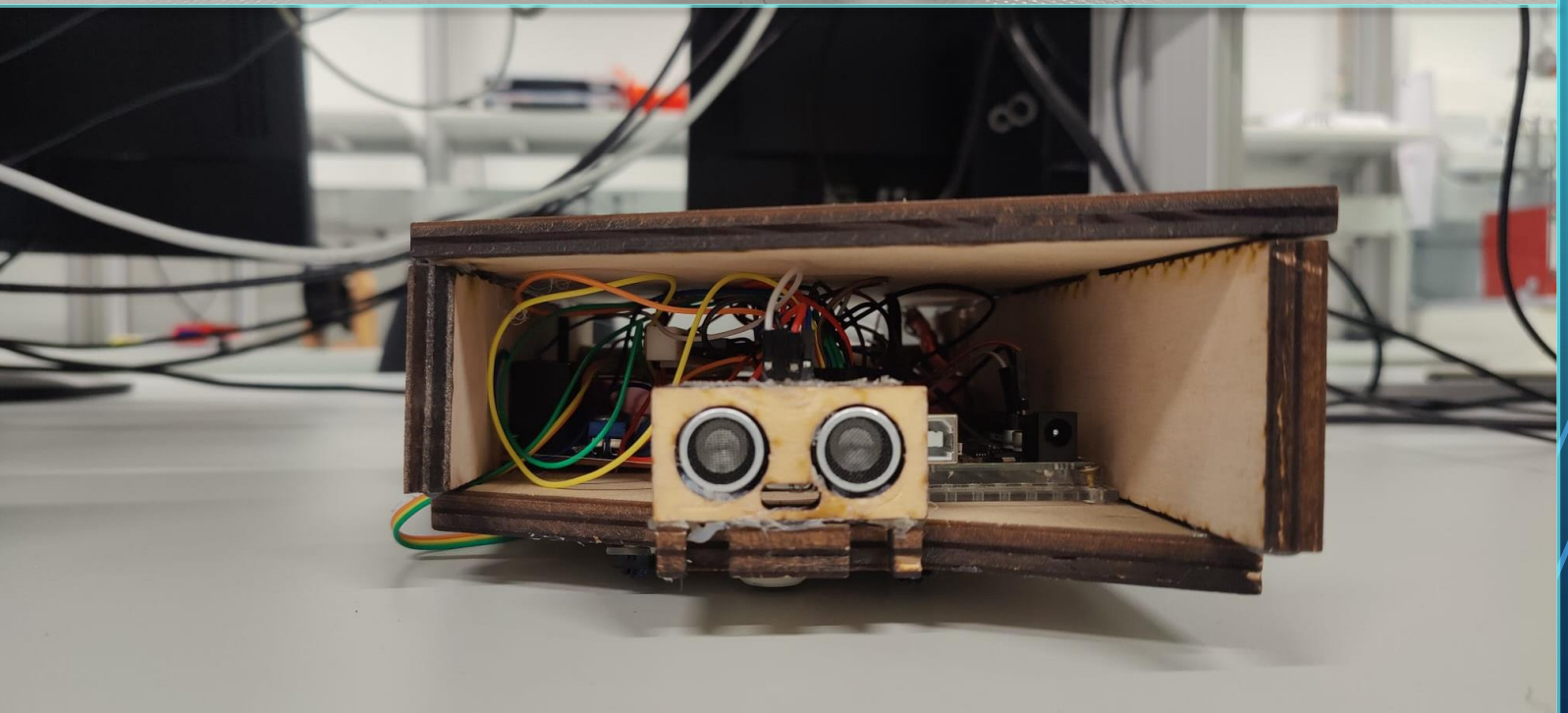


DESIGN & SCHEMATICS









FINAL PROTOTYPE

CODE

1.Track Following

- 2 IR Sensor

- IrSensor1(left ir Sensor)
- IrSensor2(right ir Sensor)

Signal – HIGH When on White Path
– LOW When on Black Path

Vehicle Out of the track:- keeps moving forward using forward function until it finds the line again.

```
void forward() { // Moving Forward
  digitalWrite(in1Pin, LOW);
  digitalWrite(in2Pin, HIGH);
  digitalWrite(in3Pin, LOW);
  digitalWrite(in4Pin, HIGH);

void right() { // Moving right side of the track
  analogWrite(enA, 130);
  analogWrite(enB,160 );
  digitalWrite(in1Pin, LOW);
  digitalWrite(in2Pin, HIGH);
  digitalWrite(in3Pin, HIGH);
  digitalWrite(in4Pin, LOW);
}
}
  // Initialize IR sensor pin
  pinMode(irPin1, INPUT);
  pinMode(irPin2, INPUT);

void loop() {
  // Read IR sensor input
  int irSensorValue1 = digitalRead(irPin1);
  int irSensorValue2 = digitalRead(irPin2);
analogWrite(enA, 200);
  analogWrite(enB,200 );
  if (irSensorValue1 == 0 && irSensorValue2 == 0)
{
    forward();
  } else if (irSensorValue1 == 1 &&
irSensorValue2 == 0) {
    left();
  } else if (irSensorValue1 == 0 &&
irSensorValue2 == 1) {
    right();

  }
}
```

CODE

2. Obstacle detection

Ultrasonic sensor detects obstacles by sending sound waves.

- Trigger Pin – Sends high frequency signal
- Echo Pin - Receive the Signal

```
// Ultrasonic sensor code
digitalWrite(trigPin, LOW);
delayMicroseconds(2);
digitalWrite(trigPin, HIGH);
delayMicroseconds(7);
digitalWrite(trigPin, LOW);
duration = pulseIn(echoPin, HIGH);
distance = duration/34.2;
 if(distance==0){
  distance=100;
}
```

2. Obstacle avoiding

movement sequence:

- left() - turning left to avoid the obstacle
- forward() - moving forward to pass the obstacle
- right() - turning right to align with the original track
- forwardU() - continuing forward after avoiding the obstacle

```
if(distance<10)
    {
     left();
      delay(1000);
      forward();
      delay(1700);
      right();
      delay(1400);
     forwardU();
  irSensorValue1 = digitalRead(irPin1);
  irSensorValue2 = digitalRead(irPin2);

while(irSensorValue1 == 0 && irSensorValue2 == 0 ){
   irSensorValue1 = digitalRead(irPin1);
irSensorValue2 = digitalRead(irPin2);
}

  stop();
  delay(2000);
  forwardU();
  delay(100);
   irSensorValue2 = digitalRead(irPin2);
  turn();
  while(irSensorValue2 == 0){
   irSensorValue2 = digitalRead(irPin2);
}
}

}
```

REFERENCES

- [1]https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.sciencebuddies.org%2Fscience-fair-projects%2Fproject-ideas%2FRobotics_p042%2Frobotics%2Farduino-self-driving-car&psig=AOvVaw12ht2KLSrzdl5yJLgyfdQz&ust=1687195535503000&source=images&cd=vfe&ved=0CBEQjRxqFwoTCLCs_6arzf8CFQAAAAAdAAAAABAR
- [2] https://upload.wikimedia.org/wikipedia/commons/thumb/4/4c/Logo-tinkercad-wordmark.svg/2560px-Logo-tinkercad-wordmark.svg.png
- [3] https://www.einscan.com/wp-content/uploads/2018/11/pressrel1.jpg
- [4] https://i.ytimg.com/vi/PrhFy8tD2t4/maxresdefault.jpg

RESULTS AND CONCLUSION

- Develop an autonomous vehicle that can drive autonomously on a given track.
- Being able to detect obstacles, avoid the obstacle and return back to the track.
- Optimize and maintain a constant speed.