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Precision Farming Using Autonomous Vehicle

Group A1:

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Arsany Girgis

(1)

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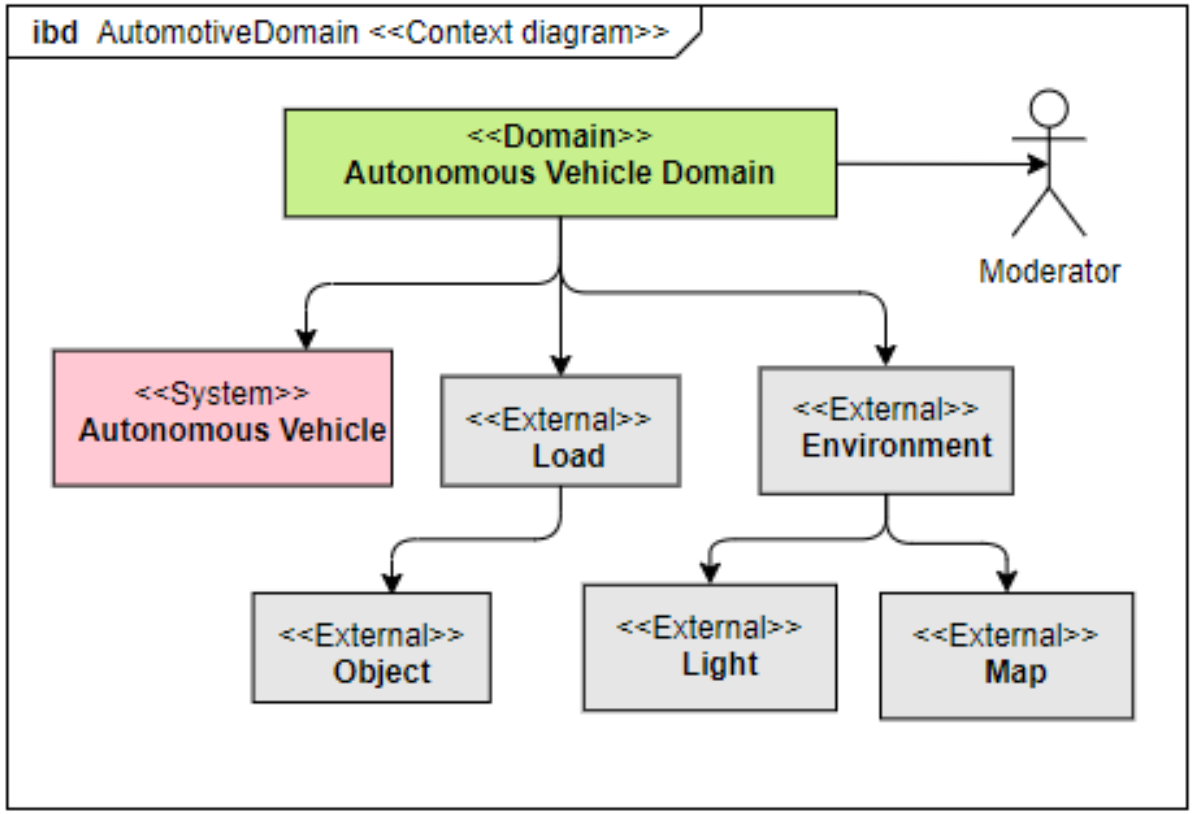
The Software Modelling

Context Diagram



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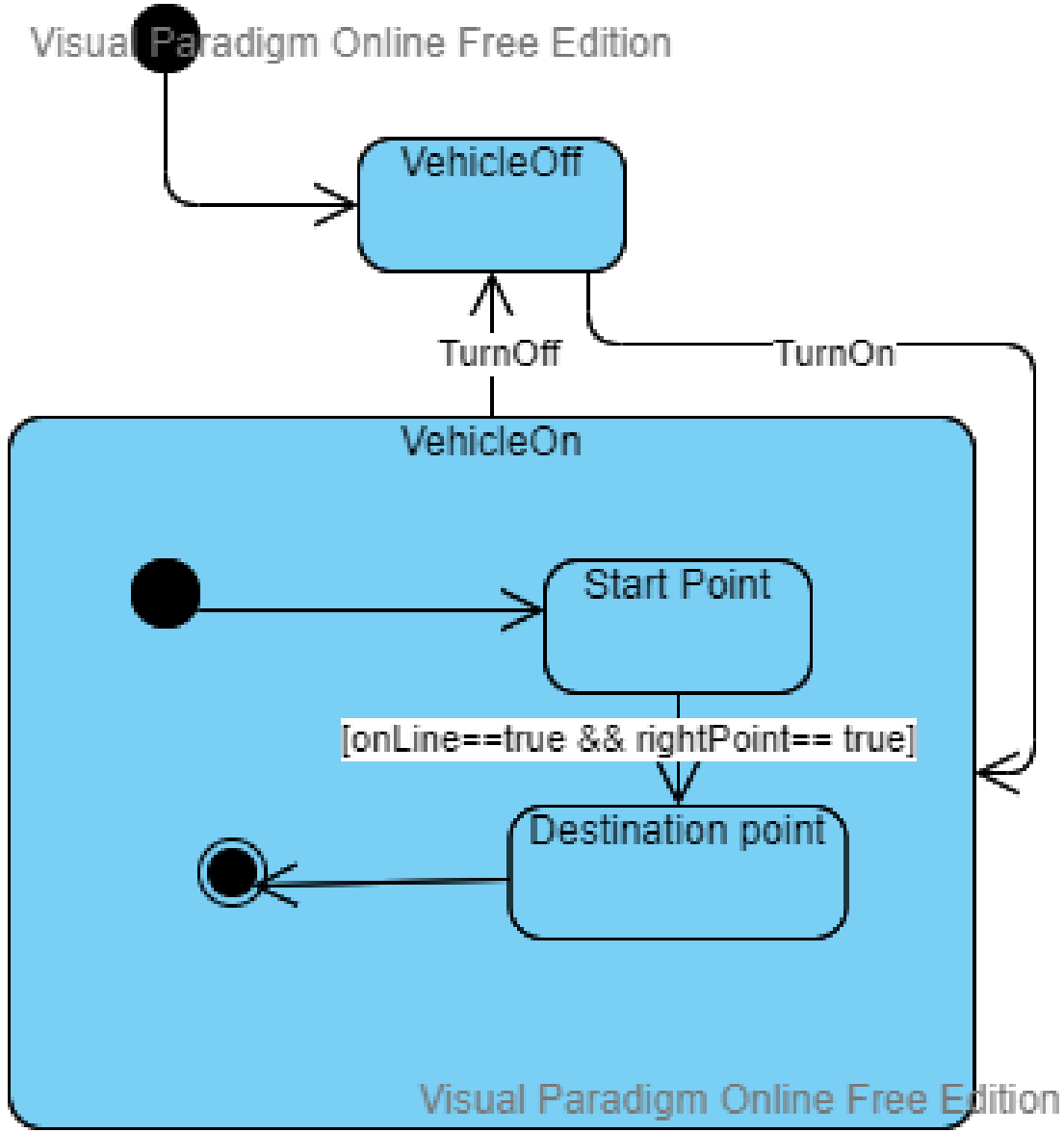
State Machine Diagram



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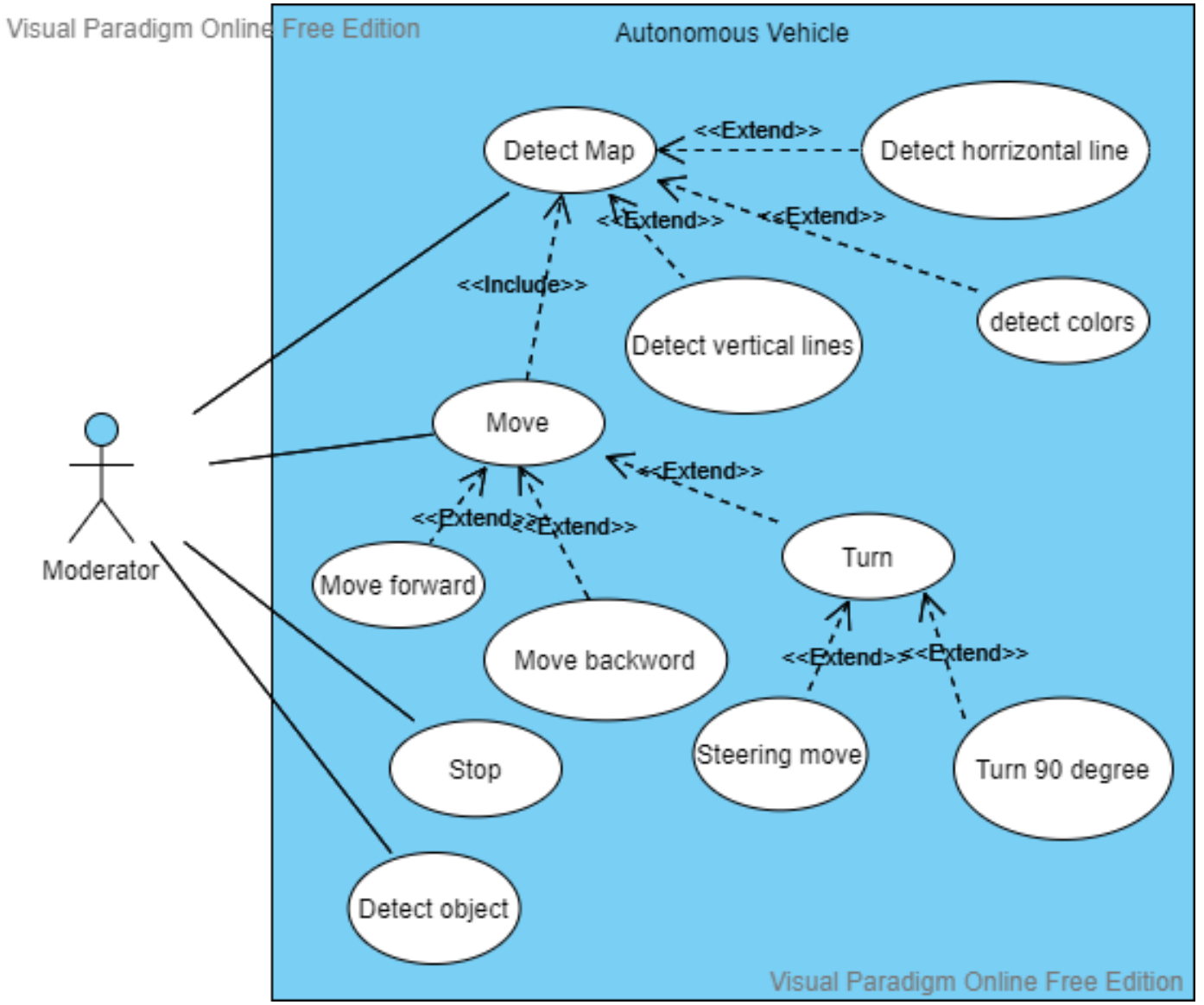
Use Case Diagram



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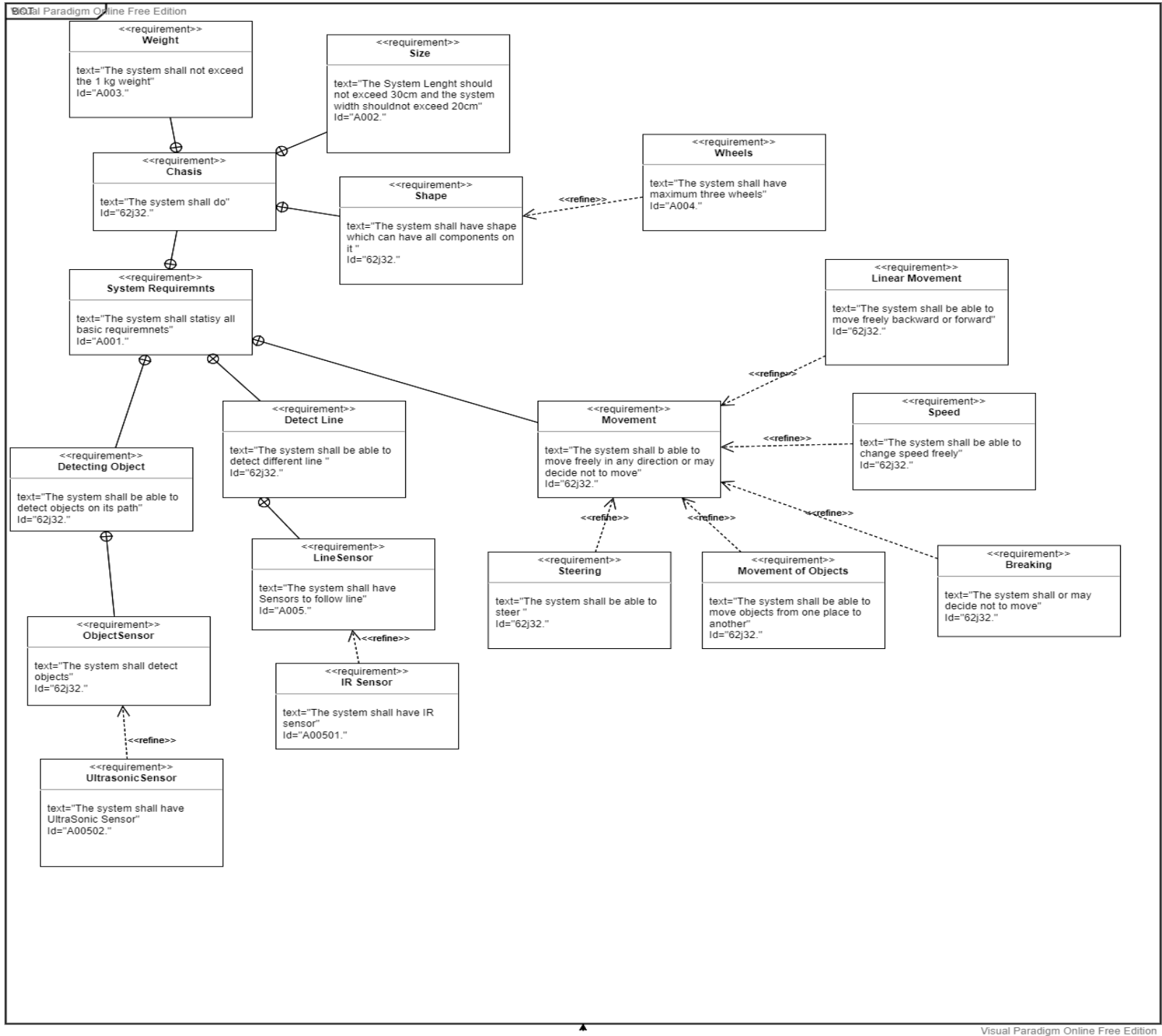
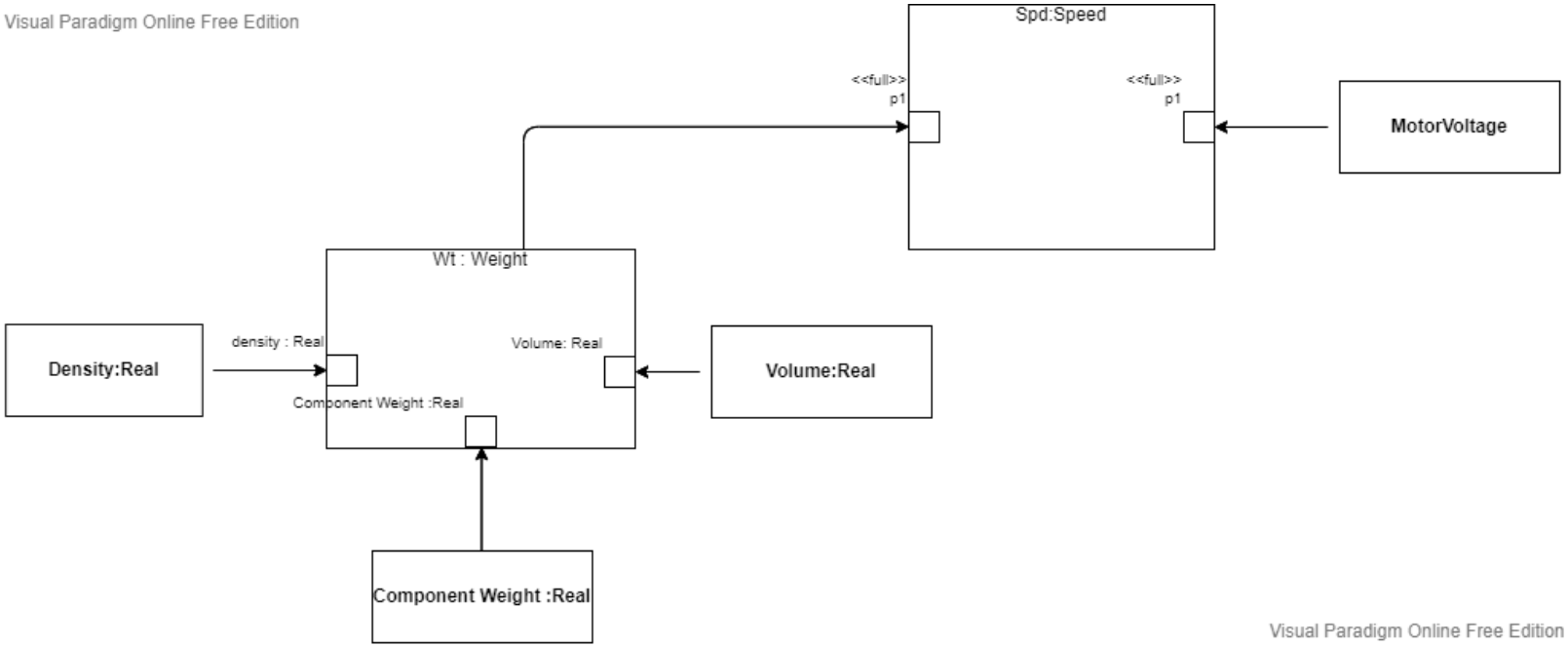
Requirement Diagram



Parametric Diagram



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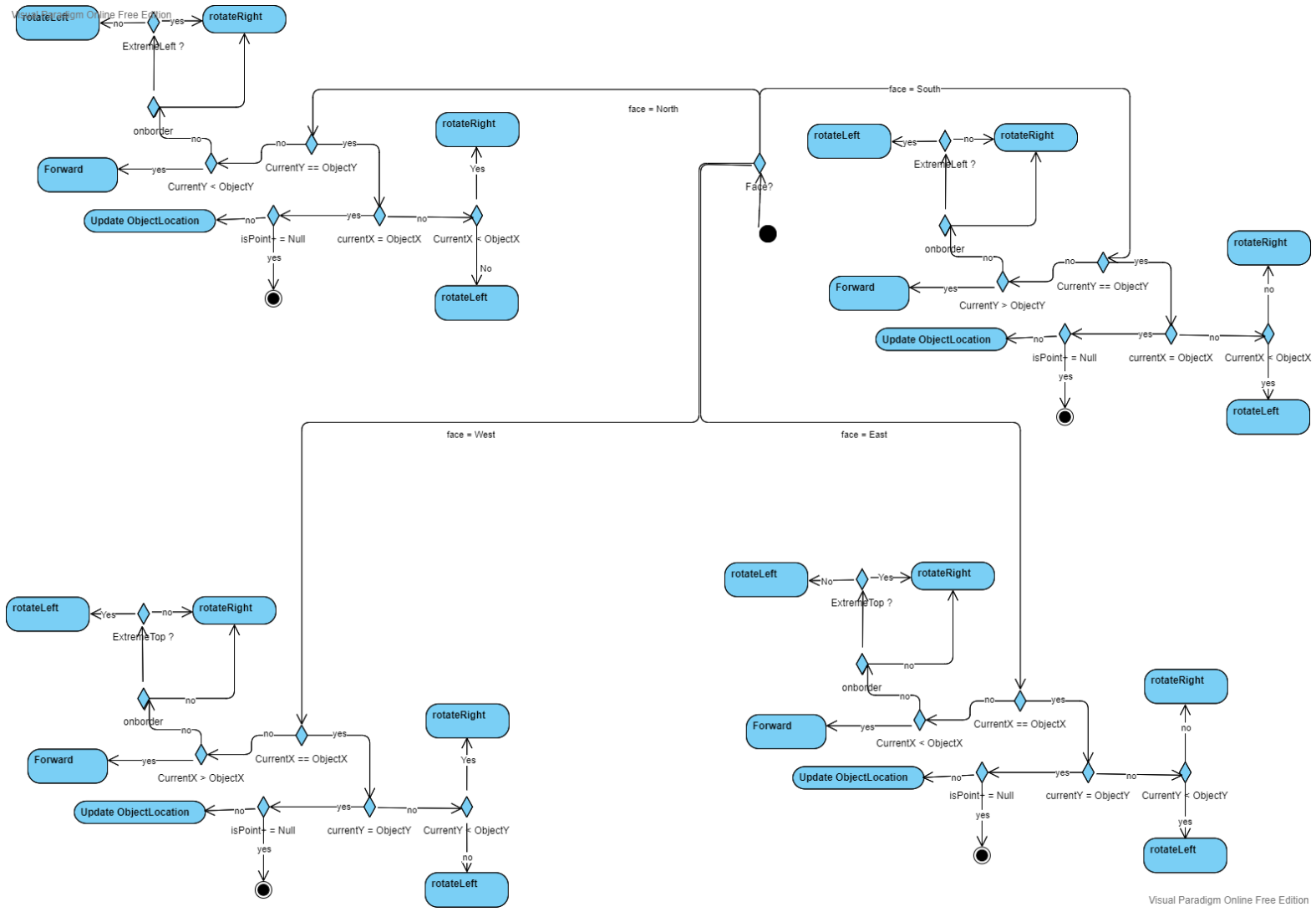
Activity Diagram



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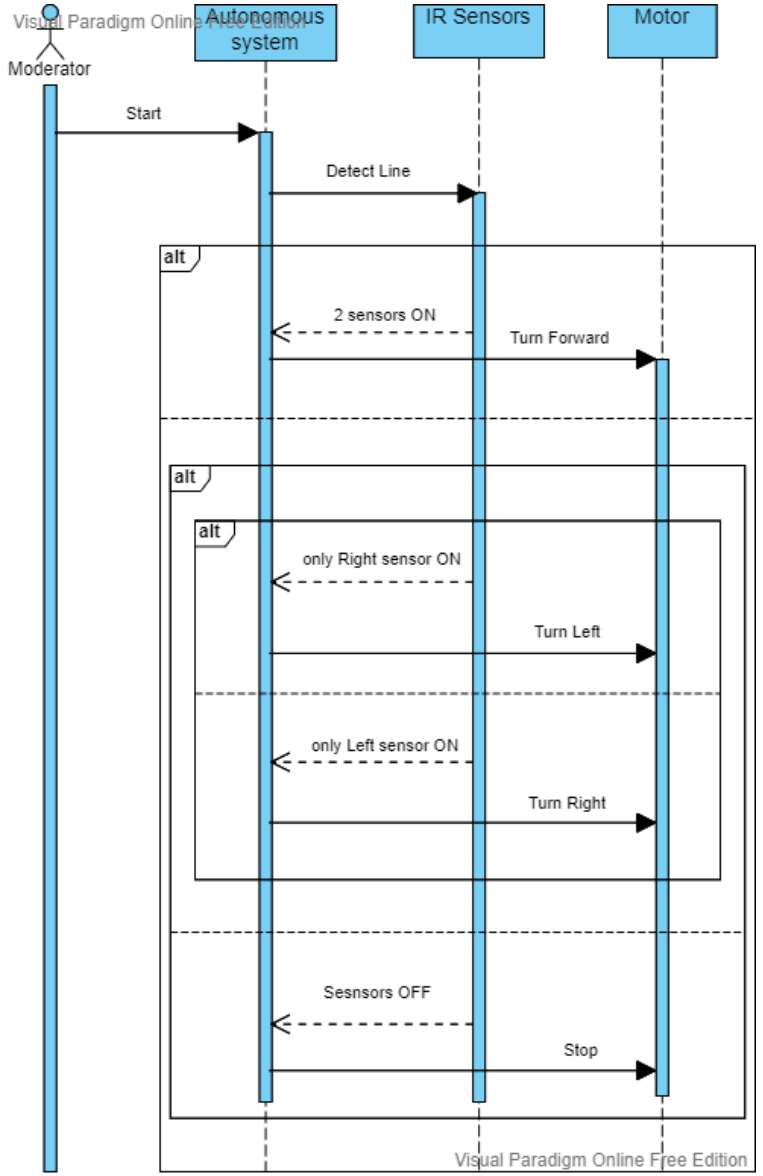
Sequence Diagram



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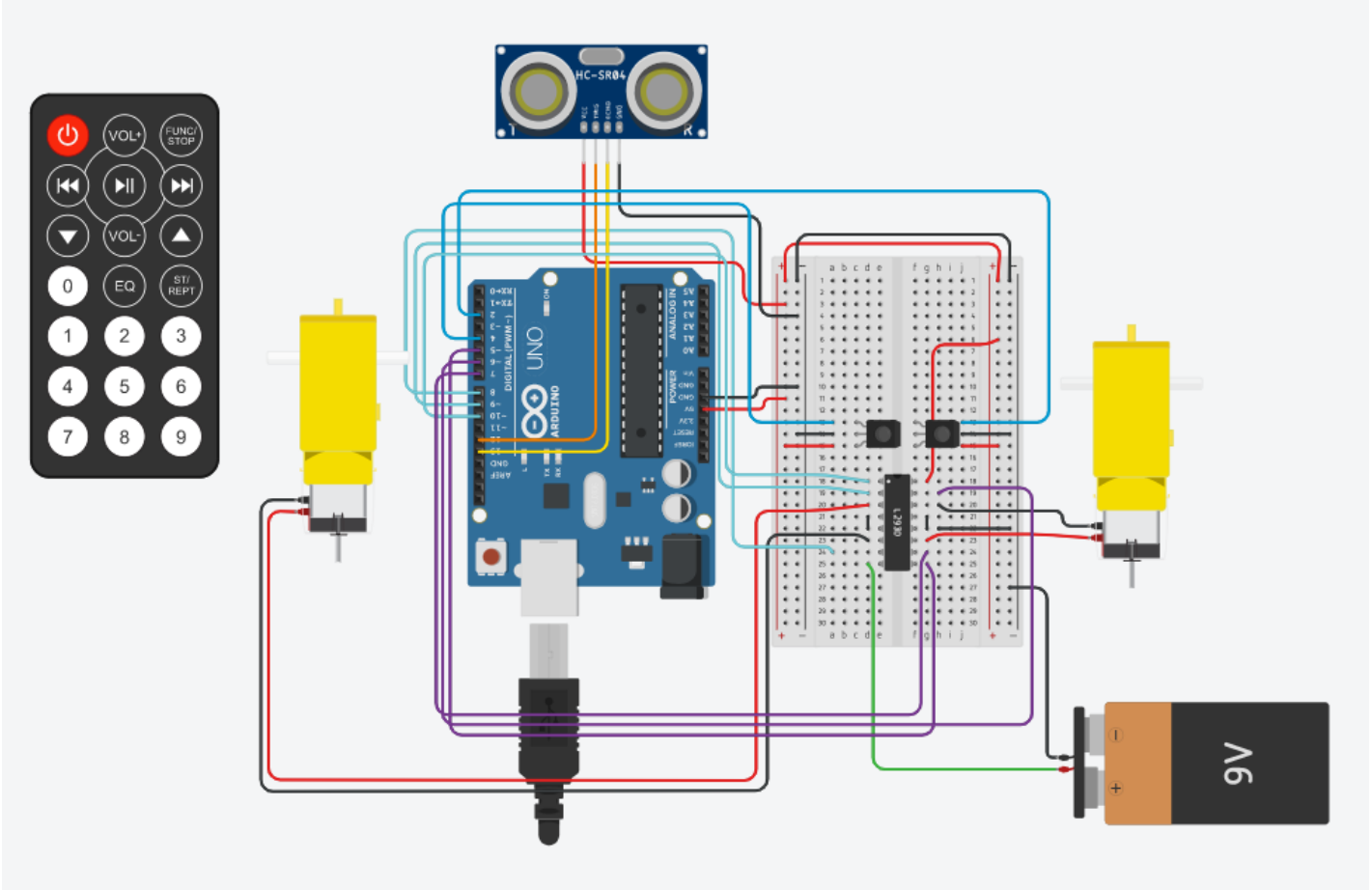
TinkerCad simulation



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The Hardware Modelling

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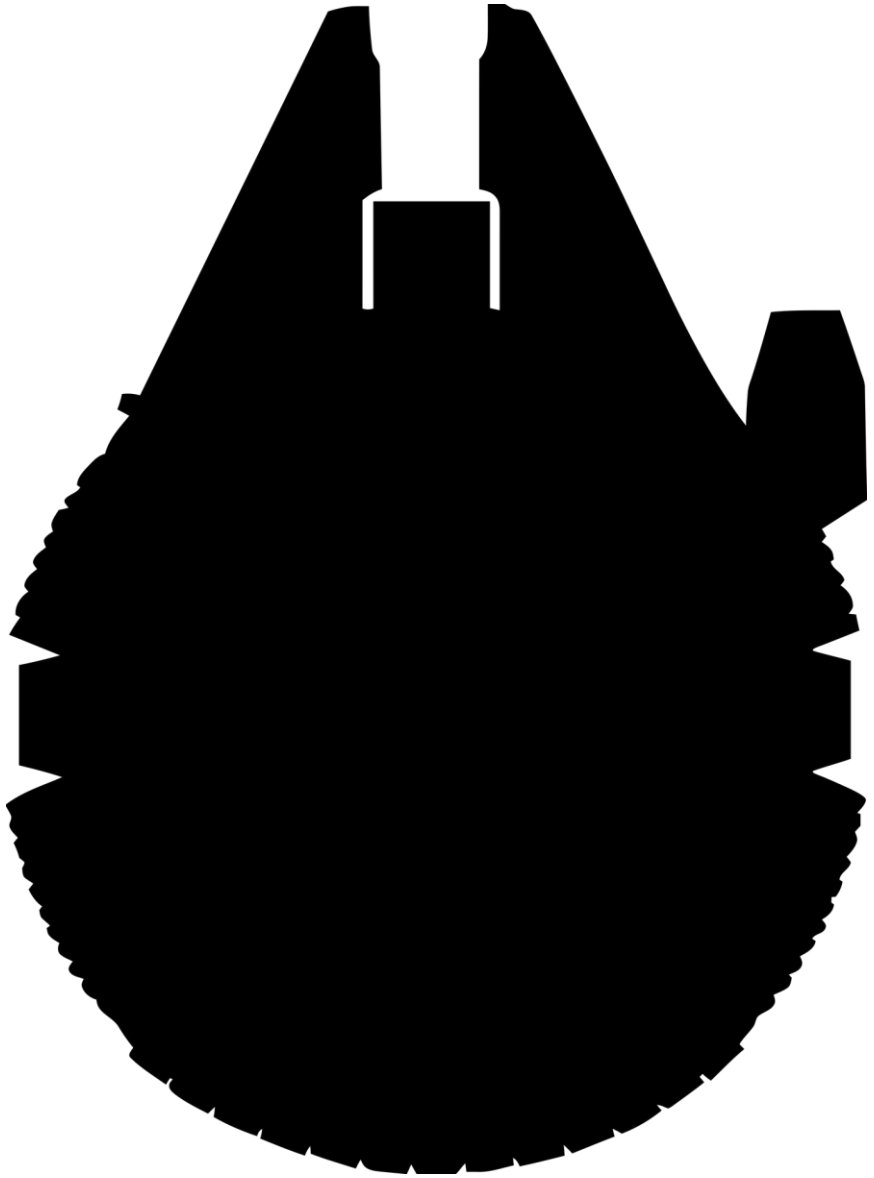
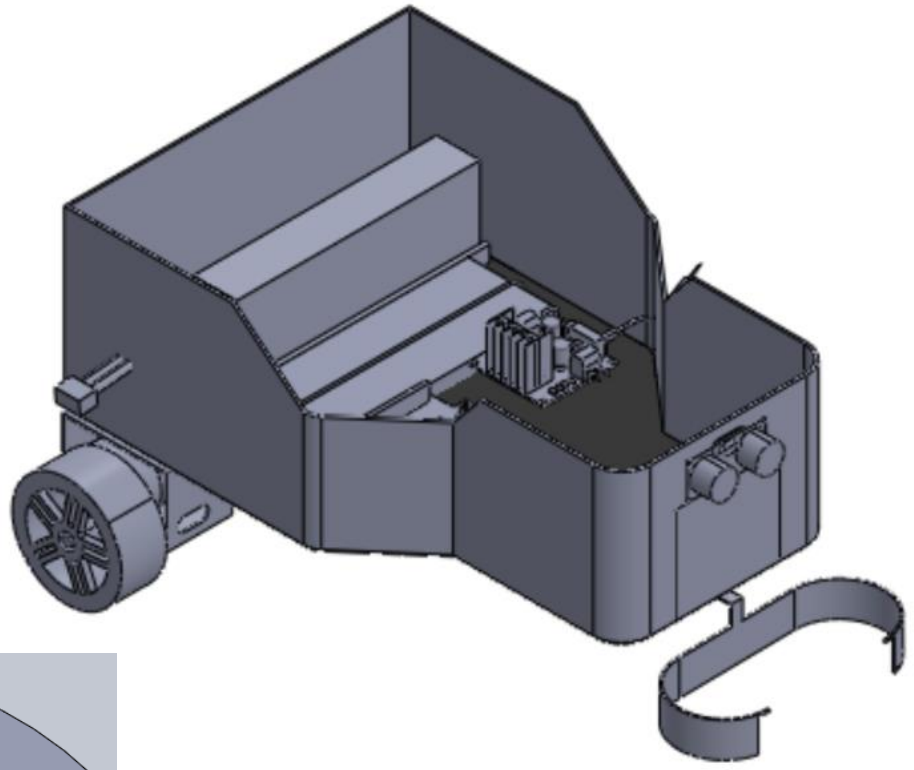
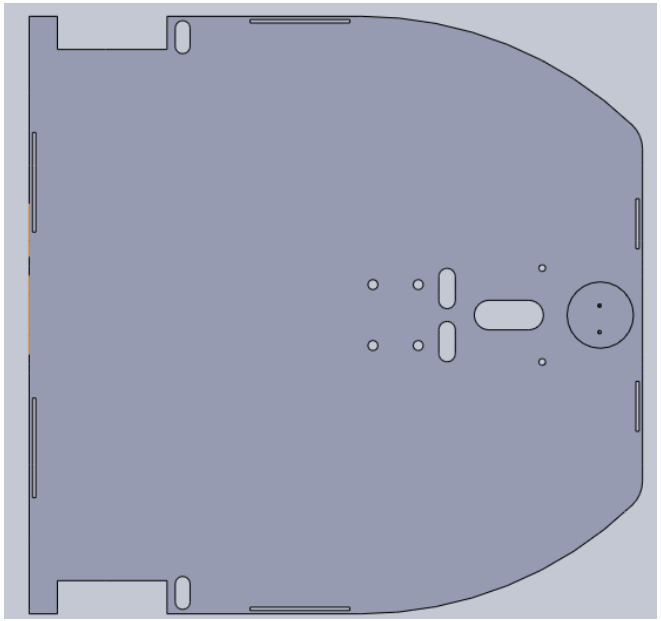
Design Inspiration



(1)

Design1





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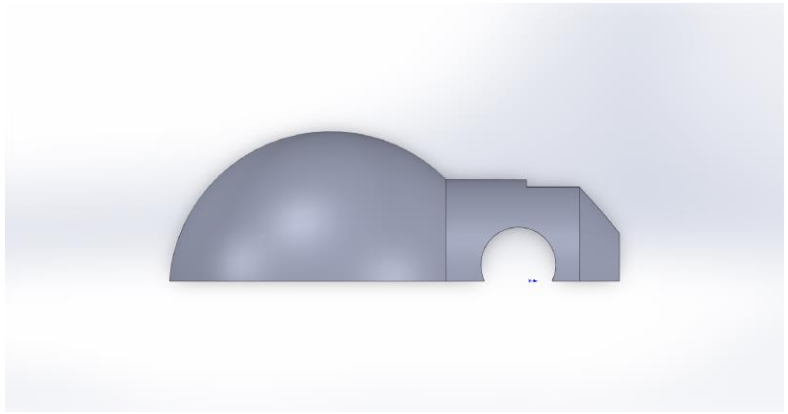
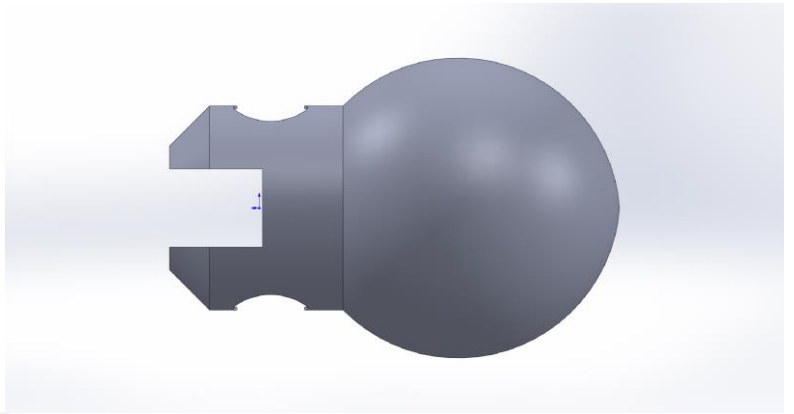
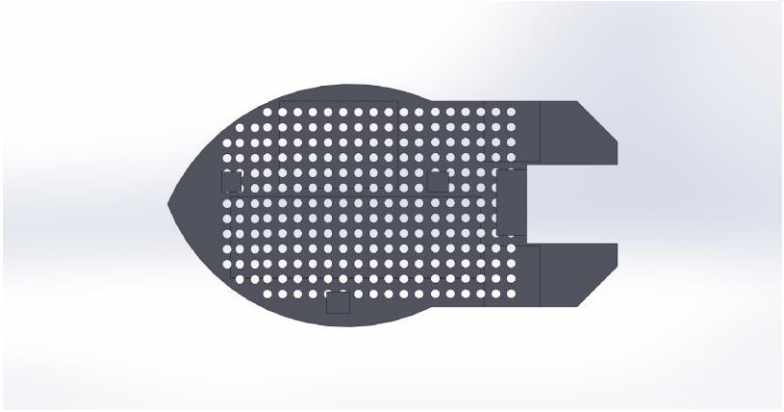
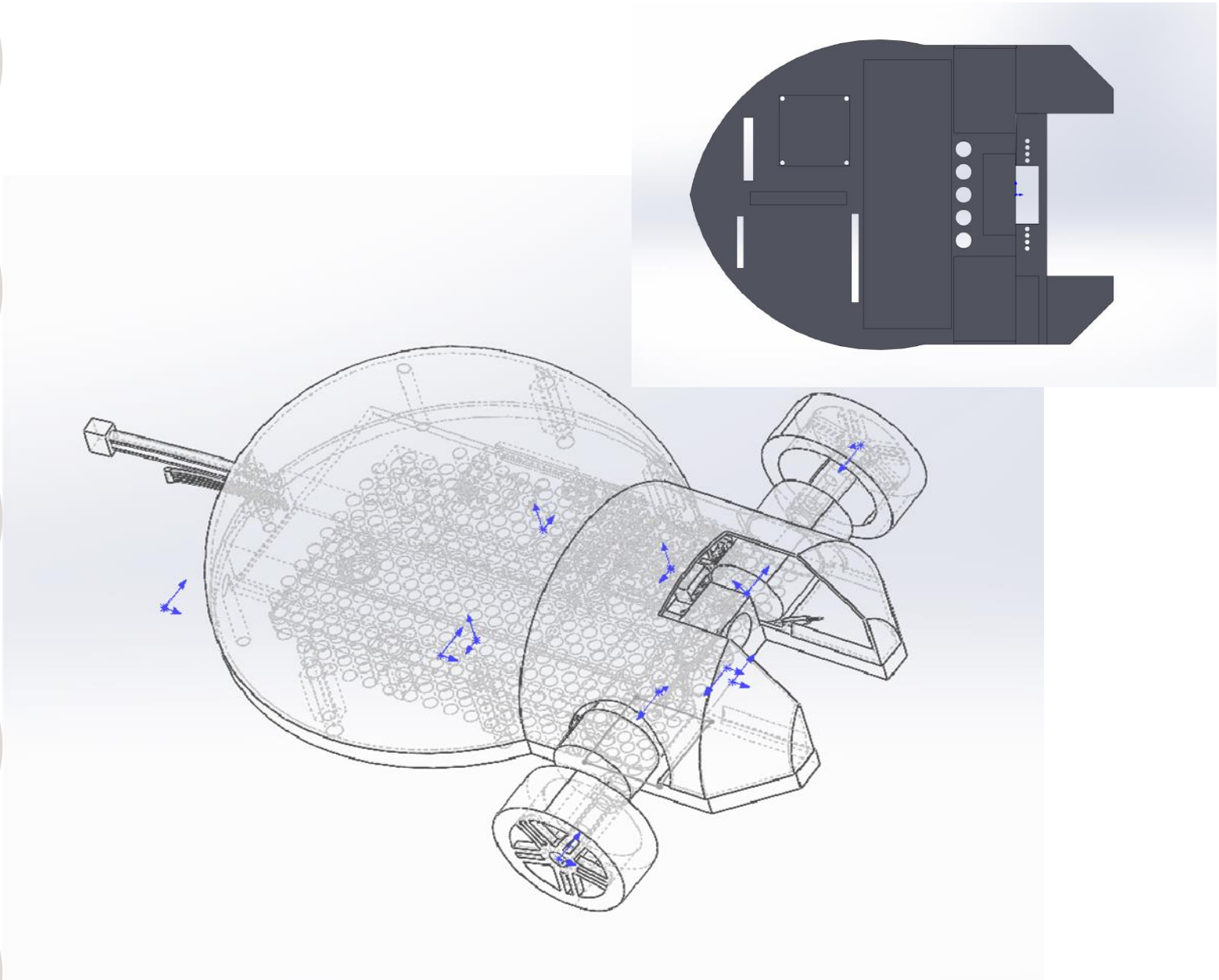
Design2







Design2



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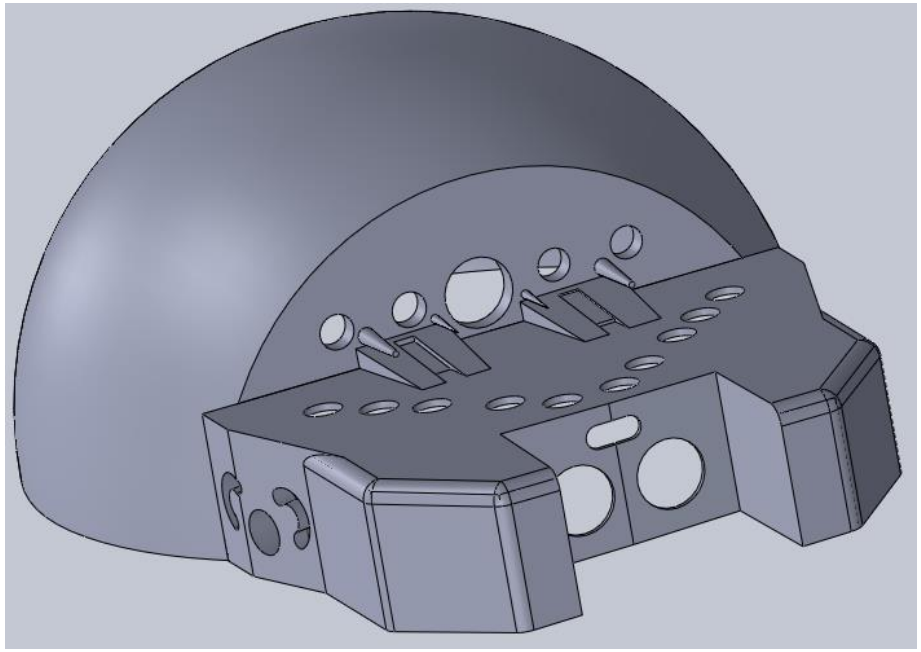
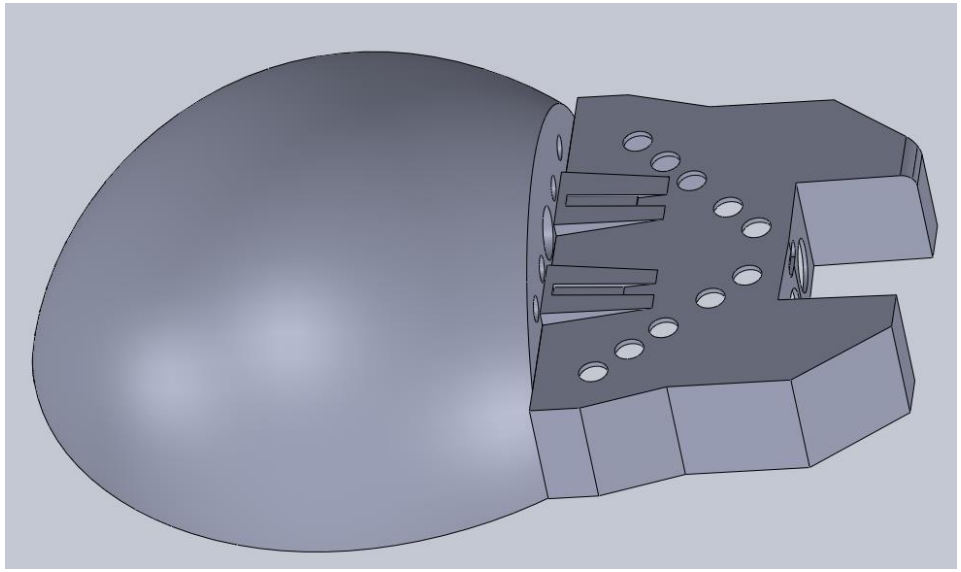
Final Design





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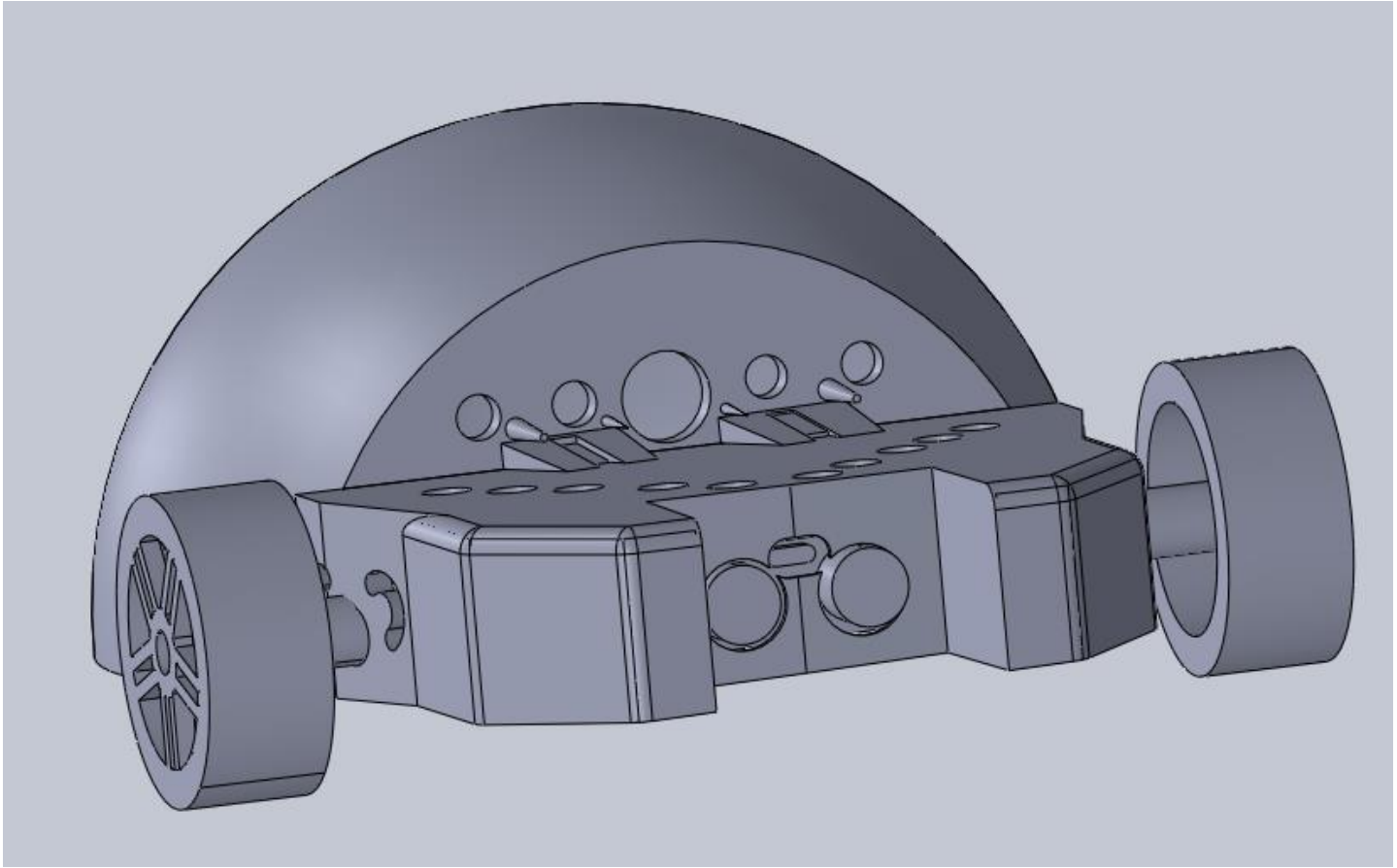
Final Design



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Code Implementation

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Motor Pins Configuration

```
//This is to rotate motor
void switchState(){
  switch(state){
    case Stop:
      digitalWrite(motorA1,LOW);
      digitalWrite(motorB1,LOW);
      digitalWrite(motorA2,LOW);
      digitalWrite(motorB2,LOW);
      break;
    case Forward:
      digitalWrite(motorA1,HIGH);
      digitalWrite(motorB1,HIGH);
      digitalWrite(motorA2,LOW);
      digitalWrite(motorB2,LOW);
      break;

    case Right:
      digitalWrite(motorA1,HIGH);
      digitalWrite(motorB1,LOW);
      digitalWrite(motorA2,LOW);
      digitalWrite(motorB2,HIGH);
      break;

    case Left:
      digitalWrite(motorA1,LOW);
      digitalWrite(motorB1,HIGH);
      digitalWrite(motorA2,HIGH);
      digitalWrite(motorB2,LOW);
      break;

      case Backward:
      digitalWrite(motorA1,LOW);
      digitalWrite(motorB1,LOW);
      digitalWrite(motorA2,HIGH);
      digitalWrite(motorB2,HIGH);
      break;
  }
}
```

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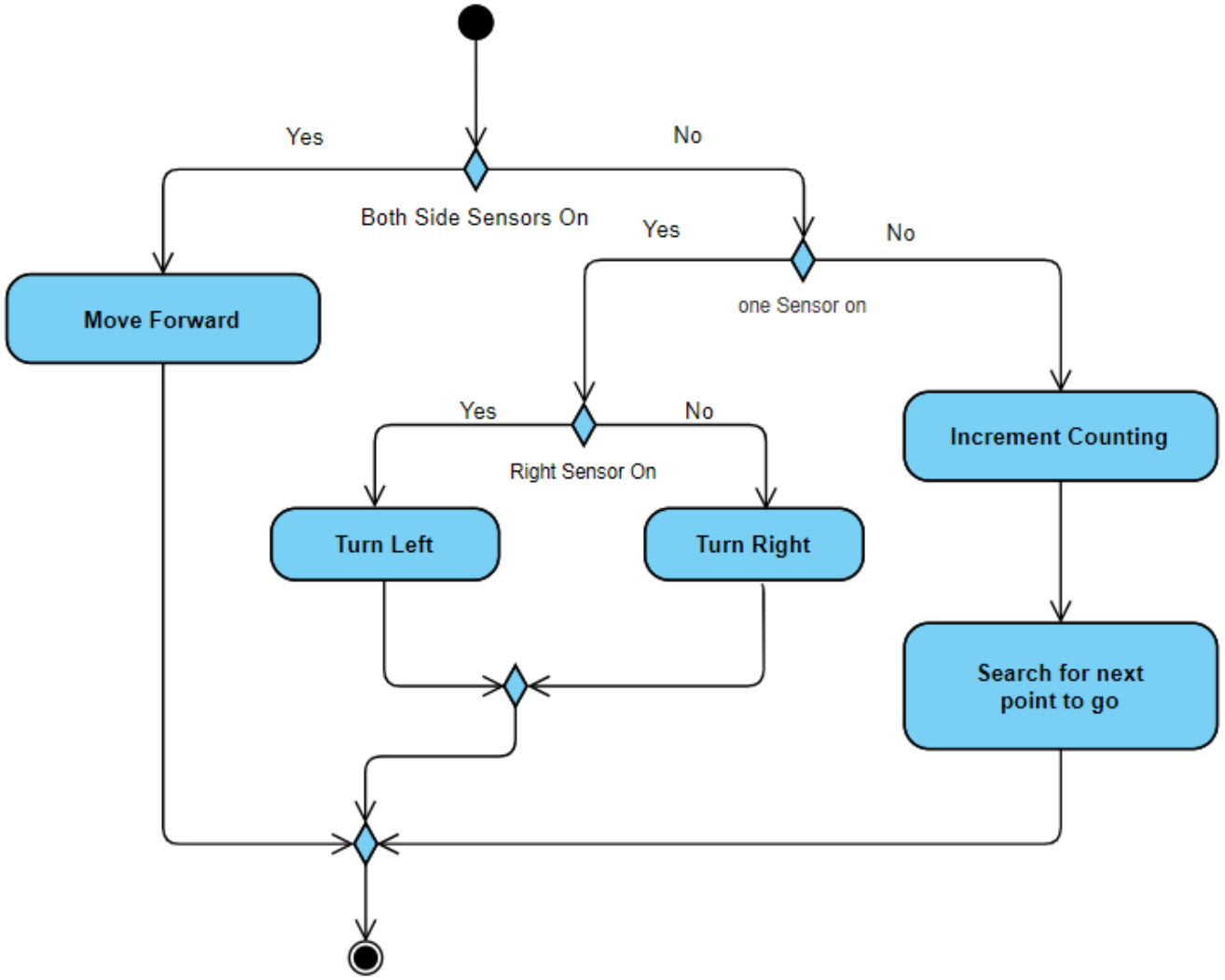
Line Follower Logic



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Line Follower Logic

```
// This is to keep bot allign
void onLine()
{
   if(digitalRead(ln1) == HIGH && digitalRead (ln2) == HIGH)
  {
    change = true;
    state = Forward;
  }
  if(digitalRead(ln1)==HIGH && digitalRead(ln2)==LOW)
  {
    state = Left;
  }
   if(digitalRead(ln1)==LOW && digitalRead(ln2)==HIGH)
   {
    state = Right;}
```

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Line Follower Logic

```
  if (digitalRead (ln1)== LOW && digitalRead(ln2)== LOW)
  {
    if (change == true){
      change = false;
      mapp(); // Here we are updating the position on map
    }
    state = Stop;
    switchState();
    Movement();
  }
  switchState();
}
```

Color Detection

```
//This is to get Green using filter  s2 s3
int getGreenPW() {
  digitalWrite(S2,HIGH);
  digitalWrite(S3,HIGH);
  int PW;
  PW = pulseIn(sensorOut, LOW);
  return PW;

  }
//This is to get Blue using filter  s2 s3
int getBluePW(){
    digitalWrite(S2, LOW);
    digitalWrite(S3, HIGH);
    int PW;
    PW = pulseIn(sensorOut, LOW);
    return PW;
  }
```

```
void loop(){
    Serial.println(currentColor);
}
```

```
//This is to get red using filter  s2 s3
int getRedPW() {
  digitalWrite(S2,LOW);
  digitalWrite(S3,LOW);
  int PW;
  PW = pulseIn(sensorOut, LOW);
  return PW;
  }

  // This code is to get current color
void colorCall(){
    getRedPW();
    getBluePW();
    getGreenPW();
    getColor();
}
```

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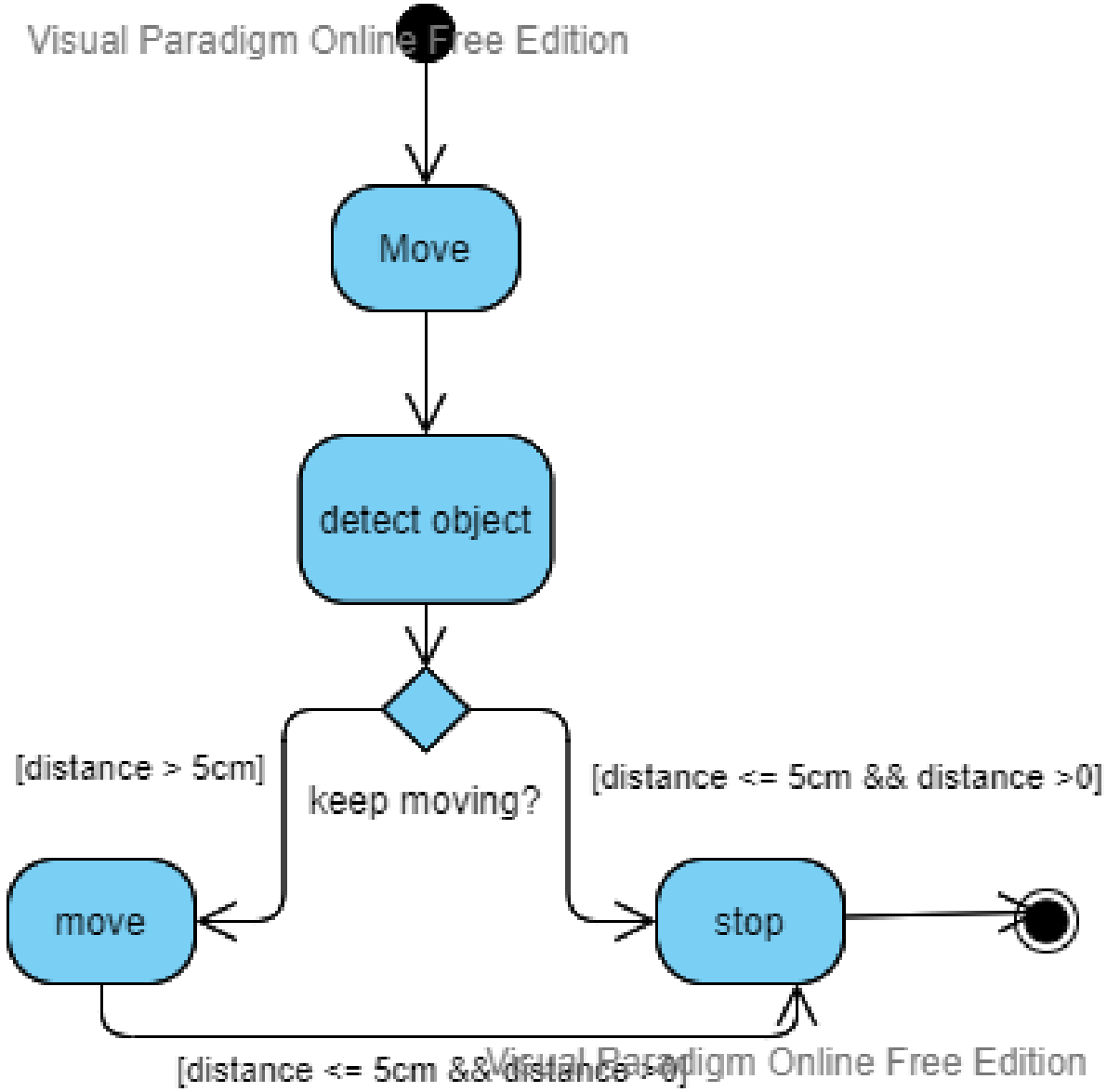
Color Detection

```
//This is to update the color variable and also to calibrate the readings
void getColor(){
    if ((redPW >= 114 && redPW <= 150) && (greenPW >= 324 && greenPW <= 350) && (bluePW >= 364 && bluePW <= 395))
    {
        currentColor = 0;} // orange
    else if ((redPW >= 320 && redPW <= 340) && (greenPW >= 505 && greenPW <= 520) && (bluePW >= 235 && bluePW <= 355))
    {
        currentColor = 3;} // purple
    else if ((redPW >= 174 && redPW <= 230) && (greenPW >= 190 && greenPW <= 210) && (bluePW >= 320 && bluePW <= 335))
    {
        currentColor = 2;} // green
    else if ((redPW >= 232 && redPW <= 290) && (greenPW >= 170 && greenPW <= 190) && (bluePW >= 130 && bluePW <= 160))
    {
        currentColor = 1;} // cyan
    else if ((redPW >= 90 && redPW <= 108) && (greenPW >= 95 && greenPW <= 115) && (bluePW >= 80 && bluePW <= 95))
    {
        currentColor = 4;} // white
    else if (((redPW >= 900 && redPW <= 960) && (greenPW >= 1000 && greenPW <= 1065) && (bluePW >= 800 && bluePW <= 860))
    || ((redPW >= 622 && redPW <= 750) && (greenPW >= 710 && greenPW <= 810) && (bluePW >= 500 && bluePW <= 677)))
    {
        currentColor = 5;} // black
}
```

Object Detection



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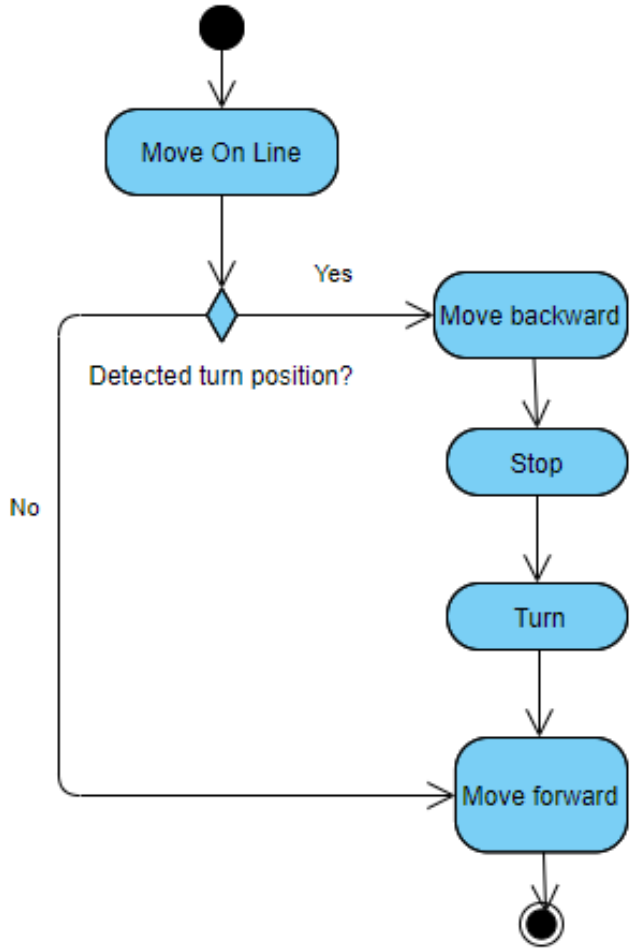
Object Detection

```
#define sonicTrig 12
#define sonicEcho 11
volatile int duration, distance;
volatile bool objectDetected= false;
void setup() {
   pinMode(sonicTrig,OUTPUT);
   pinMode(sonicEcho,INPUT);
   Serial.begin(9600);
}

void loop() {
void ultraSonic()
{
  digitalWrite(sonicTrig,HIGH);
    digitalWrite(sonicTrig,LOW);
    duration = pulseIn(sonicEcho,HIGH);
    distance = duration*0.0343/2;
    Serial.print("The Distance: ");
    Serial.println(distance);
/* the distance should be positive because at some points
 *  the ultrasonic detects with negative numbers*/
 */
    if (distance <=50 && distance >= 0)
      {
        Serial.println ("Object detected" );
        Serial.print ("Distance of the object from the car is " );
        Serial.print ( distance);
        Serial.println ( " cm");// print out the distance in cm.
        objectDetected = true;}
      else{ objectDetected = false;}
}
```

90° Turn


Move On Line
Yes
Move backward
Detected turn position?
Stop
No
Turn
Move forward

90° Turn

```
case Backward:
//analogWrite(motorPowerA,180);
//analogWrite(motorPowerB,100);

digitalWrite(motorA1,LOW);
digitalWrite(motorB1,LOW);
digitalWrite(motorA2,HIGH);
digitalWrite(motorB2,HIGH);
break;
```

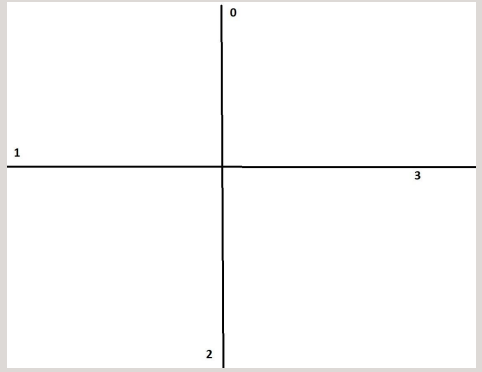
```
void rotateLeft()
{

      state = Backward;
      switchState();
      state = Stop;
      digitalWrite(motorA1,LOW);
      digitalWrite(motorB1,HIGH);
      digitalWrite(motorA2,HIGH);
      digitalWrite(motorB2,LOW);
      delay(500);
}
```

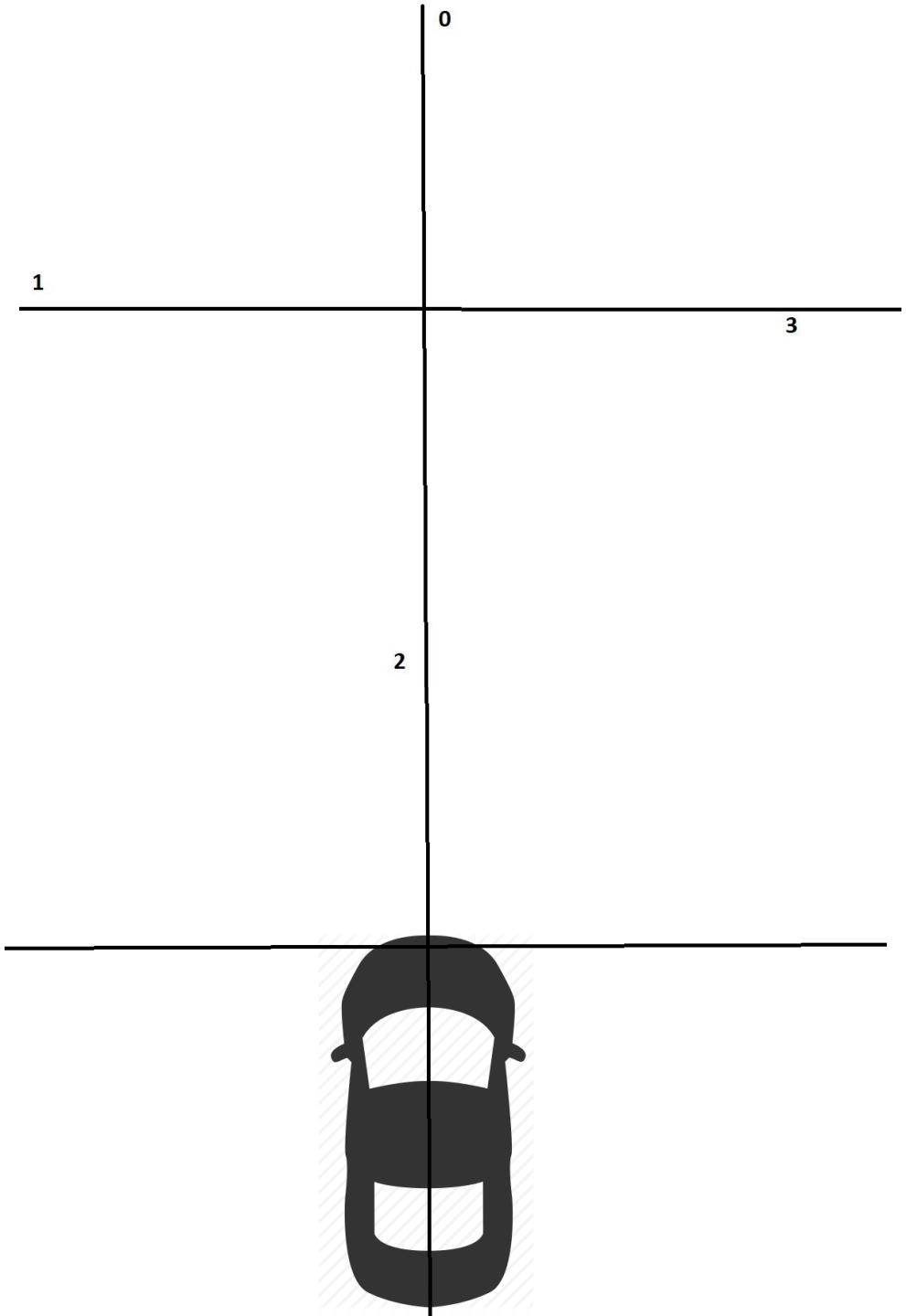
90° Turn

```
void rotateRight()
{

      state = Backward;
      switchState();
      state = Stop;
      digitalWrite(motorA1,HIGH);
      digitalWrite(motorB1,LOW);
      digitalWrite(motorA2,LOW);
      digitalWrite(motorB2,HIGH);
      delay(500);
}
```

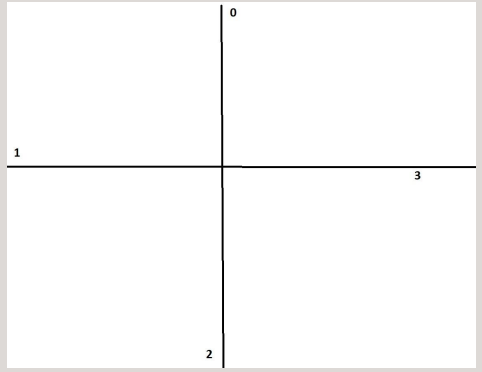
```
if (digitalRead (ln1)== LOW && digitalRead(ln2)== LOW)
{
  rotateRight();
  state= Forward;
  switchState();

}
```

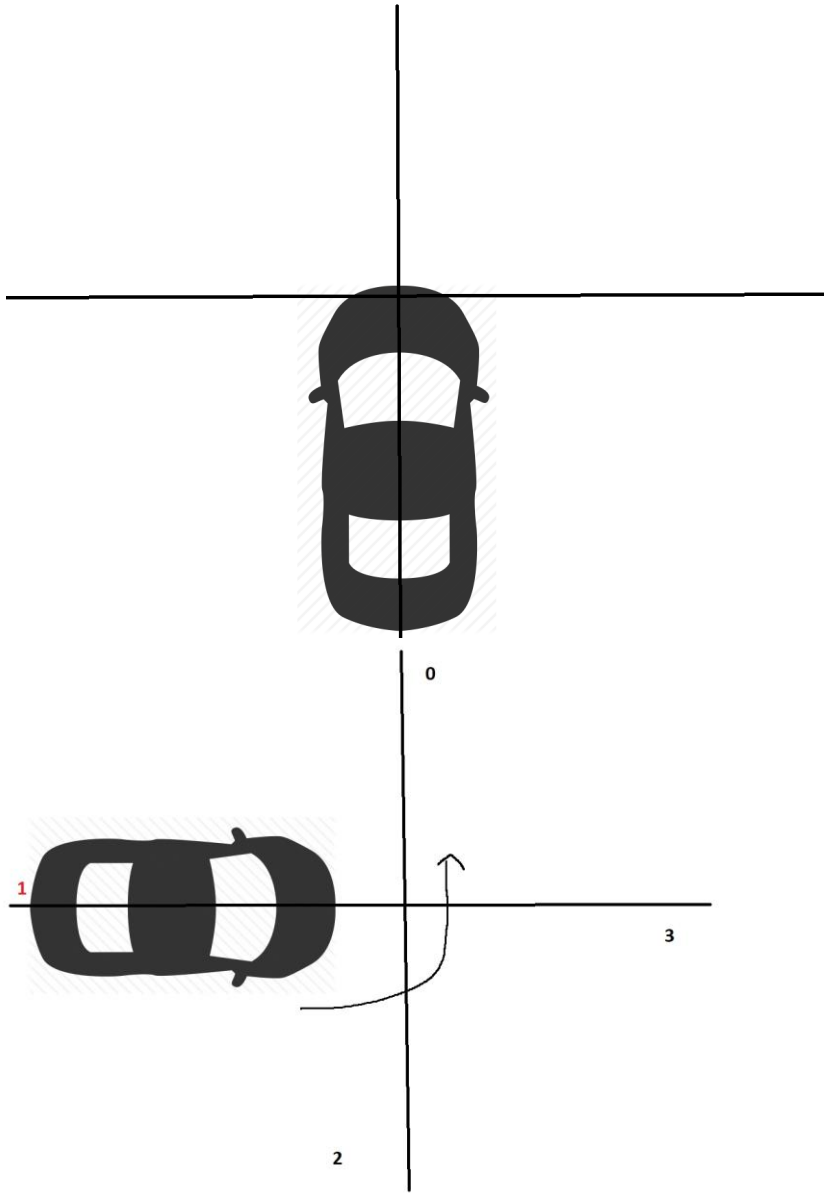
Mapping





Algorithm





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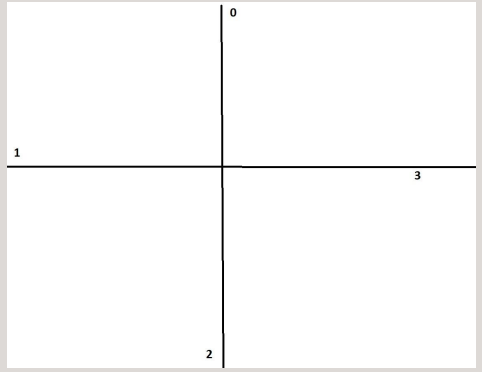
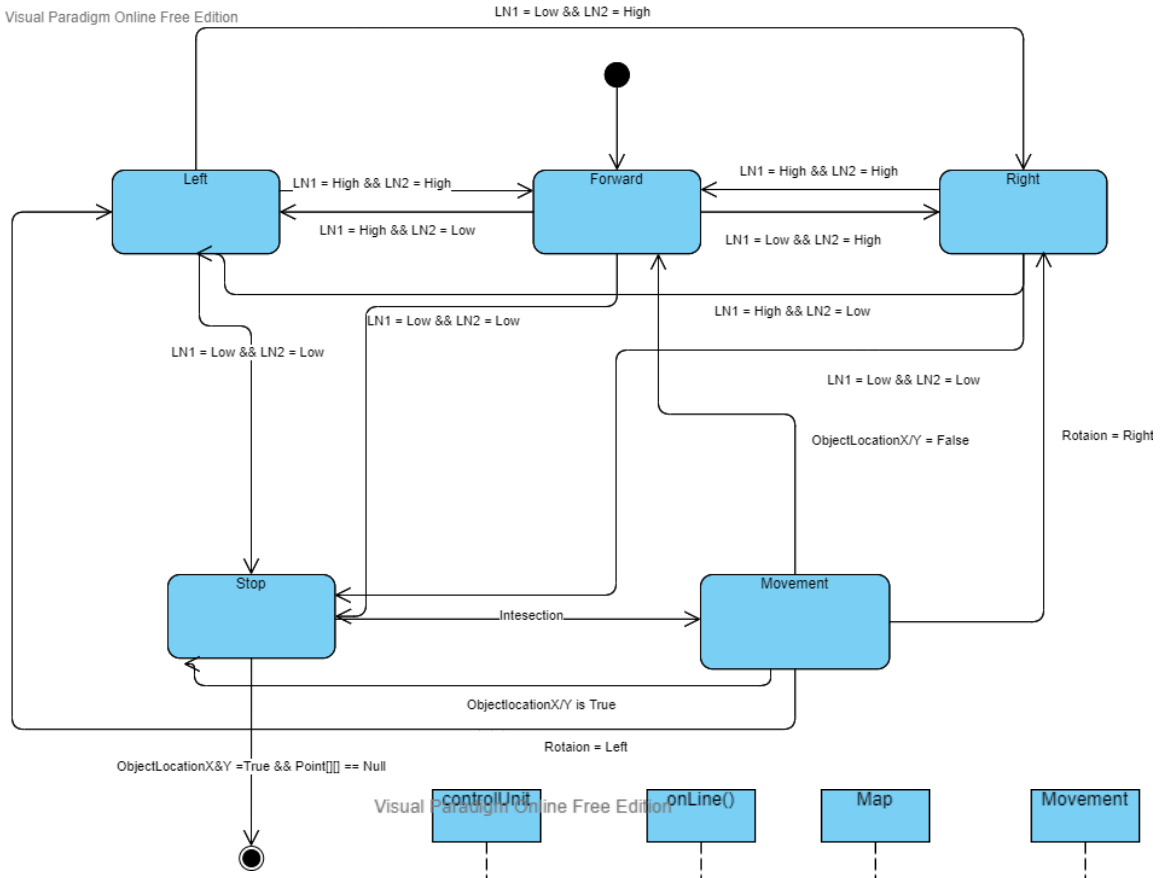
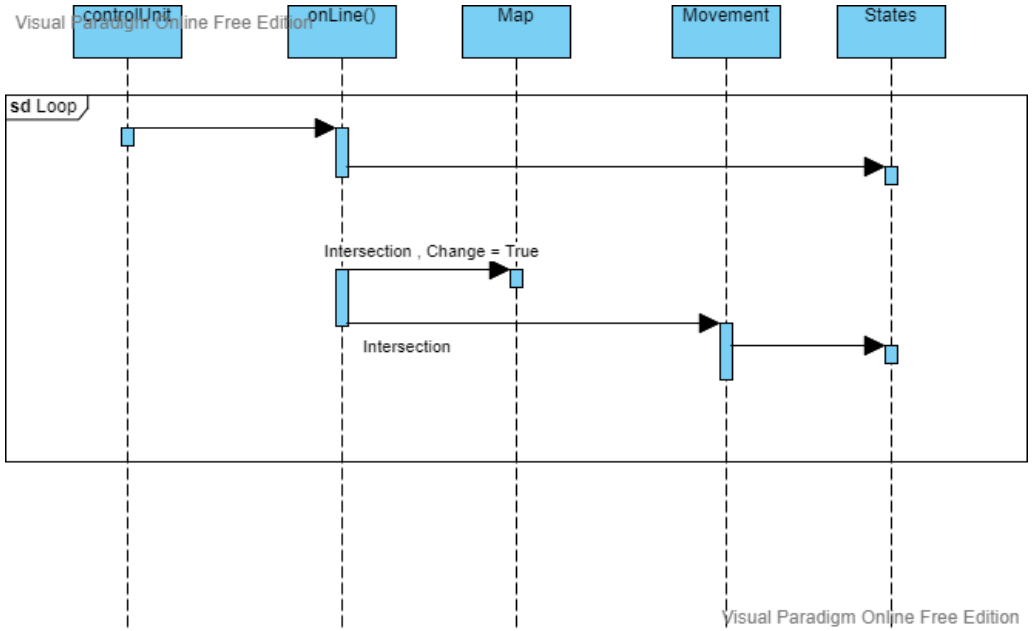
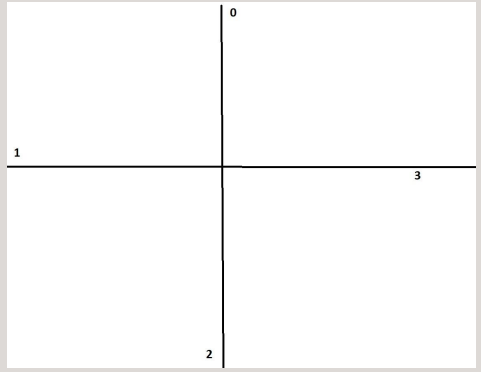
Algorithm

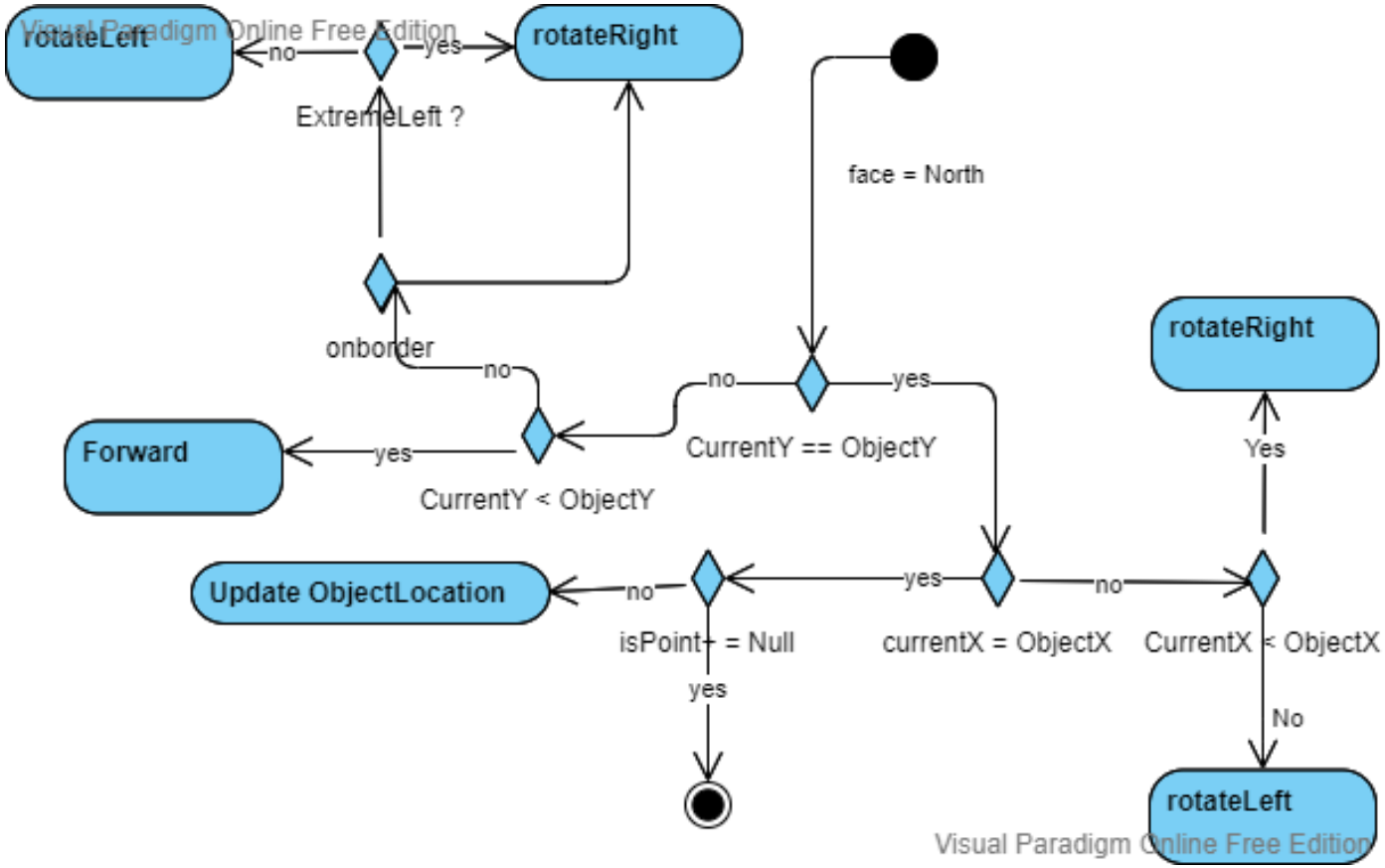




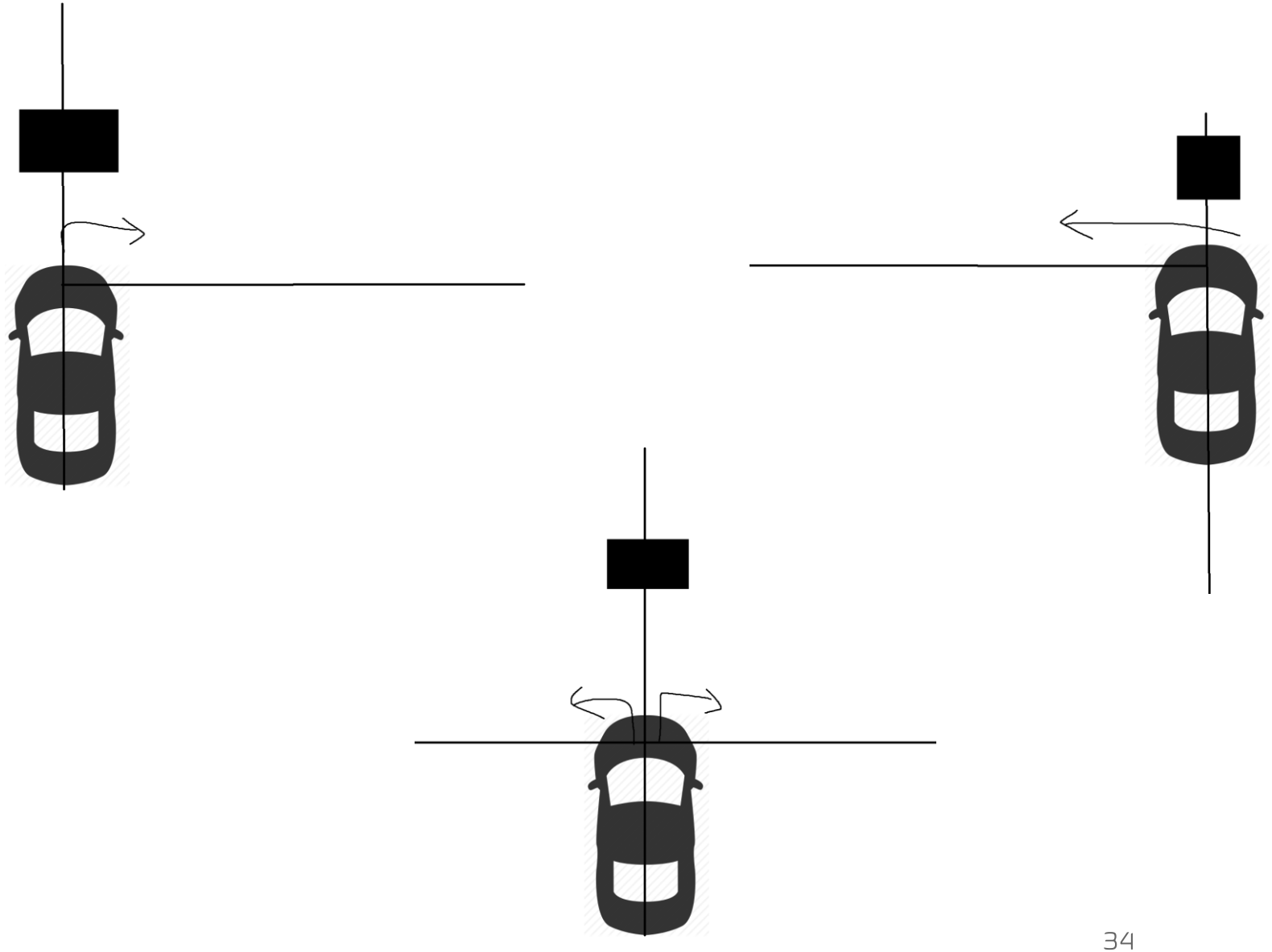


Algorithm


0
1
3
2


rotateLeft
no
yes
rotateRight
ExtremeLeft ?
face = North
onborder
no
no
yes
rotateRight
Forward
yes
CurrentY < ObjectY
CurrentY == ObjectY
Yes
Update ObjectLocation
no
yes
no
isPoint = Null
currentX = ObjectX
CurrentX < ObjectX
yes
No
rotateLeft
Visual Paradigm Online Free Edition

Obstacle Avoidance



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Sources

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