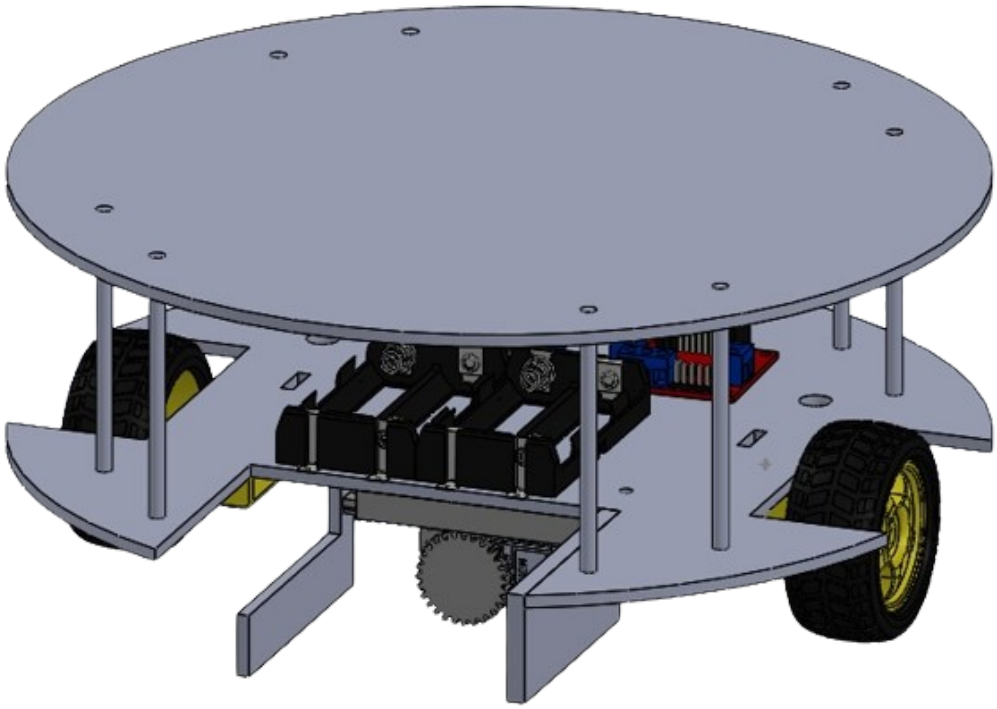
Hockey Robot



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1)Mechanical Parts:

1) Frame

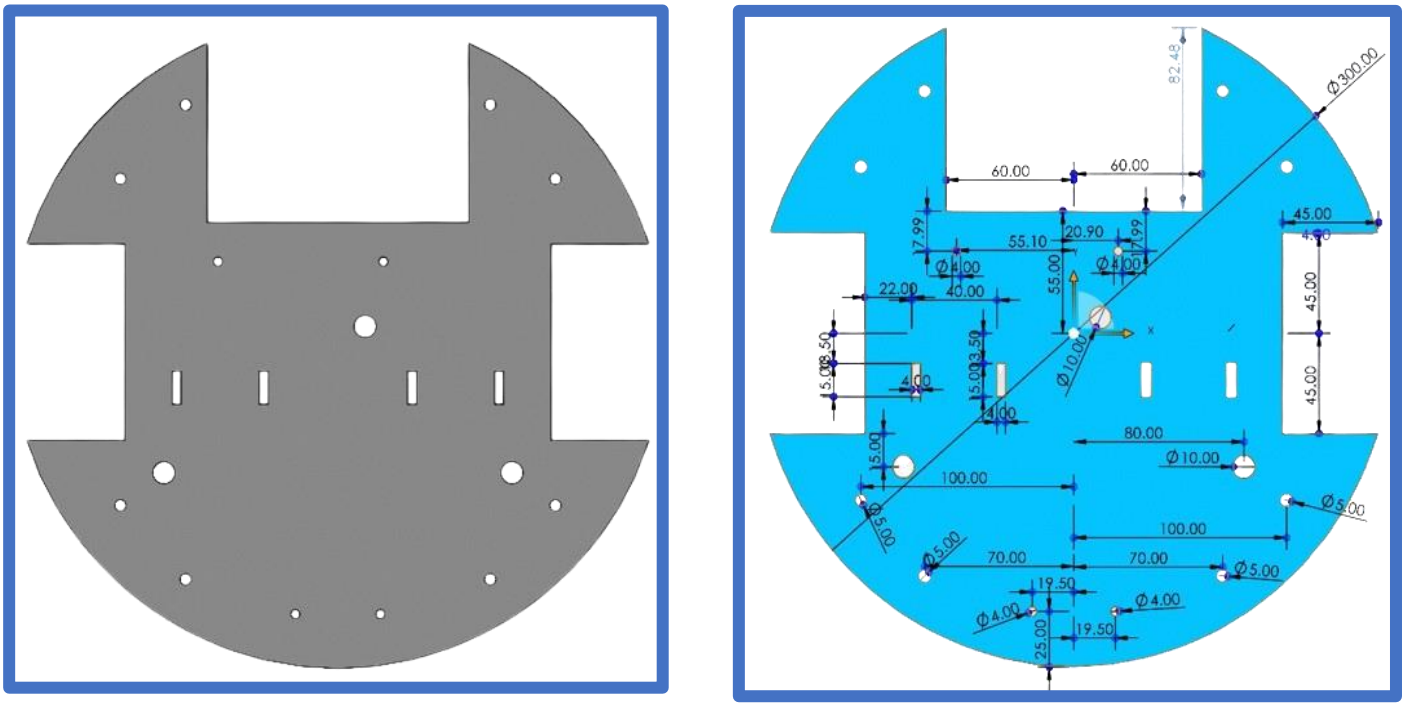

Figure 1: Wood MDF Lower Frame

2) Servo Holder

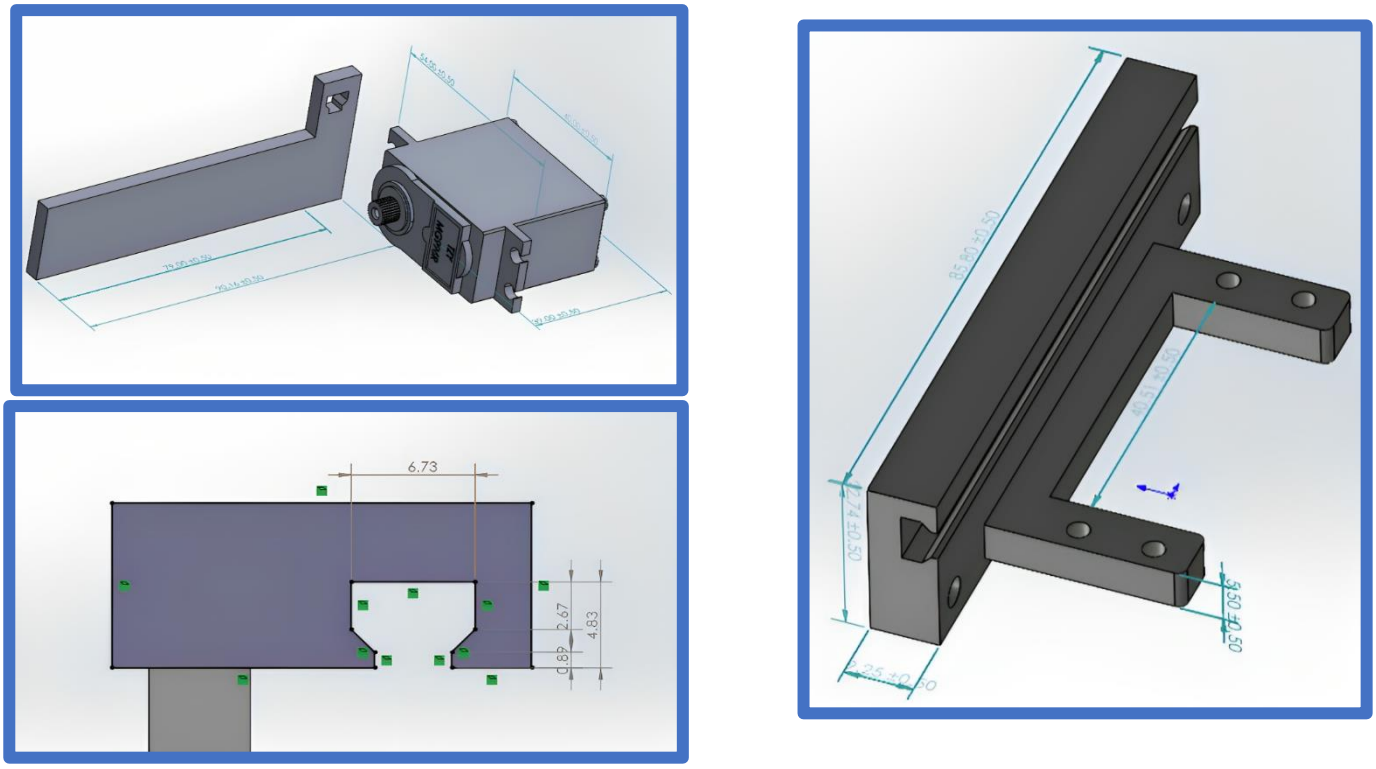

Figure 2: Holder of Servo with Rack & Pinion Mechanism

2) Stress Analysis:

The maximum displacement for uniform force of 5N on front of the car is equal to 0.005mm and is located at the tip of the front.

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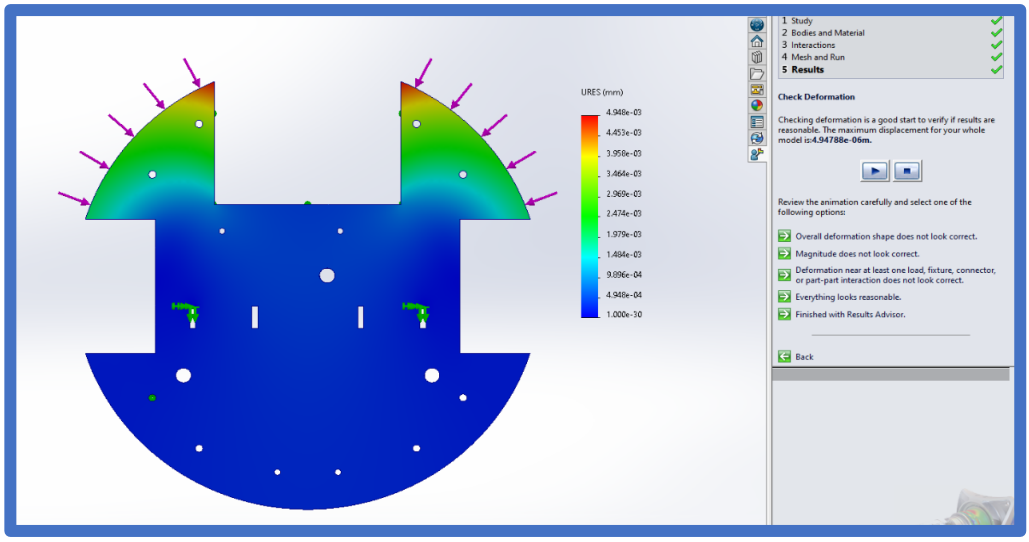


Figure 3: Analysis on 5N

The maximum displacement for uniform force of 10N on front of the car is equal to 0.01mm and is located at the tip of the front.

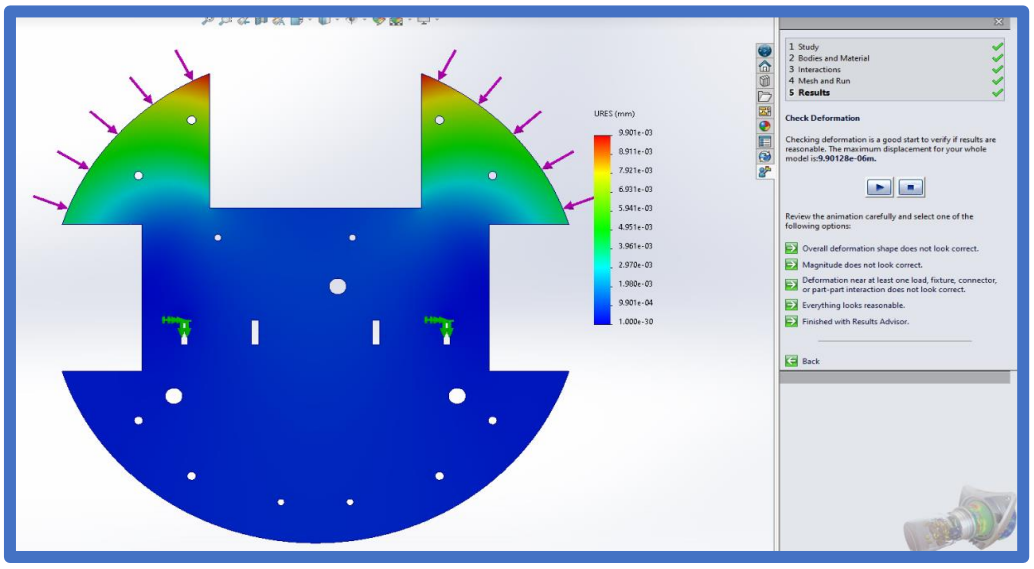


Figure 4: Analysis on 10N

The maximum displacement for uniform force of 20N on front of the car is equal to 0.02mm and is located at the tip of the front.

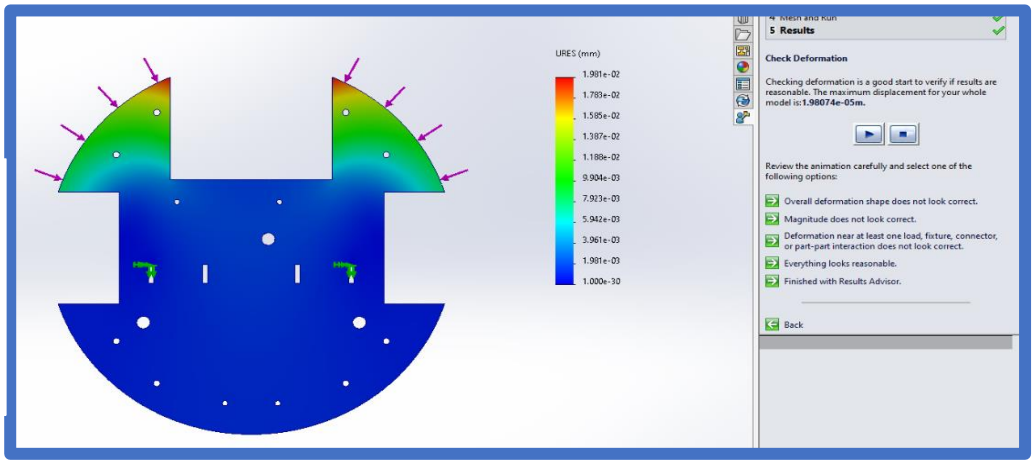


Figure 5: Analysis on 20N

Block Diagrams

1) Overall System Autonomous Block Diagram

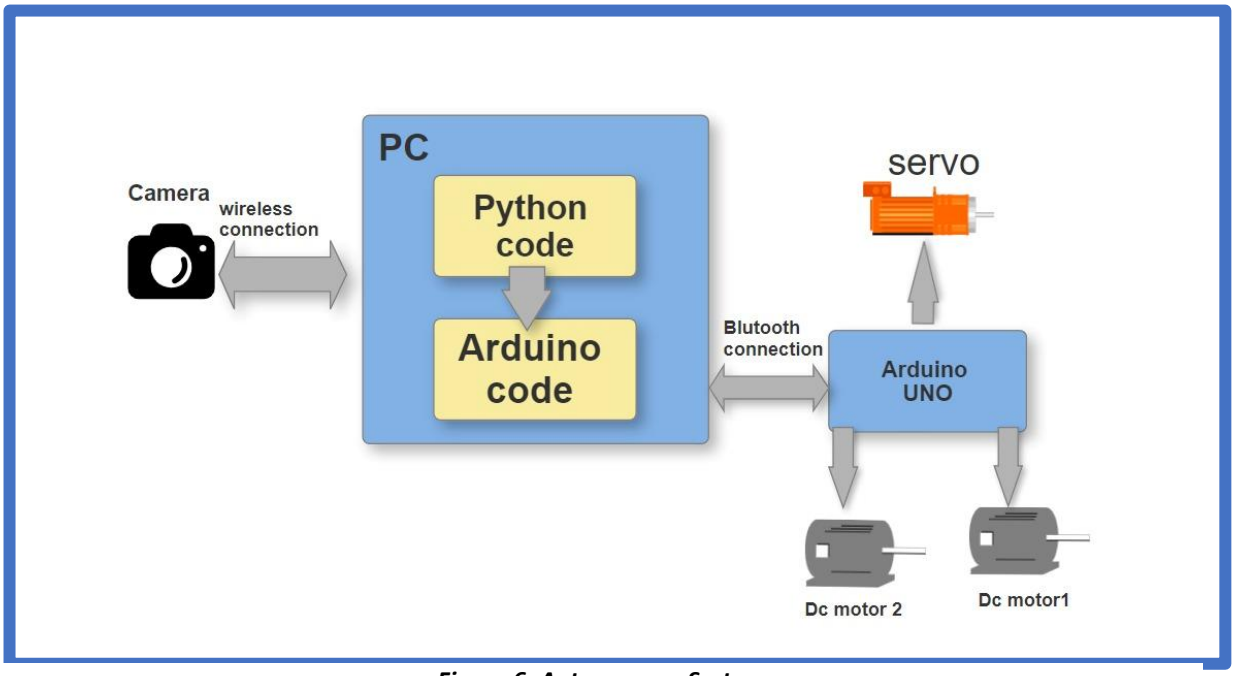


Figure 6: Autonomous System

2) Overall System Automatic Block Diagram

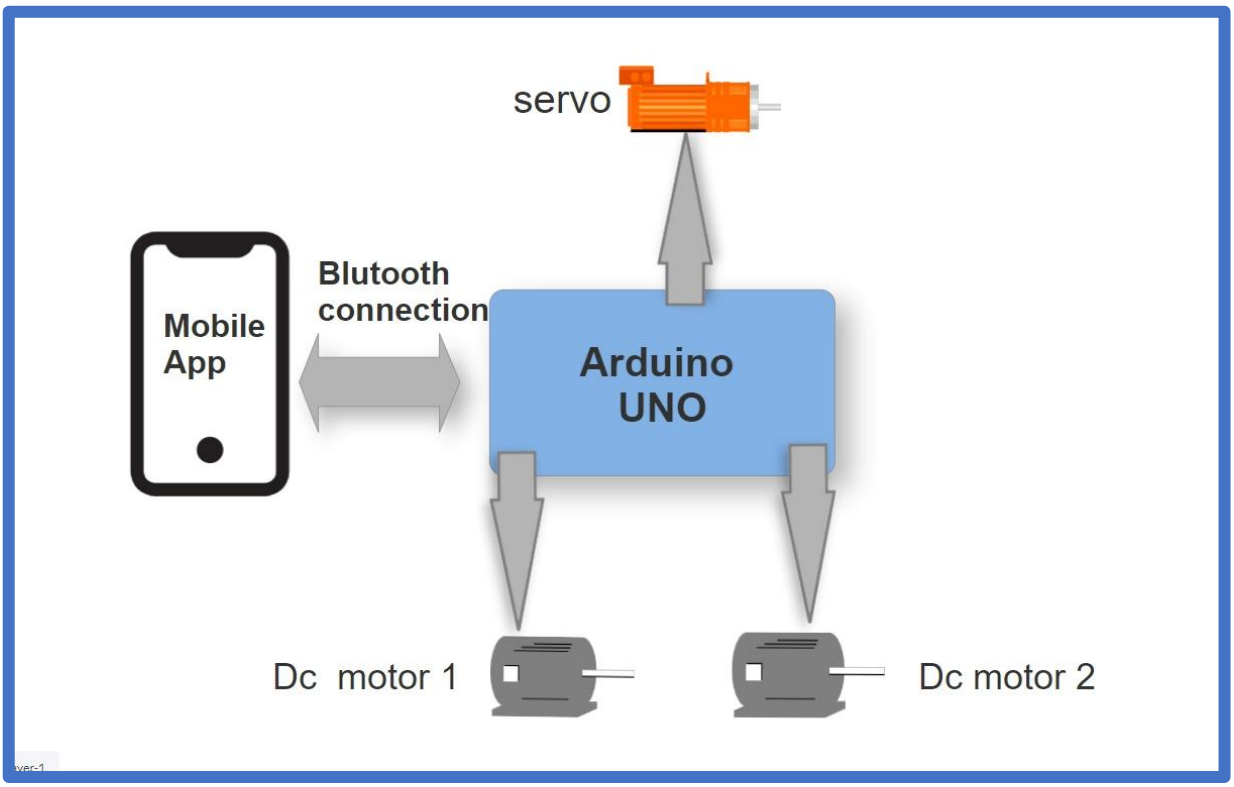


Figure 7: Automatic System

Block Diagrams

3) Hardware Block Diagram

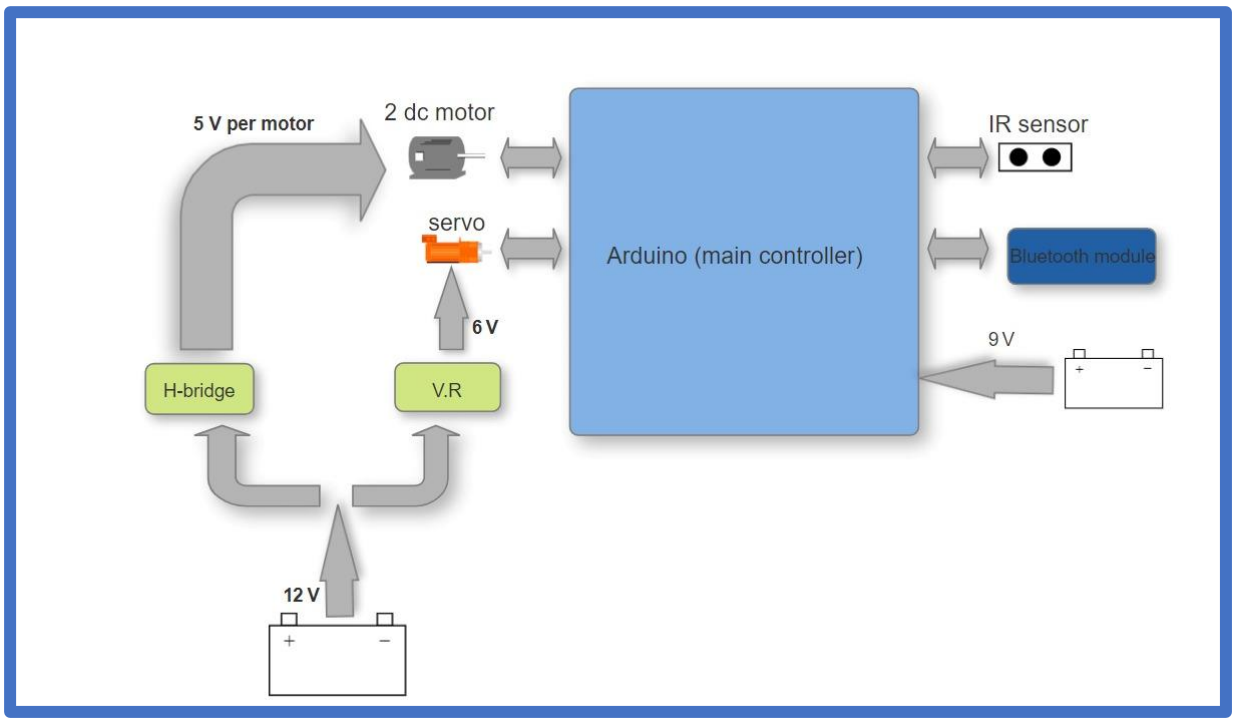


Figure 8: Hardware System

4) Software Block Diagram

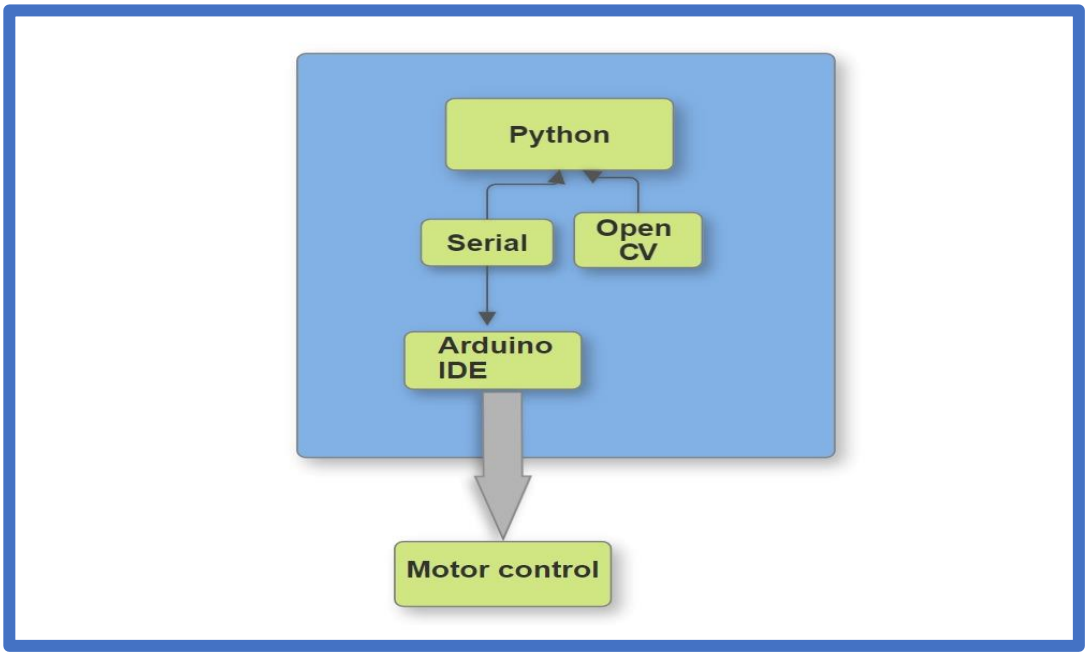
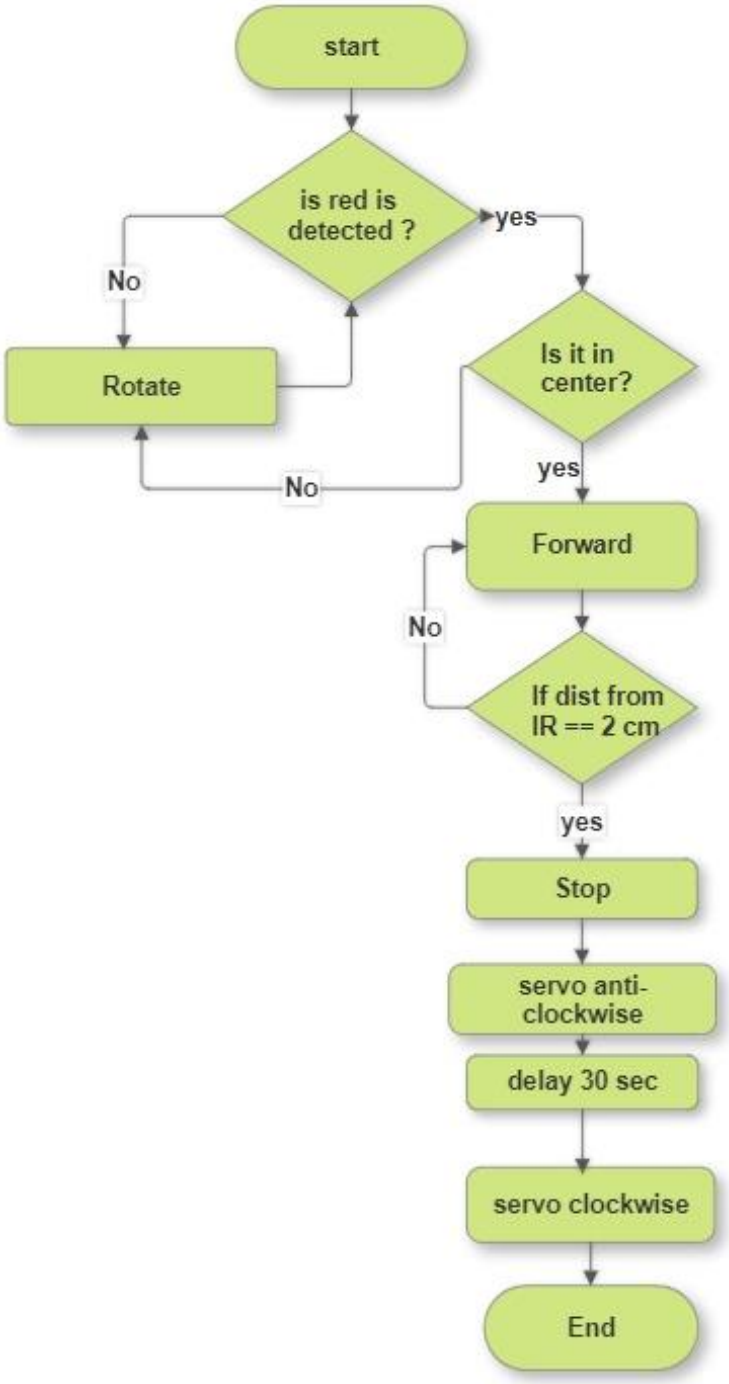


Figure 9: Software System

Flowchart


start
is red is detected ?
yes
No
Rotate
Is it in center?
No
yes
Forward
No
If dist from IR == 2 cm
yes
Stop
servo anti-clockwise
delay 30 sec
servo clockwise
End

Cost Analysis

Cost Analysis		
Component	**Quantity**	**Cost (EGP)**
Breadboard	1	30
Arduino Uno	1	270
DC Gear Motor Dual Shaft 3:12 VDC 450 RPM with Wheel 65 cm	2 x 50	100
Battery 9V	1	20
9V Battery Holder	1	6
L298 Motor Drive Module	1	75
XL4016 DC-DC Buck Converter 8A Step Down 4-36V to 1.25-36V	1	125
Bluetooth Module HC-05	1	190
Infrared IR Obstacle Avoidance Sensor 3 Pin	1	35
Servo Motor (Full Metal Gear) MG996R TowerPro Continues Rotation	1	220
Li-ion Battery 14500 1100mAh 3.7V	4 x 45	180
18650 Battery Case Holder 4 cells	1	20
Metal Caster Wheel for Robot	1	35
Switch ON/OFF	1	2
Jumpers		25
3D Printed Parts for Rack and Pinion	2	100
Wood MDF Frame 4.5mm	2	40
Motor Holder 4.5mm	2	10
Mobile Holder	1	150
Bolts and Nuts		30
		Total Cost = 1663 EGP

1) Python *(Circle Detection):*

```
while True:
    ret, frame = cap.read()
    into_hsv = cv2.cvtColor(frame, cv2.COLOR_BGR2HSV)
    L_limit_red = np.array([0, 70, 50])  # setting the red lower limit
    U_limit_red = np.array([10, 255, 255])  # setting the red upper limit
    r_mask = cv2.inRange(into_hsv, L_limit_red, U_limit_red)
```

Figure 10: Put the limits of HSV color of red.

```
for cnt in cont:
    # check for contour area
    if (cv2.contourArea(cnt) > 100 and cv2.contourArea(cnt) < 306000):
        # Draw a rectange on the contour
        global sora
        sora= cv2.minAreaRect(cnt)
        box = cv2.boxPoints(sora)
        box = np.int0(box)
        cv2.drawContours(red, [box], -1, (255, 0, 0), 3)
        #print(rect[0][0])
    red = get_dist(sora, red)
```

Figure 11: Drawing Bounding Box

2)Arduino:

The direction and speed of the two motors are managed by the Arduino. Apart from the robot's servo control and all its sensors.

```
void setup() {
  arm.attach(11);
  // Start the Bluetooth serial connection
 // BTSerial.begin(9600);
  Serial.begin(9600);
  pinMode(5,OUTPUT);
  pinMode(6,OUTPUT);
  pinMode(7,OUTPUT);
  pinMode(IR_left, INPUT);
}
```

Figure 12: Initialize Pins as Output Pins

```
void forward (int speed)
{
  digitalWrite(IN4, HIGH);
  digitalWrite(IN3, LOW);
  analogWrite(EN3, speed);
  digitalWrite(IN1, LOW);
  digitalWrite(IN2, HIGH);
  analogWrite(EN1, speed);
}
```

Figure 13: Forward Motion Function

```
void right (int speed)
{
  digitalWrite(IN3, LOW);
  digitalWrite(IN4, LOW);
  digitalWrite(IN1, LOW);
  digitalWrite(IN2, HIGH);
  analogWrite(EN1, speed);
}
```

Figure 14: Right Motion Function

3) Communication

```
data = len(contours)
if(sora[0][0]>=253 and sora[0][0]<=400):
    data=0
    self.obstacle_detected = True
    arduino.write(b'0')
elif(sora[0][0]<253 and sora[0][0]>0):
    data = 1 #shayef object  yemen
    arduino.write(b'1')
elif (sora[0][0] > 400 and sora[0][0]>0):#shayef object shemal
    arduino.write(b'2')
elif(sora[0][0]<0):
    arduino.write(b'3')
```

Figure 15: Check Object is in the Centre of the Frame

```
  if (data == '0')
{
    if(digitalRead(IR_left)==0)
      {
      stop();
      delay(3000);
      arm.write(120);
      delay(2000);
      arm.write(90);
      delay(5000);
      arm.write(70);
      }
      else if(digitalRead(IR_left)==1)
      {
        arm.write(90);
        forward(80);
      }
}
```

Figure 16: If Python sends Arduino 0, this code will execute

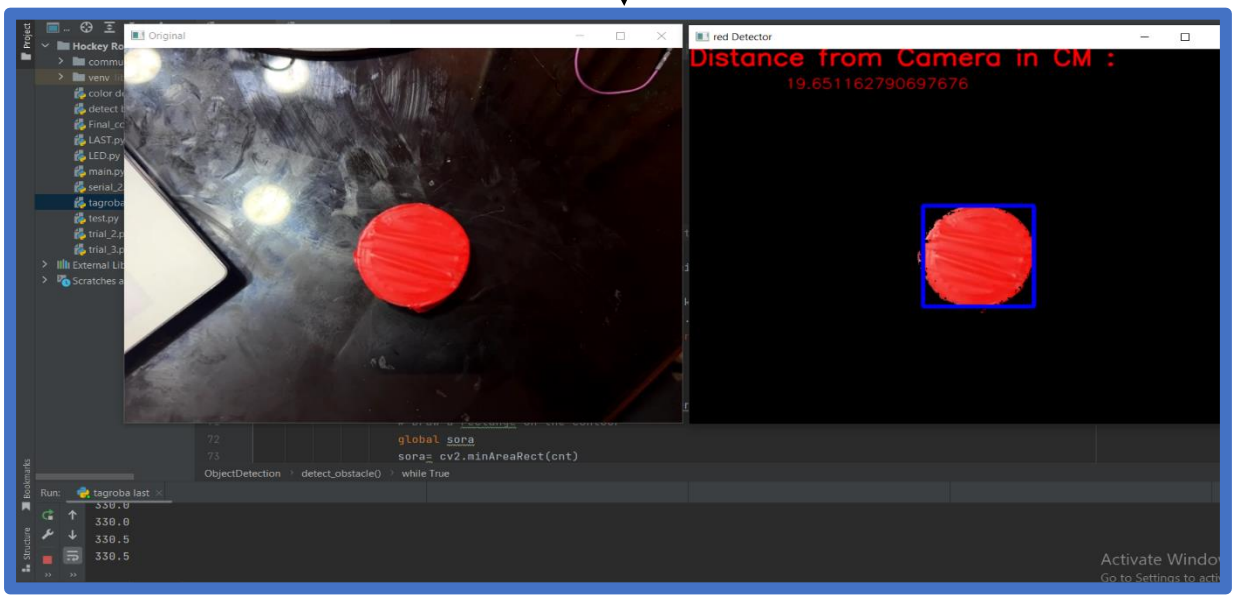


Figure 17: Color Detection

- **When the object is in the middle of the frame, python sends to Arduino 0 to let it execute the code under its condition.**
- **If the data is 1, this means that the object is on the right of the camera.**
- **If the data is 2, this means that the object is on the left of the camera.**
- **If the data is 3, this means that the camera does not see anything.**

Steps:

1. **Download Iruin Webcam form play store on PC and Phone.**
2. **Download RC Bluetooth Car (for manual control).**
3. **Download Code from link:**
4. **Connect PC with Bluetooth module and see its COM (for autonomous control).**
5. **Connect Phone with Bluetooth module with password "cr7" (for manual control).**
6. **Connect PC and Phone on the same Wi-Fi. (for autonomous control).**
7. **Compile RC Car Arduino Code (for manual control).**
8. **Compile Communication Arduino Code and Python Code and put the COM of the Bluetooth module (for autonomous control).**
9. **Enjoy!**

Figure 18: Iriuim Webcam icon

Figure 19: RC Car Application icon

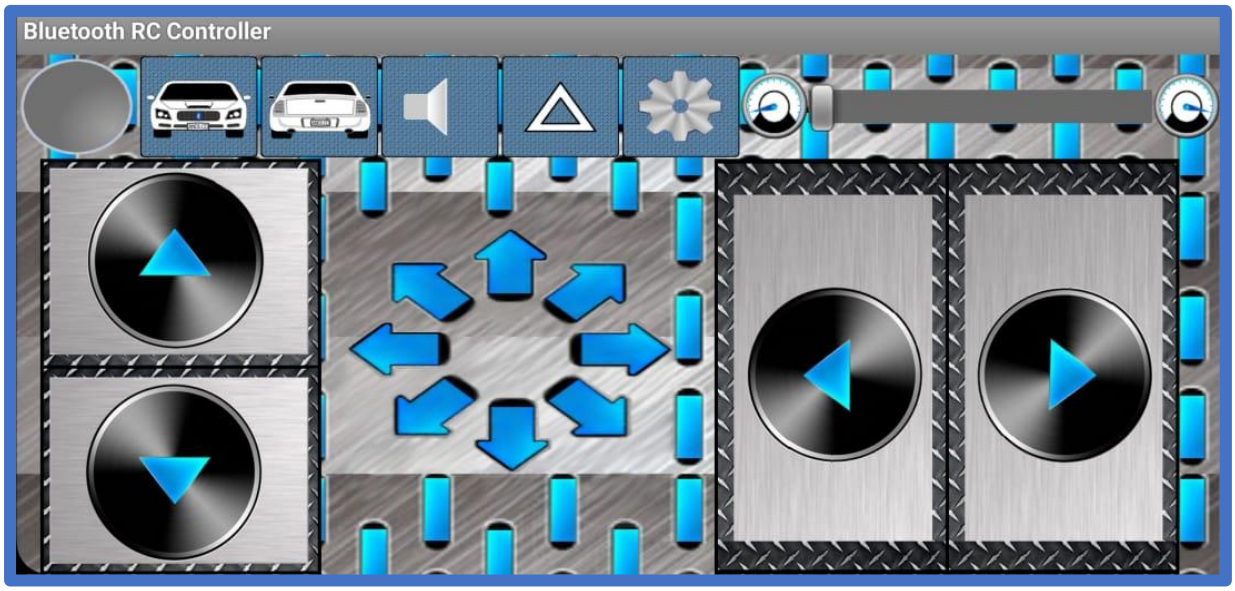


Figure 20: RC Car Application