ROBOGAMES 2023

IARC

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TEAM INFO

Team name: Operation Kriti
Team leader's name: Gaurav Tale
Contact details of team leader: 8208629169
Contact no: 8208629169
Email ID: gauravtale136@gmail.com
Leader Tech ID: 10060

Number of members in the team (max 6): 5
MEMBERS:(other than leader)

| S.no	Name	Tech ID	Email Address	Contact no.
1.	Shailesh Deshmukh	10198	itsdshailesh@gmail.com	8999789261
2.	Sagar More	10174	2021bec517@sggs.ac.in	9130561236
3.	Sarthak Khandare	10124	2021bin003@sggs.ac.in	9403929599
4.	Tushar Kuntawar	10085	2002.tushar.kuntawar@gmail.com	8624923826

Introduction

Mobile robots are becoming increasingly popular due to their ability to navigate complex environments, perform repetitive tasks with precision, and enhance efficiency and productivity.

In this project, a line following and wall following robot will be designed with the ability to detect red and green light and decode a 2X2 grid to follow instructions. The robot will utilize various sensors, controllers, and programming techniques, including line following and wall following sensors, a camera, and image processing algorithms. Also the robot will be sending real time telemetry data to a laptop for analysis. The resulting robot promises to be a versatile and efficient tool for various applications, such as warehouse automation, surveillance, and transportation. It will be able to respond to traffic signals or other color-coded instructions and follow specific paths to perform tasks.
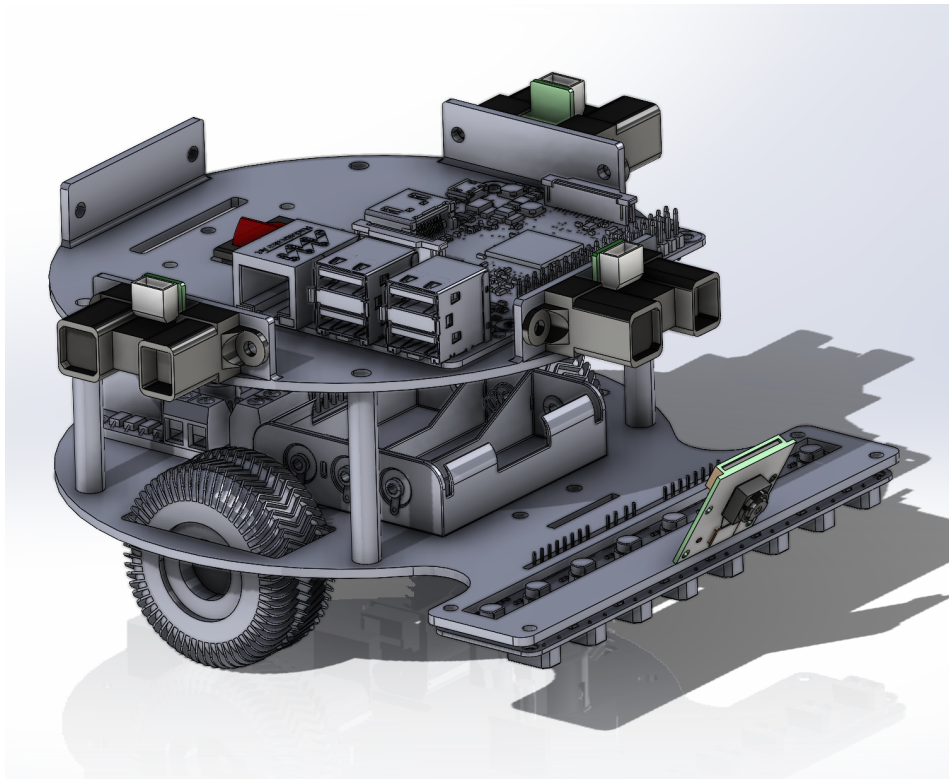
CONSTRUCTION

A. Overall Dimensions (in mm)

Dimensions(L x B x H): 164 x 160 x 87

B. Type of drive

Two wheel drive (With 2 castor wheel)

C. Type of Actuators integrated

1. Servo motor
2. Magnetic Encoder with Micro Metal Gear motor

D. Types of sensors integrated

1. Raspberry Pi
2. QTR IR sensors array
3. Ultrasonic distance sensors
4. Kill Switch
5. Raspberry Pi Camera Module
6. Motor drivers L298N

E. Description of Anatomy of the Bot

1. **Line following and Wall following**

   We are going to use the QTR IR sensor array for line following. QTR sensors are mounted near the front of the bot , facing the floor. For the Wall following ultrasonic sensors are placed on Front , left and right sides facing outwards.

2. **LED light color detection and Matrix Detection**

   The camera is mounted near the QTR IR sensors array facing towards the front of the bot.

3. **Motor mounting**

   Two Metal Micro Gear motors are used to drive the bot with Two Rubber wheels and Two castor wheels. As in the diagram.

4. **Placement of other components**

   Raspberry is placed on the top, and battery and motor drivers go on the bottom board.
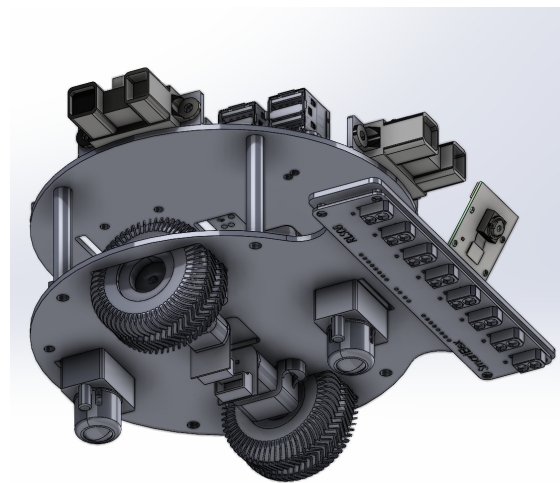
WORKING PRINCIPLE

A.   Line Following:

The Bot will follow the line with PID control.

B.   Color Detection:

Images from the camera will be used to find the color of the LED strips.

C.   Matrix Detection:

Images from the camera will be analyzed using OpenCV. A quadrilateral contour will be searched for in the image using an algorithm based on the number of siblings and parents in the contour hierarchy and its four points will be extreme points of the matrix.

After getting the extreme four points of the matrix the decoding can be carried out by finding the color of centroid of the individual sub squares.

According to the above system's output, speed of the bot is modulated, or angle of exit is determined.

1.   Speed regulation

The speed of the bot will be determined using the encoder motors, and it will be regulated using PID control.

2.   Angle determination along the circle

The angle will be determined using the distance traveled along the circle and radius of the circle, all the while following the line conditionally.
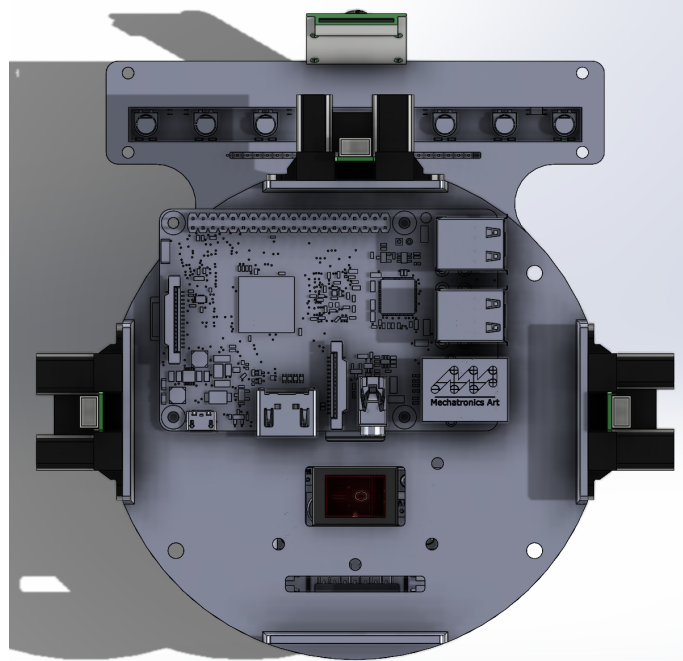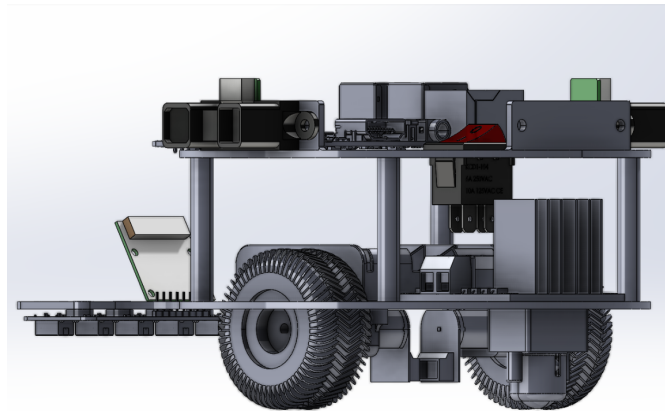
D. Real Time telemetry dashboard

Websockets will be used to send telemetry data in real time from the robot to a laptop for showing the decoded matrix.

E. Wall Following:

PID control will be used to maintain a set distance between the bot and the wall. The bot will go forward all the time, and when a wall is in front it will turn based on ultrasonic sensor measurements on the sides of the bot.

References

https://drive.google.com/drive/folders/16F97nnedkwwe-Pxu3jo-ce7N3kXedPqm?usp=sharing

Real time data plotting

https://www.pololu.com/product/4760
https://www.raspberrypi.com/

Any information you would like to share

Participated in Eyantra , Smart India Hackathon, ROBOCON robotics based competitions.
Also currently participating in ROBOCON and Eyantra. And competing for stage 2 ROBOCON and also Eyantra.