OBSTACLE AVOIDANCE FOR GROUND ROBOT

ESW PROJECT Group 9

Team 25

Introducing Our team: Gigahertz

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Behind our Project: Motivations and Objectives

- Obstacle avoidance is the property which all the self-driving autonomous cars and delivery drones mostly rely on. Hence Our project is focused on developing a ground robot capable of seamlessly navigating through any obstacles encountered in its path, thereby achieving robust Obstacle Avoidance capabilities.
- The motivation behind this project comes from a deep seated curiosity to explore the frontiers of robotics technology. Ultimately, The satisfaction of watching a robot successively navigating through Obstacles is itself the most powerful motivator for us, pushing us to overcome any hurdles in the project.

Sensors and Components Overview

- 4 Gear motors – to be attached to 4 wheels

Link: https://www.amazon.in/Techleads-shaft-Smart-Robot-Arduino/dp/B07N64F7MM/ref=sr_1_8?crid=1DR7M2Q8L67ZS&keywords=gear+motor&qid=1693745245&s=industrial&sprefix=gear+moto%2Cindustrial%2C275&sr=1-8

- 4 Rubber wheels – for wheels of car robot

Link: https://www.amazon.in/Techleads-shaft-Smart-Robot-Arduino/dp/B07N64F7MM/ref=sr_1_8?crid=1DR7M2Q8L67ZS&keywords=gear+motor&qid=1693745245&s=industrial&sprefix=gear+moto%2Cindustrial%2C275&sr=1-8

- 18560 or 18650 Li-ion battery

Link: https://www.amazon.in/UT-Rechargeable-Battery-Lithium-Charging/dp/B0CG46M47C/ref=sr_1_3?crid=7V76325OBZ33&keywords=18650+li+ion+battery&qid=1693746309&sprefix=1860+li+ion+battery%2Caps%2C237&sr=8-3

Sensors and Components Overview

- Esp32 Microcontroller
- HC-SR04 Ultrasonic sensor
- Servo motor
- Jumper wires – 5 of each kind
- Acrylic sheet 20*20 cm – Base for the car robot
- Cardboard 1m*1m size – for making obstacles as a part of DATA Analysis.
- L293D motor Driver – for driving the 4 gear motors attached to wheels of car

Link: https://www.amazon.in/Robotbanao-Controller-Motors-LED-Indicator-Mechatronics/dp/B07D4MJVMF/ref=sr_1_16?keywords=motor%2Bdriver%2Bl293d&qid=1693746197&s=industrial&sr=1-16&th=1

Sensors and Components Overview

- Glue sticks – Used for Glue gun that we have already

Link: https://www.amazon.in/Themisto-Purpose-Transparent-Melt-Sticks/dp/B072K4R4R7/ref=sr_1_10?crid=EBCUDNM2D0T0&keywords=glue+sticks&qid=1693746048&sprefix=glue+sticks+%2Caps%2C229&sr=8-10

- Embeddinator Ultrasonic sensor Holder Bracket for Mounting – for putting Ultrasonic sensor on the servo motor

Link: https://www.amazon.in/Embeddinator-Ultrasonic-Holder-Bracket-Mounting/dp/B0B8CY3DYZ/ref=sr_1_7?crid=MVQ99Q0ZG6J&keywords=ultrasonic+sensor+holder+for+servo+motor&qid=1693745073&sprefix=servo+to+ul%2Caps%2C230&sr=8-7

Implementation Overview

- The car model which we utilize as the ground robot in this project, has the following features:

1. A body made of water-resistant acrylic sheet
2. It has 4 Driving wheels with four gear motors attached.
3. The gear motors and all of the sensors are connected through the jumper wires to Esp32 and motor driver, which are attached to the car's body.
4. The car's front section has the servo motor mounted Ultrasonic sensor that measures the distance between the robot and the obstacle and uses an esp32 to communicate with the servomotor to tell it to move in that direction.

Implementation Overview

- In our project, we use the energy-efficient local path planning technique “Predictive Artificial Potential Field Algorithm” as our approach.
- For DATA ANALYSIS stage of our project, we intend to build multiple obstacle patterns of varying distances and determine the effectiveness our algorithm in a range of actual-world scenarios.

Deliverables

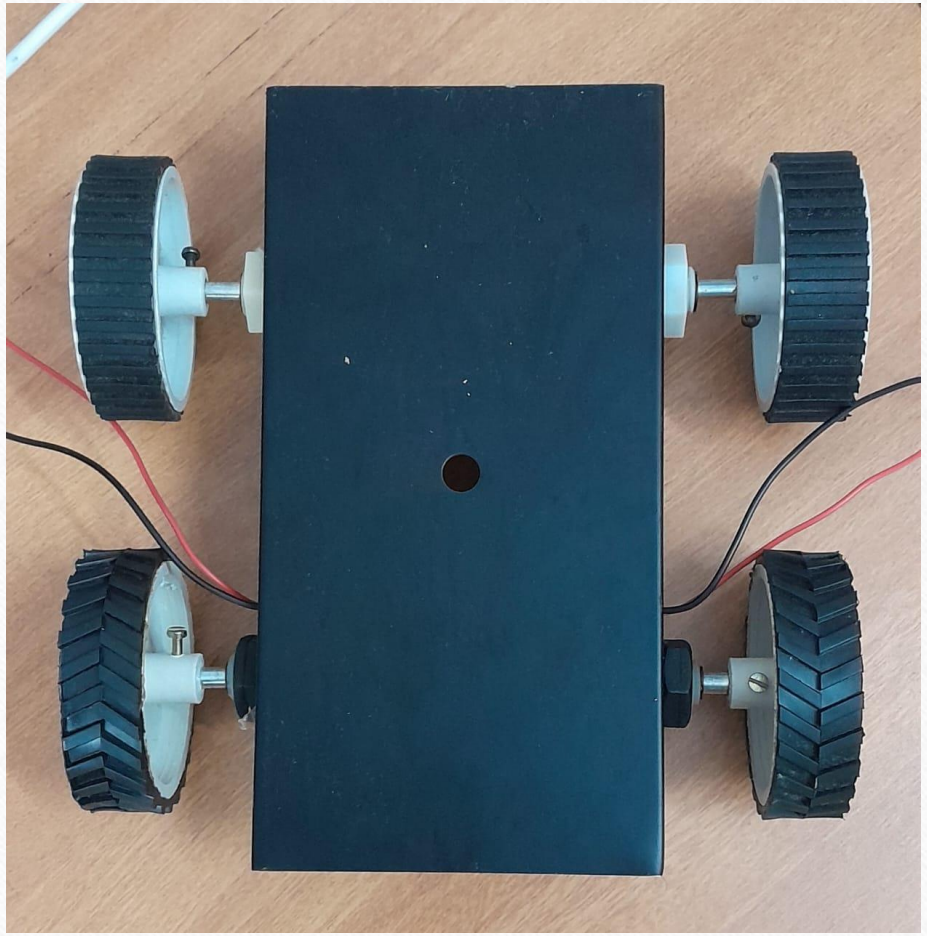
- The robot will accomplish the following by the end of our project:

1. **Obstacle Identification and localization**: The robot will successively detect the obstacles in its path. In addition to that, it also finds the position and relative size of the obstacle.
2. **Obstacle avoidance**: the robot will be capable of executing a safe path while avoiding obstacles in moving towards the destination. This involves making decisions such as slowing down, stopping or changing direction to steer clear of obstacles.
3. **Navigation**: Incorporating Obstacle avoidance into its navigation strategy, the robot will be able to move from one location to another safely.

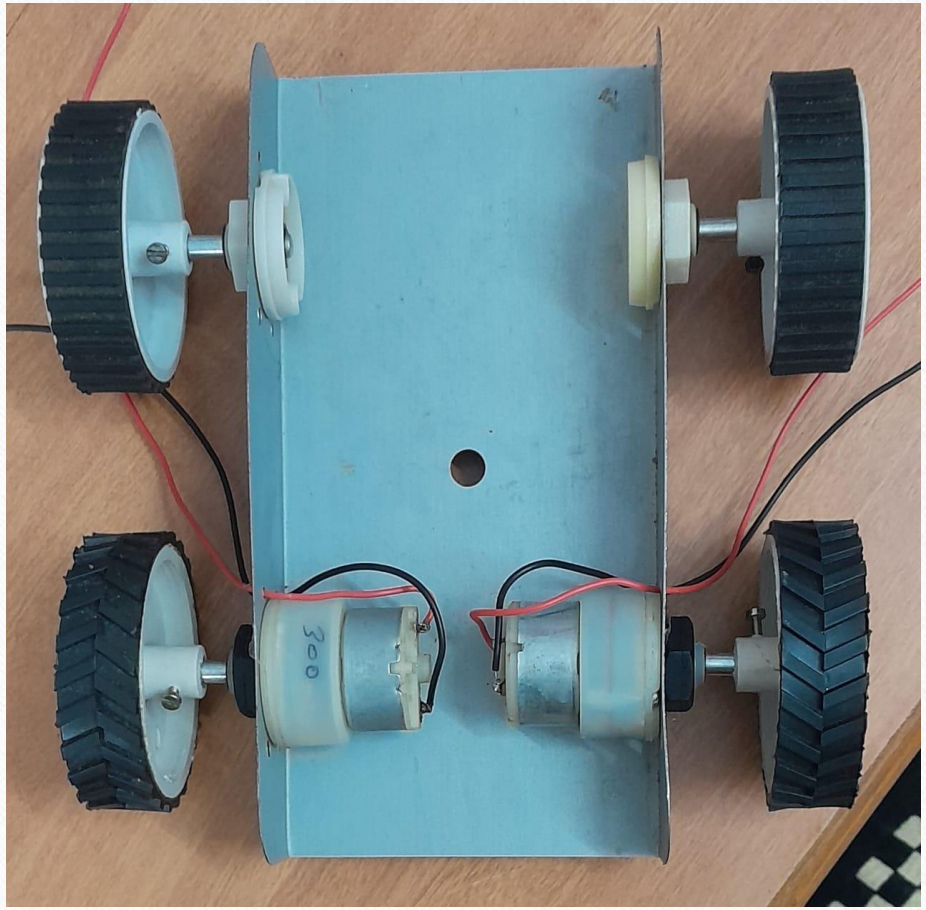
Progress

- In the 1st lab since we got the parts:
  1) We decided the robot design in which there will be a 4 socket metal body, so that we can have 4 wheels. Out of these 4 wheels the 2 at the front are attached to motors(these motors were handpicked after checking their functionality at 12 V) and the 2 behind are dummy wheels. After this, we attached the wheels along with motors to the metal body of the robot.

  2) We soldered the wires connected to the motors for future usage.



Top View of Progress



Bottom View of Progress

Task Assignment Overview

1. Making the car model: Sai deekshith and Swaroop
2. Coding of servo motor and Potential field algorithm: Chanukya and Pratyush Jena
3. Creating several obstructive patterns for data analysis: Swaroop
4. Final presentation: Sai Deekshith.

Tentative Timeline Estimated

- 5th SEP 2023 – Building the physical model of the Car
- 14th SEP 2023 – Devising the potential field algorithm
- 21st SEP 2023 – Completing the servo motor part
- 28th SEP 2023 – Integrating the code of servo motor and potential field algorithm with Esp32
- 5th Oct 2023 – Testing phase of obstacle avoidance Robot
- 12th Oct 2023 and beyond – Additional features to be added to the Robot based on the error of analysis of testing phase