EN2533 Robot Design and Competition
Team AGNI

Sensors

Ultrasonic Sensor

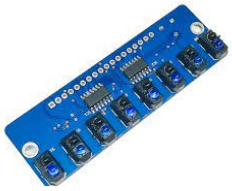
We selected an Ultrasonic sensor for obstacle detection and guard bot part tasks.

.

Reasons for Selection:

- **Low Cost**: Ultrasonic sensors are relatively affordable. Since we use 5 ultrasonic sensors we have to consider cost of sensors considering our budget.
- **Relatively High Range**: Ultrasonic sensors are capable of providing a relatively long-range detection capability. This makes them suitable for detecting obstacles at a distance.

IR Sensor



We decided to use an IR array for line following and coloured line following

Reasons for Selection:

- **Line Detection Coverage**: An IR Array provides a wider coverage area for detecting lines or tracks, making it more efficient for line following tasks.
- **Simplicity**: Using an IR Array simplifies the sensor setup as it typically contains multiple IR sensors in a single package, reducing wiring and complexity.

Colour Sensor TCS3200

We selected TCS3200 Colour Sensor for colour detection.

Reasons for Selection:

- **Accuracy**: TCS3200 is known for its high accuracy in colour detection, making it suitable for distinguishing a wide range of colours.
- **Versatility**: It can detect a wide range of colours, making it versatile for tasks that require distinguishing between different hues.

Sound Detection Sensor MD0220

We selected MD0220 Voice Sound Detection Mic Sensor for sound detection.

Reasons for Selection:

- **Purpose-Specific**: MD0220 is designed specifically for voice and sound detection, making it a suitable choice for applications where you need to respond to sound cues or commands.
- **Voice Detection:** This sensor is optimised for voice detection, which can be advantageous in scenarios where the robot needs to react to voice commands or environmental sounds.

Actuators

We plan to use two 6V 300 rpm N20 motors with encoders for our robot.

Reasons for Selection:

- **Higher Efficiency**: N20 motors are known for their efficiency. They can convert a larger portion of electrical energy into mechanical work. This is advantageous for achieving better performance while optimising power usage.
- **Low Power Consumption**: N20 motors typically have low power consumption, making them suitable for our robot where energy efficiency is crucial. This helps to extend the robot's operating time on a single charge.
- **300 rpm**: This rpm value is enough to complete the ramp part without any trouble.

Batteries

We use a 11.1V 3300mAh 3S 40C LiPo battery pack as the power source for the 12V DC motors, servo motors which control the arm, and PCB with sensors.

Reasons for Selection:

- **High Energy Density:** This battery offers a high energy density, it can store a significant amount of energy in a compact form. This is essential for powering various robotic components efficiently.
- **Optimal Voltage Output**: With an output of 11.1 volts, this battery is well-suited for powering our robotic components, ensuring they operate with optimal performances.
- **Lightweight:** LiPo batteries are known for being lightweight, contributing to the robot's agility and overall mobility. The reduced weight makes it easier for the robot to move and respond quickly.

Wheels

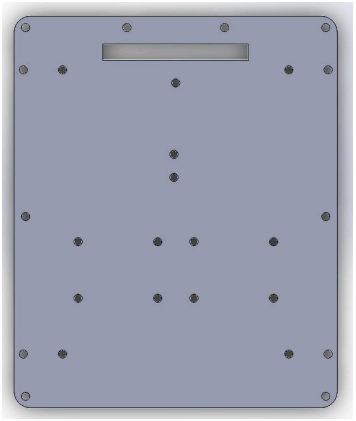
We use 4 D-axis 43mm Rubber Tire Wheels (54mm diameter) for our robot.

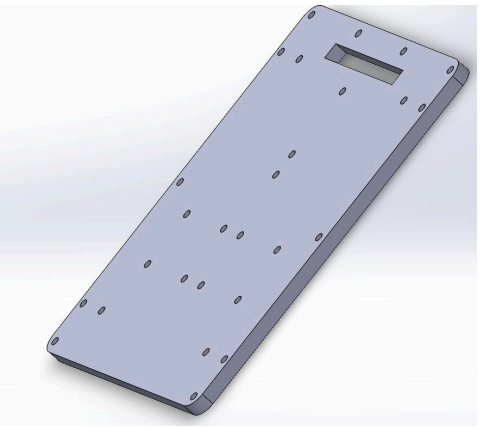
Reasons for Selection:

- **Stability and Weight Distribution**: Implementing four wheels provides improved stability and even weight distribution, especially on hard surfaces. This enhances the robot's balance and performance.
- **High Grip Wheels:** The high-grip wheels were chosen for their ability to deliver strong adhesion and traction. They play a crucial role in maintaining stability and control during robot movement.
- **Slippage Prevention**: These wheels offer the necessary grip to prevent slippage, ensuring the robot follows its intended path accurately.

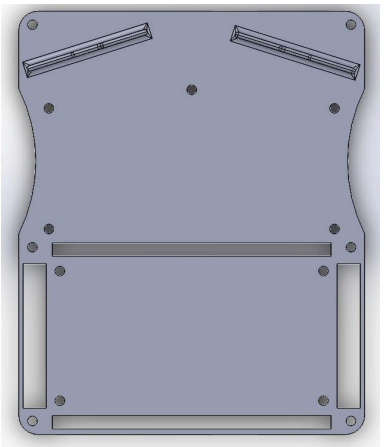
CAD Designs

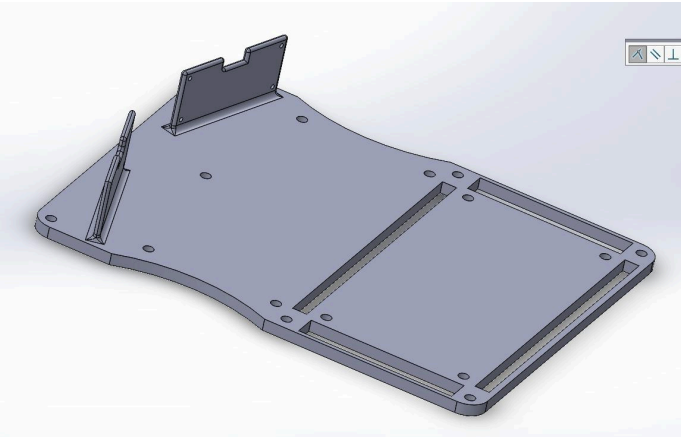
Bottom Stage

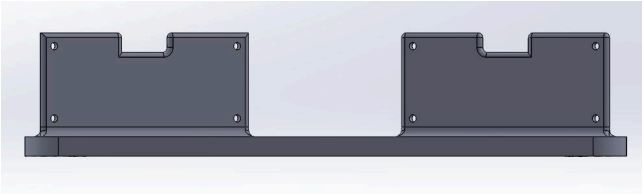




Upper Stage







Mechanisms

Task 1: Line Following

For the initial task of the competition we are required to follow the Line. In order to detect the Line with better accuracy we are using an IR array with 8 IR modules. And in order to smoothen the movement of the robot we will be adding a PID controller. The PID control system processes the IR sensor data and it will make real-time adjustments to the robot's motor output, ensuring that it stays on the line with precision.

Task 2: Obstacle Avoidance

The second task we have involves an environment filled with obstacles and we are required to follow the line avoiding the obstacles. In order to detect obstacles we will be using Ultrasonic sensors. They will be strategically placed to cover the required vicinity. For this as well we will be using a PID controller for smooth movement and higher precision.

Task 3: Ramp Navigation

In order to go through the ramp we are focusing on what needs to be done by the mechanical design side. We have calculated the height the chassis needs to be from the ground and where the tyres need to be situated relative to the chassis. And the PID controller we are implementing for the obstacle avoidance will be adjusted and implemented for this task as well to slow down the robot when its coming near to the ramp, so the robot can smoothly enter the ramp.

Task 4: Box Manipulation

To tackle the box manipulation challenge, we will equip our robot with a robotic arm with stepper motors equipped in joints for precise movements. We will be using TOF sensors to detect the presence of the box. We are open to including a readymade robotic arm purchased from a shop. But if we can't find a robotic arm which satisfies our requirements we will be 3D printing our own. We will decide on that in the near future after some more discussions and searching.

Task 5: Coloured Line Following

For this task, the robot will find the colour of the box and follow the coloured line. Firstly, the box will be picked up by the arm, and using the TCS3200 colour sensor the colour of the box will be detected. According to the colour of the box, the robot will follow the line with a search method to reach the destination.

Task 6: Guard Robot Avoidance

In the final task, our robot encountered a guard robot blocking its path. We will be using Ultrasound sensors in the front to detect the guard robot’s movements and figure out the

direction of the guard robot. Along with the direction we have identified, the TOF sensor in the front will decide when we should enter the guard Robot area to successfully evade the guard robot and reach the final destination.

Team Members -

- Sahan Abeyrathna - 210005H
- Lasitha Amarasinghe - 210031H
- Ruchira Abeywardhane - 210015M
- Rajitha Niroshan - 210433R
- S.Thamirawaran - 210629A