

EN-2533 Robot Design and Competition

Innovatronix Initial Proposal

210253N, 210027C, 210236P, 210254T, 210272V

1. Introduction

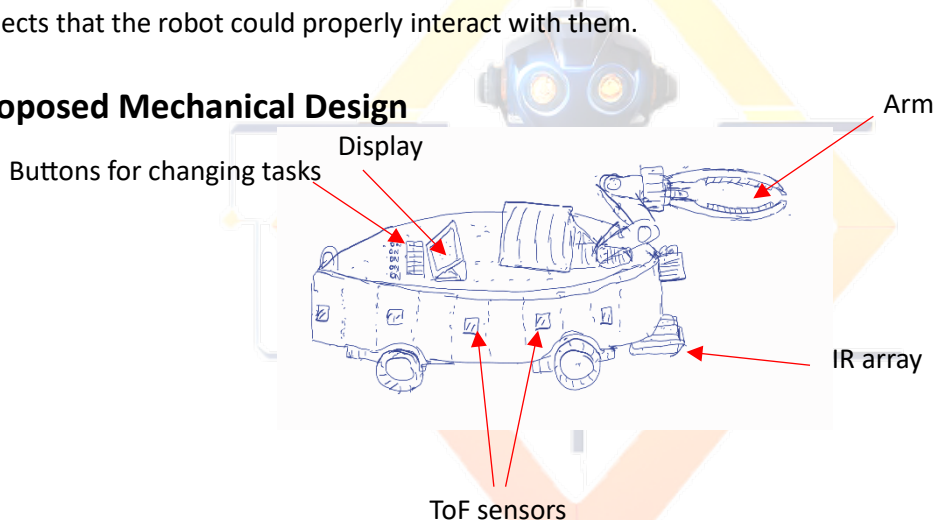
This document contains our strategy and other necessary details for designing a suitable robot for the Robot Design Competition of the EN-2533 module.

2. Overall Strategy

Our overall strategy involves using sensors to calculate parameters regarding the surroundings of the robot and use these sensor readings as inputs to a microcontroller on order to control actuators of the robot.

As all subtasks are connected with one another via lines, detecting the line and following it should be a key part of our overall strategy. Due to the presence of obstacles and items that the robot needs to interact with, another key component of our strategy is the measurement of distance from the robot to these items. The robot needs to detect obstacles and avoid them and also measure the distance to other objects that the robot could properly interact with them.

3. Proposed Mechanical Design



4. Sensors used

The following sensors have been used for each of the following purposes:

- i. Object detection: VL53L0XV2 Time of Flight sensor
This sensor sends a pulse of IR light and waits for the reflection. Based on the time it takes for the reflection to return to the sensor, it is able to measure the distance between itself and other objects.
The primary reason for choosing this sensor is the good performance over long and short ranges, good detection of objects not perpendicular to the sensor and the compact size.
- ii. Line detection: IR array with 10 IR transmitters and receivers
The proposed IR array would contain 10 IR transmitters and receivers operating based on the triangulation principle. Since black would absorb all light and white would reflect all light it is possible to detect a white light on a black surface with this. The distances between sensors would be small at the middle and would increase as moving outwards in order to have a smooth moving robot.
- iii. Sound detection: For detecting sound from the speaker in task 5, we propose to use a microphone. This would record audio and based on the intensity of the audio detected, we could stop the robot or resume motion.
- iv. Colour detection: The TCS230 colour sensing module would be used for detecting the colours of the lines and boxes in subtask 4. The sensor consists of photodiodes that are sensitive to red, green and blue light. By obtaining the values of red, green and blue wavelengths obtained from the sensor, it is possible to determine the colour of the boxes and lines.



5. Actuators used

The robot consists of two main types of actuators

- i. DC motors: These motors are proposed to be used for the wheels of the robot. The proposed robot would contain 4 wheels and each wheel would be individually rotated by a motor. The main reason for the use of 4 motors is to provide increased torque to facilitate quicker accelerations.
- ii. Servo motors: Servo motors are proposed to be used for the controlling of the robot arm. We propose to use 2 servo motors, one for grabbing items with the arm and the other for raising or lowering the arm if needed.

6. Algorithms

It is proposed that the following algorithms be used.

Line Following:

Move forward

If left sensor detects line:

Decrease speed of left motors

Else if right sensor detects line:

Decrease speed of right motors

Else steer straight

Colour Detection:

Follow line

Stop when colour detected:

Read colour

Go right and check colour

If line colour is same as box colour:

Follow line

Else:

Go back and follow other

line

If white detected:

Place box

Obstacle Avoiding:

If object detected on left:

Steer right until suitable distance is maintained

Go straight

Wait until line detected again

If object detected on right:

Steer left until suitable distance is maintained

Go straight

Wait until line detected again

Guard Robot Detection:

Wait at junction

If right ToF detects before left ToF:

Turn right and go to final destination

Sound Detection:

Follow line

If sound intensity above set level:

Stop all motors

Else:

Follow line

Box Detection:

Follow line

If front ToF reports small distance:

Stop

Pick up box

Hook Detection

Follow line

If front ToF reports small distance:

Stop

Grab hook

Move backwards

Go around ramp

7. Task Delegation

210253N - Jayathilaka C.B.N.L. – Sensor selection and programming

210027C - Alahakoon U.M.Y.B. – Mechanical design

210236P - Jayakumar W.S. – Enclosure and algorithms

210254T - Jayathilaka D.E.U. – Algorithms and PCB design

210272V - Karavita K.V.D.T.N. – Algorithms and mechanical design