Department of Electronic and Telecommunication Engineering

University of Moratuwa

Module EN2533 – ROBOTIC DESIGN AND COMPETITION

CAD DESIGNS

TEAM HELIOS - Group-03

JATHUSAN S.	**200239T**
KOWRISAAN S.	**200312L**
MALANBAN K.	**200373X**
MANIMOHAN T.	**200377M**
SAIRISHAN R.	**200552V**
RUKSHANTH S.	**190533U**

This report is submitted as a final report of module EN2533

05th December 2022

Introduction

We have designed particular CAD design using the solidworks software. We have designed sensors, actuators, batteries and processor (Arduino 2560) for both online simulation and physical task. Then we assembled them and created our models. We have used the best components without considering about the cost for the online task. At the same time, we considered about the cost as well as the performance and selected the suitable components.

Now we consider the components for the online task and physical task separately.

Online simulation

For the online simulation, we have used the sensors to sense the color, calculate the height and identify the obstacles. we have used the actuators to navigate the path and pick and carry the objects. We have selected the rechargeable batteries.

➢ Body

We have selected metal as the material for the body. All the sensors are attached at the front side of the body while Arduino and its power supply is attached at the backend of the body. One ultra-sonic sensor is attached at the top of the arm. At the top of the body arm and grabber is located. We selected dimensions of the body considering the inclined paths it needs to travel and its balance when picking the boxes and moving along the inclined surface.
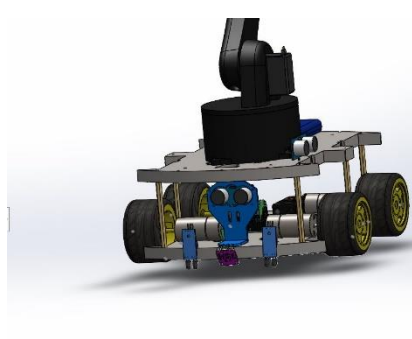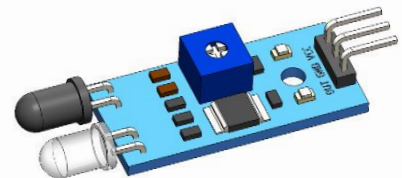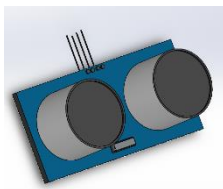

➢ Sensors

• IR sensor
We selected this sensor to complete the following tasks
   1. Line following
   2. Chess Board Square Detection.

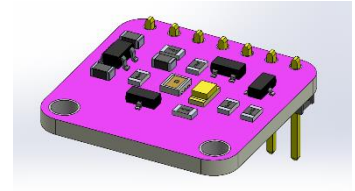#### • Ultra-sonic sensor
We selected this sensor to complete the following tasks.
   1. Obstacle Avoidance
   2. Wall following

- **RGB sensor**

  We selected this sensor to complete the following tasks.
  1. Use to detect the colour of the path in the task.

➢ **Actuators**

- **Brushless DC motor**

  We need BLDC motor to traverse through the flat surface. At the same time our robot should climb on a inclined plane. Therefore, we need more torque

- **Stepper motor**

  In the simulation, there is a chessboard, we should navigate through the board and mate the game by one move. So that, there is a need to find the King (Black) by differentiate them from other keys.so that we need to check every key step-by-step by comparing their height and color using ultrasonic sensor and IR sensor. So that we need to rotate our robot(sensor) slowly and stepped

- **Servo motor**

  We need to pick the rook and place at the correct place. To complete that we need to handle the robot arm by applying the torque through with a range of angle.
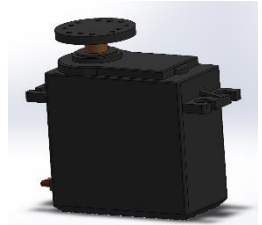
➢ **Batteries**

We can use either rechargeable batteries or primary cells for our tasks. Sensors and Arduino are connected to a battery. Motors connected to the wheels are connected to one battery for each. Batteries are connected to the motors at the arm also. They should be able to last until the whole task ends.

➢ **Mechanism**

The robotic arms can rotate about the joint. Arm can rotate about the axis perpendicular to the body as well as axis parallel to the body at the bottom (Like shoulder joint). So, the arm can rotate in the space about the joint connected with the body. It can rotate in a plane around 120 degrees about the joint. At the top of the arm grabber can rotate about the joint.
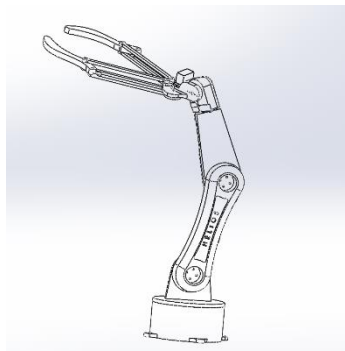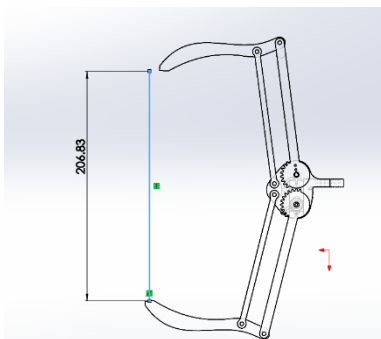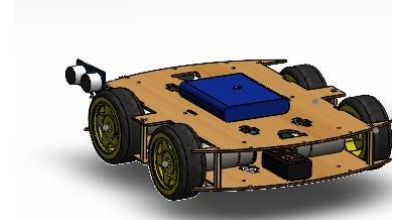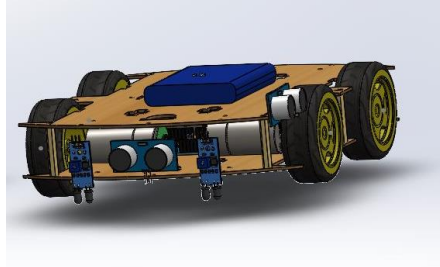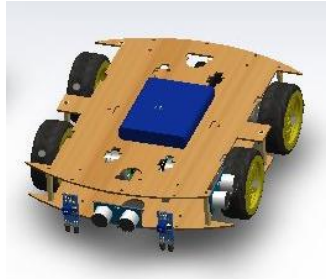
Physical Task

For the physical task we used the sensors to detect the colour and obstacle avoidance. We use sensors to detect the colour, avoid obstacle. Actuators are used for wall following and line following. Here as we need to do many testing, rechargeable batteries are the most suitable option.

➢ **Body**

For this task body is made from wood. All the sensors are attached at the front side of the body while Arduino and its power supply is attached at the backend of the body.
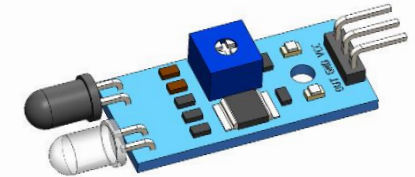

➢ **Sensors**

• **IR sensor**

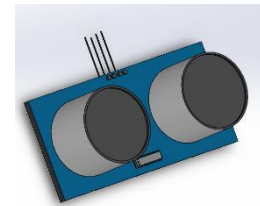We selected this sensor to complete the following tasks
1. Line following
2. maze solving Physical Task

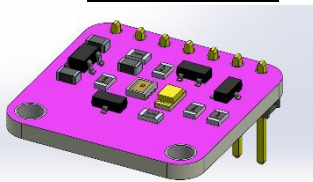### • **Ultra-sonic sensor**

We selected this sensor to complete the following tasks.
1. Obstacle Avoidance inside the Blind Box.
2. Wall following

• **RGB sensor**

We selected this sensor to complete the following tasks.
1. Use to detect the Red colour line near the wall.

➢ **Actuators**

We will complete some small tasks rather than online simulation using the motors. At the same time, we need to consider about the budget also. Therefore, we try to implement the tasks using the Brushed DC motor, which is the motor available in the market for the low price.

- **Brushed DC Motor**

  For the physical tasks, we need to navigate through the flat surface only. For the linear translation we don't need to apply more torque. That's why, its able to use Brushed DC Motor

> **Batteries**

As we have to do the tasks many times, using recharge is better option than using primary cells for each trial. Four batteries connected to the wheels need power supply. Arduino system and sensors are connected to a separate battery.

Thank you