Department of Electronic and Telecommunication Engineering

University of Moratuwa, Sri Lanka

EN2532 - Robot Design and Competition

ROBOT MECHANICAL DESIGN REPORT

Group : BRAND

Submitted by

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Initial Prototype of the Mobile Robot

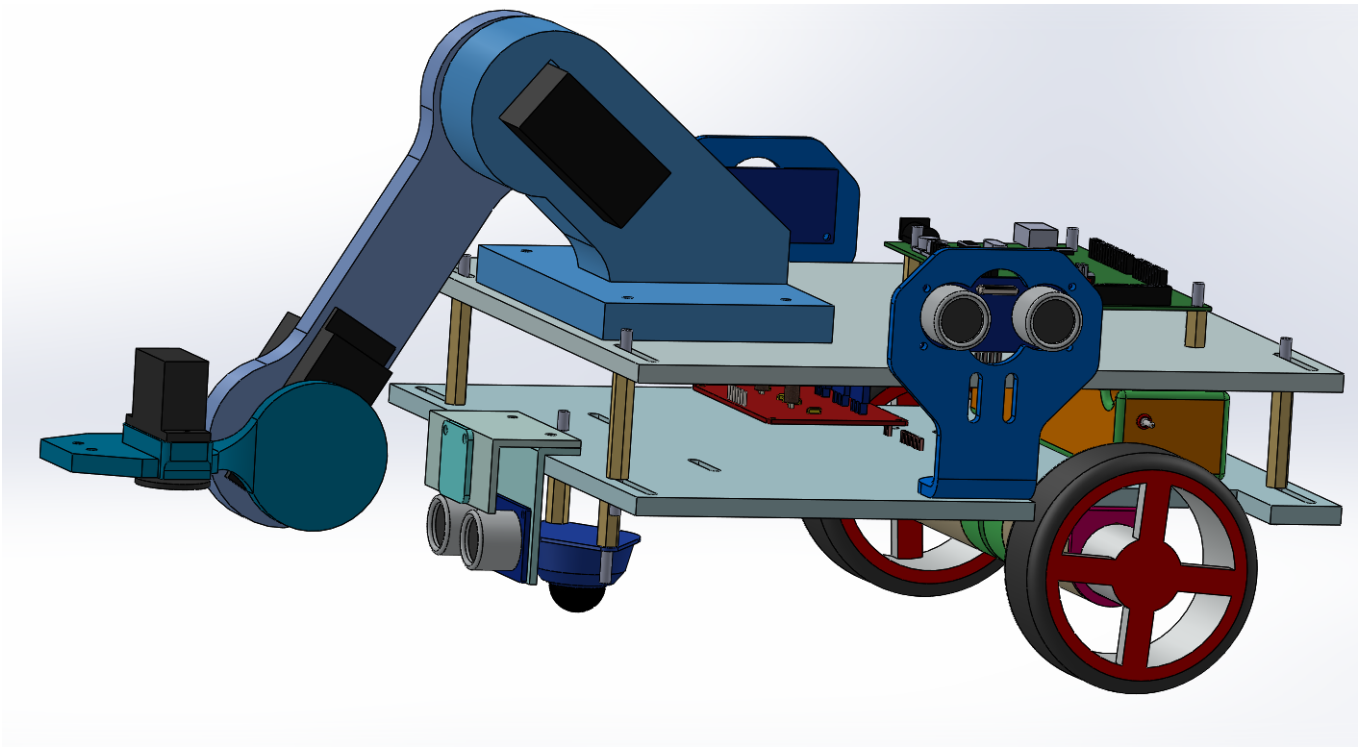

Figure 1: Initial Prototype of the Mobile Robot

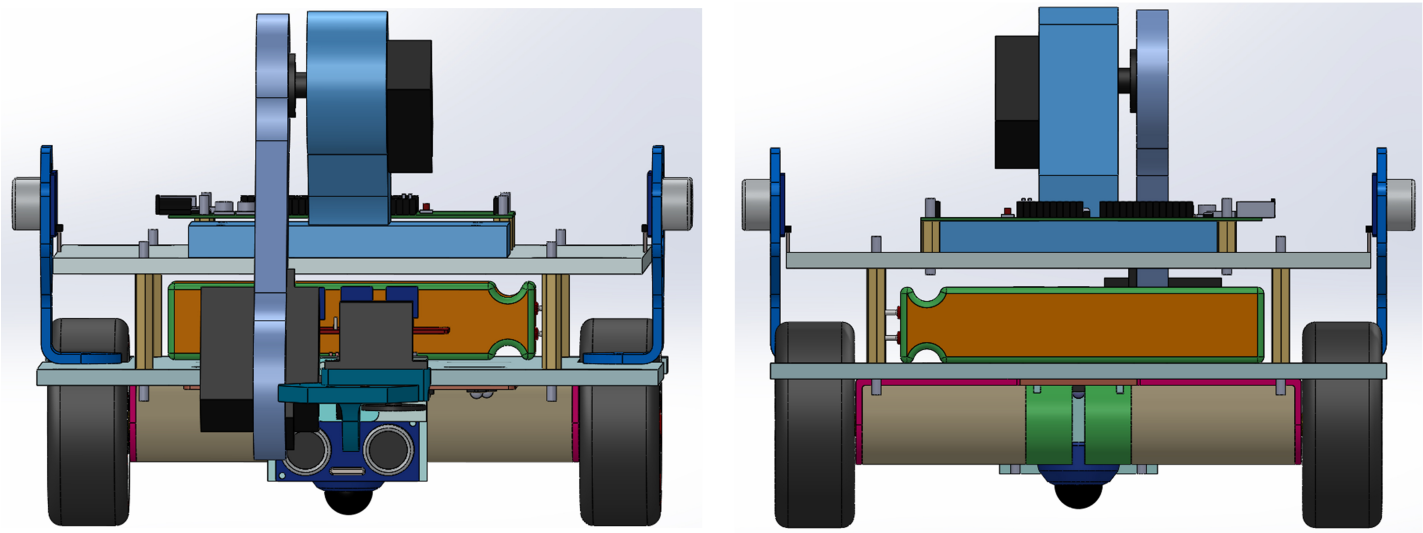

Figure 2: Front and Back Views

Explanation for each Component or Mechanism

Robot arm

Robot arm is used to lift the box which robot has to inspect the colors of front and bottom sides. The arm is made of plastic to reduce the overall weight and to facilitate for the servo motors which are not capable of lifting a huge weight because of their less torque. In addition to the parts shown in figure there will be a gripper mechanism in front of the arm to hold the box.

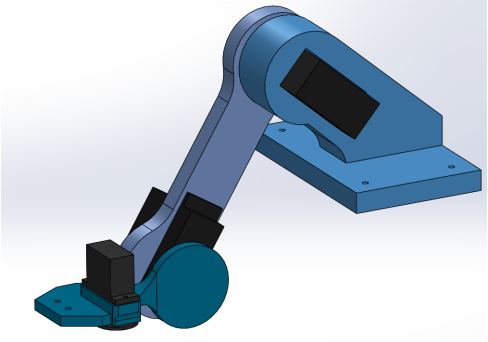

Figure 3: Robot arm

Platforms

Platform is the part where all the sensors, micro controllers, actuators and every other components including mechanisms like robot arm are attached. Therefor it should be made of strong materials such as wood, metal or Acrylic Plexiglas which is widely used in making small robot chassis.

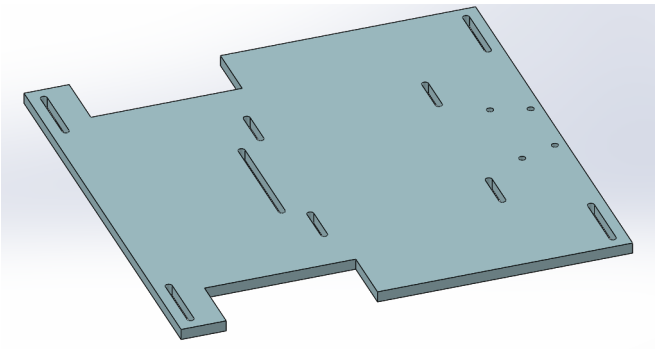

Figure 4: Lower platform

In our robot there are two platforms, one top of the other to facilitate all the necessary components nicely otherwise robot will be a real mess because of not having enough space to attache all the required components.

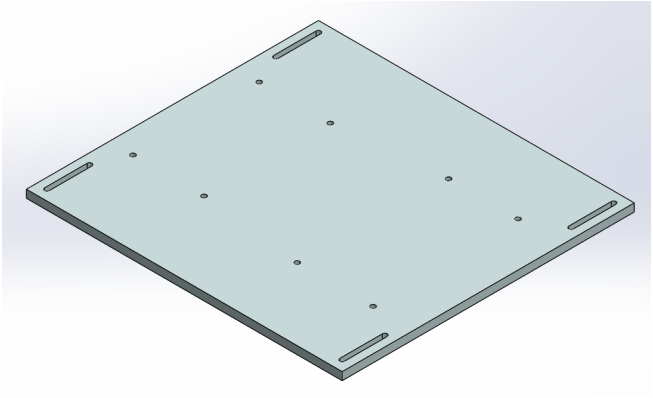

Figure 5: Upper platform

Spacers

Spacers are mainly used to make the gaps between upper and lower platforms. In addition to that spacers with low height are used to maintain the distance between platform and the PCB s.

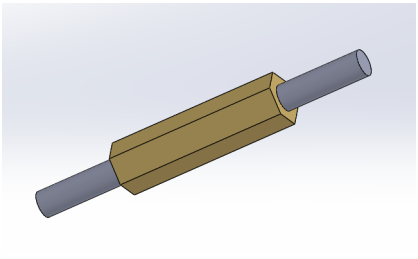

Figure 6: Model of a common brass Spacer

Arduino Mega 2560 Board

Arduino board is used as a open-source microcontroller board. It is based on Atmega 2560 microcontroller. This is used as robot brain. It takes environmental information and process these details and gives resultant output which programmer says. In short it is used to control the other components of the robot. it has its own 5V and 3.3V outputs so they can also use as input for other components.

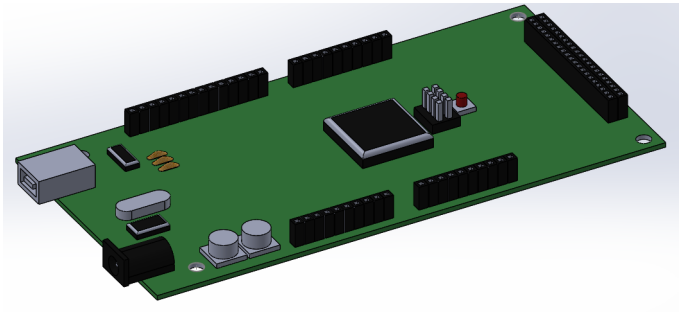

Figure 7: Model of the Arduino Mega Board

HC-SR04 Ultrasonic Sensor

This is an ultrasonic sensor, also known as an ultrasonic transducer that is based on a transmitter and receiver and mainly used to determine the distance from the target object. In our case, we use this sensor to detect distance to the colored box and distance to the walls in wall following part.

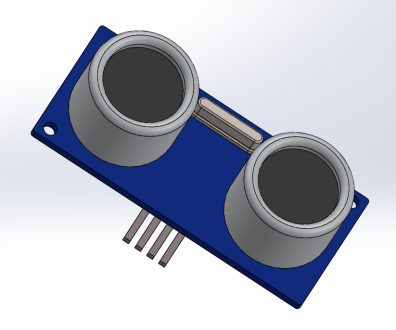

Figure 8: Model of an Ultrasonic Sensor

So, we have to use three ultrasonic sensors for achieve this task. Two sensors are attached on the left and right sides of the robot to detect the distance to the wall following part. One sensor is attached to detect the distance to the box. It mainly depends on the sound waves working on "non-contact" technology. The required distance of the target object is measured without any damage, giving accurate and precise details.

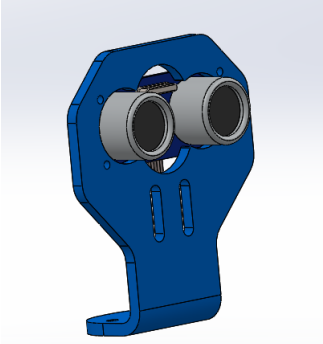

Figure 9: Ultrasonic sensor and its holder

TCS34725 RGB sensor

The high sensitivity, wide dynamic range, and IR blocking filter make the TCS3472 an ideal color sensor solution for use under varying lighting conditions and through attenuating materials. We use this to detect the colour of the box which is placed in the middle of a line segment which is a radius of the circle.

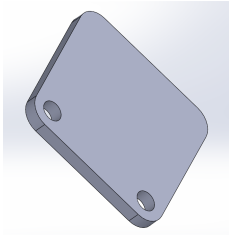

Figure 10: Model of the Color Sensor

Senser Holders

Sensor holders are used to attach sensors to the main platform whenever it is not possible to obtain the desired inputs by directly attaching them to the platform. Holes are there to attach the holders in front of the lower platform.

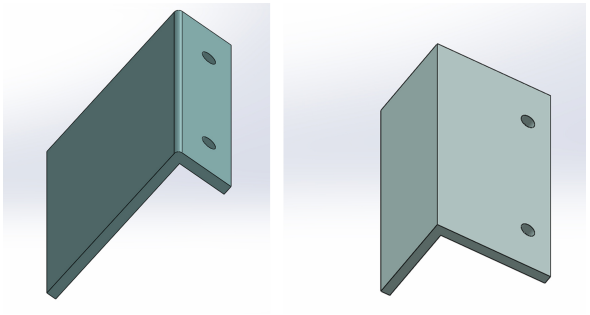

Figure 11: Front ultrasonic sensor holder(left) and color sensor holder(right)

IR Sensor Panel

This sensor is categorized as reflective sensor. In this module both emitter and photo-transistor are packed as a package. This sensor is used to detect presence or absence of a reflective object or to identify the line. Mostly it is used to detect lines for line following robots. In our robot, this sensor is also used as line detector.

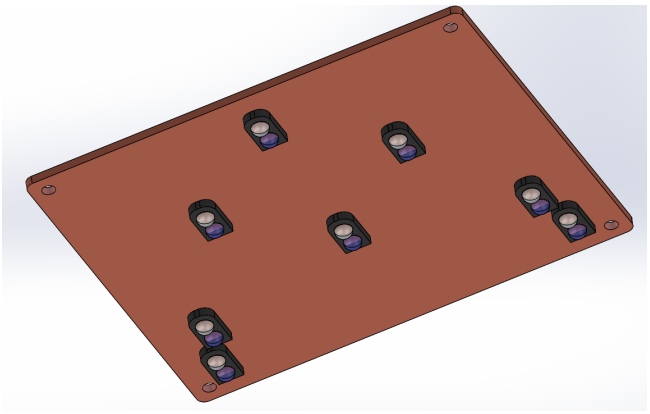

Figure 12: Model of the IR sensor panel

Gear Motors

We are asked to use two metal motors with following features for the robot as they are provided by the university.

- 25D Pololu metal gear motors
- 12V high power
- 48 CPR Encoder
- 34:1 Gear ratio

Gear motors are used to supply the necessary rotary motion to wheels. The quadrature encoders in this motor can be used to add speed and position feedback to our metal gear motors. We use these encoders to find the number of turns the wheel has turned, so we can find the distance traveled by the robot.

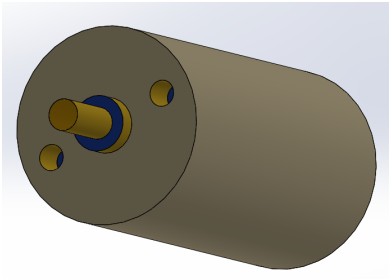

Figure 13: Model of the 25D Pololu Metal gear motor

Wheels

We use two robot wheels with dimensions of diameter 6.5 cm and width 2.5 cm. In our project we are expecting to use plastic rims. We are hoping to use semi pneumatic wheels as it holds its shape with combination of air and strength of side walls. We use the flat wheels as their grip is high so we can maintain the balance of the robot even when it is going on the ramp.

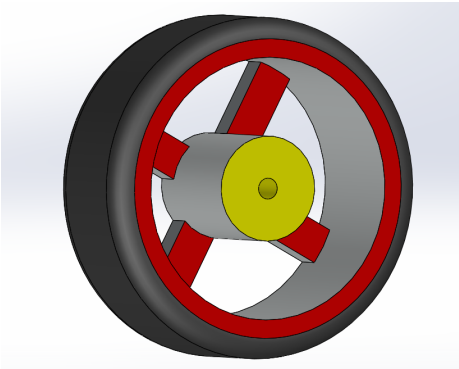

Figure 14: Model of the Wheel

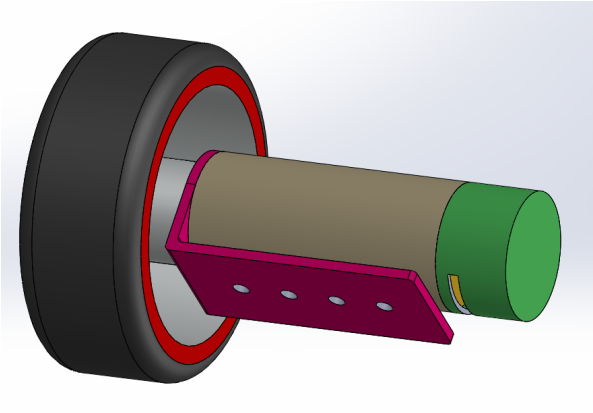

Figure 15: Model of the Assembled Wheel, Motor, its holder and the guard for Encoder(Green color part)

Power Supply Unit

The battery acts like the heart of robot. Because it empowers all electrical parts of the robot. Different components of the robot require different voltages. But we only use one battery unit for that.Therefore, the main voltage should be distributed to different voltages as needed for each component. (Such as 12V in to 9V, 6V, 5V, and 3V). To accomplish this task, we use the power supply units (Power distribution circuit).

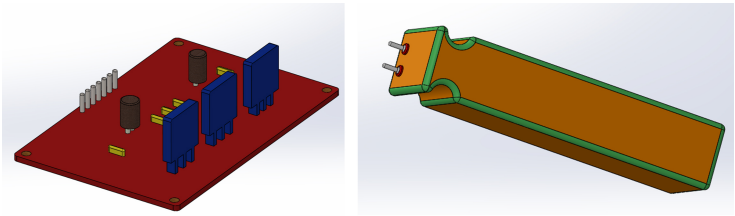

Figure 16: Model of the Power distribution Circuit and Battery

Caster Wheel

A caster is an undriven, single, double, or compound wheel that is designed to be attached to the bottom of a larger object to enable that object to be moved. There are two types of caster wheels as wheel and ball caster. We use the ball caster as it has much more agility than wheel caster. Its purpose is to act as a great third contact points for small robots.

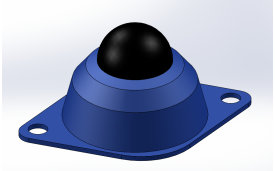

Figure 17: Model of the Caster Wheel