Department of Electronic & Telecommunication Engineering
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Team Skull Axis

Assignment – 06

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Wall following part

We intend to use ultrasonic sensors to accomplish this task. Three ultrasonic sensors will be used to detect the distances between the robot and the walls. We have placed one sensor in front of the robot aiming in the front direction, which we can use to detect the barriers in the way in front. Then the other two sensors are placed in the sides with angle of 72 degrees from the symmetrical line of the robot base. They are intended to be used to maintain adequate distance between the robot and the wall. Despite that we planned to use the left-hand rule algorithm to create a self-guided movement of the robot.

Line following

We use an IR sensor panel to fulfill the line following task. This sensor panel is fixed on the bottom of the front side of the robot. Among the 8 sensors in the IR panel 3 of them are sensing the right side of the white line, other 3 sensors are sensing the left side of the white line and the rest of them are used to detect the white line. When the robot is following the dotted line for a certain amount of time all the sensors will not receive any signal due to the missing of white dash. The robot will move forward a distance equal to the gap between two dashes in that certain time period.

Arm

The robot arm is connected to the front of the robot. This can be moved from 3 places. From the place where the arm connects to the robot chassis it can rotate 360° on the robot chassis plane. At the second joint it can rotate 180° vertically and the last joint at the gripper end can rotate 360°. All these joints are moved and rotated through servo motors. The gripper at the end of the arm can grab and rotate the box and the cylinder easily through these 360° rotating joints. Since there are 3 joints it is very easy to insert these objects to their dedicated slots. Also this can grab and carry the blue/red ping pong ball from the start of the task till it is set to the goal post. At the shooting task, the arm will hold the ball slightly to push it to the goal through a solenoid.

Shooting the ball

To accomplish this task we use a solenoid push and pull valve, an electromagnetic component. When voltage is applied the solenoid moves and when voltage is removed the solenoid springs back to its original position. It develops a linear force in a single direction.

Pi Camera

In order to achieve this task we are going to use a PI camera. The camera is controlled by a RaspberryPi board. We use this camera to detect two objects (cylinder and cube), holes and the color of the ball. We are with the intention to implement a “Deep Learning” based object detection using the OpenCV for the above task. Then with the help of the robot arm we can grab the object. Then the robot will try to find the correct slot for the picked object. To differentiate the two slots, we use another deep learning-based module. After identifying the correct slot object will be inserted to the correct slot using the robot arm. After completing that task we have to pick a ball randomly according to the color. Once again, a model will be used to identify the colors.

Color detection Part

This is used to identify the color of the floor. So the TSC3200 sensor is mounted at the bottom of the robot. Since the colors of the floor are given (fixed) we can feed the sensors with the respective color values. Due to this reason we can keep away the Pi camera from this task.

Motor drive

The robot is using a motor driver to drive the 2 brushed DC motors which rotate the wheels of the robot. Furthermore, to make the robot arm become functional it needs to connect through motor drivers because the microcontroller cannot drive the servo motors with its output voltage.

Micro controller

Here we use an Arduino Mega board and a RaspberryPi board as our microcontrollers to accomplish our different tasks. Pi camera is controlled by Raspberry Pi board while the other components are controlled by Arduino Mega board.

CAD Design

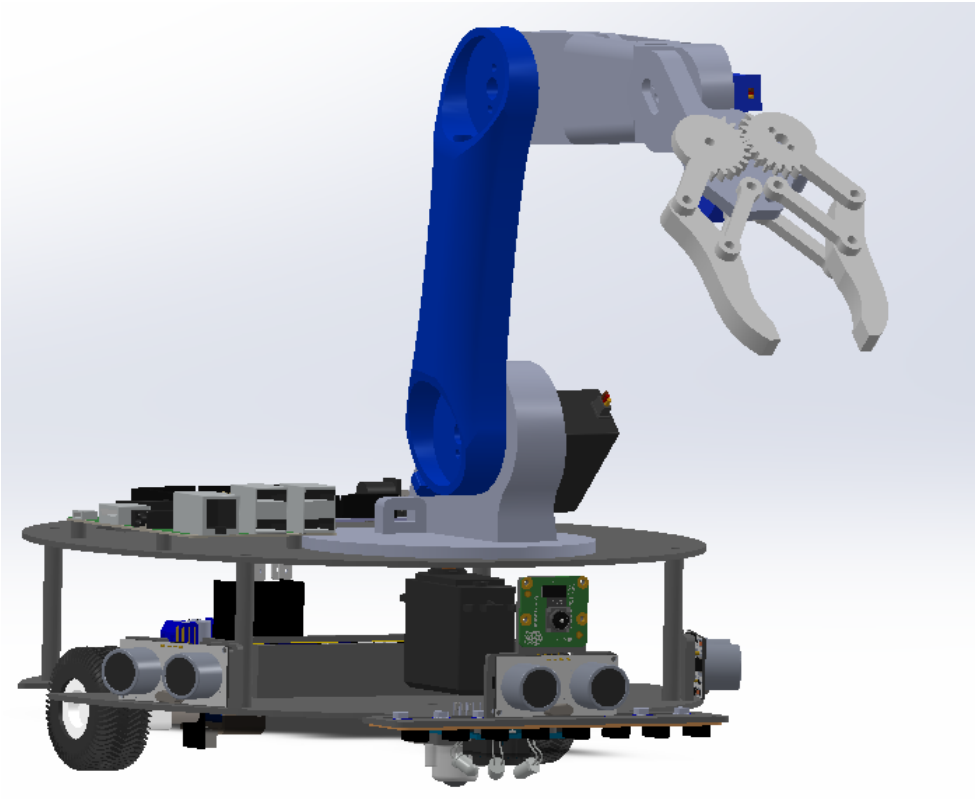

Figure 01

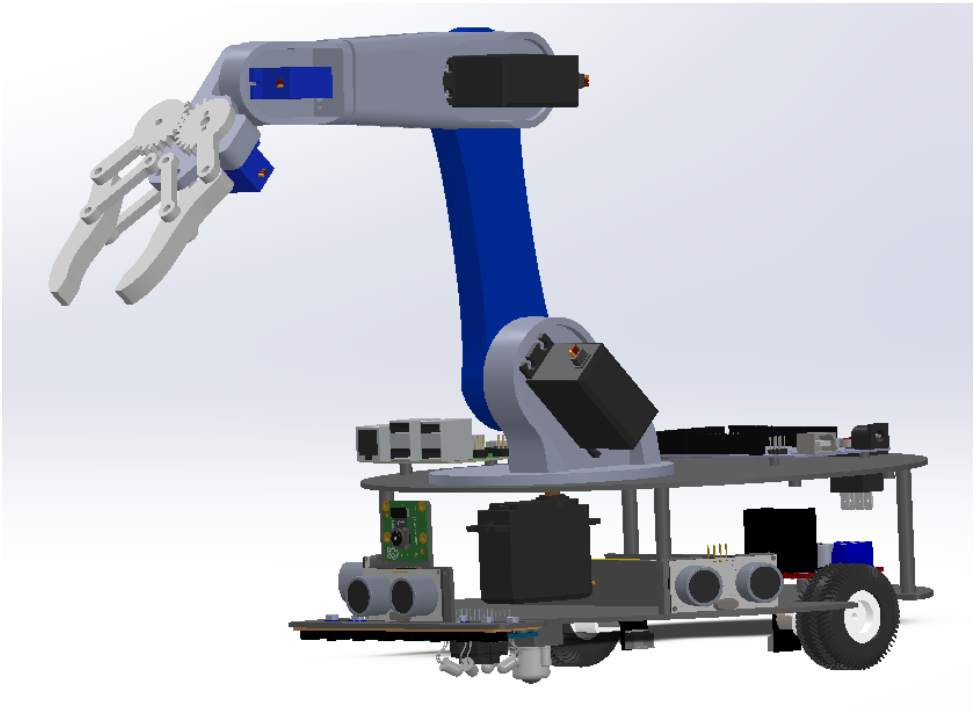

Figure 01

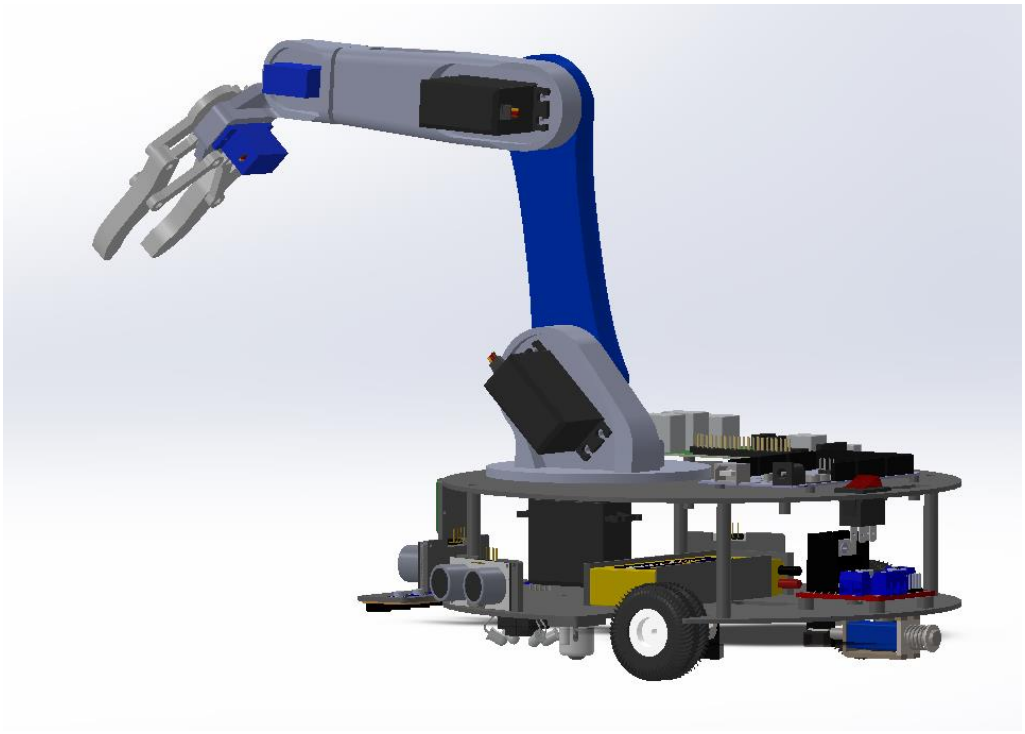

Figure 03

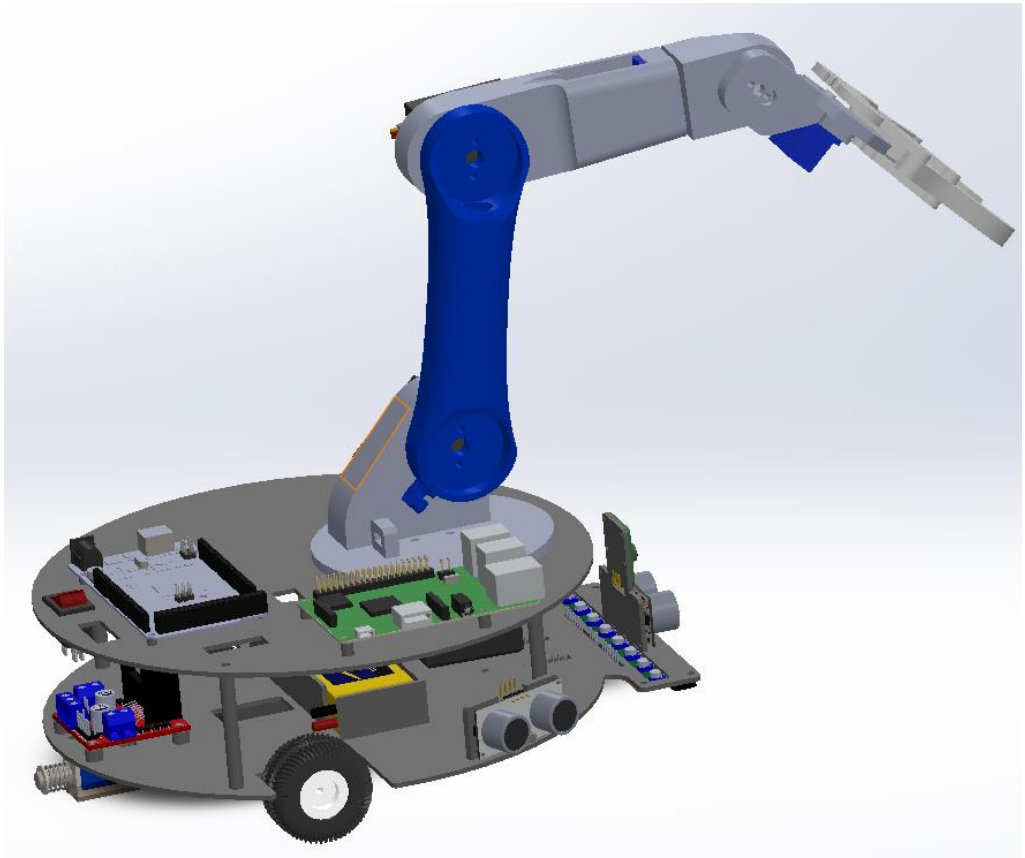

Figure 04

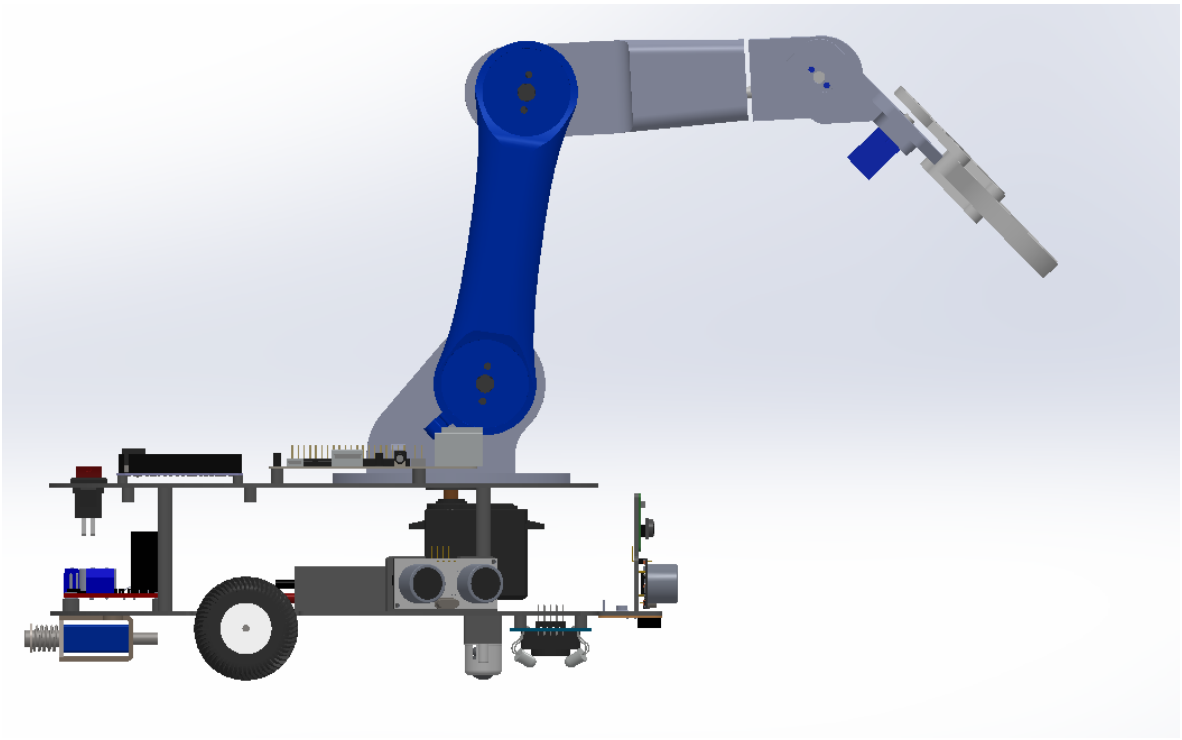

Figure 05