

# HARDWARE DOCUMENT

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GROUP 11

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## **Abstract**

This document is intended to outline 3 hardware designs and the differences between them. It will cover the input components (ultrasonic sensors and color sensors), the output components (motors), and the ball launching mechanism.

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# 1 EDIT HISTORY

- March 8th 2017:
  - **Ethan Lague:** Initial set up of document sections (including table of contents), completion of first draft of sections 1 through 7.
- March 9th 2017:
  - **Alex Lam:** General Re-Formating

## **2 ULTRASONIC SENSORS**

### **2.1 Design 1**

The robot in design 1 uses 2 ultrasonic sensors for localization and obstacle avoidance. The first ultrasonic sensor is placed static horizontally facing the front. The second ultrasonic sensor is placed vertically on a motor where it will rotate to either face the left or right side. It will only be engaged once the first motor sees an obstacle and will turn either left or right to face the obstacle. Refer to Figures 1 through 4.

### **2.2 Design 2**

The robot in design 2 uses 3 ultrasonic sensors for localization and obstacle avoidance. The first is placed static horizontally facing the front. The two others are placed static facing the left and right sides of the robot. Similar to design 1, the two sensors facing either side will only be engaged when in the process of obstacle avoidance. Refer to Figures 5 through 8.

### **2.3 Design 3**

The robot in design 3 uses 2 ultrasonic sensors for localization and obstacle avoidance. Both sensors are placed horizontal with an angle of 90 degrees between them on a motor. One sensor will face the front, and that will be used for localization. During obstacle avoidance, the motor will rotate the sensors so that one is facing the front while the other is facing the side that the obstacle is on. Refer to figures 9 through 12.

## **3 COLOR SENSORS**

### **3.1 Design 1**

The robot in design 1 uses 2 color sensors for odometry correction. The two sensors are placed adjacent to each other with respect to the robots velocity. they are placed vertically facing the ground with a gap of 3 mm. Refer to figures 1 through 4.

### **3.2 Design 2**

The robot in design 2 uses 1 color sensor placed at the front of the robot facing the ground with 3mm of separation. Refer to figures 5 through 8.

### **3.3 Design 3**

The color sensors in design 3 are placed the same as in design 1.

## **4 MOTORS**

### **4.1 Design 1**

The robot in design 1 uses 4 Motors. 2 NXT motors are placed on either side of the robot each attached to a wheel for movement of the robot. 1 EV3 motor is used for the ball launcher. Another EV3 motor is placed horizontally in the middle of the robot for the rotating Ultrasonic sensor. Refer to figures 1 through 4.

### **4.2 Design 2**

The robot in design 1 uses 3 Motors. 2 NXT motors are placed on either side of the robot each attached to a wheel for movement of the robot. 1 EV3 motor is used for the ball launcher. Refer to figures 5 through 8

### **4.3 Design 3**

The robot in design 1 uses 4 Motors. 2 NXT motors are placed on either side of the robot each attached to a wheel for movement of the robot. 1 EV3 motor is used for the ball launcher. Another EV3 motor is placed horizontally at the front of the robot to turn the two ultrasonic sensors. Refer to figures 9 through 12.

## **5 BALL LAUNCHER**

The ball launcher is the same for all three designs. An EV3 motor is placed vertically towards the back of the robot. A long arm is extended from the motor with a claw like basket to hold the ball. The motor is oriented so that the arm rotates perpendicular to the robots velocity to increase the overall stability when firing. Refer to all figures.

## 6 FIGURES

Figure 1: Design 1 front



Figure 2: Design 1 back

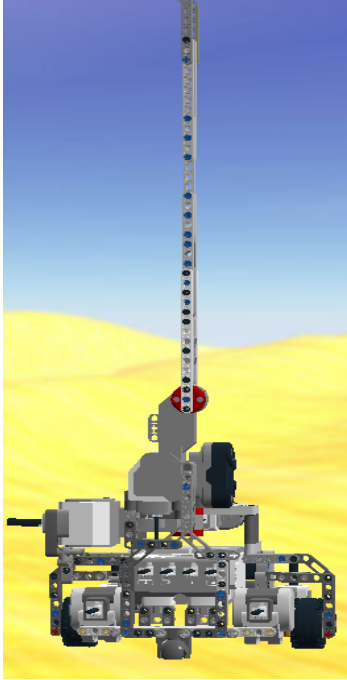


Figure 3: Design 1 side 1

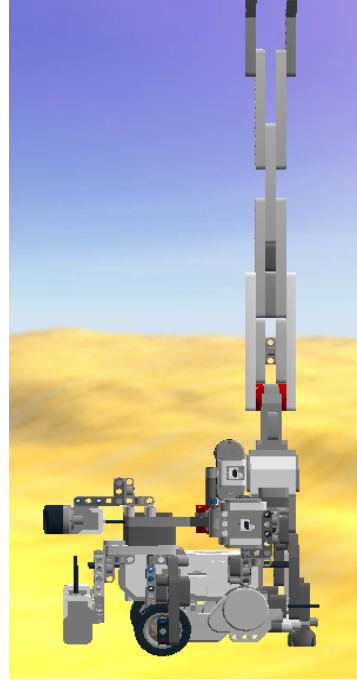


Figure 4: Design 1 side 2



Figure 5: Design 2 front

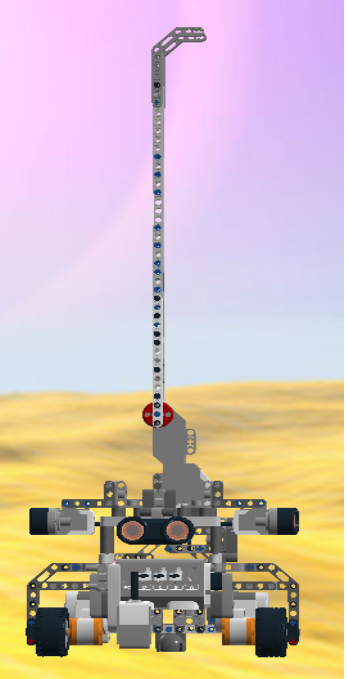


Figure 6: Design 2 back

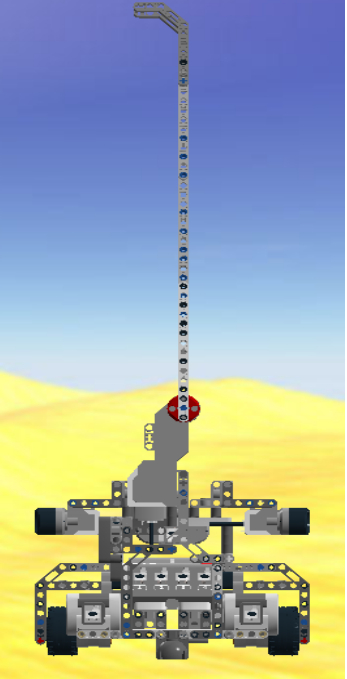


Figure 7: Design 2 side 1

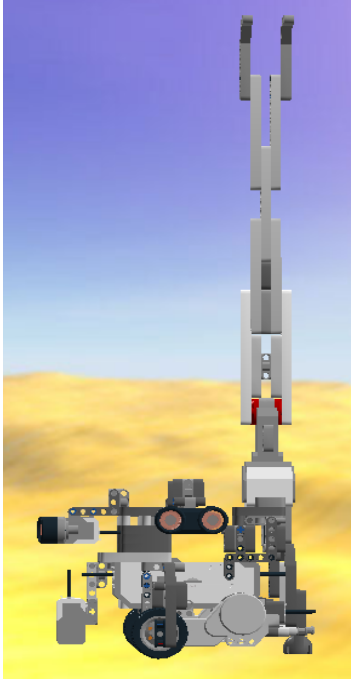


Figure 8: Design 2 side 2

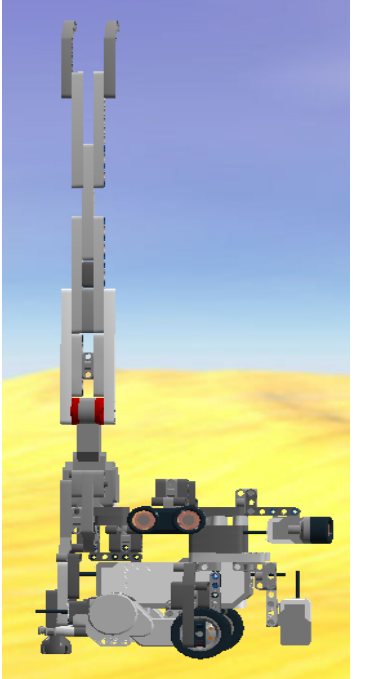
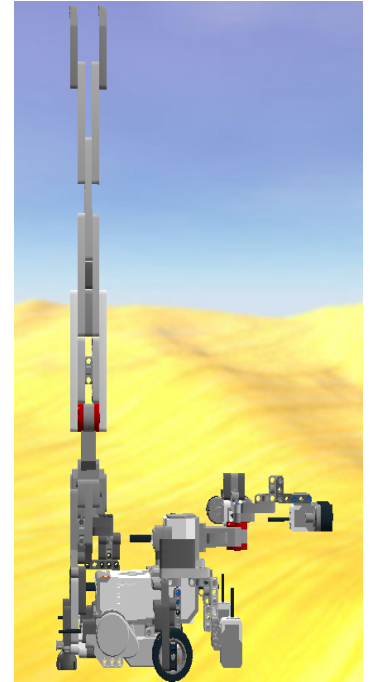
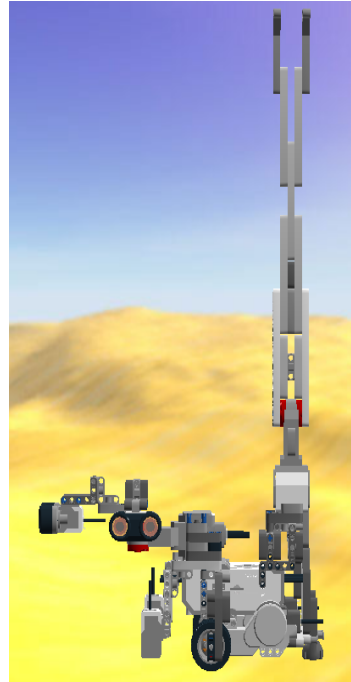
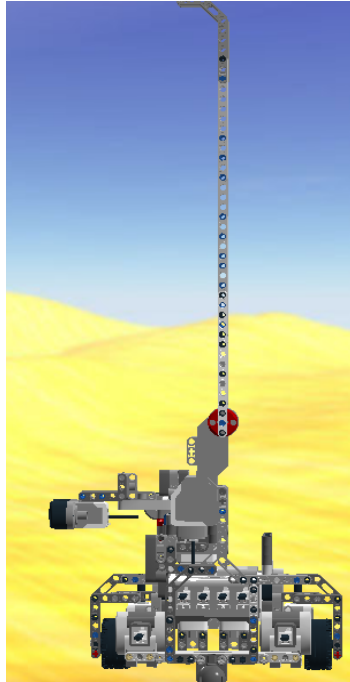
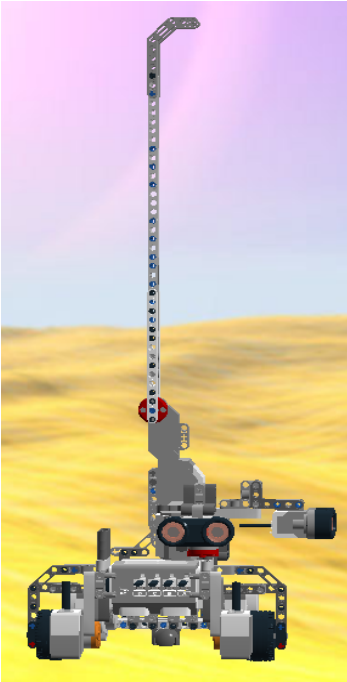


Figure 9: Design 3 front    Figure 10: Design 3 back    Figure 11: Design 3 side 1    Figure 12: Design 3 side 2



## 7 GLOSSARY OF TERMS

- Ultrasonic sensor: A sensor which emits sound waves to pick up its proximity to an object.
- Color Sensor: A sensor which picks up on the color of an object which given the black lines on the field can help the robot know where it is.