HARDWARE DESIGN DOCUMENT

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1.0 - TABLE OF CONTENTS

2.0 - MOTORS

The large NXT motors are older than the EV3 ones, but other than a difference in attachment points, they are identical.

The main difference between the large and medium motors is power and precision. The large motors are more powerful, but less accurate, while the medium motor is less powerful, but more precise. The large motors will be used for jobs like driving the robot around, while the medium motor will be used for jobs like moving a sensor back and forth. All motors connect to ports A through D on the top of the brick.

3.0 - BRICK

The brick has four ports for motors (A through D) and four ports for sensors (1 through 4).

4.0 - SENSORS

The gyroscopic sensor allows you to measure the angle and angular velocity of the robot. It is not used often, but may be useful for this year's project. All sensors connect to the ports labelled 1 through 4 on the bottom of the brick.

The light (colour) sensor can determine the colour of an object, the intensity of the light reflected by an object, or the ambient light level. To detect the black lines on the game floor, the intensity of reflected light will be used. Determining the colour of an object will be useful for identifying the opponent's flag during the competition.

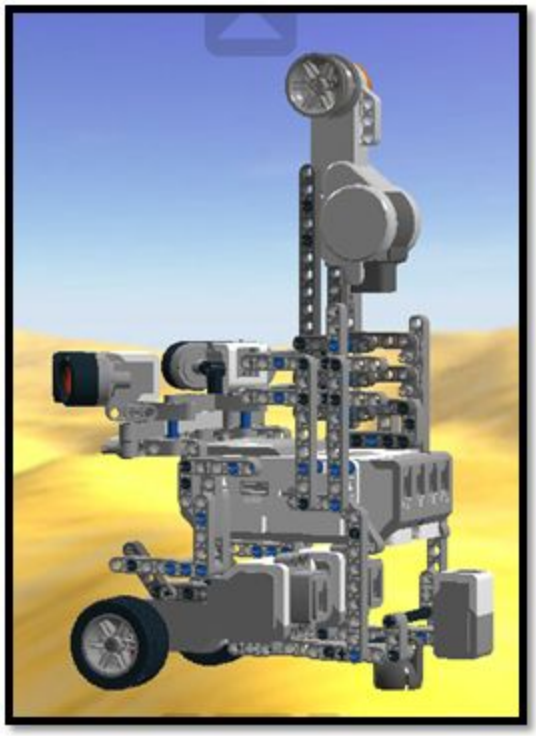
The ultrasonic sensor is used to measure distance by sending ultrasonic waves and measuring how long it takes the wave to echo back. Its main use is in detecting obstacles the robot needs to avoid.

5.0 - Alternative Hardware Designs

5.1 - Option 1

- Set two ultrasonic sensors at 45 degrees in front of the robot.
- Set one light sensor in front of the robot, between the two ultrasonic sensors, facing straight ahead.
- Set the other light sensor as close as possible to the floor on the back of the robot, pointing downward for localization.
- Set the EV3 brick horizontally (important for the balance point).
- Set the wheels slightly larger than the width of the EV3 brick, with two motors.

PROs	CONs
Can detect a good range of distances since the two ultrasonic sensors are both oriented at a 45 degree angle.	No remaining ports for gyro sensor.
Only three motors, the weight is well-distributed.	Might fail to detect an obstacle at 180 degrees
The two light sensors are set pretty low.	The two ultrasonic sensors might be set too high and give incorrect readings. All the sensors are fixed.



5.2 - Option 2

- Set one ultrasonic sensor and one light sensors that are pivoting together in front of the robot. Use one medium motor.
- Set one fixed light sensor as close as possible to the floor on the back of the robot, pointing downward for localization.
- Set the EV3 block horizontally toward the front of the robot to avoid wheel slippage. As a result, we will need to add more weight toward the back for equilibrium. Thus, this robot will be heavier than the others.

PROs	CONs
The smallest robot, lower chance to hit obstacles during navigation or localization.	Height is too low.
The lightest robot, less supporting pressure on both motors.	Supporting arm needs revision .
Light and US sensors attached together, more efficient in detecting obstacles and targets.	

5.3 - Option 3

- Set only one ultrasonic sensor in front of the robot that is pivoting. We will have to use one medium motor.
- Set one fixed light sensor in front of the robot that is facing straight ahead.
- Set one light sensor as close as possible to the floor on the back of the robot, pointing downward for localization.

PROs	CONs
Both the ultrasonic and light sensors positioned in front are low enough.	The stability of the arm should be revised.
The ultrasonic sensor can be moved.	The light sensor is not attached to the ultrasonic sensor, so it can't pivot and is less efficient for detecting the object's color.
Simple design, leaves one spare port for the gyro sensor if necessary.