ECSE 211 DESIGN PROJECT

HARDWARE DOCUMENT

Version *1.01*

03/02/2018

ECSE 211 TEAM 11

VERSION HISTORY

Title	Hardware Document			
Description	Keeps track of all Hardware related design and building			
Created By	Enan Ashaduzzaman, Hardware Team Leader			
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1.00	Enan Ashaduzzaman	Created the Document. Asserted 3 possible preliminary designs coupled with their respective advantages/disadvantages	1st March	
1.01	Luka Jurisic	Peer reviewed the document. Formatted the Document	3rd March	Preliminary Week 2 submission Content complete

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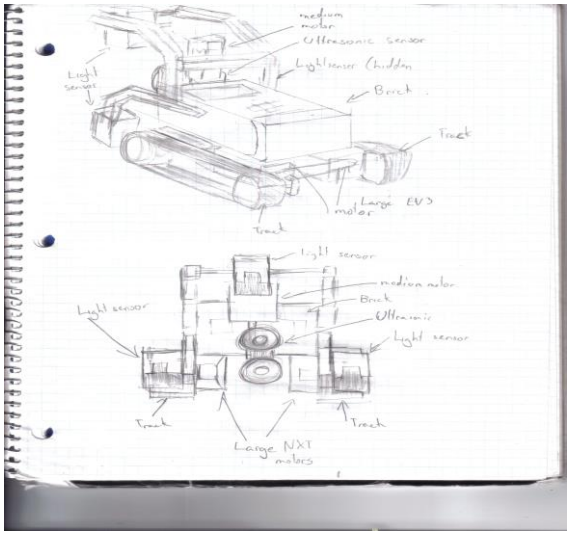
2 DESIGN PROCESS

In the preliminary stages of the project, multiple designs were created while taking into account the Systems, Constraints, and Requirements documents. These designs and ideas mainly came from the research and development phase of the project. From previous experiences of the past five labs, all three teams put their knowledges together in order to think of the best suitable designs for the robot.

At the end of the week, the team came to a consensus that three designs were best suited for the project. The advantages and disadvantages of each designs were looked at and through testing, the team will have a better knowledge of which design to work with during the final phase of the project.

3 PRELIMANARY DESIGNS

3.1 Prelimanary Design #1



The design consists of three main features. The robot will be utilizing the track belt rather than the traditional wheels. The wheels will be attached to two large EV3 motors as they are better structured than the previous generation. With the better traction of the belt, it is believed that the robot will have more grip, thus helping it overcome the bumps that it will encounter on

the bridge. Moreover, on each side of the robot, there will be a light sensor. These light sensors will be used for the odometer correction. From previous labs, it was understood how important it is for the robot to navigate properly, thus the two light sensors will help with the accuracy of the robot's navigation. Furthermore, the variable ultrasonic sensor in front of the robot will help it detect blocks on all three sides of the robot. Finally, the robot will use another light sensor which will be placed about 11cm off the ground. This sensor will be used to detect the colors of the blocks. By keeping the light sensor at a constant height, it will be able to detect the colour of the blocks more effectively without reading error.

EV3 Key Parts

- 3 light sensors (2 used for localization, 1 used for colour detection)
- 1 ultrasonic sensor
- 2 Large EV3 motors
- 1 Medium EV3 motor

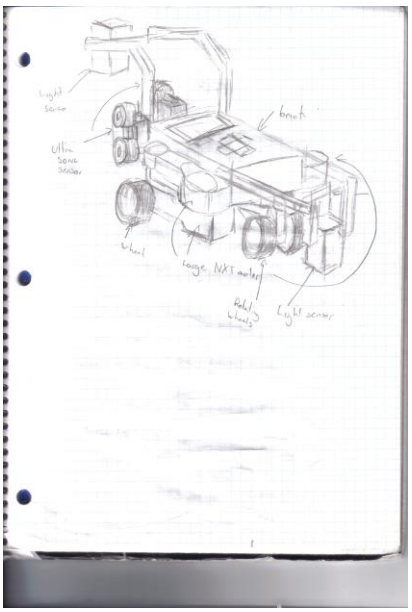
Advantages

By using the track belt rather than the wheels, the robot will be able to overcome the bumps more efficiently. Moreover, this method is a simpler approach without the need of creating a complex variable track. The use of two light sensors will be very important as it will output more accurate results for the robot's navigation. The variable ultrasonic sensor allows the robot to detect blocks on every side of the robot without the use of multiple sensors. Finally, having the variable ultrasonic sensor will decrease the need of having multiple ultrasonic sensors on each side of the robot, thus simplifying the design process of the robot.

Disadvantages

The use of the track belt as the wheels will most likely not be as accurate as the traditional wheels. Also, having the robot speed through the bumps might ruin the navigation. Finally, using the two light sensors for odometer correction is a method been used by anyone in the group.

3.2 Prelimanary Design #2



The design of this robot consists of a very wide track. Like the previous design, the wheels will be controlled by two large EV3 motors. The track will be variable and will be controlled by two large EV3 motors as well. When the robot is travelling over the bridge, the track will expand to 25.75 cm. When the robot is travelling inside the tunnel, the track of the robot will be in its regular state of 21.82 cm. The wide track will allow the robot to be more stable. There's also going to be a wheel at the back end supporting the robot (similar to the design of a plane). This wheel will be able to rotate whenever needed. Two light sensors will be attached to the robot. One light sensor will be attached on the back end of the robot while the second light sensor will be used to detect the colour of the blocks. Just like the previous design, the light sensor will be placed about 11cm from the floor keeping it at a constant height. Finally, two ultrasonic sensors will be used, on will be placed in front of the robot while the other will be placed on the left side of the robot.

EV3 Key Parts

- 2 light sensors (1 used for localization, 1 used for colour detection)
- 4 Large EV3 motors (2 motors used to create the variable track, 2 used to rotate the wheels)
- 2 ultrasonic sensors

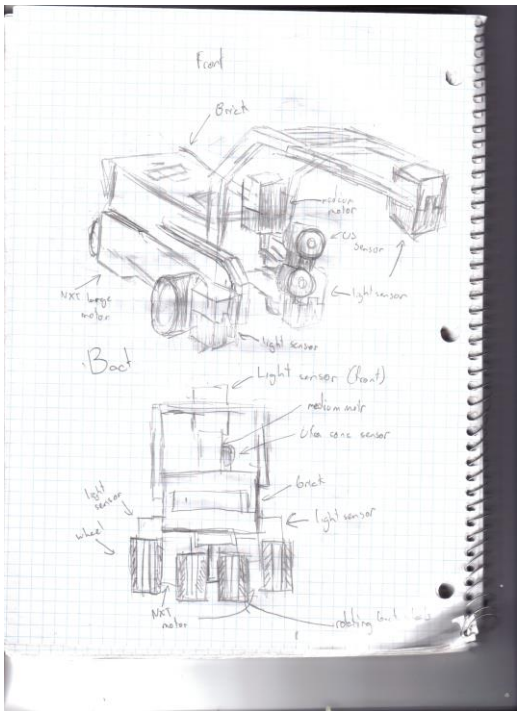
Advantages

The variable track will allow the robot to travel over the bridge without going over the bumps. This will not affect the localization of the robot. Moreover, having the two ultrasonic sensors will allow the robot to detect blocks on multiple sides of the robot.

Disadvantages

Having a variable track minimizes the ability to use a medium motor. This forces the robot to either use two ultrasonic sensors in order to detect blocks on multiple sides of the robot. It also forces the robot to use only one ultrasonic sensor during the odometer correction. Finally, having a variable track that spans 21.82 cm in its stable condition is very wide for a robot. This increases the chances of the robot from knocking a block from one tile to another which is prohibited in the rules of the game.

3.3 Prelimanary Design #3



This design is very similar to “Preliminary Design #1.” The main difference is that this design uses the traditional wheels which were utilized from labs one to five. There’s also going to be a wheel at the back end supporting the robot (similar to the design of a plane). This wheel will be able to rotate whenever needed. Similar to Design #1, two light sensors will be used for

the odometer correction and one light sensor will be placed about 11cm from the floor to detect the colours of the block. The two light sensors will allow for more accurate navigation results. Having the light sensors, a fixed distance from the blocks allow for more precise readings of the colours. One variable ultrasonic sensor will be implemented to detect blocks on all three sides of the robot. The ultrasonic sensor will be attached to a medium motor, allowing it to turn. The idea behind this robot is to have one half of the robot traveling on water while having the other half of the robot traveling on the bridge, mainly on the portion that is not affected by the bumps. This idea still needs to be confirmed by the professor.

EV3 Key Parts

- 3 light sensors (2 used for localization, 1 used for colour detection)
- 1 ultrasonic sensor
- 2 Large EV3 motors
- 1 Medium EV3 motor

Advantages

Advantages of this robot includes that the wheels are more accurate at navigation than the belt system. The robot itself is also a simple design without the complicated variable track method. Having the variable ultrasonic sensor allows the robot to detect objects on every side without the use of multiple ultrasonic sensor. Keeping the light sensor at a constant height to detect the block colours is a more efficient and accurate method. Finally, the use of two light sensors as a form of odometer correction will be more accurate than having a single light sensor on the back end of the robot.

Disadvantages

This idea is just a proposition as the group doesn't know if this method will be accepted by the professor. Also, using the two light sensors for odometer correction is a method that the group never worked with before.