ROBOTICS LOGBOOK

WONSUNG-I RESCUE

Title: **Robotics Logbook**

Team Name: **Wonsung-i Rescue**

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Day 1: 23-6-2013 – Brainstorming

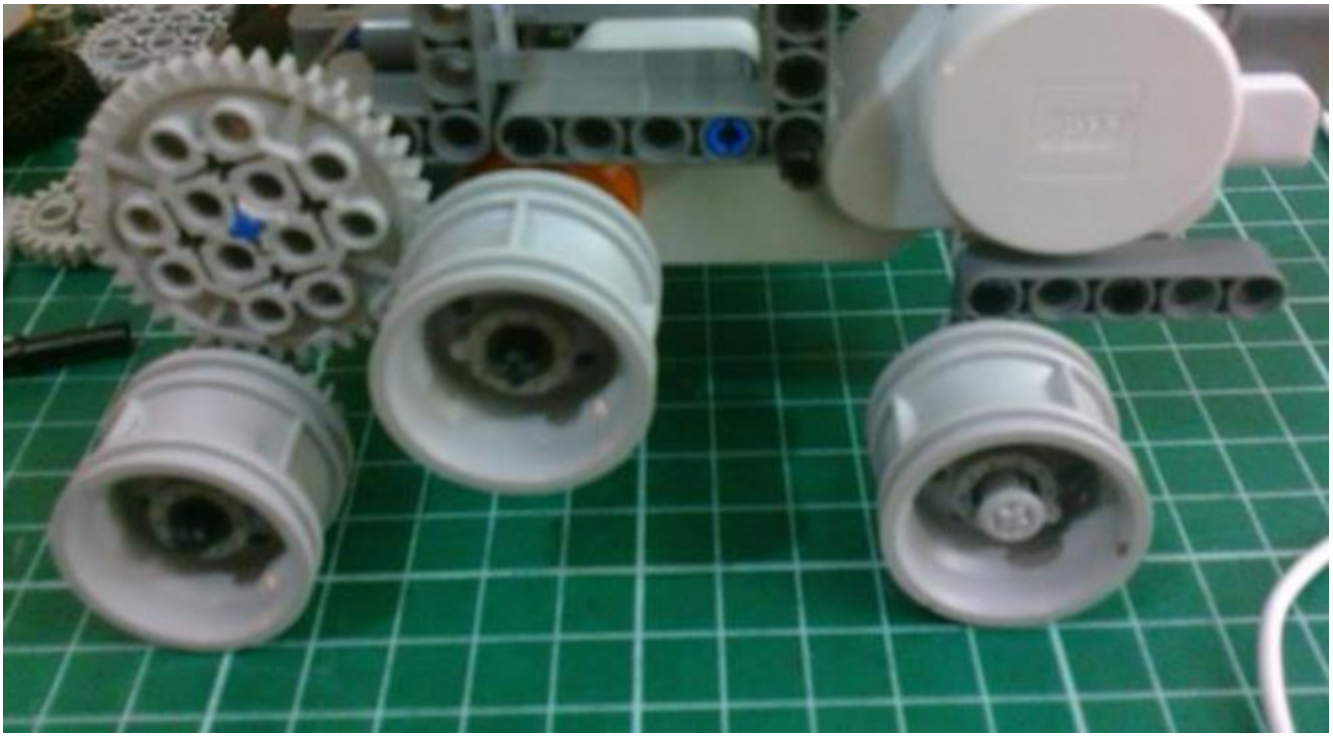
QUICK POINTS

- Thought about **designing the robot**
- Mainly looked at **structure** and how it will affect **movement through the course**
- Decided the **code** will be made **based on design of robot**
- Began constructing the robot

DESCRIPTION

Today we focused on brainstorming ideas. We decided to use treads for our robot, which was very much unlike previous years where we had used wheels. We chose treads because we believe they are more stable and are able to overcome uneven terrain with causing the robot to flip over. The treads will be particularly useful for sloped courses, as they increase friction to prevent it from falling off. Based upon previous experiences, we decided to use two half-wheels for the lifting mechanism.

We opted to position the NXT brick in an upright position to allow more space for the can lifting mechanism. With these decisions we began to construct the robot



The three wheels that would hold the tread.

We faced our first problem with our design soon – our second wheel, being powered by the motor, was causing the tread to slip, since it didn't contact with much of the tread. With this problem, it was decided that we would gear the top and front wheels upon the motor so that they would spin the treads. This was done is hope of creating a faster and more stable robot, when the code is written.

Day 2: 30-5-2013

QUICK POINTS

- **Light sensors** and **issues** with them – distance apart, positioning
- **More stabilising** of the robot – possibility of bulkiness
- **Line following code** was written

DESCRIPTION

This week was dedicated to attaching the light sensors and finalising the treads and movement of the robot. The light sensors were difficult to implement properly without causing the robot to become too bulky. We had to find the best way to stabilize the light sensors so that we would still have room to attack the distance and touch sensor.

We decided the distance sensors should have a maximum distance of two centimetres, as the line is 15mm.

The light sensors were placed close to each other for better line following.

The parts of the robot which held the wheels were attached to each other so the wheels would not bend inwards.

We also began coding the robot, by first simply following the line and taking values. We made sure the robot's light sensors were placed correctly, and went on to stabalise the robot.

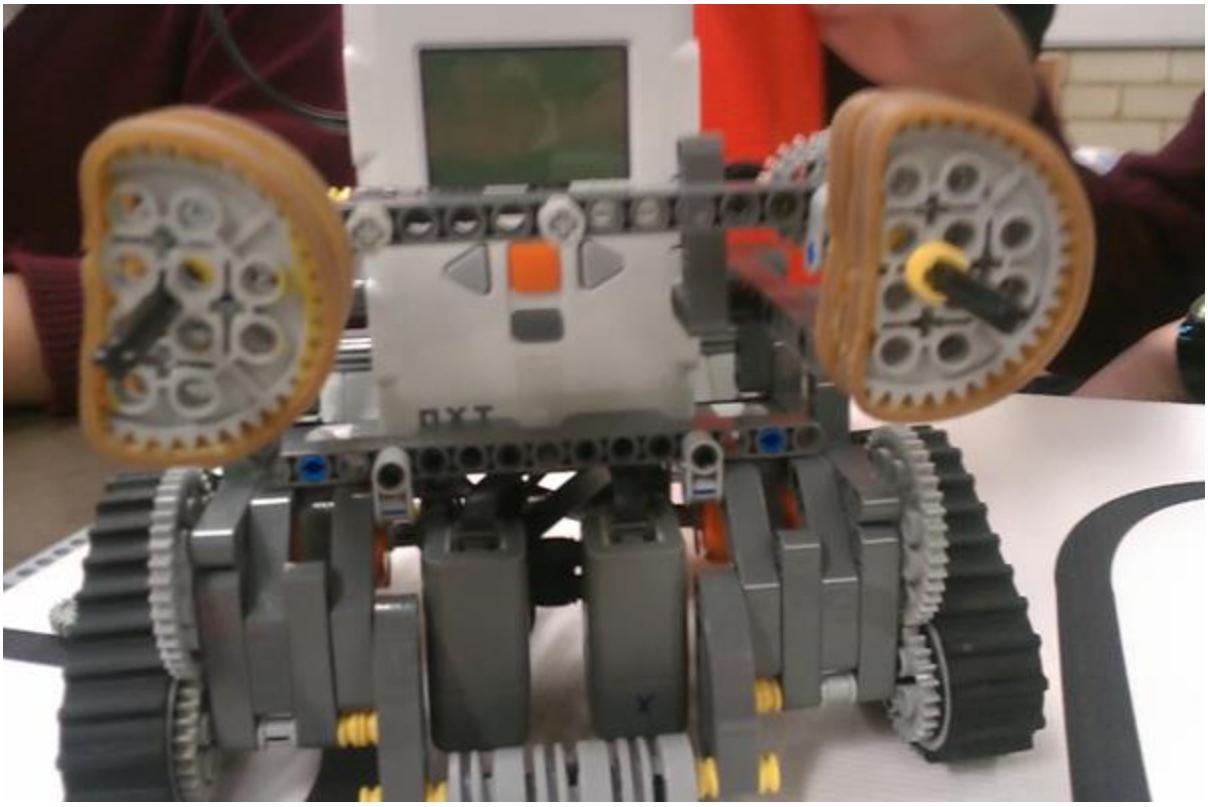
Day 3: 6-6-2013

QUICK POINTS

- **Can lifting mechanism**
- Some speed changes due to the bulkiness of the robot

DESCRIPTION

With the wheels and the light sensors completed we moved our focus onto the can lifting mechanism. We began by creating the majority of the mechanism; the frame and the gears. We then attached a motor placed, on the side of the robot. The motor made the robot somewhat unbalanced on one side, and because of this we thought of placing the motor on the back of the robot. However, we ended up not doing so, as we didn't want the robot to be too elongated. To complete the mechanism, we obtained four big gears and cut them to two thirds the size.



The gears had rubber bands glued together for better grip.

After cutting the gears, the rubber bands were also cut and were attached to gears using a hot glue gun.

We also adjusted the code for line following to a medium speed at motor speed = 50. We also refined the movement of turns by making it more smooth.

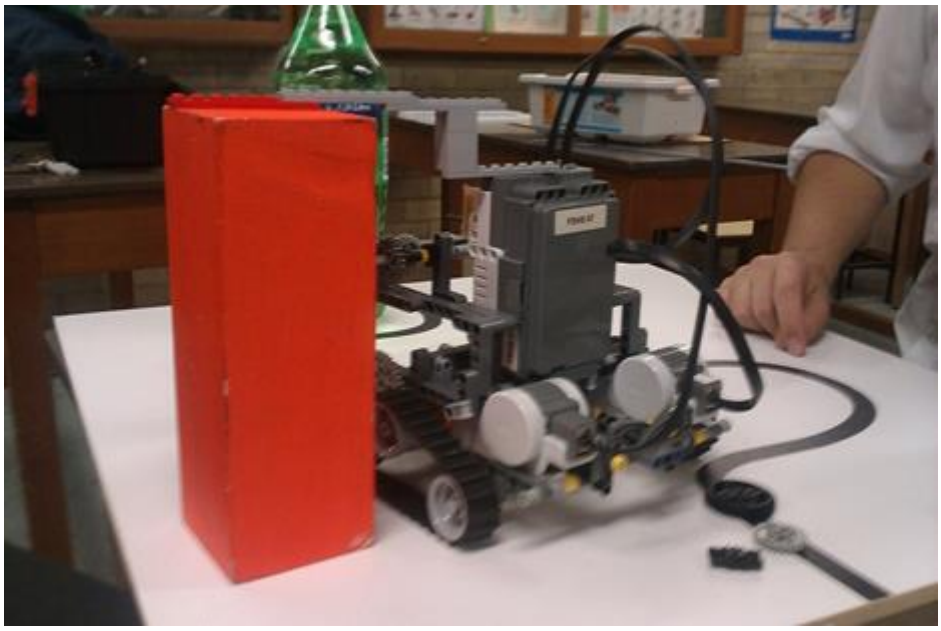
Day 4: 13-6-2013

QUICK POINTS

- Code should be **written while we construct** – some tiles were tested
    - Green square coding issues
- **Space and height limit** issues of the robot

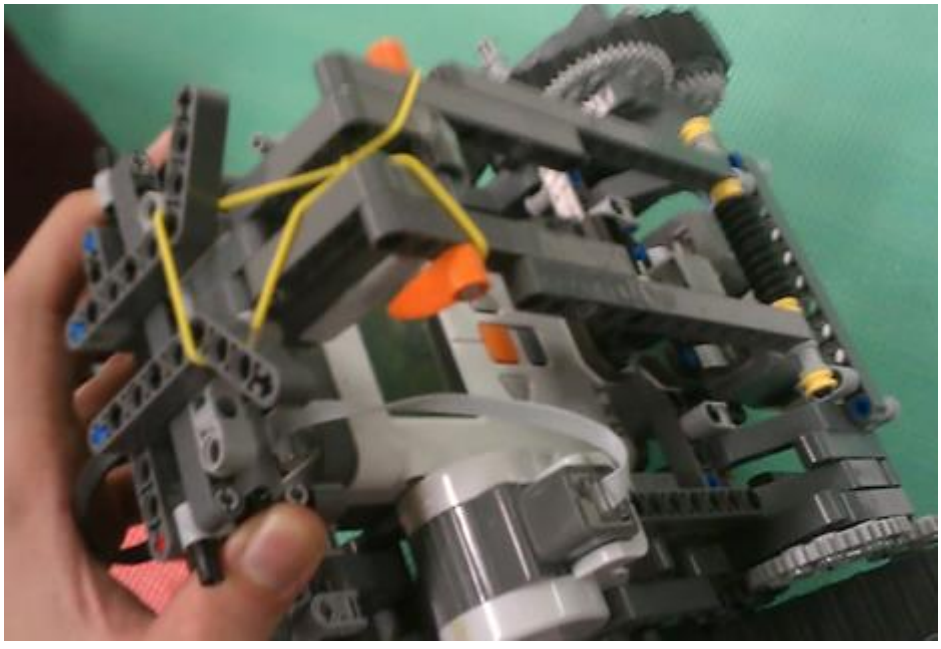
DESCRIPTION

As we continued to build the robot, we became worried that we would run out of space and go over the height limit. To makes sure we were still under height limit, we measured using Lego pieces.



Measuring the height of the robot.

We concluded that we still had 3 2/3 of block units left, and this was just enough space for the touch sensor apparatus. Therefore, we began building a touch sensor apparatus to attach to the robot.



The touch sensor is hidden underneath the frame near the orange holders and yellow elastic band.

We wrote out the green square code, adjusting the white and black value differences so that the green square code could fit. After writing it, however, there were issues with the black line detecting green, due to the small differences between black and green values. We decided that we would fix this issue in the future.

We also tested the robot for the Bridge tile and the Speed Bumps, of which both tests succeeded due to the designed treads and the robot's perfect height off the ground.

Day 5: 18-7-2013

QUICK POINTS

- Fixed **green square problem**
- Added **light shields** to the sensor

DESCRIPTION

We fixed the detection of green square by expanding the differences in values of reflected light to around 22 (out of 100) increments from its initial 9/100. This allows our robot to specifically look for green squares, instead of guessing if the black line is green or not.

The code for green square was now complete, and to improve accuracy we added light shields – paper wrapped around each light sensor – to get a better reading every time.

As well as following the line, the robot could easily make its way up slopes.

Additionally, we added the distance sensor, which will be used later for detecting the can.

Day 6: 25-7-2013

QUICK POINTS

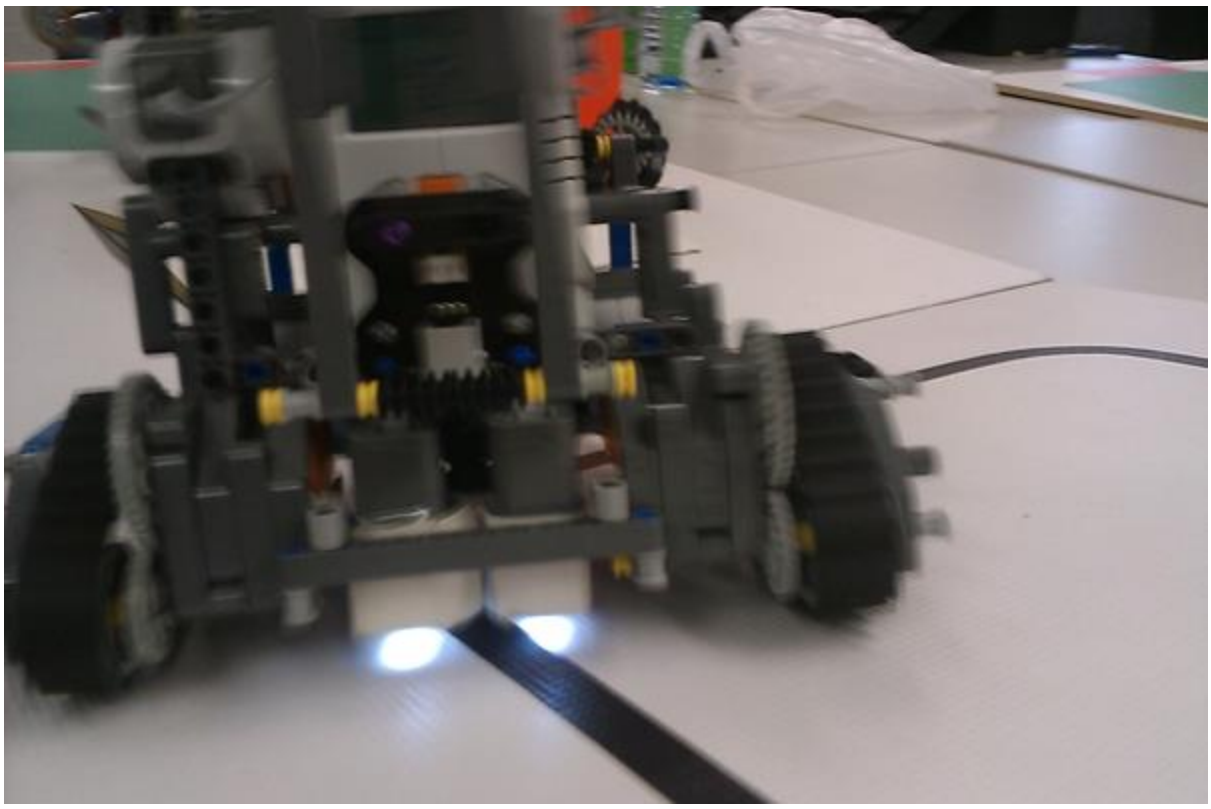
- Checked all **hardware** to make sure everything was **stable**
- **Water tower** code

DESCRIPTION

Today we did our final check for all the hardware components, and ensured that all parts were stable and would not fall off during the competition.

We also progressed in our code by tackling the water tower code. We adjusted the positioning of the elastic band that held our touch sensor to make sure that it wouldn't accidentally trigger anything while it was on a slope or seesaw, and went to writing the code.

The code was written separate from the normal code, as we had to measure the exact movements of the robot around the water tower. This was done by adjusting motor values, assigning time values for these motor speeds, and adding them all together to avoid the bottle and continue onto the line.



Testing the Line Following & Water Tower programming

This was very simple, as we had worked on timed movements previously in solving the green square issue, and not many problems were found after perfecting the movements.

Day 7: 1-8-2013

QUICK POINTS

- **Final 'Oil Spill' code**
- Minor adjustments to **lifting mechanism**

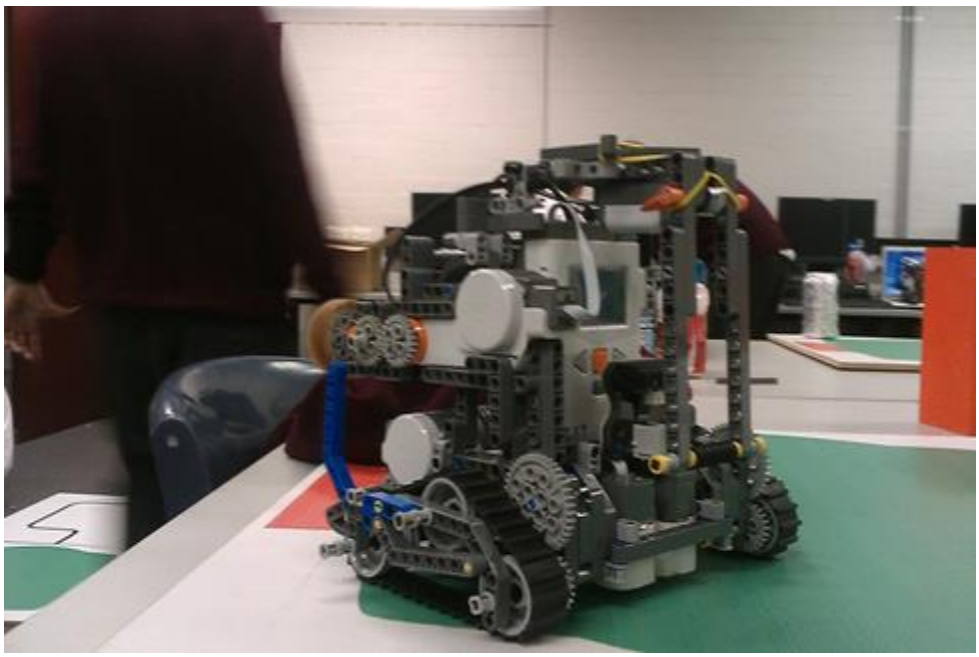
DESCRIPTION

Before we started on the Oil Spill code, we simplified all movement codes by creating a function that was easy to use and easy to understand – where move(left,right); could easily make the motors rotate the numbers placed in 'left' and 'right'. We also cleaned up the code by removing irrelevant sections.

We began writing the Oil Spill code, by splitting the tile into separate sections, such as 'Find the Can' and 'Lift the Can'. This was fairly hard, as the lifting mechanism was slightly skewed to one side and was not directly in the middle of the robot. We fixed this by adjusting the position of the robot before collecting the can.

Another problem was that the can could fall off if the lifting mechanism rotated too much. We therefore added an extra pivot on top of the lifting mechanism so that the robot could hold onto the can with three arms – thus allowing a more stable release onto the block.

Today we began to test the robot and its programming to work out any errors or bugs in the program. The majority of errors were found in the turning at the green squares and the end tile in detecting and lifting and dropping the can on the block.



Testing the final tile programming

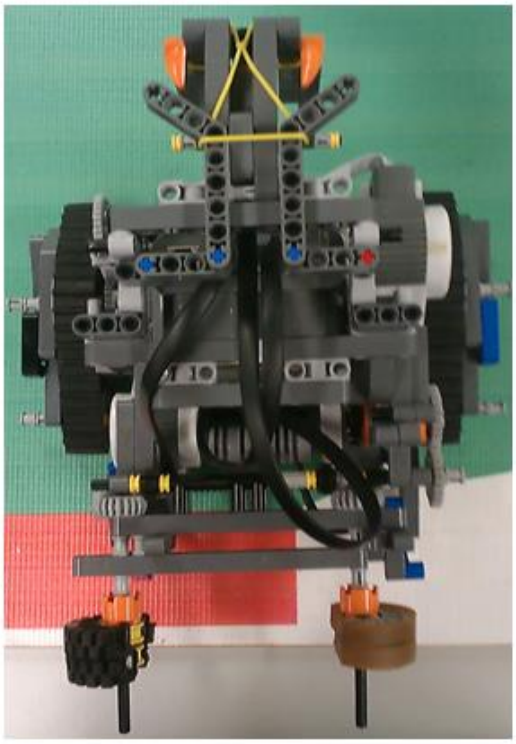
Day 8: 8-8-2013

QUICK POINTS

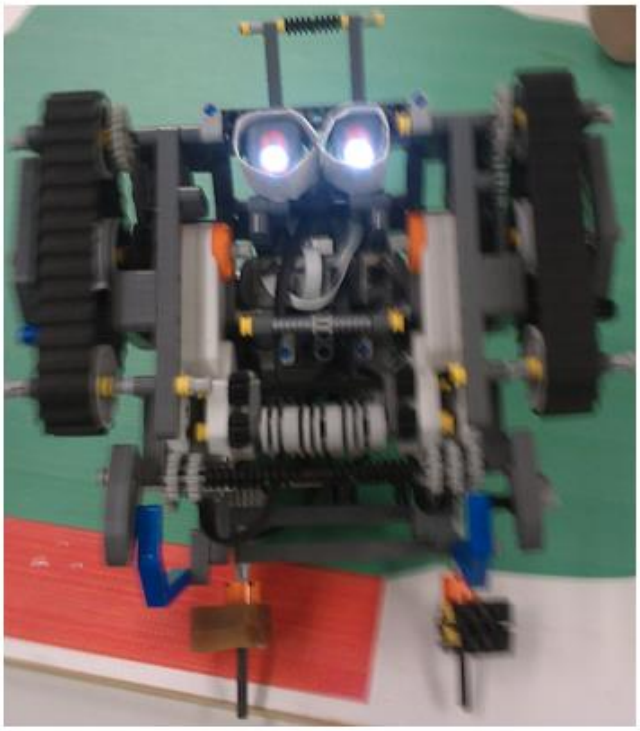
- Minor fixes to robot and code

DESCRIPTION

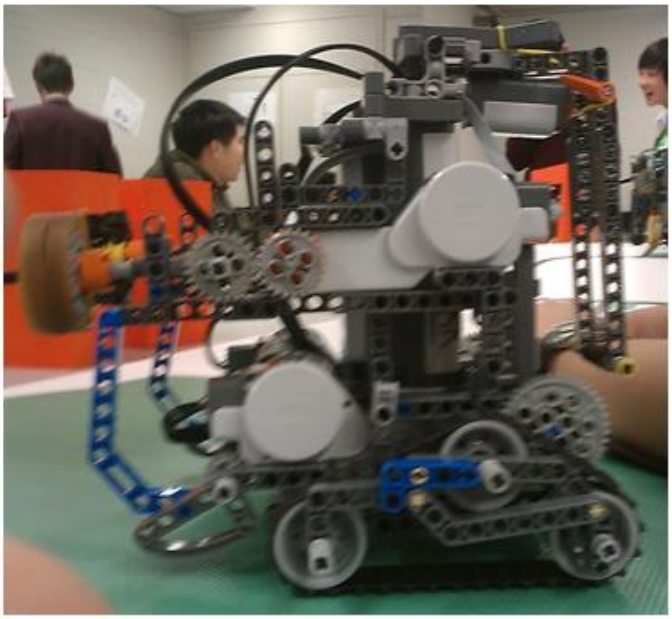
This week was focussed on finalising the robot and its programming. Final modifications were made to the actual robot along with the programme. However, although some minor repairs and alterations may be necessary, the overall robot is essentially completed.



Top View



Bottom View



Side View

Day 9: 12-8-2013

QUICK POINTS

- Robot **run through course tiles over 20 times** to ensure everything was working

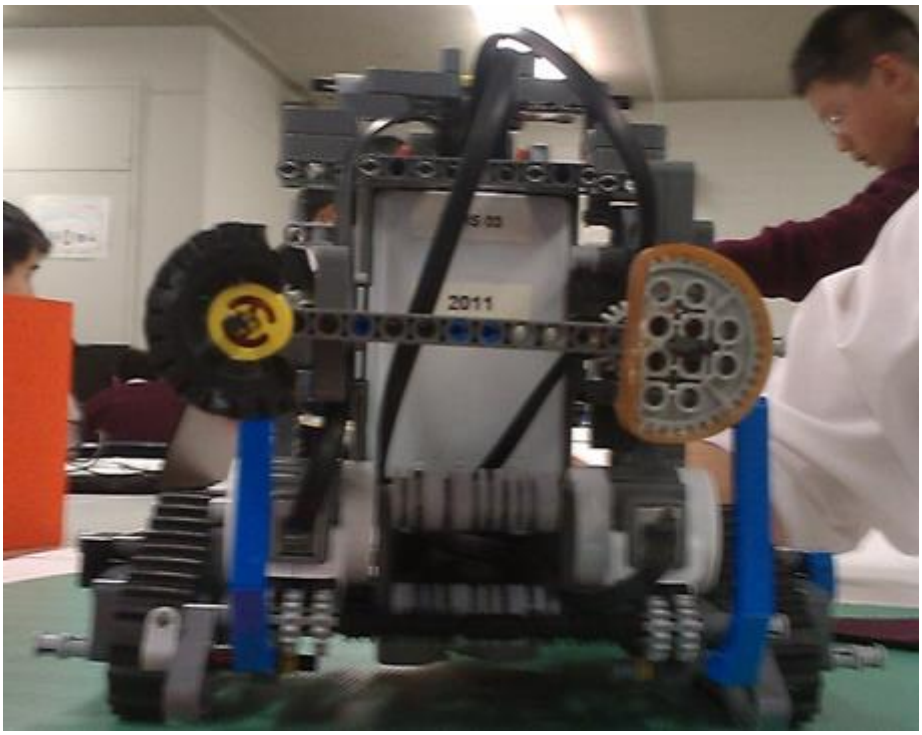
DESCRIPTION

Today we finalised everything by running the robot through the whole course many times. On particular tiles, such as the gridlock, we worked to refine the green square turning.

Running through the course over 20 times made sure that the robot could properly do everything it was supposed to do, and for every tile, we carefully looked at the sensors and its position on the tile. We also carefully analysed motor movement and tread movement to make sure it was working well.

We also tested our robot on the more 'chance' tiles, such as the seesaw, to make sure the robot did not get stuck, fly off or flip over during the process. We were happy for choosing treads as these tiles were much easier to complete than other groups' attempts.

In terms of hardware, we used a hot glue gun to attach elastic bands to attach an elastic band to the half tyre to hold it in place and provide further stability in the event of the can slipping when it is lifted up. This was to stabilise the lifting mechanism and ensure it would not break.



The half gears that had the elastic hot-glued to them

Last Words

Overall, we feel that we have completed our robot in a good space of time, and we managed our time very well. Although some problems took up much of our spare time, they were eventually fixed. The robot itself looked great ("It's a tank!"), and we will work together as a team in the future.

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