

Martin Dunn 1705105 Lego Assignment

by Martin Dunn

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Integrating Project

M4x01506

Lego assignment

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Introduction

The task at hand for this project was to use a Lego Mindstorms robot and design the way in which it would be built to make it work correctly for the tasks given. The robot had to then be programmed to overcome 3 tasks, Line follow, Block avoidance and navigating a maze. This challenge was taken on by a group of 3 people each having one section each to focus on and then to piece them all together in the end to make it work as one whole program. But in this case only one section of the Task has been completed as there was only 1 member working solo to complete the line follow.

The task of completing the line follow needed only basic knowledge of the Mindstorms robot and it was required to utilise all the basic operations that had been learn over the previous sessions. There were a number of way it could have been done and it was up to the individual to complete this task how they see fit and in the most efficient way.

Mindstorms Design

The design of the Robot was totally the groups/individual's choices, as there are several ways it could be designed for the task to be carried out successfully and it is down to the users to figure out what is the best and most reliable for the given part of the course.

As the line follow was the main focus here, the main attachment that would be needed for the robot is a Colour Sensor, as the robot is required to follow a line of a certain colour along the floor making corners and curves when the line does, so the colour sensor is the most logical choice for this task and that is what was chosen. It was fixed to the front of the robot about 0.5cm above the floor as the closer it is to the surface the more accurate the reading is of the colour as the sensor makes its readings by seeing how much light is reflected back off the surface that is it shining onto and this determines what colour that the sensor is looking at.

Motors/Sensors

To get the robot to move it is required to have motors that are connected to the wheels that are programmable in many ways so that you can control the speed, distance and direction of the robot at any given point. Motors can also be used for many other things then just moving the robot from pint A to point B but none of them are really useful in the given task of line following. Two large motors are used to power the wheels and they are individually programmable so that you have much more precision over the movement and direction of the robot as you can easily slow one side and speed up the other to make a quick movement to the left or right if needed. This is similar to what will be done to make the corners in the line following problem, but it will not be fast, it will be a slow and steady pace to make sure that it is following the correct path as accurately as possible.

As stated in the "Mindstorms Design" section the only sensor used on this robot was the colour sensor. As the task is to follow a line that is in the shape of an S on the floor and it is half red and half blue with a white line in the middle. So the easiest option would be to colour sensor. Think of the robot as a person and how you would use your own senses to navigate a blue/red line on the floor, you would rely mostly on your vision of that colour to make sure that you are going in the correct direction and making the corners correctly, the robot is the same premise, it uses the sensors similarly to the way we would use our own, so when the program is finished what the colour sensor sees will depend on what the robot's motors do and what motion it has, just like us Humans.

Programming the Robot

The first and only section of the course that was to be completed here was the line follow. This would need the robot to advance down a line of red and blue and stick to it as well as making the corners appropriately to ensure it would make it to the end correctly. The main piece of equipment used here was the colour sensor mounted on the front very close to the floor.

The colour sensor was set in a loop with a decision and it was set to measure Reflected Light intensity. A reading was then taken on the edge of the blue line and another reading on the white just outside the blue. The decision was then set if the light intensity threshold was in the blue where it needed to be it would just manoeuvre forwards, until the intensity changed to an amount that was not in the region specified it would then manoeuvre left or right depending on what was needed to stay on the line. This system also worked perfectly for the corners as it would just follow as it came off the line the intensity would change, and it would move back to the line where it needed to be.

The robot was set at a constant speed of 5 as this would make sure that its movements and readings are much more precise and it can't manoeuvre much more accurately, if the robot was to travel faster then it would be less accurate and could potentially end up veering off or just making a lot of mistakes before reaching its end destination if it ever would reach it that is.

The programming for the robot was fairly basic as the line follow was much easier than some of the other obstacles it would have to overcome in the full course, but it still took some clever thought process and trial and error to get the light intensity levels totally correct in some parts of the line.

Conclusion

When this task was first presented to us it seemed to be very basic and seemed like it would be very easy, but when you start to investigate the software and the robot itself it turns out to be a lot harder than you first expected. There were several things to overcome.

Firstly, we had to learn how to correctly use the software and what settings could be used with what parts of the robot. This was not straightforward and did not come easily as there are many different settings and multiple of the different settings can all be used to operate the same piece of equipment. There were also loops and switches that had to be utilised and learnt because they make the task much easier when they are understood and used correctly. Secondly, the different gadgets and pieces of equipment that could be attached to the robot had to be learnt too, there were a number of different sensors and motors from colour sensor to ultrasonic sensors and touch sensors and they all had to be tested individually to fully understand what they are capable of achieving and if they would be useful to the current task that would need to be completed. This I would say took the most amount of time and understanding because you would have to remember how they worked and what made them work best e.g. the colour sensor was incredibly inaccurate if it was not really close to the surface it was trying to take a reading from.

There was also the small problem of battery life in the robots to overcome, if you were using the robot for a large amount of time the motors would begin to become inconsistent depending on how much battery that robot currently had, one motor would regularly turn faster than the other even though they would both be set to do the same action at the same speed. This is probably the most infuriating problem to try and get by because the robot could work 3 out of 5 times but never 100% of the time.

Overall I think the Mindstorms were a challenge to get used to but once its going it can be an incredible amount of fun and a large sense of reward once it does what it is supposed to do correctly.

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GRADEMARK REPORT

FINAL GRADE

64/100

GENERAL COMMENTS

Instructor

Assessment Component 1 (Report):

Introduction: Fairly clearly stated. Would be helpful to include a basic diagram.

4/5

Background Research: Needs to be referenced, Are there any alternatives to the method you chose (ie 1 colour/2 colours used?)

8/15

Project Plan: There doesn't seem to be one?

Design Process: You have discussed what you did quite well, but you need to include screenshots/diagrams of the robot and the task in process to fully illustrate what you did.

25/40

Evaluation and results: Generally good, again, objectives were achieved. Be careful to to write too colloquially! 20/30

Assessment 1 Total: 57%

Assessment Component 2 (Demo):

Technical knowledge/skill 17/20

Analytical and Problem-solving skills 16/20

Quality of result 42/60

Good overall, follows line, a little on the slow side. Cannot mark transitions between sections as not completed with group.

Assessment 2 Total: 75%

OVERALL MARK FOR MODULE: 64%

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