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Lego Mindstorms assignment

final

by Alexandru Mardare

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Introduction

For this assignment we have been asked to get in a group of three people and complete a task where we have been asked to program an EV3 Lego Mindstorms robot to follow a line then to avoid a block and then to fully go around a maze and find its path to the exit. This operation can be achieved through team effort and through accurate programming. The programming has to be done on a special Lego EV3 programming software where you have to drag and connect different blocks. Each block does an operation for example the move tank option will program the robot to move in the directions you want it.

Line following

The line following can be achieved through the use of accurate and adequate code for the situation. Before the code has to be set up you firstly have to construct the robot in a way where it can be used for line following. The way that you would construct it is by getting a colour sensor and placing it in a position where you know its close enough to detect the colours on the sheet. The sheet also had bends so you need to adjust the robot with the colour sensor through the use of code in the programming software. The colour sensor can be set to any colour you want which is available to the user through the programming part. The sensor also has to be adjusted in a way that there is enough light shining on the sheet and that the light covers the colours on the sheet. In the group a team member has to be in charge of this process.

Block avoidance

Block avoidance can be yet achieved through the use of code and the proper robot construction tools. For the block avoidance again someone has to take control of this to create a sustainable team effort. The block avoidance will be completed through the use of either a touch sensor or the Ultra-sonic sensor. The robot will have to approach the block after it comes from line following. The way that the robot has to avoid the block is by going around it through the correct use of the sensors then stop once it gets in place ready to go into the maze.

Maze

For the maze situation this sounds like a harder process as you have to use the sensors and the programming at a very high level in order to achieve a smooth journey through the maze. In my opinion for the maze I would personally use the Ultra-sonic sensor as it can

measure distances from the walls and also the touch sensor which it should help the robot find its way again when it hits something like the wall. The robot has to find its way around the maze and successfully exit the maze.

Research

For this assignment research is key essential in order to complete the task successfully. The research I have carried out was from using the Art of Lego Mindstorms EV3 programming book by Terry Griffin from the university library and also some various YouTube videos to help out in getting a better understanding of what had to be done. For my part in the group I have decided to look and complete the line following part of the task as it seems to be the task that flows with me better plus the thought of using sensors on different colours is really interesting. Personally I have not used any videos to help me out but I have used parts from the book which have helped but not in great amount as I had to adjust everything to the environment and also the task that has been set out. [1] <https://www.amazon.co.uk/LEGO-MINDSTORMS-Programming-Full-Color/dp/1593275684>

Tools/Techniques

Each person in the group has been given a part to construct the robot. These parts include line following, block avoidance and maze navigation. We have decided as a group to all take a role in building and programming the robot. I have taken the role to complete the line following task, Ryan has been given the role to complete block avoidance and finally Patryk nominated himself to do the maze navigation. The tools and techniques that I will need to complete my task are firstly a computer which can run the Mindstorms software along with the robot brick itself and also a colour sensor to detect the colours on paper. An important technique which I have to apply is gathering all my previous knowledge from previous lessons and apply it to this current operation to successfully complete the task.

Other team members will have to apply the same techniques when it comes to programming but this won't apply for the construction of the robot as each team member has a different task and a different way in approaching the building of the robot plus the parts needed for the other team members are also different for example the block avoidance task will need a touch sensor or a Ultra-Sonic sensor in order to successfully work. The other team members will also have to apply previous knowledge from the previous lessons when it comes to programming as previous information is also a fundamental key to achievement. We have also decided throughout the team to use The Art of Lego Mindstorms EV3 programming book to help us with some of the programming

<https://www.amazon.co.uk/LEGO-MINDSTORMS-Programming-Full-Color/dp/1593275684>



Planning the operation/ time management.

In order to successfully complete this assignment everyone in the group needs to plan on how this will be done. For example we need to have a talk on who takes the which part when it comes to programming and constructing the robot. A great plan also consists in good communication in the group. This has been achieved by simply making a group chat on Snapchat and keeping everyone informed and up to date on what is happening.

Time management is also key when it comes to solving this problem as the time set by the lecturers might not be enough to complete this task and this is when team effort and communication comes into place as the whole team will have to decide and agree on when its the best time to catch up with work and also where is the best place for this to take place. The way that good time management can be organised is by having everyone in the group to decide how much time will be spent on the programming and how much time will be spent on the building of the actual robot and if there is any other spare time to allocate for catch up if needed.

Everybody in the group also has to agree on what parts have to be used to create the robot and if there is any software or any other way in which we can plan the design. There is a large range of parts which can be chosen and the right ones have to be carefully selected in order to get the robot working. The design of the robot is also fundamental as you need to point out the best places to put the parts for example the colour sensor might have to go quite low to the ground in order to pick up any colours.

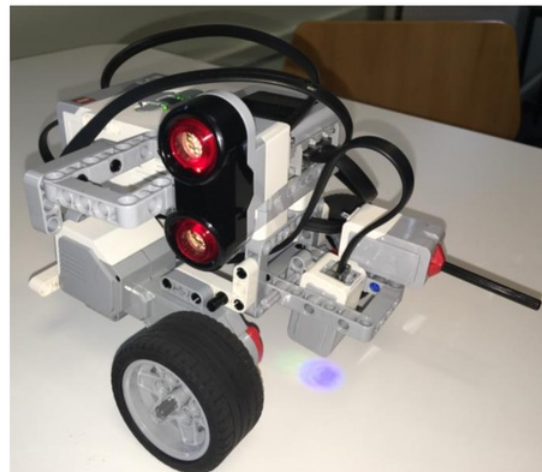
After careful planning each member in the group was given a part. The part I have been given was to do the line following. In order for me to successfully get the line following to work I have to get the adequate parts and also have a word with everyone in the team so we can all analyse the best position on the robot to place the specific parts. Placing parts in the wrong place on the robot can lead in problems such as colours not being detected etc. Ensuring that everything goes and fits to what has been designed will guarantee in a successful operation.

Before starting the actual task it is always a good idea to try out and experiment with the programming and to see what each part does and how it can be programmed and adjusted to the appropriate settings for the appropriate environment. Ensuring that all the code fits perfectly together and the programming draft works perfectly this will lead to a better understanding on how to start the actual operation as it gives you a better idea of what you will be doing.

The design of the robot. Hardware and software.

Designing the robot wasn't really a difficult task as we already knew where and how to attach all the components. The components have to be attached in a way in which you know they will work as intended for example the colour sensor has to be the right distance from the ground in order to read data and to detect the colours. This can be observed through the use of the statistics available within the software. The ultrasonic sensor has to

be placed on the side of the robot in order to successfully detect the wall of the maze and the touch sensor has to be placed at the front as that will collide with the block when it has to avoid it and go around it. Below I will display before and after photos which I have personally taken of the actual robot.

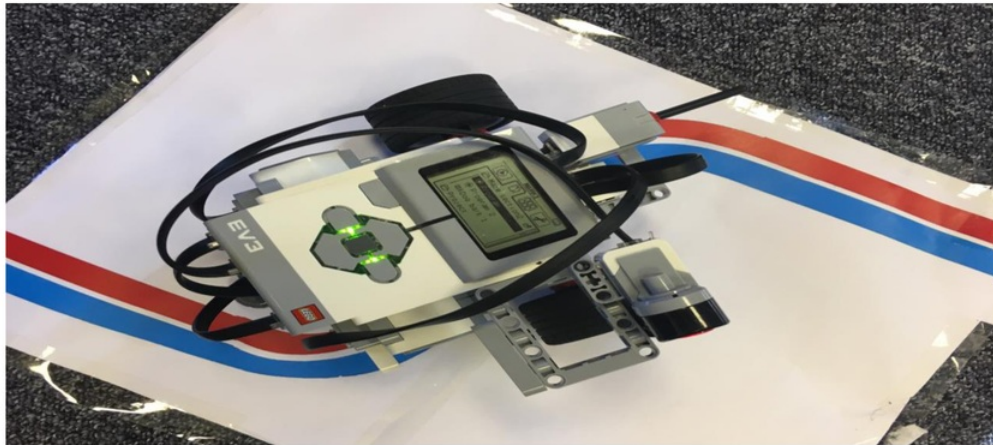


The software side of the robot got a little more complicated as the software side will always be harder compared to the actual building of the robot. In order to help us with the building of the robot we have used the Art of Lego Mindstorms EV3 programming book. Designing the final piece of software everyone in the team had to first design their own draft for that task they have offered to be doing. For example I have offered to do the line following task and in order to get a successfully complete it I had to experiment with the programming side until I had to get it right. It took many hours to complete and figure out but in the end I have managed to successfully complete my part and so has everyone else in the team. Below I have included some photos from the robot when it was in action.

The first photo represents the robot in action when it is approaching the block.



The second photo represents the robot doing the line following which was my part in the operation.



And the third and final photo represents the robot following the wall around the maze. With this part we had the most amount of problems ranging from port errors to programming errors but in the end it worked as it should.



Assessing the success of the project/ What would I change if I had to do this project again?

The way that I have assessed this project is by looking at the robot and making sure that it successfully does every task as it should for example I would tick off if everything has been done successfully and maybe look at ways in which I can improve it. In order for me to make a clear judgement assessment I would have to gather the whole team to take a look at how the robot behaves and if everyone agrees with me.

If I had to do this project again I would definitely change the way that time has been managed for example we should have allocated more time in the group for the programming rather than the building as in my opinion the programming matters more than the actual design of the robot. Another aspect that I would change is the communication. I would make the communication more effective meaning that I would have everyone in different social media sites group chats as sometimes we have encountered communication issues on the service we were using due to updates and loss of signal. But overall I think that this project went better than I have expected it with some minor issues which were fixed during this project.

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GRADEMARK REPORT

FINAL GRADE

62/100

GENERAL COMMENTS

Instructor

Assessment Component 1 (Report):

Introduction: Quite clearly stated, as it's a visual assignment, it would be helpful to include a diagram of what you intend to achieve 4/5

Background Research: You have stated what sources you have read for "a better understanding of what had to be done" - but you should say exactly what was helpful - any particular chapters or any particular approaches you adopted as a result of your research?

7/15

Project Plan: You have mentioned some of the things you did to manage the project - you have said that everyone decided how much time would be spent on the programming - but you don't say what was decided! Do a diagram with a list of tasks and the amount of time allocated to them, show which tasks are going on at the same time, or in what order they will be done.

3/10

Design Process: Photos were clearly shown of the physical build/sensors. You haven't really focuses on the code, you need to include some explanations of coding approaches taken here.

20/40

Evaluation and results: Results are shown with appropriate screenshots. What problems were encountered and overcome? Did it work for any line? More detail needed 18/30

Assessment 1 Total: 52%

Assessment Component 2 (Demo):

Technical knowledge/skill 15/20

Analytical and Problem-solving skills 16/20

Quality of result 45/60

Assessment 2 Total: 76%

Transitions need to be smoother/more automatic. Maze section needs less extreme turns so that it could negotiate a smaller space, and to detect a definite end point. Overall, very good however.

OVERALL MARK FOR MODULE: 62%

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