

Integrating Projects Lego Completed Philip Richmond 2212266

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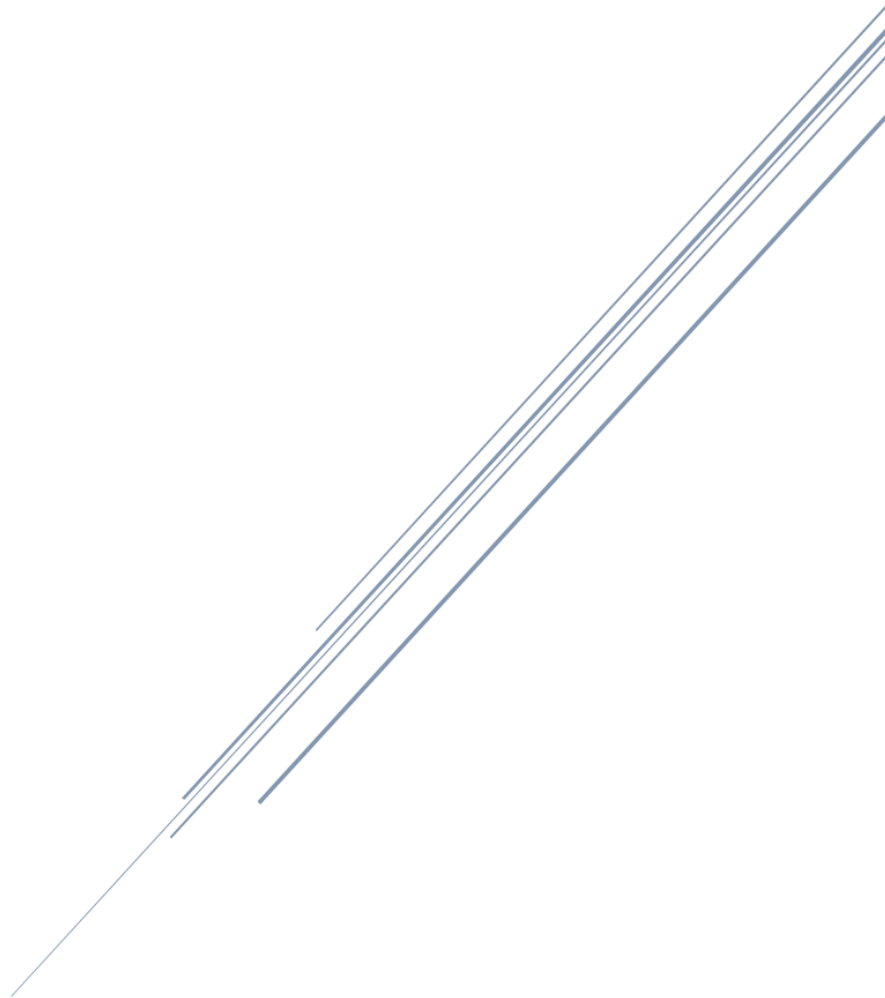
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LEGO MINDSTORMS PROJECTS

Integrating Projects ACHA4008



Philip Richmond
2212266

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1 Introduction

In this project, the user will design and program a robot using Lego Mindstorms EV3 programming software [1] [2]. The robot was required to travel from designated starting point and reach a defined finishing point, by successfully completing each stage of the course. This project utilised various sensors programming techniques to enable the robot to detect and respond to obstacles, navigate obstacles, and maintain its course along the way. This report will provide a detailed overview of the design and programming of the robot, as well as a step-by-step account of its performance during each stage of the course. This report will also show the challenges faced during this project and how these challenges were overcome.

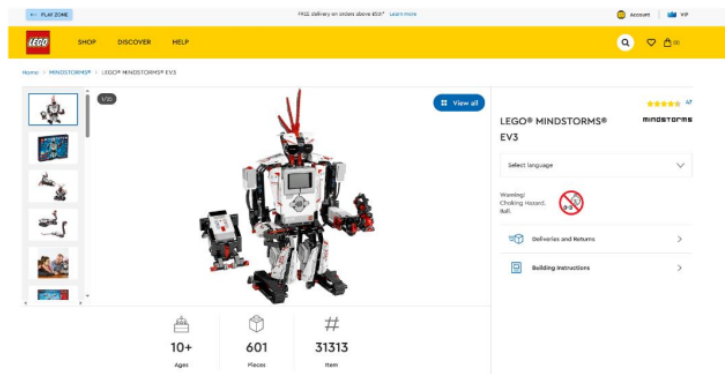


Figure 1 Above is the Lego purchase site for the hardware that was used. [1]



Figure 2 Above is the download site for the EV3 software. [2]

2 Literature Review

The EV3 Lego Mindstorms uses touch sensors, infrared sensors and light centres for navigation that can be programmed using Legos educate teachers addition platform. This software provides a user-friendly interface that allows programmers to create a testing program to create custom programs, the software using a drag and drop coding function. The Lego Mindstorms EV3 software offers several benefits to programming robots with touch sensors [3, p. 60], infrared sensor [3, p. 60], and light sensor [3, p. 54]. For example, the software provides a wide range of prebuilt programming blocks that allow programmers to easily incorporate sensor data into the thier code.

Coding functions in the Lego minds storm EV3 software can be used to create programs that incorporate touch sensors, infrared sensors, and light sensors in a variety of ways. For example, programmers can use conditional statements to make the robot respond differently depending on the sensor data it receives. They can also use loops and variables to create more complex programs that allow the robot to perform more sophisticated tasks. [3]

The use of Lego Mindstorms EV3 software for programming robots with catch sensors, infrared sensors, and light sensors have several advantages over other programming platforms. For example, the software is highly intuitive and user-friendly, making it easy for even the novice programmer to create custom programs for the robot. Additionally, the software is highly flexible and can be easily customised to meet the specific needs of a particular application or task. [3] [4]

3 Implementation Plan

3.1.1 Identify the course requirements.

- Determine starting and finishing points of the course.
- Determine the length and width of the course.
- Identify any obstacles that the robot must navigate around or through.
- Determine any specific actions that the robot performed along the course.

3.1.2 Design the robot.

- Choose the type of Lego Mindstorms EV3 kit that best suits your needs.
- Determine the size and shape of the robot that will allow it to navigate the course efficiently and attach the necessary sensors to the robot, such as the colour sensor ultrasonic sensor and touch sensor.

3.1.3 Program the robot.

- Use Lego Mindstorms EV3 programming software create a new project.
- Choose the appropriate program blocks to enable robot to navigate through the course, such as moving forward, turning, and stopping.
- Utilising the sensors to detect coloured lines and obstacles and adjust the speed and direction of the robot accordingly.
- Implement any Pacific actions are robot needs to perform such as moving from one stage of the problem to another.

3.1.4 Test the robot.

- Test the robot performance on the course, making any necessary adjustments to the design of the programme.
- Conduct multiple trials to ensure the robot can successfully navigate the course consistently.
- Identify any areas where the robot may be struggling and adjust a program or design accordingly.

3.1.5 Evaluate the results.

- Analyse the robot performance and determine its strengths and weaknesses.
- Reflect on the challenges encountered during the project and identify areas of improvement.
- Consider how the robot could be modified in order to to tackle more complex courses in the future.

3.2 Success Criteria

3.2.1 Stage 1

- Did the robot successfully start from there designated starting point.
- Was the robot able to detect the curved lines and move forward.
- Was the robot able to detect the obstacle and navigate around it.
- Was the robot able to detect the coloured lines after moving around the obstacle.
- Did the robot reach the endpoint of stage without any major issues or errors.

3.2.2 Stage 2

- Did the robot successfully start from the finishing point of the previous stage.
- Was the robot able to navigate the course and make any necessary turns or detours.
- Was the robot able to execute any specific actions that it needed to perform during this stage correctly i.e., make a finishing sound at the end.

3.3 Schedule

Task	Start Date	End Date	Duration
Introduction to EV3 Mindstorms	31.01.2023	08.03.2023	7 weeks
Identify course requirement	14.03.2023	28.03.2023	3 weeks
Design the Robot	14.03.2023	28.03.2023	3 weeks
Program the robot	14.03.2023	03.05.2023	8 weeks
Test the robot	14.03.2023	03.05.2023	8 weeks
Demonstrate robot	10.05.2023	10.05.2023	2 hours
Evaluate results	10.05.2023	12.05.2023	2 days
Finish and complete the assignment	12.05.2023	14.05.2023	2 days

4 Design of Robot

The robot will be designed with a sturdy frame and large wheels to enable it to move smoothly across the course. A touch sensor will be mounted at the front to detect any obstacles in its path. The touch sensor will be programmed to feel for the walls and adjust accordingly to move around the maze. The robot also has two infrared sensors mounted one in the front and one on the side to detect barrier in order to move around it. Additionally, the robot will have one light sensor mounted in the front pointing to the floor to detect two coloured lines that make up the first stage of the course.

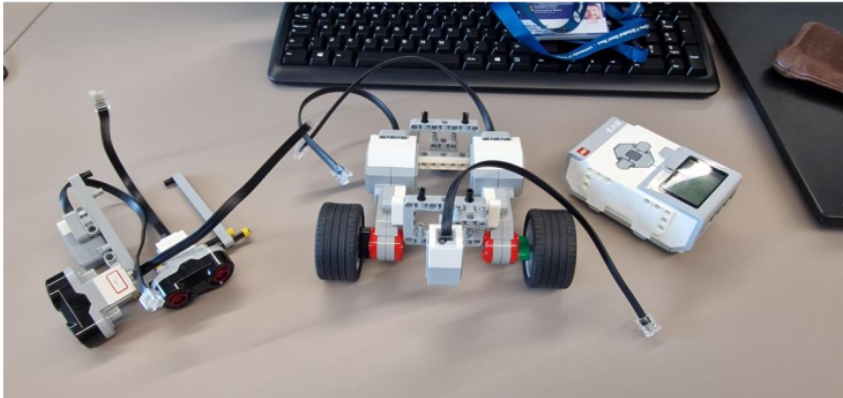


Figure 3 construction of the robot



Figure 4 completed robot

4.1 Software

The robot software will be developed using the Lego mine storm is EV3 programming environment. The software will be designed to control the robot's movement and respond to sensor inputs from touch sensor infrared sensor and light sensor.

The program will include a combination of basic movement commands, such as forward, left, and right, and statements, such as loops, switches, and if/else statements, to enable the robot to read the sensor input and navigate through the course. The touch sensor will be programmed to detect any obstacles in the robot's path and move accordingly. The infrared sensor would be used to detect an obstacle and then run a preprogrammed set of instructions to navigate around obstacle. The lights sensor is used to help the robot navigate over a predetermined set of coloured lines.

Using some blocks for debugging, it can be helpful to add some blocks claim different notes before each block so you can tailor where each move stealing black begins and ends. Be sure that the sound blocks play type is set play once so that the tribe out doesn't stop wired plays a sound. [3, p. 91]

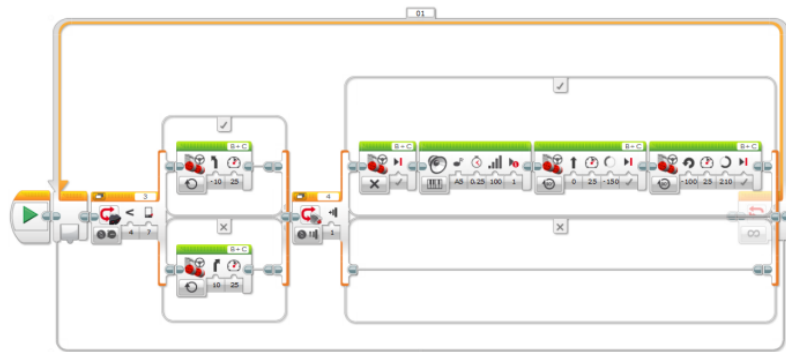


Figure 5 program for the maze section.

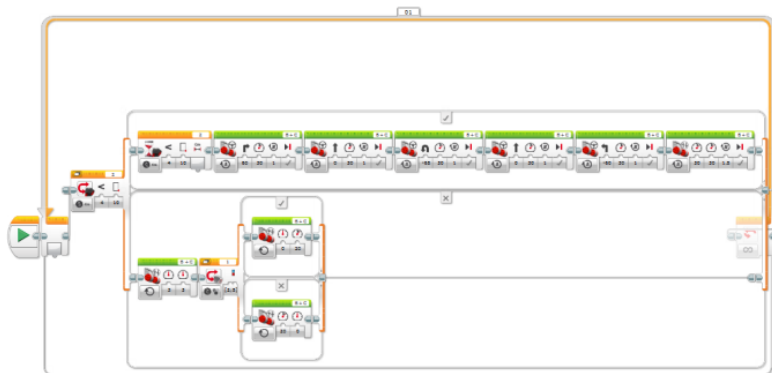


Figure 6 Program to complete the follow line and navigate around an obstacle section.

5 Results

During the demonstration, the robot successfully navigated through the first stage of the course using the infrared sensor, and light sensor.

However, due to unforeseen technical difficulties, the robot could not transition smoothly into stage two of the course.

Moving forward robot was successful in completing stage two of the course using the touch sensor.

The robot successfully demonstrated its ability navigate through a complex environment using a combination of touch sensors, infrared sensors, and light sensor, and be able to attend for areas of improvement in design and programming of the robot.

6 Evaluation

The design of the robot is a critical aspect of the overall success of this project. Robot physical design should be tailored to the specific task environment in which the specific problem was given. The robot design degree did attach sensor, infrared sensor, and light sensor. The Lego mine storm EV3 software provided a user-friendly interface allowed programmers to create custom programs for the robots using a drag and drop coding function. The software offering advanced programming capabilities such as data logging and debugging that in abled programmers to create more complex skill programs for the robot. Additional programming function in the software can be used to create programs that allow the robot to perform its tasks and navigate through complex environments successfully. Although further research and time was needed to complete this task to its full extent.

Due to the results of the demonstration, the design of the robot was appropriate for the first stage and second stage of the course and successfully met the requirements of the project.

During the demonstration, despite our best efforts we were unable to identify the cause of the problem and were unable to get both stages to work together. While it was disappointing that we were unable to showcase the robot's full capabilities during the demonstration. We believe that the project was still successful in achieving its objectives.

Overall, design, testing, and demonstrating of the robot are critical components of this project. A well designed and effective tested robot can demonstrate benefits of using touch sensors, and infrared sensors, and light sensors for navigating through both stages of the specific problem.

7 References

- [1] Lego Group, "Lego Mindstorms," Lego Group, 2022. [Online]. Available: <https://www.lego.com/en-gb/product/lego-mindstorms-ev3-31313>. [Accessed 08 05 2023].
- [2] Lego Group, "Lego Educate," 2023. [Online]. Available: <https://education.lego.com/en-gb/downloads/mindstorms-ev3/software>. [Accessed 08 05 2023].
- [3] T. Griffin, The heart of the Lego mindstorms is EV3 programming, 2014.
- [4] K. Umbleja, "Learning to Program with Lego Mindstorms – Difference Between K-12 Students and Adults," in *Teaching and Learning in a Digital World*, New York, Springer, 2018, pp. pp.447-458.

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GRADEMARK REPORT

FINAL GRADE

70/100

GENERAL COMMENTS

Instructor

ASSESSMENT COMPONENT 1 (60%)

Project Introduction 3.5/5

Background research 7.5/15

Project plan 10/10

Design Process 30/40

Evaluation and results 15/30

Total: 66%

Comments:

Try to avoid the active tense "the user". For example, instead of "The user will design and program a robot..." write "A robot will be designed and programmed"

Literature review needs detail on possible solutions - for example, you might want to talk about possible methods of traversing mazes and so on, rather than just the equipment itself.

Introduction is OK, but state briefly what the actual task is.

Plan is shown very clearly, well done couldn't ask for more really!

Design includes photos which is helpful. It could have been a bit more detailed eg show a picture of the

course to be traversed.

For the evaluation, you could have talked in a bit more detail about the successes/problems eg - traversing the line slowly and what were the limitations of the maze?

ASSESSMENT COMPONENT 2 (40%)

Technical knowledge/skill 14/20

Analytical and problem-solving skills 14/20

Quality of result (performance of the finished application or suitability of the design) 47/60

Total: 75%

Comments: A good attempt, although there were limitations in the maze section. Your efforts in the line section were very good.

OVERALL TOTAL FOR MODULE: 70%

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