

Lego Spike Report

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1. Introduction

In this project, we used LEGO SPIKE Prime to build and program a robot. The robot had to complete specific tasks, such as following a line and navigating a maze. This project helped us improve our

teamwork, problem-solving, and programming skills. It also gave us a better understanding of robotics and automation. [1]

1.2 What is LEGO SPIKE

LEGO SPIKE Prime is a robotics kit designed for education. It includes LEGO Technic pieces, sensors, motors, and a programmable hub. The kit helps students learn programming and engineering through hands-on activities. It uses a visual coding interface like Scratch or Python, making it easy to understand and use. [2]

1.3 Importance of Robotics

1.3a. Educational Significance of Robotics

Robotics is important in education because it provides hands-on learning. It helps students develop problem-solving and coding skills. By working with robotics kits like LEGO SPIKE Prime, students learn about automation, engineering, and technology in a fun and interactive way. [2]

1.3b. Role of Robotics in Technical Advancement

Robotics plays a big role in technology and innovation. In factories, robots help make products faster and with greater accuracy. In healthcare, robotic systems assist in surgeries and patient care, improving treatment. Robots are also used in space exploration to go places humans cannot reach. Additionally, robotics helps improve artificial intelligence and automation, leading to new technological advancements. [2]

1.3c. Integration of Robotics in Multiple Academic Subjects

Robotics connects different subjects like math, physics, computer science, and engineering. When students use robotics in their studies, they can apply what they learn in real-world situations. This makes learning more engaging and practical. [3]

1.4 What is the Problem

1.4a. Challenge Description

In this project, we had to design and program a robot to complete two tasks:

Follow a coloured line, move around a box, and continue following the line.

Use a different sensor to navigate through a maze without hitting obstacles.

To complete these tasks, we had to make sure the robot was stable, had properly calibrated sensors, and was programmed to detect and avoid obstacles.

1.5 My Participation in this Project

My main task in this project was designing the robot. I made sure it was the right size and well-balanced. I also helped position the sensors correctly so the robot could follow the line and navigate the maze smoothly. Additionally, I worked with my teammates to solve any problems related to movement and stability. This teamwork helped make the robot function properly. [4]

2. Group Organization

2.1 Why is Group Work Important

Group work is important because it allows people to combine their skills and ideas to solve problems more effectively. Working in a team also helps improve communication, cooperation, and time management skills. It teaches us how to work with different people and share responsibilities to complete a task successfully. [1]

2.1a Transferable Skills Learnt from Group Work

By working in a group, I developed important skills that will be useful in the future. I improved my teamwork, problem-solving, and communication skills. I also learned how to plan and manage tasks better, which will help in both academic and professional settings. [5]

2.1b Lessons I Learnt from This Project

From this project, I learned that good teamwork is essential for success. Each member had a different role, and we all depended on each other to complete our parts. I also realized that regular communication and testing are key to solving problems quickly and avoiding bigger issues later. [2]

2.2 Group Roles

Our group had three members: Alin, Ahmad, and myself. Each of us had a specific role:

Alin worked on the coding for line following.

Ahmad programmed the robot to navigate the maze.

I worked on designing the robot to make sure it was the right size and balanced.

All of us worked together on journaling our thoughts and documenting our progress. [6]

2.3 Why This Group Construct Worked for Us

Our group structure worked well because each member had a clear role that matched their strengths. Alin and Ahmad focused on coding, while I handled the design. This allowed us to work efficiently and avoid confusion. Since we all contributed to journaling, we kept track of our progress and shared ideas easily. [1]

2.4 How We Made Sure We Worked in Sync

To stay organized and work efficiently, we did the following:

Held weekly meetings to check our progress and discuss issues.

Shared all files and updates using Google Drive so everyone had access to the latest work.

Helped each other when someone got stuck or needed feedback.

Tested the robot after every major change to make sure it was working correctly. [4]

2.5 Where We Could Have Improved

Although our group worked well together, there were some areas we could improve:

Better time management: Sometimes, we spent too much time on small issues instead of moving forward.

More detailed documentation: While we kept track of our work, we could have written more detailed notes to make problem-solving easier.

Clearer task assignments: At times, we overlapped in some tasks, which caused minor confusion.

By improving in these areas, we could work even more efficiently in future projects. [7]

3. Literature Review (Additional Research)

3.1 Academic Sources on Robotics and Programming (Source Materials)

For this research, we used books, articles, and online resources that discuss robotics, programming, and building techniques. Some sources included:

Academic papers on using robotics in education.

Articles on programming tools like Python and block-based coding.

Books on designing and building robots.

Online guides on how to use LEGO SPIKE Prime in learning. [8]

3.2 Tools and Techniques in Robotics

In robotics projects, including LEGO SPIKE Prime, some common tools and techniques are:

Programming Software: Block-based coding (Scratch) and Python for controlling robots.

Sensors and Motors: Color sensors, ultrasonic sensors, and motors help the robot detect objects and move accurately.

Testing and Debugging: Regular testing and fixing errors improve robot performance. [8]

Modular Design: Robots are built in parts so they can be easily adjusted or upgraded.

3.3 Investigation into Robotics Components

3.3a Hardware Components

LEGO SPIKE Prime includes: (See Figure 3.3a.1)

Programmable Hub: The main unit that controls the robot.

Motors: Help the robot move and rotate.

Sensors: Colour sensors for line following ultrasonic sensors for detecting distance.

Technic Pieces: Used to build the robot's structure and keep it stable. [9]

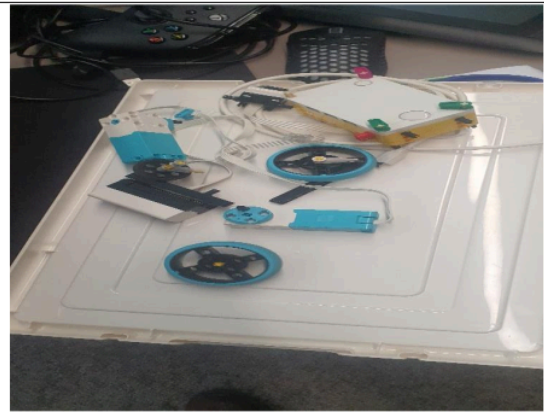


Figure 3.3a.1

3.3b Software and Programming Tools

Scratch-based Coding: A simple, visual programming method.

Python: A more advanced programming language for better control.

LEGO Education App: A software tool for coding and testing the robot. [7]

3.3c Construction Techniques and Mechanics

Balance and Weight Distribution: Making sure the robot is stable and does not tip over.

Gear Systems: Used to control speed and power.

Sensor Placement: Placing sensors correctly to improve accuracy in navigation.

Researching these topics helped us understand how robotics works and how to apply these ideas in our project. [4]

4. Problem Solving Plan

4.1 Introduction

Solving problems in this project required a clear plan and teamwork. My role as a designer was important in making sure the robot was the right size, balanced, and worked well with sensors.

4.2 Action Plan

Research & Planning: Reviewed past projects and literature on LEGO SPIKE Prime designs.

Initial Design: Created a basic model, focusing on size and weight balance.

Testing & Adjustments: Attached motors and sensors, tested stability, and made changes as needed.

Final Testing: Worked with teammates to ensure the design supported the coding properly.

Documentation: Took notes on changes and challenges for future improvement. [5]

4.3 Flow Chart

Research → Initial Design → Build Model → Attach Sensors → Test & Adjust → Final Testing → Documentation

4.4 My Approach to Designing the Robot

Week 1: Research and sketch design ideas.

Week 2: Build first version and test balance.

Week 3: Attach sensors and motors, check function.

Week 4: Work with programmers to finalize movement.



Week 5: Test and document improvements.

This structured approach helped me complete my tasks efficiently while supporting my team's work. [9]

5 Robotics Project Report

5.1 Robot Design



5.1a Original Design

We do not have a picture of the original design, but at first, we attached both a push sensor and a distance sensor. Ahmad suggested using the push sensor because we had problems with the distance sensor. However, this made the robot too long, which made it difficult to complete the maze.

Also, the motors were placed too far apart. This caused the robot to get stuck on the walls of the maze. The design needed adjustments to improve movement and navigation. [10]

5.1b Why I Had to Change It

The original design had two main problems:

Length of the Robot – The extra push sensor made the robot too long, making it hard to turn in the maze.

Motor Placement – The wide placement of the motors caused the robot to keep getting stuck on the maze walls.

To fix these issues, I removed the push sensor and adjusted the distance sensor. I also moved the motors closer together to make the robot more compact. [10]

5.2 Current Design

The final design was shorter and narrower. I lifted the distance sensor so it could detect obstacles better. The motors were placed closer together, allowing smoother movement through the maze. These changes made the robot more efficient and able to complete the task successfully, see (Figures 5.2.1 and 5.2.2. and Figure 5.2.3 and Figure 5.2.4)



Figure 5.2.1



Figure 5.2.2



Figure 5.2.3



Figure 5.2.4

5.3 Why It Worked

The final design was a success because:

The smaller size made it easier to navigate through tight spaces.

Better motor placement reduced the chances of getting stuck.

The adjusted distance sensor improved obstacle detection.

These improvements helped our robot complete the project tasks more smoothly. [2]

6. Success Assessment

6.1 Breakdown

This project had different steps, and each step had its own challenges. The main steps were:

Building the Robot – Designing and putting together a balanced robot with the right sensor placement.

Line Following Programming – Writing code to make the robot follow a line and go around a box.

Maze Navigation – Writing code to make the robot go through a maze and stop at the right place.

Final Testing and Changes – Checking if the robot worked properly and making improvements. [11]

6.2 Stagewise Assessment

We had different goals for each step:

Building the Robot – The robot should be stable, well-balanced, and have sensors in the right place.

Line Following – The robot should follow the line and go around the box.

Maze Navigation – The robot should move through the maze and stop at the red marker.

Final Testing – The robot should complete all tasks without problems. [9]

6.3 Results and Evaluation

After finishing each step, we looked at what went well and what didn't:

Building the Robot – The final design worked better after we changed the motor placement and sensor positions.

Line Following – This was difficult because Alin, who worked on this part, was absent on the assessment day. Ahmad had to quickly write new code. The robot followed the line but could not go around the box. However, it did stop on the green strip as planned.

Maze Navigation – Ahmad's code worked well, and the robot moved through the maze and stopped at the red marker without any problems.

Overall Performance – The robot completed most of its tasks, but our group had communication issues. We figured out some solutions too late. [10]

6.4 Reflection

I learned a lot from this project:

Good planning and teamwork are important – We had trouble because we didn't communicate well and solved some problems too late.

Backup plans are needed – When Alin wasn't there, we had to rush a new code. If we had a backup plan, we would have been more prepared.

Testing is very important – The maze navigation worked well because we tested it properly. The line-following had problems because we had to rush it. [5]

6.5 Conclusion

This project taught me many lessons. Even though we had some problems, we were able to build and program a working robot. The maze navigation was successful, but the line-following task had issues due to last-minute coding. Next time, we will plan better, communicate more, and have backup plans to avoid these problems.

7. Bibliography

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Lego Spike Report

GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

44/100

PAGE 1

PAGE 2

PAGE 3



Comment 1 | Transferable Skills(15)

introduction briefly touches on the importance of robotics

PAGE 4

PAGE 5

PAGE 6



Comment 2 | Engagement with Literature(15)

Most of the research is descriptive and lacks critical application to project decisions.

PAGE 7

PAGE 8



Comment 3 | Transferable Skills(15)

plan is written in a logical sequence, and weekly actions are described well. However no formal timeline or visual plan (e.g., Gantt chart) shown



Comment 4 | Knowledge and Understanding(40)

strongest technical part of the report however the design seems mostly reactive (trial and error) rather than pre-planned with rationale.

PAGE 9

PAGE 10



Comment 5 | **Transferable Skills(15)**

comparison shows an understanding of what contributed to success and what didn't. however, could be improved by connecting lessons learned to specific technical insights

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44

ENGAGEMENT WITH LITERATURE(15)



5

KNOWLEDGE AND UNDERSTANDING(40)



COGNITIVE AND INTELLECTUAL(30)



9

TRANSFERABLE SKILLS(15)



8