

## **Lessons Learned Document**

Group: 2

Project Title: Multifunctional Robot

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### **Introduction**

This document summarises the key lessons learnt throughout the project, highlighting successes, challenges, and areas for improvement. It aims to provide insights that can enhance future project execution.

### **Project Overview**

Objective: The aim of this project is to develop an intelligent, remotely controlled robot with good navigation and observation capabilities.

Overview: The project focuses on creating a multifunctional robot that incorporates precise directional control via joysticks, stable Bluetooth wireless control and an integrated ultrasonic sensor for obstacle detection.

### **Key Lessons Learnt**

#### **What Went Well**

- Effective Collaboration
  - The team maintained strong communication and had regular meetings, allowing everyone to keep track of each other's work and stay updated.
- Project Planning
  - In general, the project planning was clear and assisted the team in remaining focused. A detailed Gantt chart was created at the start of the project and followed closely, with clear milestones and deadlines. This helped the team keep track of all completed tasks and upcoming tasks, whilst keeping a timeline in mind. Tasks were delegated evenly to ensure even workload, leading to a successful project.
- Technical Achievements
  - The ultrasonic sensor worked effectively and as intended.
  - Buzzer received and transmitted signal when obstacle detected.
  - Joysticks and motors functioned correctly, with precise directional control.

- Quality Assurance and Testing
  - Code implementation and debugging was carried out in an orderly fashion, making it easier to test our components.
  - Whilst writing code, the team carried out regression testing which allowed the team to identify specifically where the errors were, as testing was carried out each time new code was added.
  - The team also tested the performance of the components once the code was complete. Eg. The ultrasonic sensor essentially worked, however, it was discovered that the sensor did not receive any echo readings when approaching anything at an angle rather than in a parallel manner, which is an issue that would not have been picked up from the code directly or the simulated version.
  - The team tested individual components first, before integrating them together, ensuring a smooth process.

### Challenges Faced

- Time management
  - The first HC-SR04's fuse blew, and the second one had insufficient voltage running through it. After the first one, physical testing had to be paused due to ordering a replacement component. This caused delays in progressions that could have been avoided.
  - The project timeline was tight, and unexpected technical issues, such as delays in hardware delivery, caused a bit of a strain on meeting deadlines. Time management could have been improved by accounting for these potential delays.
  - In general, prioritising tasks was done efficiently, however, the Bluetooth module presented difficulties, which had delayed the progression of the project. Discovering these issues at an earlier stage would have allowed the team sufficient time to tackle the problem.
- Technical Issues
  - Coding the ultrasonic distance sensor presented difficulties. Connecting the sensor to the buzzer was a challenge. The code had zero errors however when connected to the either a simulation or real equipment, it did not work. To work out the issue, a lot of manual debugging had to be done, rewriting only parts of the code to carry out incremental testing, which eventually lead to the solution.
  - The Bluetooth module also presented challenges. Programming the components to pair with each other was difficult, as the module had to be paired to a computer first before using a serial monitor to send AT commands

to the modules. Discovering this too late also impacted our time management and the projects functionality.

### Areas For Improvement

- Improved documentation
  - While the project had detailed technical documentation, accounting for potential issues beforehand would have allowed for a more successful project. Also, recording testing at specific stages throughout the progression of the project would have helped the team to stay more organised.
- Better risk management
  - Future projects should include a more detailed risk management plan, addressing potential issues like technical roadblocks. The problems encountered stemmed from a lack of time management due to technical issues developing. Discussing potential issues first would have been more efficient than waiting for them to occur as we went along.
- Prioritisation
  - Prioritising all tasks efficiently would result in a smoother process, allowing sufficient time for tackling developing problems.

### Conclusion

Overall, the communication and dynamic of the team played a huge role in the development of the project, allowing each team member along with the tasks to collaborate effectively with one another. The challenges faced have taught the team how to be more efficient, and by applying these lessons to future projects, the team will be better prepared to handle challenges.