**Deliverable F – Prototype 1 and customer feedback**

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**Abstract**

This deliverable outlines the conception and testing of the first prototype of the product we are developing for our client. Additionally, this report provides documentation of the tests that were conducted on prototype 1 and their results. It also analyzes critical components of the product, leveraging the teams current engineering science knowledge. Additionally, this deliverable addresses the development of the test plan of our second prototype.

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1. **Introduction**

This deliverable outlines the conception and testing of the first prototype of the product we are developing for our client which is a maze that players navigate alongside the Robomaster S1 and encounter different events which convey ethical concerns around lethal autonomous weapons systems (LAWS). This report provides documentation of the tests that were conducted on prototype 1 which were mainly focused on the user experience and their results. It also analyzes critical components of the product such as the robot, leveraging the teams current engineering science knowledge. Additionally, this deliverable addresses the development of the test plan of our second prototype which is focused on the most crucial subsystem of our product, the robot’s behavior.

1. **Prototype 1**

Please refer to the PowerPoint file entitled “Prototype 1” submitted with this deliverable. It consists of multiple drawings explaining different stages of the game in detail.

1. **Analysis of Critical Components**

**Analysis of critical components or systems**

This report is an analysis of critical components of the robomaster S1, and components of the maze. This includes a list of components or systems, Predicted Failure Modes & Effects Analysis, and a Root Cause Analysis of the critical failure modes, as viewed in class.

**List of components and systems**

1. Robomaster S1’s ability to read signs and symbols

The Robomaster S1 will read signs presented by the player, and at intersections to make decisions. This component is highly critical, as this is how the player communicates with the robot, and how the robot knows what code to execute and when.

1. Robomaster S1’s ability to move, and traverse its environment

The Robomaster S1 has four-wheel omnidirectional movement, which allows it to move and rotate around the maze. This component is highly critical, as the robot this is how the robot will stay alongside the player as the player navigates the maze.

1. Robomaster S1’s ability to shoot lasers

The Robomaster S1 is equipped with a blaster mounted on a 2-axis mechanical gimbal, which allows it to shout lasers at specified targets. This component is used when the robot shoots the player at the end of the maze.

1. Tarp

The tarp is what the maze will be drawn on. The player and the robot will stand and move on the tarp to navigate the maze.

1. Robomaster S1’s programming

The Robomaster S1 has 46 programmable components and 6 programmable AI models which will be used to perform manoeuvres and tasks in the maze. This component is highly critical as it is what directs the robot as it plays the game.

1. Story of the game

The game has a story and a narrative that serves to communicate ideas and emotions with the player. This component is highly critical as it serves to convey the ethical concerns to the player.

**Predicted Failure Modes & Effects Analysis  (PFMEA)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| PFME # | PFME | Effects | Mode Likelihood | Effect Severity |
| 1 | The Robomaster S1 is unable to read signs and symbols | The Robomaster S1 will be unable to take inputs from the player | 3 | 4 |
| 2 | The Robomaster S1 will get stuck on the tarp | The Robomaster S1 will be unable to move about the tarp | 2 | 4 |
| 3 | The blaster on the Robomaster S1 won’t shoot | The player will not get shot by Robomaster S1, which will undermine the ending of the game | 1 | 2 |
| 4 | The tarp will not be held down in place, and may move. | This may have negative effects on the Robomaster S1 movement and mapping | 2 | 2 |
| 5 | The program will not run as intended | The Robomaster S1 will be unable to function | 3 | 4 |
| 6 | The storyline of the game is not immersive | The experience of the player will not be immersive | 2 | 2 |

The Predicted Critical Failure Modes & Effects (PCFMEA):

1. The Robomaster S1 is unable to read signs and symbols
2. The program will not run as intended

**Root Cause Analysis of the critical failure modes (RCA)**

PCFMEA 1: The Robomaster S1 is unable to read signs and symbols

* Why is the Robomaster S1 unable to read signs and symbols?
  + The signs and symbols are too small for the Robomaster S1 to read
* Why are the signs and symbols too small?
  + The sizes of the signs do not meet the required size for optimal readability by the Robomaster S1
* Why do the sizes of the signs not meet size requirements?
  + The signs were made without consideration of Robomaster S1’s reading abilities.
* Why were the Robomaster S1’s abilities not taken into consideration
  + There is a lack of information and data on the Robomaster S1’s abilities.

PCFMEA 2: The program will not run as intended

* Why will the program not run as intended?
  + Code logic error
* Why is there a code logic error?
  + Incorrect order of operations in the code
  + Incorrect flow chart.
  + Syntax errors
* Why is there an incorrect order of operations, incorrect flow chart, or syntax errors?
  + Lack of experience with the IDE

1. **Prototype 1 Test Plan, Analysis and Results**

Please refer to the excel sheet entitled “Prototype 1 and Test Plan Documentation” submitted for deliverable F. It consists of the test plan for prototype in detail as well as the test results.

1. **Feedback and Comments**

* Reword the storyline and events to make them clearer and easier to understand and also enhance it
* Add an element in the game which would make the players feel they are in control when they are actually not to enhance the betrayal moment
* Storyline with more at stake is more immersive and emotionally involving
* Make sure the game ends with a defeat for the players
* Make the robot more autonomous and let it make independent decisions

1. **Bill of Materials**

Please refer to the excel file entitled “Bill of Materials” submitted for deliverable F.

1. **Test Plan For Prototype 2**

Please refer to the excel file entitled “Prototype 2 Test Plan” submitted for deliverable F.