**Project Deliverable H: Prototype III**

**University of Ottawa**

**GNG1103: Engineering Design**

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***Abstract***

This deliverable focuses on prototype III and the improvements we have made since the second prototype. Based on the feedback we got from the client meeting 3 on our first and second prototype, we concluded the speaker on the robomaster itself will be loud enough for the players of the game to hear, and there is no need for us to purchase an additional speaker for our game. We have since changed how we are doing the tracking in between the elimination stages, we’ve also changed and improved on how the robomasters movement will work since prototype II. We then compared the third prototype to the test plans, and analyzed the results of the testing. We have also updated the BOM and target specifications. Our third prototype will focus on ensuring participants have an immersive experience in order to understand a minimum of three ethical concerns associated with AWS (autonomous weapons systems).

**Table of Contents:**

**1. Introduction 4**

**2. Prototype - III - Why 4**

**3. Prototype - III - What 5**

**4. Prototype - III - When 5**

**5. Prototype - III - How 6**

**6. Code Explanation 6-9**

**7. Prototyping Test Plan 10**

**8. Updated BOM 10**

**9. User Prototype Feedback 11**

**10. Demonstration of Prototype III 11**

**11. Conclusion 11**

1. Introduction

This document outlines the creation, and development of our third prototype, and documents our test plan for this third and final prototype. The goal for the third prototype is to complete all of the code needed for the game. This code for the third prototype solves any of the issues that we faced during the first and second prototypes, and adds all of the remaining elements such as importing sound files, and finalizing how each round of the game is going to flow into the next. Another goal of the third prototype was to make it certain that the participants felt like they were in an immersive experience, and leave the experience with a new perspective on autonomous weapons systems (AWS), understanding at least three ethical concerns. This document also includes our final bill of materials, testing results from prototype two. Another thing in this document is the results of the feedback we have gotten from potential participants of the game.

1. Prototype - III - Why

The main reason for this prototype is to ensure that the entire game concept and code is completed and all final features are implemented to provide as immersive of an experience as possible. Since this is the final prototype for the game, we need to make sure that all of the subsections are able to work together without any issues. At this point we aim to have all of the robomasters decision making code fully functional, allowing it to respond to the players movements. This will give me the robomasters interactions, and experience much more impactful on the participants' view on AWS. This prototype also adjusts the story behind our game, to compensate for any changes to the games concept that we have had to make to overcome challenges with the robomasters coding. This improved story behind the game helps the participants grasp the ethical concerns that we are trying to demonstrate by allowing them to gain an understanding of a potential real world experience someone might find themselves in with AWS. Overall, this final prototype aims to smooth out any of the issues we have had in the first two prototypes, and we are going to make sure that everything works together without any issues.

1. Prototype - III - What

**What:**

The first thing we will do for the third prototype is to finalize how each of the rounds will be implemented into the code. In the second prototype we coded how each of the rounds will work, but we did not have all of the rounds combined in a single code. In this prototype we will be combining all of the different round codes and adjusting them to work together without failures occurring. Another thing that we will be doing in the third prototype is ensuring that the robot always goes back to its original position. In part of our code the robomaster lunges at the participants to attempt to scare them, but it would not always go back to where it started, but we will be fixing that in this prototype. The next thing that we will be doing is adjusting the story to the game's new mechanics that have had to change since the previous prototypes. One of the things that we have had to change is how the players become aware that they are eliminated, originally we had it speak out “you are eliminated”, but now we have just the shooting sound effects, and the flashing lights. So we will adjust our background story to explain that. Next thing for this prototype is coming up with a way to inform the participants of the background story before beginning the game. Before the game starts there will be a brief script that whoever is organizing the game will read to the participants, and there will also be a brief explanation printed on the back of each player card in case the players want to be reminded of anything during the game. Finally for this prototype we will be setting up another survey with demonstrations, and explanations of how our game is going to work, and getting feedback from peers, family members, and even random people we find that are willing to complete the survey. We will also demonstrate the physical experience in the makerLab with the robomaster to any people that are willing to play the game. After this is done we will reflect on our feedback, and decide if any last minute changes are required to complete our objective for the project.

1. Prototype - III - When

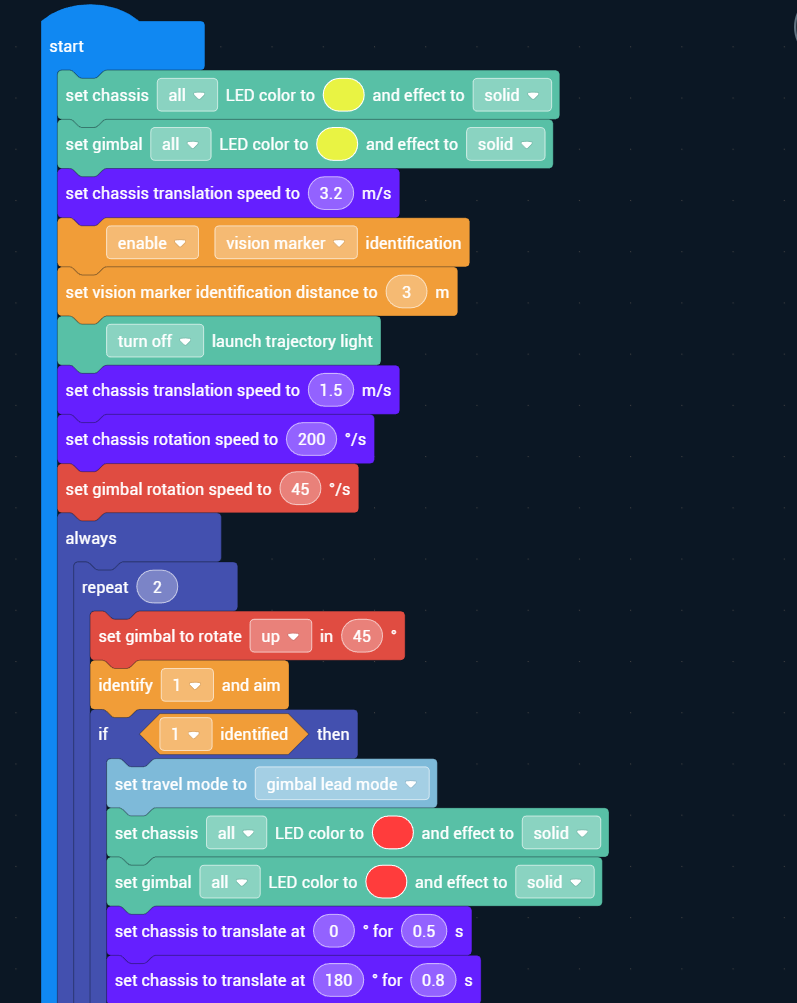
We will have all of the code combined into one program and fully functioning by Thursday, November 21, 2024. We will also have the adjusted storyboard ready for Thursday November 21, 2024. This leaves us Friday, November 22, 2024 and Saturday November 23, 2024 to get feedback from potential participants. We will then reflect on the feedback and make any last second changes on Saturday night, and Sunday November 24, 2024. Overall, the entirety of prototype III will be completed by 10pm on Sunday November 24, 2024.

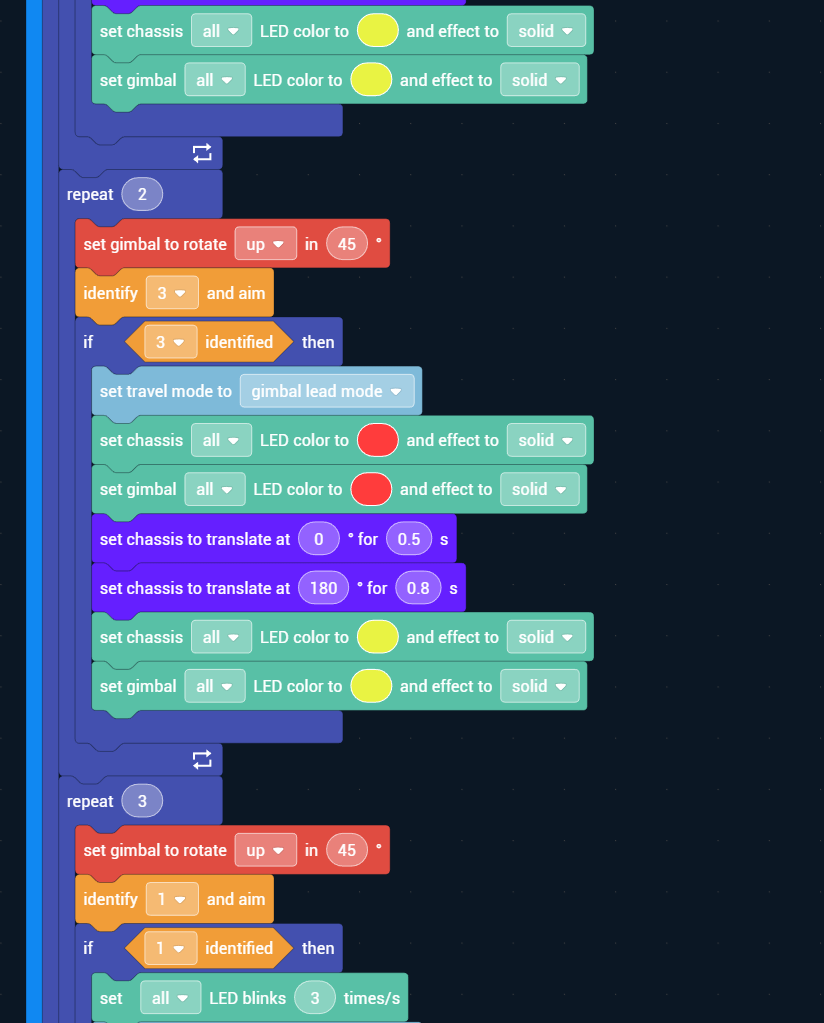
1. Prototype - III - How

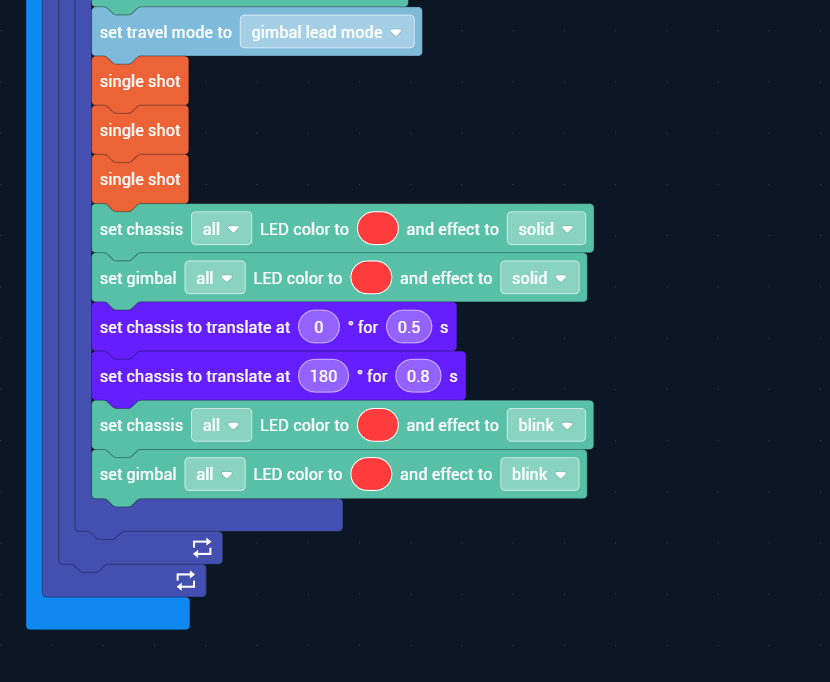
A lot of work is needed to be done in this final prototype, so we have to divide the work up efficiently to ensure that the prototype stays on schedule and everything gets completed on time. Michael and Alex will do in person testing with the robomaster, Tuesday, Wednesday, Thursday, and Friday throughout the week of November 17- November 24, 2024. In between each testing session we will do work on the code the night after we have tested to see what does, and what does not work. Doing code from home each night allows us to spend more time testing when we have physical access to the robomaster, rather than wasting time coming up with new ideas when we are using the physical robot. While Michael and Alex are doing this, Aj will be adjusting the story behind the game to ensure that the participants have an immersive experience. Aj will also be setting up the surveys, and going around to get people to complete the survey so we can analyze the results. We will then conduct the physical testing and demonstration with random people, in order to receive unbiased feedback. Finally we will come together on the weekend to reflect on all of the survey answers, and in person feedback that we have gotten from potential participants of our game, and adjust anything that received negative feedback.

1. Updated Code Explanation

Our updated code starts by setting up our code such as turning all the lights to yellow (shows up green on physical robomaster) then we set the robomasters speed for the game and ensure that the vision markers are on and have far enough reach. We also turn on the trajectory light which will serve as our red laser that gets aimed at targets. Then our code runs a few times and identifies numbers and lunges at them. Once this happens a few times the code will go into elimination mode and will eliminate player(s) in the quadrant signified by a shooting sound, colors going red and blinking lights at the players.

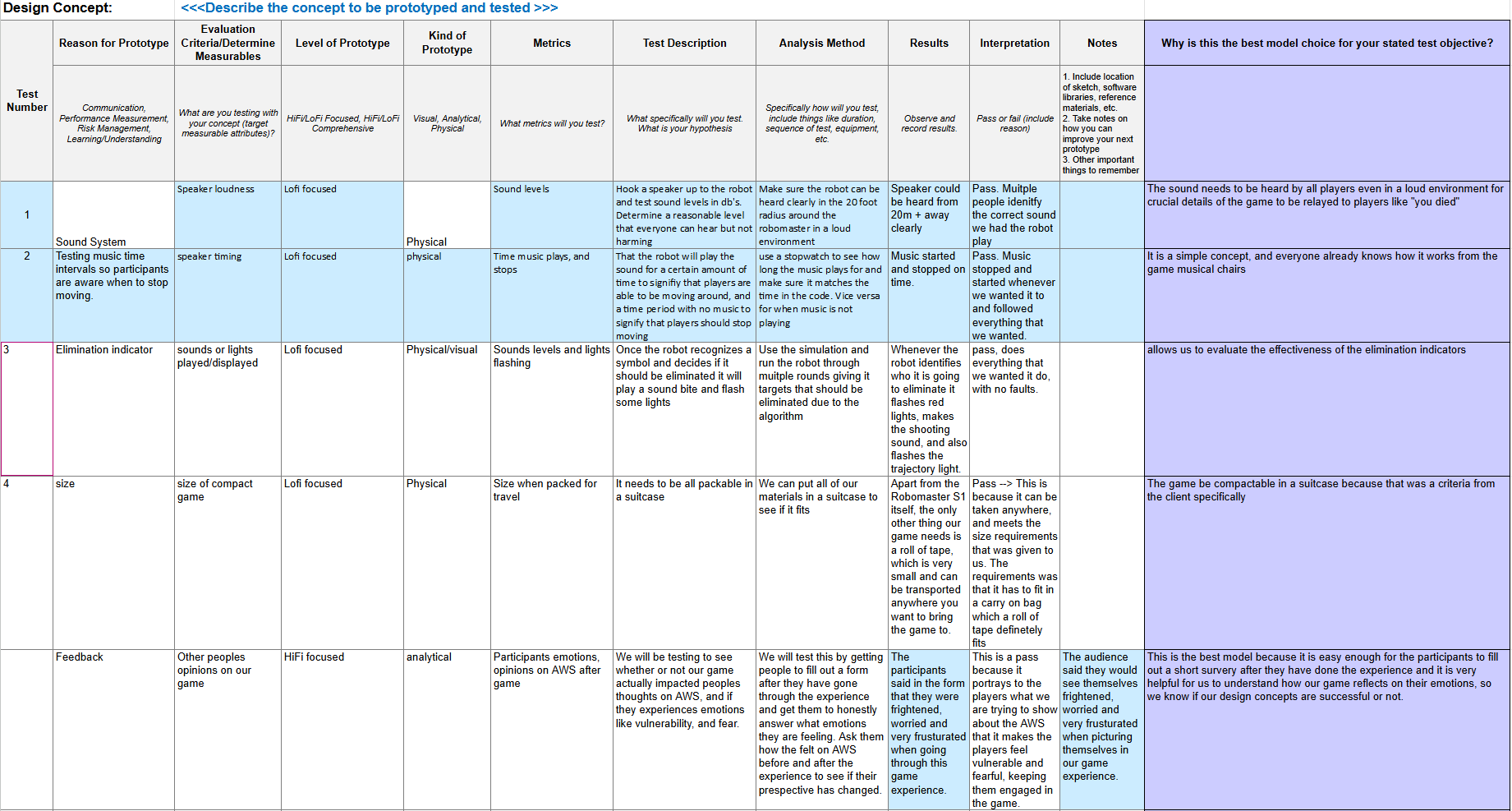
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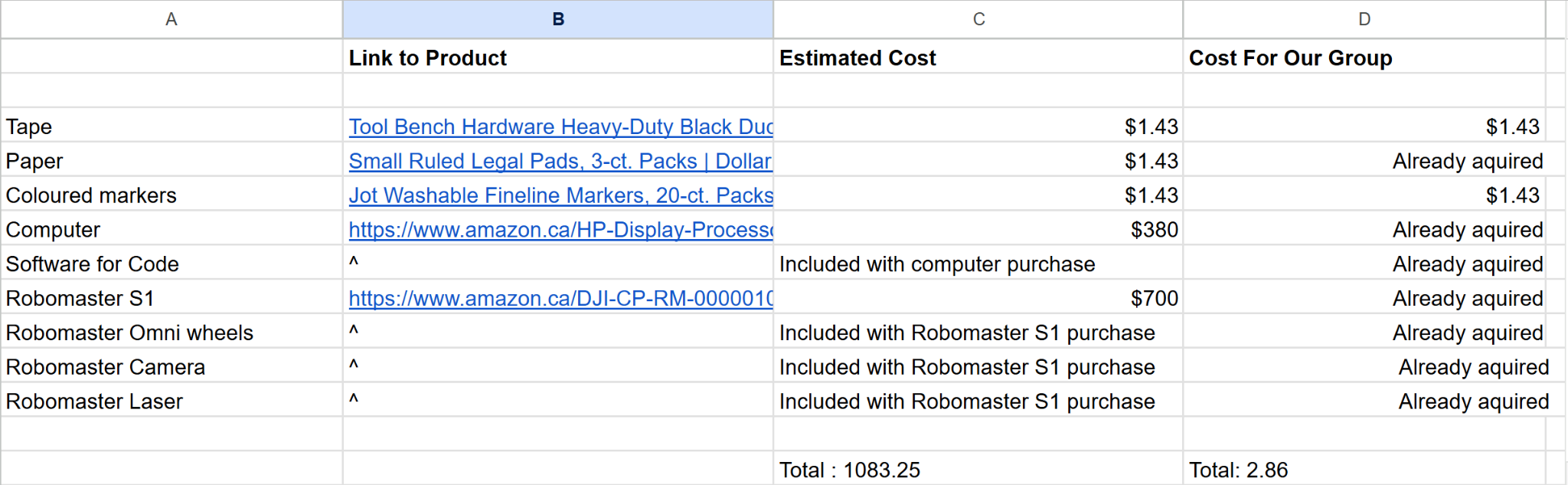
1. Prototyping Test Plan

[Prototype 3 and Test Plan .xlsx - Google Sheets](https://docs.google.com/spreadsheets/d/1BiWrpSVqpuMqzc6pdZezFb7rHEIagy-P/edit?gid=564856675#gid=564856675)



1. Updated BOM

[Final Budget Group 14 - Google Sheets](https://docs.google.com/spreadsheets/d/13gcfOTl1KLVePR-R6UaD4ufRZbPTR_-iS_s4KLsGZiM/edit?gid=0#gid=0)



1. User Prototype Feedback

For our third prototype, we have been in the maker lab with our code and have gotten much feedback from seeing how the updated code is functioning. We have also gotten feedback from our peers and other members from different groups regarding the effectiveness of our current prototype. We have gotten responses that match what we are looking for where this prototype brings a good emotional aspect to our game. After asking questions with a survey, we found that people had vulnerable and fearful emotions. Almost everyone that we demonstrated and had played our game was able to identify at least three of the ethical concerns that are associated with autonomous weapons systems. One of changes that we had based on feedback from our surveys is to changes the color of the lights on the robot, we originally had the lights in the stages where the robot is not eliminating the participants as blue, but participants felt that blue was unclear whether the robot was in the elimination phase, or in between phase. To fix this we wanted to make the lights green, but the robomaster does not have green so we changed it to yellow, and got feedback again from participants and found that the yellow was effective and they were always able to identify between elimination stages, and the in between stages.

1. Demonstration of Prototype III

[GNG 1103 Proto III Demo.mp4](https://uottawa-my.sharepoint.com/personal/aroth050_uottawa_ca/_layouts/15/guestaccess.aspx?share=EV6R0aqXokdHobxO6Oay2pwBLtpbNo-Nbjru4eKrIZOZyw&nav=eyJyZWZlcnJhbEluZm8iOnsicmVmZXJyYWxBcHAiOiJTdHJlYW1XZWJBcHAiLCJyZWZlcnJhbFZpZXciOiJTaGFyZURpYWxvZy1MaW5rIiwicmVmZXJyYWxBcHBQbGF0Zm9ybSI6IldlYiIsInJlZmVycmFsTW9kZSI6InZpZXcifX0%3D&e=NjKuIm)

1. Conclusion

The development of our prototype has been through many iterations since our first design with improving the overall tracking capabilities, symbol recognition and responsiveness. This final prototype is able to track moving targets, correctly identify symbols and will lunge at hostile symbols. The RoboMasters decision making was improved to improve on display of ethical concerns. Through user feedback and testing, we confirmed that the updated prototype successfully evokes emotional responses such as fear and vulnerability. The implementation of sounds and music helped with the story aspect and made it feel more like a game. Adjustments to the RoboMaster ensure a seamless game experience. This prototype serves as an impactful tool and promotes the impacts of AWS.