**Deliverable G – Prototype II and Customer Feedback**

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8th November 2024

**Abstract**

This document outlines the development of our second prototype and prepares a test plan for our third prototype. In addition to that it provides the test results of the tests conducted on prototype 2 and provides the analytical, numerical and experimental models of our second prototype. Additionally it talks about how the feedback we got enhanced our product.

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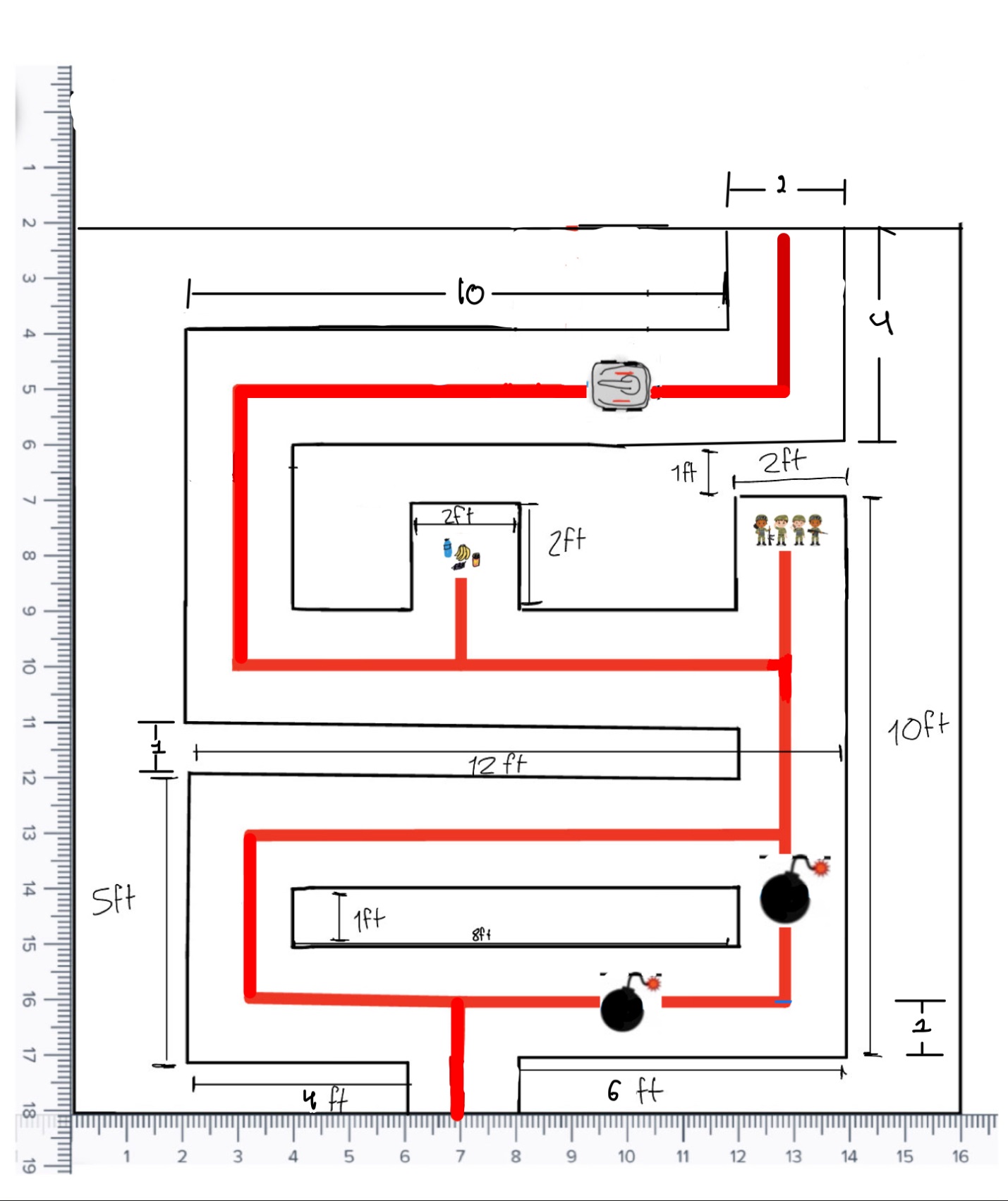
1. **Introduction**

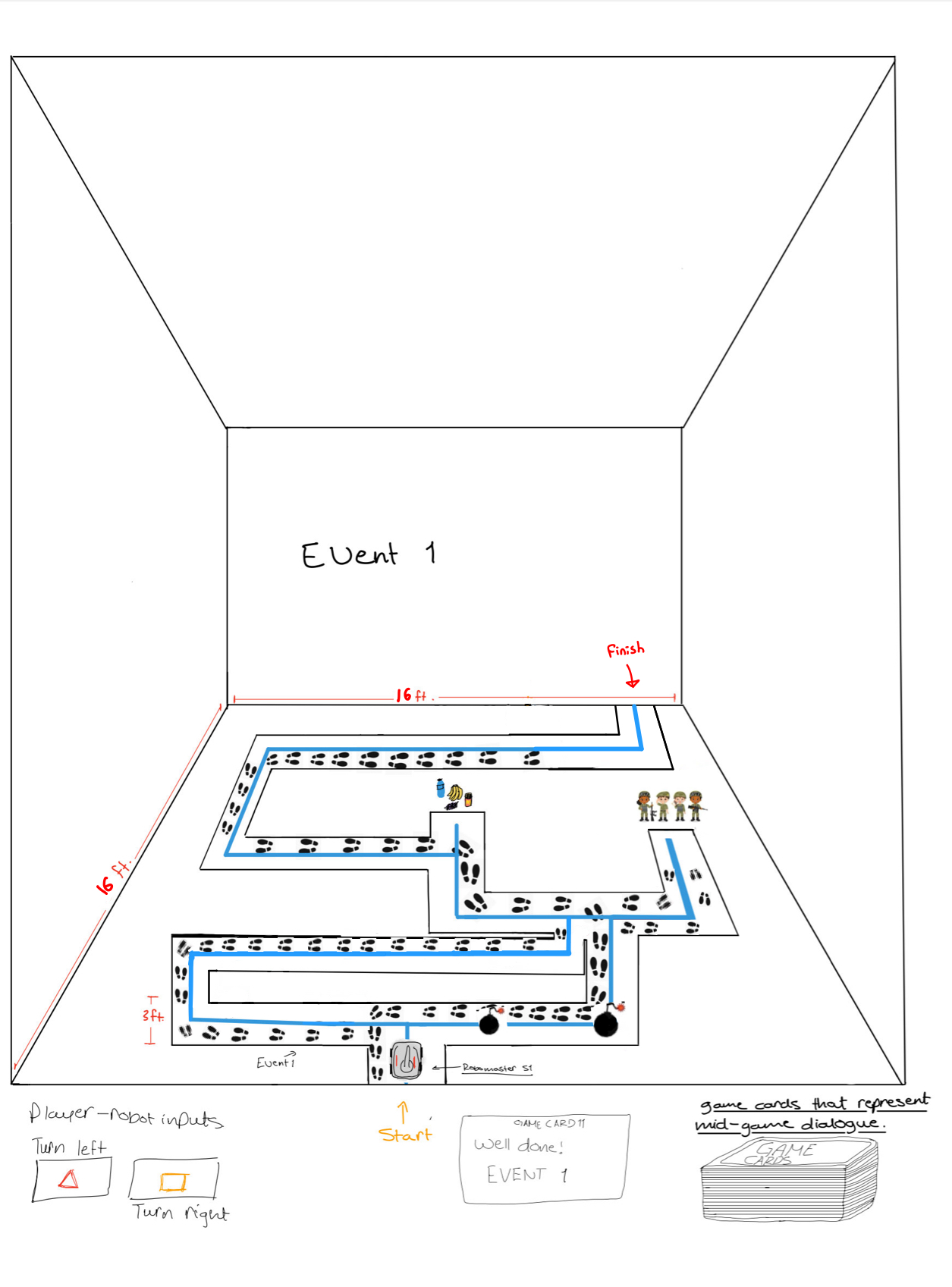
This document presents the second prototype of our maze navigation game, highlighting the product’s most critical subsystem: the RoboMaster S1’s navigation and behavior code. It shows how the RoboMaster S1 has been programmed to navigate the maze, interact with users, and perform decision-making tasks in response to ethical dilemmas, forming the core functionality of the game. This document also presents numerical, analytical and experimental models of our game alongside the results of the tests conducted on the second prototype. Additionally, this document also talks about how the client’s, classmates, teacher assistant’s and professor’s feedbacks have enhanced our prototype. Lastly, it outlines a test plan for the third prototype which will be the complete and final version of the game. The test plan outlines the test objectives, the test description, description of potential results and their usefulness and test durations.

1. **Prototype 2**

Our second prototype consists of the most crucial subsystem of our product which is the code the robot follows to make its decisions, to behave and to provide visual cues. This is the core of the game and the most crucial aspect of the game as we convey the ethical concerns around lethal autonomous weapons systems through the actions of the robot. Please see submitted video entitled “Prototype 2 Code”. It consist of a screen recording of the code script developed for our product.

1. **Analytical, Numerical and Experimental Model**

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Description :

Numerical model : The first image is the numerical model and shows the exact scaled design of our game with the real dimensions.

Analytical model : The second image is the analytical model of our game and shows how the overall game will be with the different events and encounters. Players will be able to read the scenarios through game cards and will be able to provide input to the robot with input cards.

During the first event at the first intersection players will have to choose between taking a path filled with mines and saving time or take a longer but safer path. This is the event where the players build trust with the robot as regardless of what path they choose the robot will protect them. To choose their path they have to give the robot input.

During the second event at the second intersection players will have to choose between saving hostages or save time and not save them. The robot will wait for input, but regardless of the players decision the robot will go save the civilians but there will be causalities. This is where we convey the ethical concern of lack of accountability and lack of meaningful human control.

During the third event, the players will have to decide between taking supplies that have food and medical kits for the wounded hostages saved and a wounded friend. However without waiting for input the robot will keep moving forward optimizing time. This is where we convey the ethical concern of lack of human judgement.

During the fourth event, on the path leading to the exit of the maze the robot will suddenly stop turn around and eliminate the players. This is where we convey the ethical concerns of a lasting distrust of technology, the inability to explain what happened or why and digital dehumanization.

We also use different robot features such as gun pointing, laser shooting and visuals cues to make the game more immersive.

Experimental Model: We do not yet have an experimental model as our budget and bill of material is pending approval. However the video of the product’s code entitled “Prototype 2 Code” that was submitted for deliverable G which is our second prototype is very reflective of an experimental model as the DJI software has a simulator we used to simulate the robot’s performance in the real world settings.

1. **Prototype 2 Test analysis and results**

Please refer to the word document entitled “Prototype 2 Test Plan” submitted for deliverable G

1. **Feedback and Comments and improvements from last prototype**

The feedback given by our clients, teacher assistants, professor and fellow classmates and the test results from the test conducted on prototype has heavily impacted the design and progression of our game from prototype 1. When we met our clients one on one for the first time, we were advised to raise the stakes in the events of our maze whilst keeping it simple. The simplicity of our game was something that really impressed them. We were also advised to make our maze as more of a simulation than a game, meaning that they would like for it to be more scripted and predetermined while letting the player(s) think that the game is being run by them. After receiving this feedback, we had decided to raise the stakes of the game by enforcing a more immersive plot and incorporating a more fitting storyline. We did this by immersing the player(s) into a war zone environment that they are told to flee from in a set amount of time. This gives the players a driving force to take the game seriously and to reflect on the environment they are placed in. The updated storyline that we were advised to revise has greatly augmented our game whilst having an easy-to-understand game that just makes sense. As they progress through the maze they will come across intersections that will show them autonomous weapon’s shortcomings. The revised maze includes more predetermined outcomes that are taken by the robot after it gets input from the players. The advice of incorporating predetermined outcomes into our game as opposed to player dependent outcomes helps us give the players the illusion of being in control, making the betrayal moments more impactful and immersive. In addition to that it makes the coding much more feasible and more robust as it reduces a lot of dependencies on sensors making the game less likely to fail. This was a suggestion of our client and something they found to be very interesting to incorporate. Upon presenting this to our clients, classmates, professor and teacher assistants in our last meeting, we were told that our more revised concept has definitely made the game much more immersive whilst keeping our game very self-intuitive which were key needs of our client. In addition to that we were also advised to assess different materials for making our maze such as carpet, a tarp and/or a collapsible paper maze. In this prototype we moved forward with our material choice for the maze and we chose the tarp. This feedback was really useful to us as it helped us enhance our UX and the feasibility of our game. It also helped us make a game that can easily be carried on a carry-on. As a team, the feedback was greatly appreciated and taken into consideration, and then properly executed.

1. **Test plan for Prototype 3**

Please refer to the excel sheet entitled “Prototype 3 Test Plan” submitted for deliverable G.