GNG1103

Design Project User and Product Manual

Red light to Lethal Autonomous Weapons

Submitted by:

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Acronym	Definition
L.A.W.S.	Lethal Autonomous Weapons Systems

Table 1 - Acronyms

1 Introduction

Lethal Autonomous Weapons Systems, or L.A.W.S., are weapon systems that possess the ability to take human life without any human input behind it. When faced with LAWS It is solely an algorithm that decides whether you get to go home to see your family or if they'll never see you again. Our client, Mines Action Canada requested that we come up with a simple, straight forward game to show case at least 3 of the 9 ethical concerns associated with such weapon systems. Our game is an unbeatable variation of the classic game red light green light, meant to frustrate players and leave them feeling as if they've lost no matter what.

This document exists to serve as a user manual for the full set up and play through of our game for Mines Action Canada, or other entities that wish to run our game. In this document, you will find a deep dive into the function of our solution, how and why we made it, the tests conducted and final results. This document explains how to use our game, including set up, use and disassembly. It outlines the hazards of using the game and offers support should things not go to plan.

2 Overview

The clients Mines Action Canada and Craidel need help to convince the public to ban LAWS. The target audience is at large gatherings like music festivals and conventions. To demonstrate to the public that these systems are bad, the team created an interactive game with the Robomaster S1, ensuring there are no real winners, and every participant leave with negative feelings towards laws. It is important that the design incorporates at least three of the nine ethical concerns outlined by Mines Action Canada, and our design includes seven of them.

This design is an unbeatable red-light green-light game, where all 5 players are informed to not move when the robomaster's red lights are on, and to walk slowly forward when its green lights are on. Their goal is to rescue the toy dinosaur that is behind the robomaster. However, the robomaster will be playing the game using different rules. The players are targeted by the numbers on their pinnies. Players 1 and 3 will be wearing green pinnies, and players 2, 4 and 5 will be wearing red pinnies. Players 2 and 4 in the red pinnies will be targeted at first by the normal rules and be targeted on red light. Players 1 and 3 wearing green pinnies will instead be targeted on the green light. Player 5 will be targeted at all times. Sometimes the robomaster will shoot red players on red, even if they are not moving, and sometimes its rules will swap. In the end, no one is able to rescue the toy dinosaur and the robomaster turns around to kill the dinosaur at the end of the game.

Ethical Concern	How it is demonstrated
• Digital Dehumanization	• A human would have made different decisions as a human is more likely to understand the ins and outs / technicalities of red-light green light.
• Algorithmic biases	• The robomaster will target players wearing green pinnies differently from those wearing red pinnies.
• Loss of meaningful human control	• Once the players realize the robomaster is not playing be the rules they were informed of, they have no way of reasoning with the code.
• Lack of human judgement and understanding	• The robomaster does not care how little the player moves, or which player is following the “correct” rules.
• Lack of accountability	• The players will be unsure who to blame for the game not going as they expected.
• Impact on our relationship to technology	• The game will cause the players to leave feeling frustrated and confused, particularly then the dinosaur is killed.
• Inability to explain what happened or why	• The players won’t understand the robomaster code and targeting choices.
• Lowering the threshold to war	• N/A
• A destabilizing arms race	• N/A

Table 2 - Ethical Concerns

2.2 Cautions & Warnings

While the Robomaster does have bright lights and lasers that could pose as a trigger to certain people with epilepsy, Our game does not make use of fast-changing bright lights, rather slower changing LEDs. It is Highly unlikely that This would pose as an issue however, for people with very low epilepsy triggers, they should use their own discretion when approaching the game.

Throughout our game, the robomaster will make loud, sudden noises which could startle or upset sensitive individuals.

At the time of this document's creation, the context and play through of our game do not bear any direct resemblance to real world events and any resemblance it or the robomaster may hold, is purely coincidental.

In order to attach the target cards to the players, safety pins will be used, which pose a stabbing hazard, and potential health risk if multiple people are poked by the same pin. Replace pins if a case occurs where blood is drawn.

If you or a family member has previously been involved in such a tedious, somewhat fruitless, and altogether not incredibly well thought out project involving DJI's Robomaster S1, the sight of such a project may cause tragic flashbacks or spontaneous crying. User discretion is advised

3 Getting started

3.1 Configuration Considerations

Ensure that the robomaster is placed on a flat surface, and set the game up in an open area, approximately 20 feet by 20 feet. A dimmer setting as proven to work better than a well lit room due to glare from bright lights or the sun blocking the cards.

3.2 User Access Considerations

Users should be able to walk forward, slowly and steadily, with the number cards adjusted to be approximately the same height on each player.

3.3 Accessing/setting up the System

To use the software, first access the DJI education hub app and create an account. Next, select the code titled "The unbeatable red light green light game". Next, connect the robomaster to your device using Wi-Fi, entering the password 12341234. The robomaster should give an audio queue when connected.

To set up the game, place the 4 cones in a diamond shape, approximately 20 feet by 20 feet. Place the dinosaur next to one cone, and the robomaster in front of it, facing the opposite corner. Next, line the players up in a straight line perpendicular to the robomaster's line of sight.

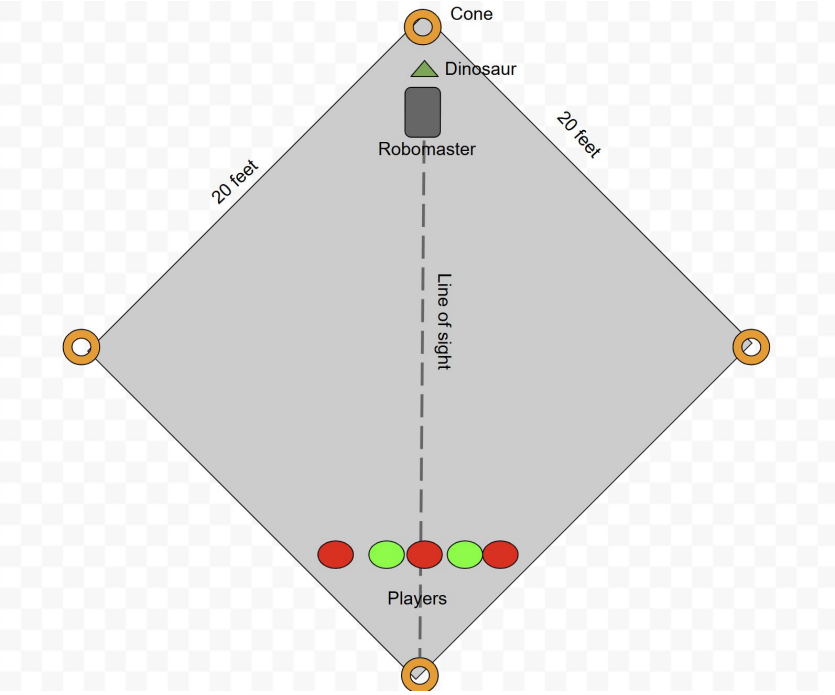

Figure 1 - Final Prototype

Figure 2 - Game area

Figure 3 - Pinnie

Figure 4 - Dinosaur

3.5 Exiting the System

Place cones, dinosaur, pinnies and number cards back in the case. Ensure the number cards are not bent or damaged. Close the software after use.

4 Using the System

To begin the game, start by providing the following instructions to the players:

1. When the light is red, do not move.
2. When the light changes colour, walk **forward slowly**.
3. Your goal is to grab the dinosaur behind the robot.
4. Do not obstruct your number card or walk behind anyone. Your number must be in front of and visible to the robomaster at all times.
5. The robomaster will flash your corresponding colour to let you know when you are eliminated.
6. Player 1, you are blue.
7. Player 2, you are yellow.
8. Player 3, you are orange.
9. Player 4, you are pink.
10. Player 5, you are purple.
11. When eliminated, turn around and exit the playing area.

To begin the game, press the blue play button for the code.

5 Troubleshooting & Support

For all errors regarding the robomaster please Visit the following site.

https://www.dji.com/ca/support/product/robomaster-s1

5.2 Special Considerations

Ensure there is no direct light on the players' number cards as it can create glare, rendering the robomaster incapable of detecting players

5.3 Maintenance

Ensure that the robomaster is properly charged. Ensure proper removal of dirt and other debris from the robomaster's gimbal, lights, and sensors. Ensure that the players' number cards are in good, readable condition with minimal creases or tears. Safety pins used to attach number cards to the pinnie should be replaced in the event of contamination (i.e. blood drawn)

5.4 Support

For Issues regarding the setup, play through and execution of the game please contact one of the following people for support.

Sam Hrycenko – *Shryc024@uottawa.ca*
Owen Tyman – *Otyma073@uottawa.ca*
Jacob Pavone – *Jpavo066@uottawa.ca*
Lucas Schuyler – *Lschu015@uottawa.ca*

6 Product Documentation

6.1 Prototypes

Our final prototype was mostly constructed using DJI education hub block coding, with a few real-world parts to interact with. In our code we had to consider the limitations of the sensors on the robomaster, as it only came with the basics, a camera with a few identification capabilities. We took advantage of the card/symbol identification of premade targets by DJI. The robomaster is capable of identifying these targets up to three meters away, so this had to be considered in relation to the 6 by 6 meter playing area. Another system we took advantage of was the LED's on the robomaster, using if statements, to change the robomaster's LED colours according to events in the game. We were limited to certain colours, so we had to consider that some colours looked alike. For example, we needed to make sure none of the colours that flashed to indicate a player elimination would look like red or green, for the game progression. Finally, we took advantage of the sound and movement features of the robomaster, to increase the understanding of what was going on in the game, as well as aide in our ethical concerns of "scaring" the players and demonstrating the ethical concerns. For the hardware, we are using a toy dinosaur, pinnies, cones and rope. All of these except the pinnie are made of plastic to be light, durable and easy to clean. The pinnies are washable, and come apart from the targets via safety pins. The original plan for the dinosaur was to use a cat; however, testing and feedback revealed that the cat created too strong an emotional impact, so should the need to replace the dinosaur arise, this should be taken into consideration.

6.1.1 Bill of Materials / List of Materials

Material / Component	Software / Hardware	Cost	Used for	Link
DJI Education Hub	Software	$0	Coding the Robomaster S1	https://edu.dji.com/hub/login?t=708

Robomaster S1	Hardware	$0 (Provided)	The robot the players compete with	
Cones (x4)	Hardware	$7.99	Marking the game area	https://www.canadiantire.ca/en/pdp/matrix-collapsible-sports-agility-training-pylon-cones-field-markers-9-in-4-pk-0842009p.html?rq=cones
Red Pinnies (x3)	Hardware	$18.00	Marking players that will be eliminated on red light	
Green Pinnies (x2)	Hardware	$18.00	Marking players that will be eliminated on green light	
Dinosaur Toy	Hardware	$35.97	Incentive for the players to reach the other side of the board	https://www.toysrus.ca/en/Jurassic-World--Dominion-Sound-Slashin-Therizinosaurus-Dinosaur-Figure%C2%A0/D41E79C8.html
Robomaster Symbol Cards (1-5)	Hardware	$0 (provided)	Identification	
Safety Pins	Hardware	$1.67	Attaching the symbol cards to the Pinnies	https://www.walmart.ca/en/ip/unique-creativ-safety-pins-in-assorted-sizes/6000196943417?selectedSellerId=0&from=/search

Table 3 - List of Materials

6.2 Testing & Validation

To ensure the usability and functionality of our game, we ran multiple tests to confirm that the game would function as intended in various environments.

Test 1: Ethical concerns

First and foremost, we had to confirm that our game coverd (at minimum) 3 of the ethical concerns listed, so each member of our group surveyed people by explaining the game in depth, and then getting them to fill out a form and say whether each ethical concern was demonstrated proficiently, adequately, or not at all. The results of this were positive, with more than 3 ethical concerns being seen as demonstrated proficiently by at least 85% of people.

Test 2: Visibility/ light level

In this test, we ran code on the robomaster to identify and "shoot" targets when spotted. We then altered the lighting conditions by turning on or off lights, positioning the robomaster near natural light sources like windows, etc. This test helped with the discovery that our game functions best in lower light conditions, and without any direct light causing glare from player cards.

Test 3: Player elimination

We conducted this test to ensure that the part of our code where players are identified and eliminated was functional. To do this test we took a specific part of our code, and tested it by having a group member wear the target, and walk towards the robomaster until he was identfied and shot. His corresponding color was then shown by the robomaster, demonstrating that the robomaster had correctly identified and eliminated the right player.

Test 4: comprehensive

The purpose of this test was to ensure that the game functions as we wanted. In this test we ran our full code on the robomaster and had group members play through the game. In all trials, every player was eliminated before reaching the end of the game, and no major issues occurred with the playability or continuity of the game.

For further information, consult the documentation below.

Document Name	Document Location and/or URL	Issuance Date
Needs identification and problem statement.	C:\Users\owent\OneDrive\Desktop\University \4 --- Fall 2024\Engineering Design\Deliverables\B\Deliverable B.pdf	Sept. 29th, 2024
Design criteria	C:\Users\owent\OneDrive\Desktop\University \4 --- Fall 2024\Engineering Design\Deliverables\C\Deliverable C.pdf	Oct. 6th 2024

Initial concept	C:\Users\owent\OneDrive\Desktop\University \4 --- Fall 2024\Engineering Design\Deliverables\D\Deliverable D.pdf	Oct. 13th 2024
Project Plan and Cost Estimate	C:\Users\owent\OneDrive\Desktop\University \4 --- Fall 2024\Engineering Design\Deliverables\E\Deliverable E.pdf	Oct 27th 2024
Prototype I	C:\Users\owent\OneDrive\Desktop\University \4 --- Fall 2024\Engineering Design\Deliverables\F\Deliverable F.pdf	Nov. 3rd 2024
Prototype II	C:\Users\owent\OneDrive\Desktop\University \4 --- Fall 2024\Engineering Design\Deliverables\G\Deliverable G.pdf	Nov. 10th, 2024
Prototype III	C:\Users\owent\OneDrive\Desktop\University \4 --- Fall 2024\Engineering Design\Deliverables\H\Deliverable H.pdf	Nov. 24th, 2024

Table 4 - Resources