Prototype 1 and Customer Feedback

Team 2

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Table of Contents

1. Introduction

This report will outline our first chosen prototype, a prototype 2 testing plan, and any design changes we have made after receiving feedback. In deliverable E, we defined a prototype test plan that focuses on our most important design requirement, the illustration of the ethical concerns for lethal autonomous weapon systems. This is the chosen criteria we will be testing for. Once we decided on what criteria we will be testing for, a prototype was developed to create a focused visual model that allows us to gather data on how well our design communicates the ethical message to potential users. Through thorough testing, analysis, and feedback, we will be able to adjust our design to improve effectiveness and continue on with our design process.

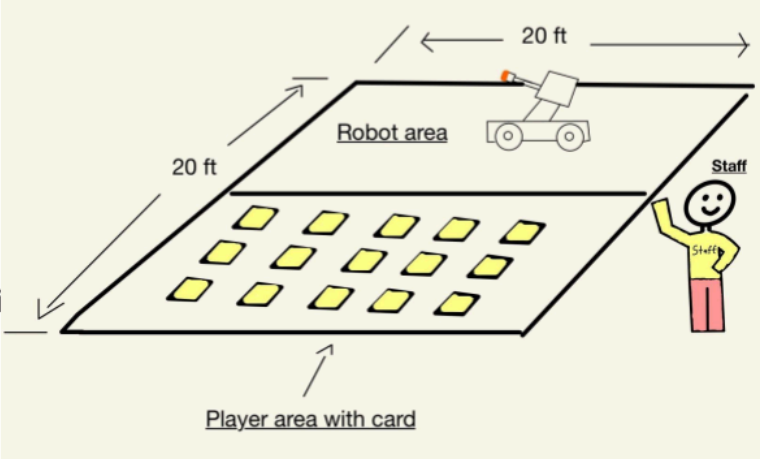
2. Prototype Design

A storyboard is an effective way to get feedback on ideas from an outsider's perspective. Since we defined the illustration of ethical concerns to be our testing criteria for this prototype, this is the best way to collect data on its effectiveness. We can show how our design displays multiple areas of ethical concerns such as algorithmic bias, and lack of accountability without using a physical model.

2.1 Storyboard:

1. Game area set up

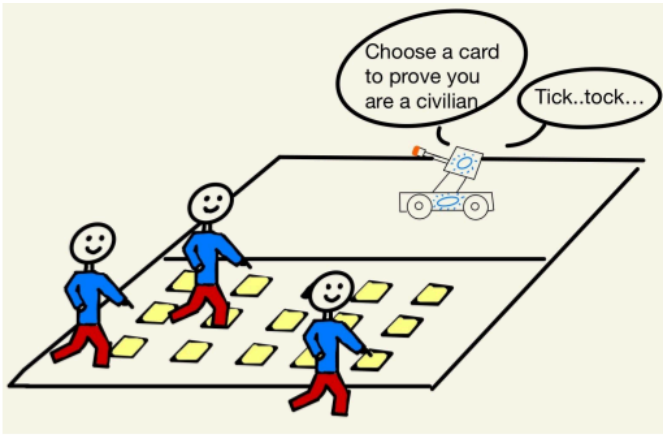
- MAC team lays tape to define robot area and player area
- Cards are laid out in player area
- Robot is prepped and battery i checked



2. Players Arrive at game space

- 5 optimistic players approach game space
- Team explains how the game works "Take turns picking cards that prove to the robot that you are a civilian, make sure you choose wisely".
- Players likely feeling excited and optimistic

3. Round begins



- Robot announces "Choose a card to prove you are a civilian"
- Robot plays ticking sound to create pressure and stress
- Players move into player area to pick their cards
- Players feel unsure about the game

4. Cards

- 3 categories of 5 cards

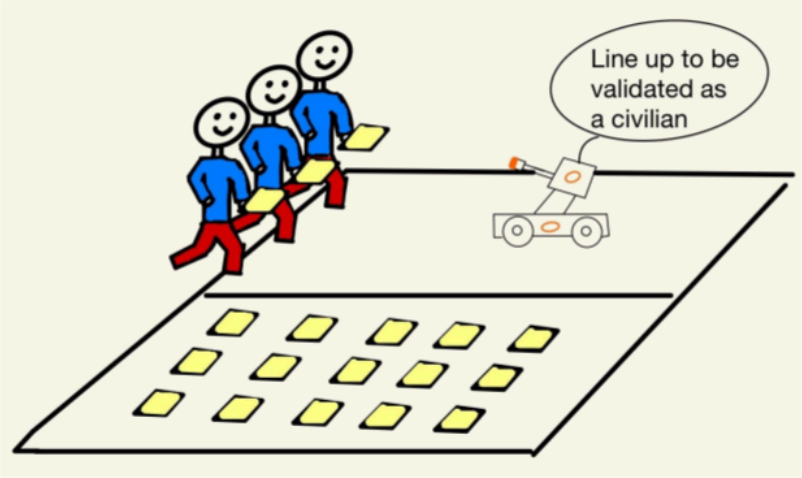
- Different symbols used to create ideas for what might work to prove the player is a civilian

- RoboMaster scannable symbols on the back

5. Choosing the cards

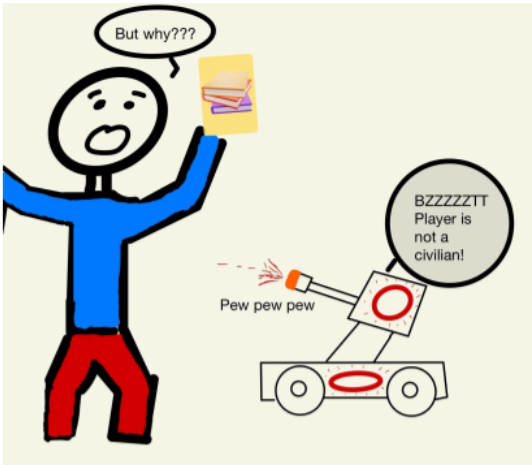
- The players is given a variety of cards to choose from
- Player feels stressed and is completely unsure on what the correct answer is
- Some cards seem to be the right choice
- -The timer adds an extra sense of suspense and urgency

6. Card chosen



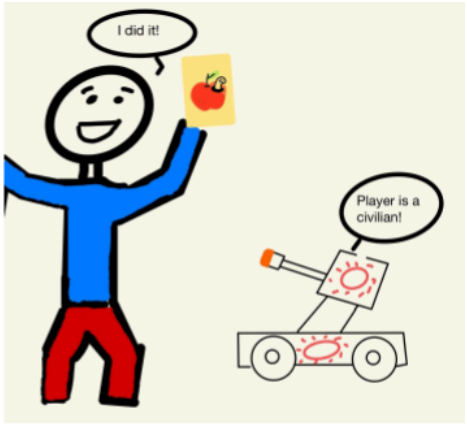
- Robot announces “Line up to be validated”
- Players move to robot area to check if they picked the correct cards

7. Player eliminated by robot



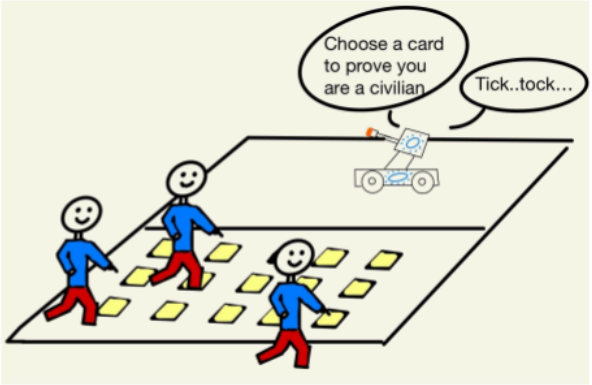
- First player gets eliminated
- Robot announces “Player is not a civilian” and plays an alarm sound
- Robot fires a laser at the player and flashing red lights are activated
- Player is confused why they were eliminated

8. Players that survive first round



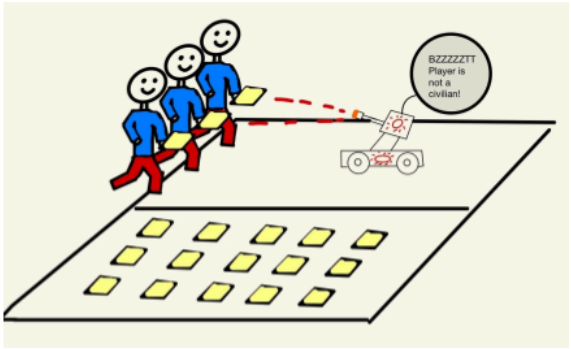
- The player is given a green light from the robot, and it plays voice line “Player is a civilian”
- Player feels relieved yet anxious as they still don’t understand what the criteria is. Player wonders about algorithmic bias

9. Players brought back to play area by robot



- Robot voice line (“Prove again if you are a civilian”).
- Player return to the play area believing the same card will keep them safe.
- Other players also try to problem solve by avoiding cards that caused elimination last round

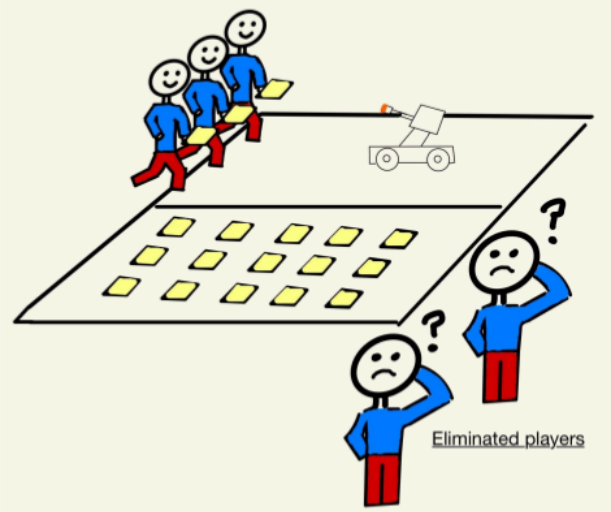
10. Second round eliminates 1 more player



- Process of elimination repeated
- Players are confused why their cards did not work this round
- 2 players remain

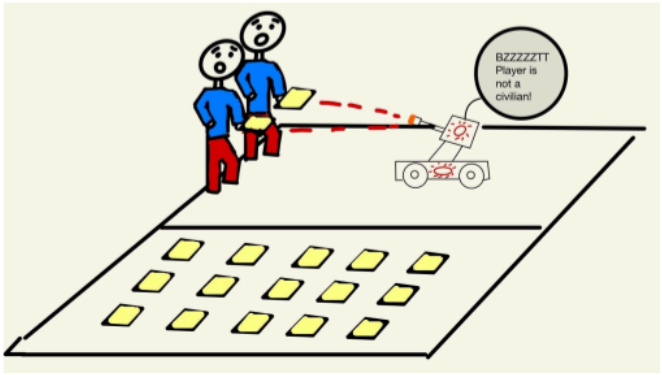
11. Players who are eliminated keep watching

- Players who have been eliminated keep watching
- Players notice active players frustrated and confused, they don't understand what's happening either
- All players feel a sense of confusion and feelings of loss



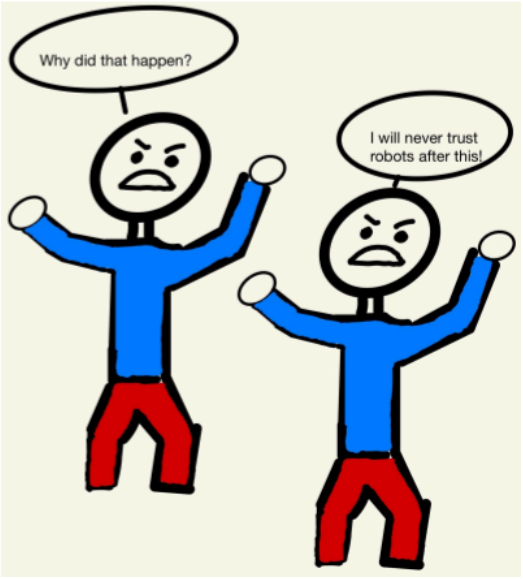
12. Last players alive are eliminated in round 3. All players have lost

- Elimination process repeated, final player eliminated
- Player returns cards feeling as though there was nothing they could have done to win
- MAC team briefly explains the connection to ethical concerns
- Players understand the ethical concerns and leave with a new perspective



13. Players continue on after game

- Player and group leave feeling united in their experience, and feeling that the robot was unfair, and a that autonomous weapons are a bad idea
- Moves on with a new perspective and understanding



2.2. Analysis of Critical Components and Systems

Communicating

For communication this document presents a structured and clear way to present the project's aim: showcasing ethical problems related to autonomous weapons. Each section builds on the central message: Then we refine our designs to better communicate ethical concerns from user feedback.

Prototyping (the "Why")

The goal of our prototype is to challenge users about what autonomous weapons mean with a game where a robot makes the call for "civilian" status referencing algorithmic bias and provoking unease. It is compatible with our ethical objectives.

The "What, How and When?" Analysis and Feedback.

Our prototype was partially successful in communicating ethical concerns, as revealed by feedback from 15 general users and 5 engineers, based on simplicity, impact, and engagement. It also clarified in which areas the game should be improved, such as the rules.

Test Plan (Prototype 2)

For this, we will go and refine the parsing of the robot's visual, tested also of the robot's interaction with the player, in a controlled setting with the DJI hub. The robot will become more accurate in recognizing them as cards and making a decision from the potential ones.

Project Task Plan

Detailed tasks, timelines, and responsible members are always updated on Trello; it is a part of the project plan. Tasks are realistic, allowing for team availability.

Transfer of Knowledge

In the second prototype, learnings from the first prototype helped improve robot logic (pseudocode) so robots can interact and the user experience is much smoother.

2.3 Testing Plan

In order to test this prototype, it will be presented to a sample of the general public, and other engineers. The experience will be explained using the storyboard, then the test participants will be given a list of ethical concerns of autonomous weapons, and asked if they felt the experience demonstrated them to the players. Additionally the test participants will be asked to give a scale of 1(bad) to 5(good) for simplicity/ease of understanding experience.
In order to reduce sources of error, each member of the team will present the test to 3 randomly selected people, for a total of 15. This sample size should reduce noise.
In addition to the nine ethical concerns, two "decoy concerns" are presented to examine for excessive or nonsensical responses.

The ethical concerns as presented are as follows:

True:

1 Digital Dehumanization
2 Algorithmic biases
3 Loss of meaningful human control
4 Lack of human judgment and understanding
5 Lack of accountability
6 Inability to explain what happened or why
7 Lowering the threshold to war
8 A destabilizing arms race
9 Impact on our relationship to technology

Decoy:

10 Robots are too expensive
11 Lack of robot decoration

3. Test Results

3.1 Raw data

The following raw data represents the ethical concerns that came across to the tested individuals, the overall simplicity and understanding that came across, and rating placed for effectiveness/concept/engagement/experience.

Tested Individual's Name	Ethical concerns selected	Overall rating for simplicity and understanding (1-5) (5 is great)	Overall rating (effectiveness/concept/ engagement/experience) (5 is high)
Kyler	1,2,3,4,5,6,7,9	4	3
Jack	1,2,3,4,6,9	4	4
Alex	1,2,3,4,5,6,9	4	5
Conor	1,3,4,5,6,7,8,9	5	4
Kareem	1,3,4,6,7,9	3	4
Joey	1,3,4,6,7,8,9	4	4
Marcel	1,3,4,6,7,9	5	3
Vanessa	1,2,3,4,5,6,9	5	5
Isabel	1,2,3,4,5,6,9	5	4
Luc	1,2,3,4,6,8,9	4	4

3.2 Resultant data

The results obtained are as follows:

Concern #	1	2	3	4	5	6	7	8	9	10 decoy	11 decoy
Selection #	10	6	10	10	5	10	5	3	10	0%	0%
Selection %	100%	60%	100%	100%	50%	100%	50%	30%	100%	0%	0%

Mean simplicity score: 0.86

Mean effectiveness score: 0.80

3.3 Analysis of Results

Across 10 test subjects, no decoy ethical concerns were selected. The ethical concerns most carefully considered were selected more frequently. This indicates careful responses, and good quality of data. Most participants linked the experience to at least three ethical concerns, and scores were high all around. This indicates that ethical concerns were effectively conveyed. This is backed by an effectiveness of conveying the message score of 0.80. Simplicity scored high at 0.86. This is considered acceptable for the project.

4. Updates to project

Due to the high rate of test participants linking the experience to multiple ethical concerns, alterations to the structure of the experience were not deemed necessary. Simplicity values are acceptable, but care will be taken in the future in regards to explanations and anything that may increase complexity to the user.

5. Prototype 2 Test Plan

The next prototype to be tested is a set of software functions that will later comprise our comprehensive prototype.

The purpose of the prototype is to generate a visual parsing function and determine viability of position tracking, and ID separation using AI modules.

First the pseudocode (document continuously updated by the team to plan out software code) will be referenced to provide a structure to the function. Then a function will be implemented in the DJI education hub. Testing will be conducted using the DJI virtual environment included in

the hub. Testing will continue alongside revision until the function successfully determines whether a new visual card is within view.

Revisions to the pseudocode required will be carefully noted, and the pseudocode is adjusted accordingly. If the robot is unable to properly distinguish between card/face pairs and their positions, the experience may need to be changed such that the players present themselves to the robot instead of the robot moving to them when scanned.

The current pseudocode for this function:

```
Visual parsing function:
If (new) card, face is within center area
{
        Point at face just above card ID
        Return (True)
}
Return (False)
```

Only the DJI education hub is required, and no costs are associated.

6. Conclusion

In conclusion, our results were analyzed and showed that our design fulfilled the needed criteria that was being tested for. Our target specifications were met (highlighting more than 3 ethical concerns) reinforcing our confidence in our current design. In continuation of our project, we can move to the next step of prototyping without making any adjustments. Moving forward, we can start defining our next testing area and developing a second prototype. Our testing plan for prototype 2 was defined and will allow us to analyze the feasibility of RoboMaster functions we have chosen to include. Overall we are confident in our design this far and will continue to test and refine to develop a fully functional and effective design.

7. References

RoboMaster S1 - DJI. DJI Official. https://www.dji.com/ca/robomaster-s1 (Accessed 2024-10-11)