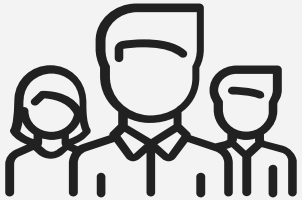
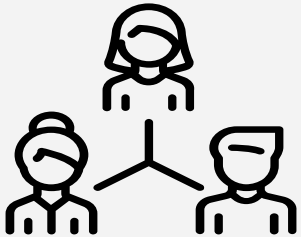
F31

Our team



Joumana
Civil Engineering

Saif
Electrical Engineering and Computing Technology



Avery
Biomedical Mechanical Engineering

Grace
Biomedical Mechanical Engineering

Mohammad
Chemical Engineering

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01 Content Overview

Problem Statement

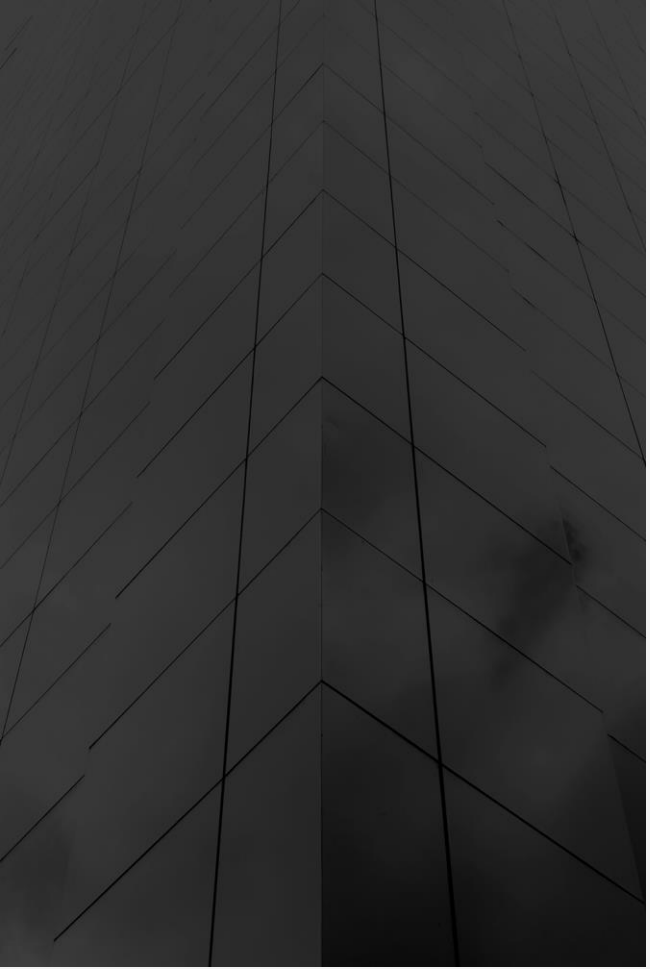
Autonomous weapons raise several moral and ethical concerns that decision makers need to be made aware of.

It is important for decision makers to start negotiations on these weapon systems before they are available to use.

Politicians and diplomats still see this issue as theoretical, and they don't see how such a revolution in warfare would have a major impact on many individuals.

Solution

Our task was to design a virtual reality experience that shows the ethical and moral issues that autonomous weapons raise. We had to take this problem and make it into a reality for decision makers.



MINES ACTION CANADA

Humanitarian disarmament organization with advocacy, research, capacity building, youth engagement and gender as its pillars. They are fighting a digital dehumanization battle as autonomous weapons turn people into simple numbers used to decide who lives and who dies, violating international humanitarian law.

Design Criteria 02

Design Criteria: Functional Requirements

Design Specifications	Relation (=,< or >)	Value	Units	Verification Method
Space required	<	1	m^2	Estimate, test
Headset model	=	HTC Vive	N/A	Testing
Ease of use	=	Yes	N/A	Testing
Languages	=	English & French	N/A	Testing

Non-functional Requirements

Design Specifications	Relation (=,< or >)	Value	Units	Verification Method
Graphic imagery	=	Yes	N/A	Testing
Safety (low range of motion)	=	Yes	N/A	Testing
Reliability	=	Yes	N/A	Testing
Realism	=	Yes	N/A	Testing
Call to action at end	=	Yes	N/A	Testing
Aesthetic appeal	=	Yes	N/A	Testing
Relatability	=	Yes	N/A	Testing

Constraints

Design Specifications	Relation (=,< or >)	Value	Units	Verification Method
Violence	=	No	N/A	Ensure/Analysis
References to real world entities	=	No	N/A	Ensure/Analysis
Health conditions	=	Yes	N/A	Ensure/Analysis
Cost	<	400	Dollars ($)	Estimate
Duration	<=	5	Minutes (min)	Estimate
Delivery time	=	3	Months	Estimate
Feminist/anti-racists	=	Yes	N/A	Ensure/Analysis
Operating conditions	=	Enclosed environment	N/A	Ensure/Analysis

Benchmarking

Values	Colours	#
High	Green	3
Average	Yellow	2
Low	Red	1

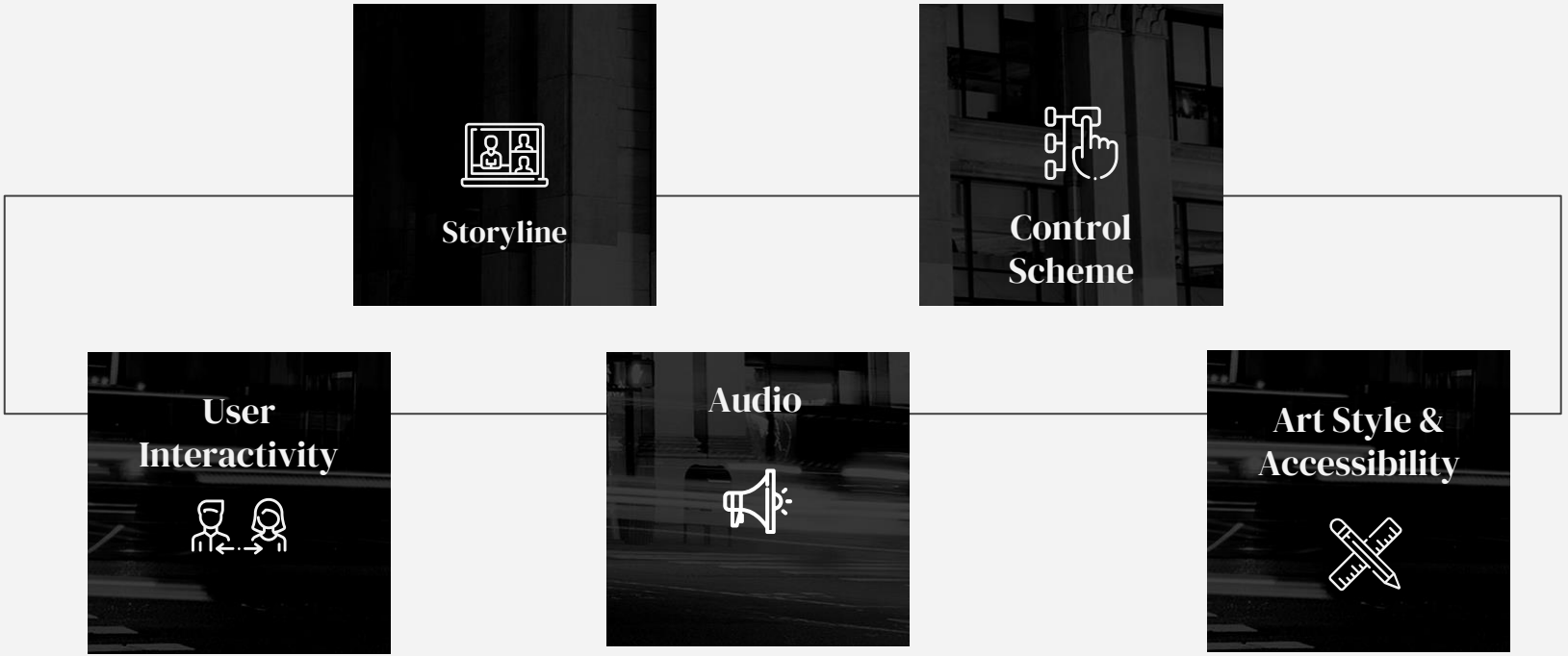
Specifications	Importance	Product 1	Product 2	Product 3
Product Name	-	Bear 71 VR	Meet your carbon footprint	Universe Sandbox
Company	-	National Film of Canada	United Nations Environment Program	Giant Army
Cost	3	Free	$26.99	$38.99
Duration	3	30 minutes	5 minutes	No limited duration
Graphics	2	Simplistic	Stylized	Realistic
Emotional Stimulation	3	High Sentimental value	Abstract interpretation	No emotional value- purely educational

Benchmarking

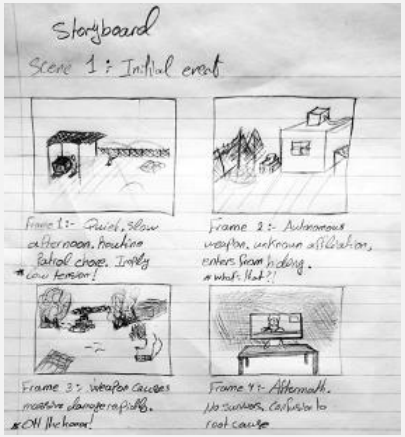
Specifications	Importance	Product 1	Product 2	Product 3
Product Name	-	Bear 71 VR	Meet your carbon footprint	Universe Sandbox
Company	-	National Film of Canada	United Nations Environment Program	Giant Army
Cost	3	3	2	1
Duration	3	1	3	1
Graphics	2	1	2	3
Emotional Stimulation	3	3	2	1
Total		24	25	15

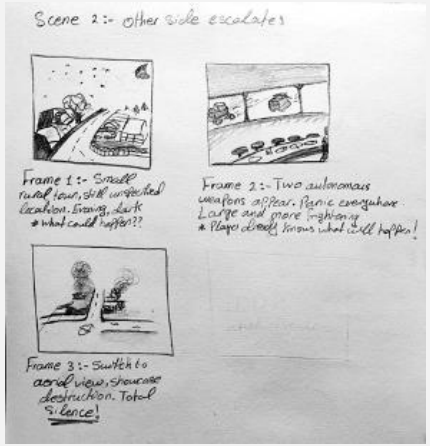
03 Conceptual Design

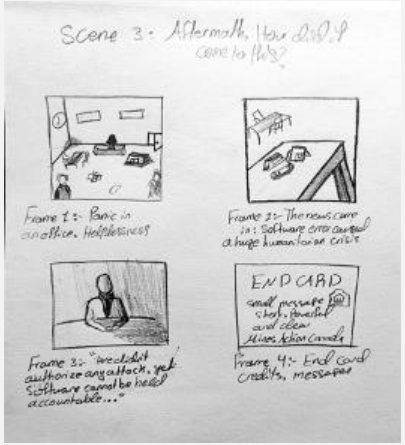
Subsystems

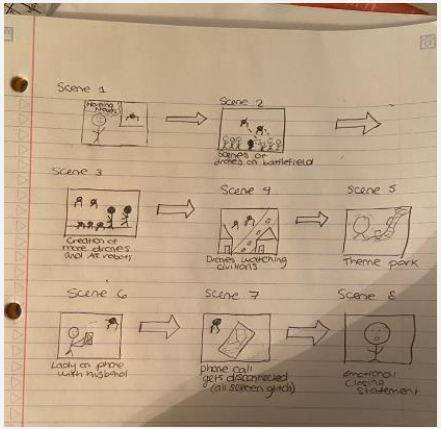

Storyline
Control Scheme
User Interactivity
Audio
Art Style & Accessibility

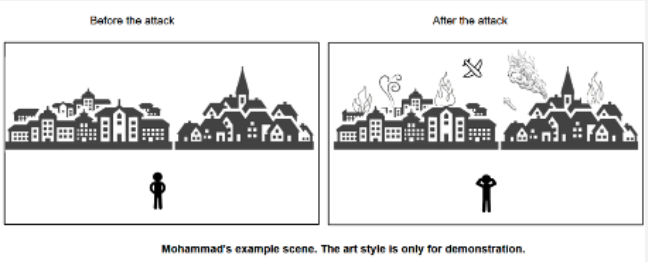
Sketches

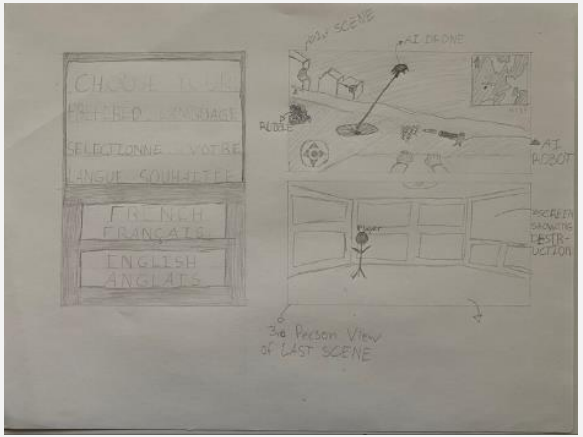

Storyboard
Scene 1: Initial event
Frame 1:- Quiet, slow afternoon. Routine patrol chore. Imply low tension!
Frame 2:- Autonomous weapon, unknown affiliation, enters from hiding.
Frame 3:- Weapon causes massive damage rapidly.
Frame 4:- Aftermath. No survivors. Confusion to root cause

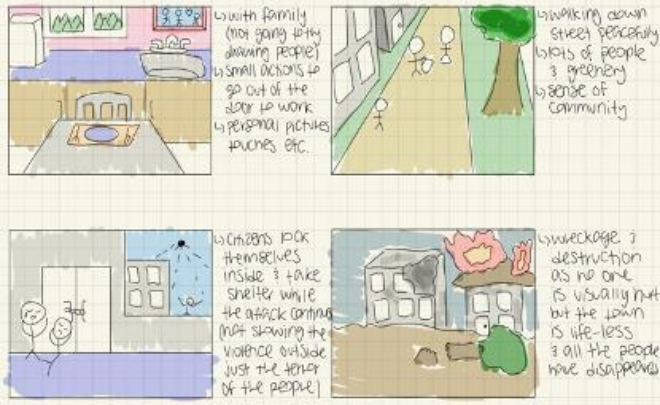

Scene 2:- other side escalates
Frame 1:- Small rural town, still unspecified location. Evening, dark
Frame 2:- Two autonomous weapons appear. Panic everywhere. Large and more frightening
Frame 3:- Switch to aerial view, showcase destruction. Total silence!


Scene 3: Aftermath. How did it come to this?
Frame 1:- Panic in an office. Helplessness
Frame 2:- The news came in: Software error caused a huge humanitarian crisis
END CARD
Frame 3:- "predidit authorize any attack, yet Software cannot be held accountable..."
Frame 4:- End card credits, messages


Scene 1
Scene 2
Scenes of drones on battlefield
Scene 3
Scene 4
Scene 5
Creation of more drones and AI robots
Drones watching civilians
Theme park
Scene 6
Scene 7
Scene 8
Lady on phone with husband
phone call gets disconnected (all screen glitch)
emotional closing statement


Before the attack
After the attack
Mohammad's example scene. The art style is only for demonstration.


AI DRONE
AI ROBOT
FRENCH FRANÇAIS
ENGLISH ANGLAIS
3rd Person View of LAST SCENE


with family (not going to try drawing people)
small actions to go out of the door to work
personal pictures touches etc.
walking down street peacefully
lots of people & greenery
sense of community
citizens lock themselves inside & take shelter while the attack continues (not showing the violence outside just the terror of the people)
wreckage & destruction as no one is visually hurt but the town is life-less & all the people have disappeared

4. Subsystem categorization

1	2	3
Bad	Average	Good

4.1 Storyline comparison

Specifications	Importance	Avery	Joumana	Grace	Saif	Mohammad
Interactivity	3	2	2	2	1	2
Relatability	4	3	2	3	3	2
Emotionally captivating	5	3	3	3	2	3
Delivers the message	5	2	3	2	3	3
Total		**43**	**44**	**43**	**40**	**44**

4.2 Control Scheme comparison

Specifications	Importance	Avery	Joumana	Grace	Saif	Mohammad
Physical actions	4	1	3	2	1	1
User interactivity	3	2	1	2	2	2
Minimal movement	5	3	3	2	3	3
Safe space for VR	5	3	3	3	3	3
Beginner friendly	4	3	2	2	3	3
Total		**52**	**53**	**47**	**52**	**52**

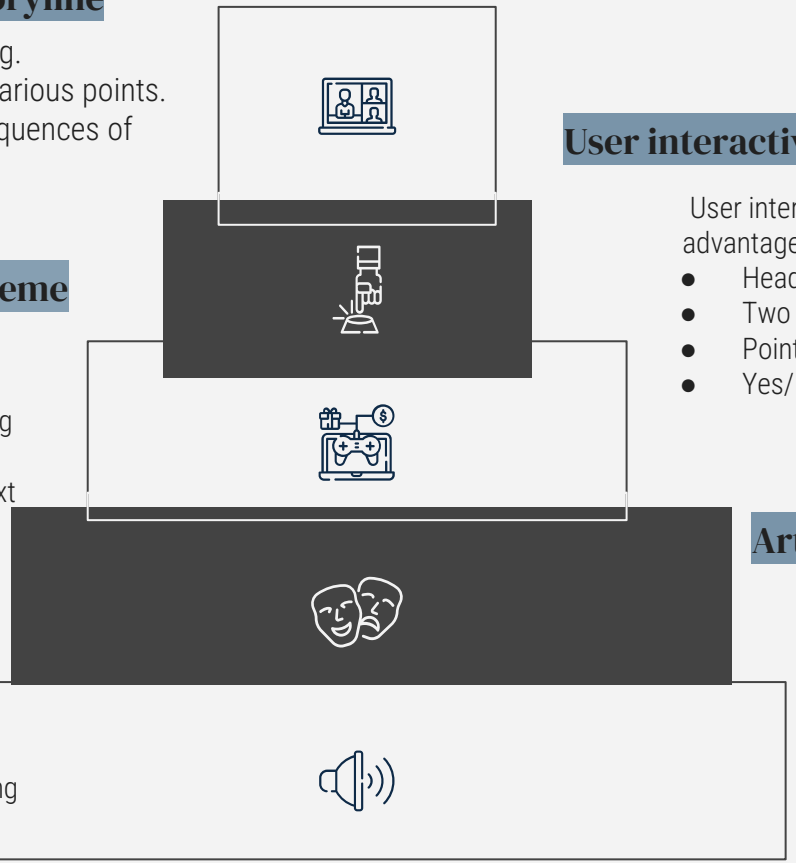
4.3 User Interactivity comparison

Specifications	Importance	Avery	Joumana	Grace	Saif	Mohammad
Small range of motion	4	3	2	2	2	3
Immersive experience	5	2	3	3	3	2
Total		**22**	**23**	**23**	**23**	**22**

Chosen Concept

Storyline

- Short, concise, engaging.
- Takes in user input at various points.
- Clear idea of the consequences of autonomous weapons.
- Modern day setting.



User interactivity

User interaction to move the story and take advantage of VR features. Setup consists of:

- Head mounted display
- Two hand tracking controllers
- Point and click (teleportation)
- Yes/No dialogue

Control Scheme

The scheme prioritizes simple control activity. We decided to minimize movement by:

- Allowing only hand movements, so no walking around
- Movement of the head - which will trigger next scenes
- Choosing options will be present, this allows some freedom to the user
- Teleportation

Art Style & Accessibility

Realistic as much as unity can go (effective) not futuristic or science fiction-like in current time, so it is relevant.

- No bright colors. (fits the context)
- No flashing imagery
- No graphic violence (as desired).

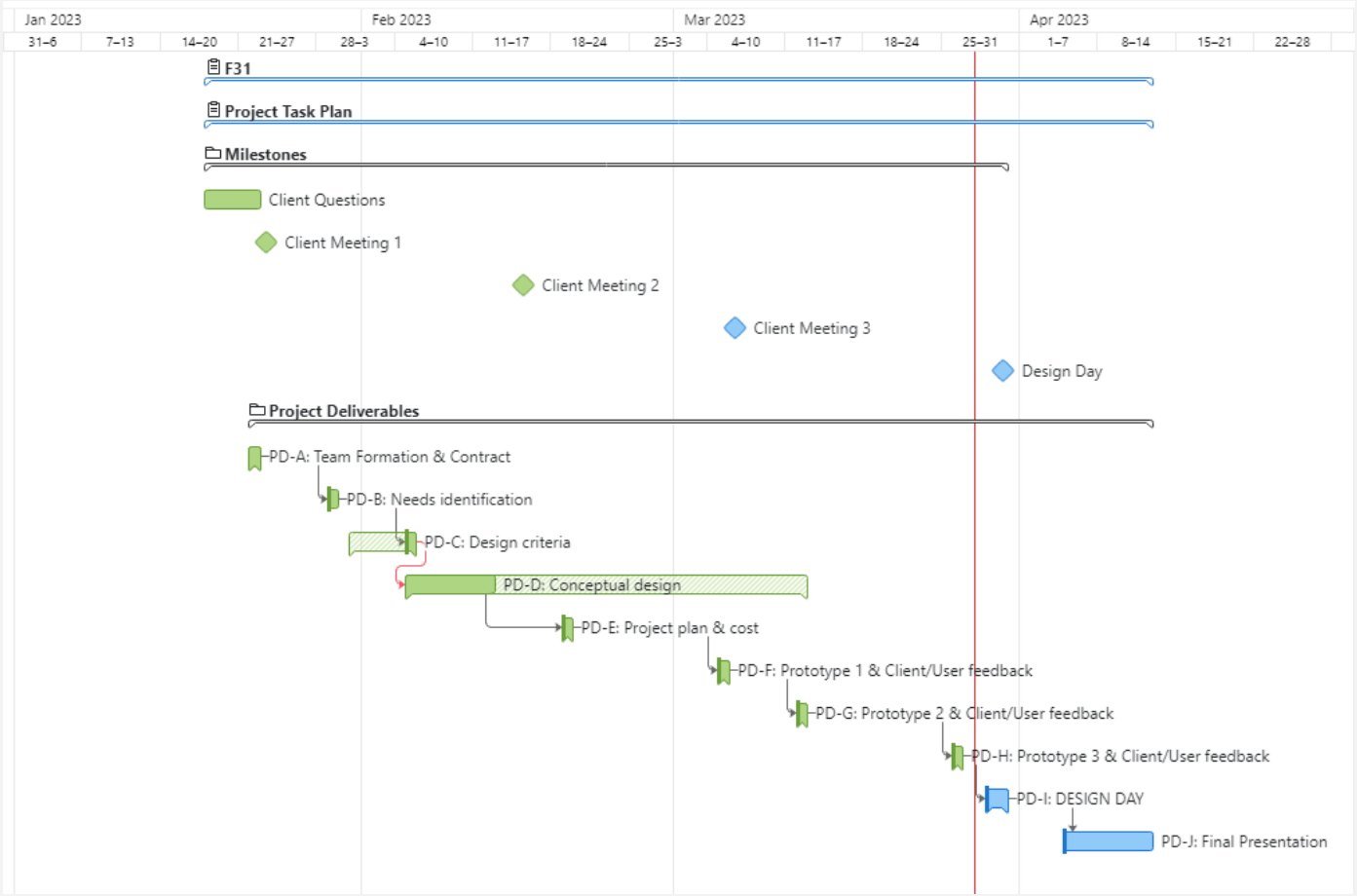
Audio

- Provide useful background information regarding autonomous weapons
- Guide the user through the experience
- Ensure the user gets the most immersive experience
- Sound effects
- Bilingual dialogue

Management Plan

04

Project Schedule



Project Risks

Risks	Impact	Importance	Probability of occurring	Solution
Program crashes	Moderate	2	High	Ask the TA or PM for experienced help, extensive testing during development.
Equipment failure	Moderate	2	High	Notifying TA immediately, backup VR sets
Data loss	High	3	Low	Periodic cloud backups, source version control
Time management	Moderate	2	High	Organizing and planning our task according to upcoming due dates, using Wrike, etc.
Group conflicts	Moderate	3	Low	Communicating continuously, working together, helping one another and solve any conflicts that come up.

Project Cost (BOM)

Part #	Part Name	Description	Quantity	Unit Cost	Extended Cost
1	Personal computers	Provided by university	5	N/A	N/A
2	Unity	3D game engine. Student/personal edition used	1/student	N/A	N/A
3	HTC Vive	VR set, provided by university	1	N/A	N/A
4	Unity Assets & Packages	Unity Assets & Packages	16	$20.00	$22.60

05 Prototypes & Customer Feedback

Prototyping Test Plan

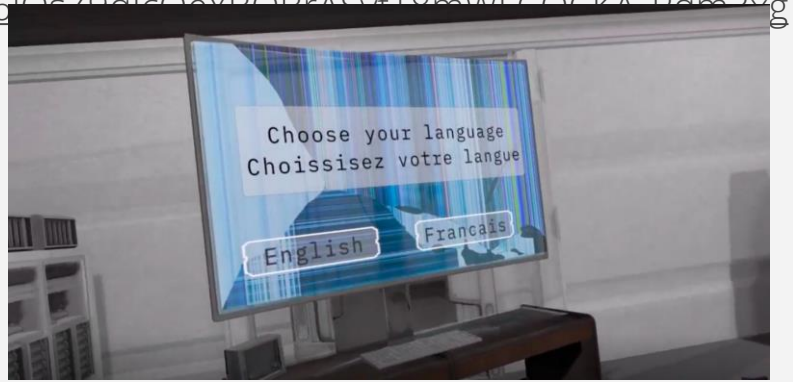
Test #	Test Objective (why)	Description (what)	Results (how)	Estimated Test duration (when)
1	Scene settings	Scene implementation, asset integration	Realistic, captivating and storytelling	3 hr
2	Model Animations	Sequencing animations correctly	Realistic and captivating interactions	3 hr
3	Camera Angles	Ensuring player vision is focused where needed	Find the best perspectives that showcase scenes	1 hr
4	Control Scheme	Method to interact with game	Measuring ease of use and learning	3 hr
5	Audio	Sound effects, ambience	Clear, captivating, bilingual	1 hr
6	User Interactivity	Integrating scene flow with VR	Teleportation method; encourages user participation	3 hr

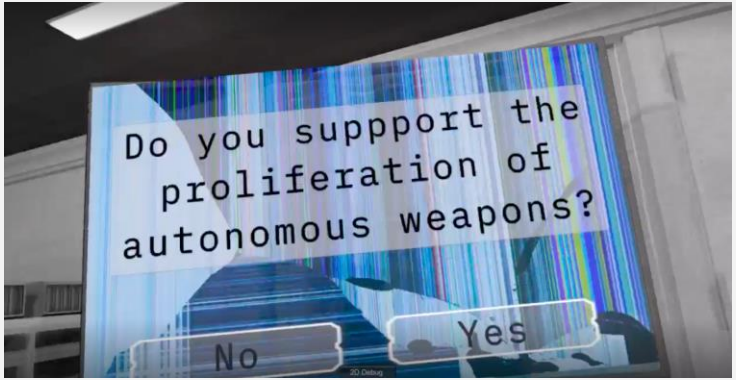
Prototype I

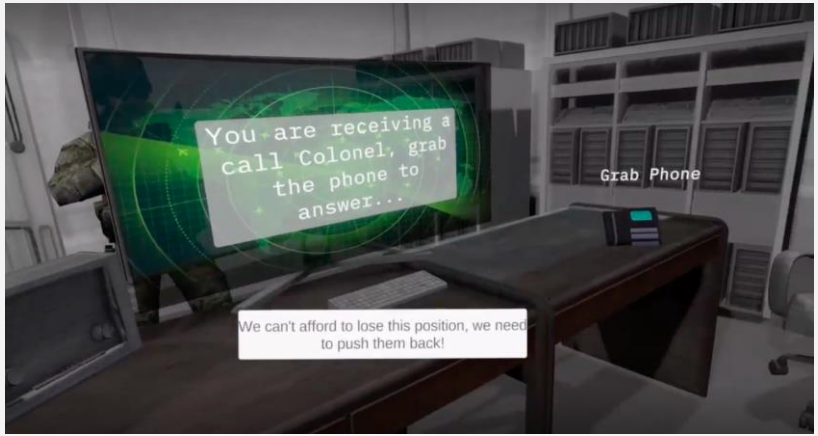
https://uottawa-my.sharepoint.com/personal/salsh036_uottawa_ca/_layouts/15/guestaccess.aspx?share=EcYrxanYNChAsL0zYz1CWBkBXZBfl866a8f7R_Rqn-sXcg

Prototype II

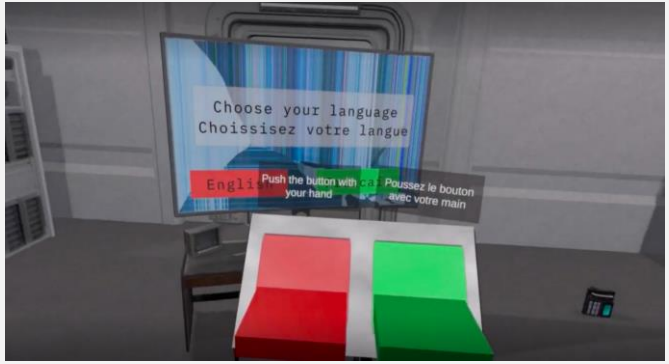
https://uottawa-my.sharepoint.com/personal/salsh036_uottawa_ca/_layouts/15/guestaccess.aspx?share=EbadTumEY6

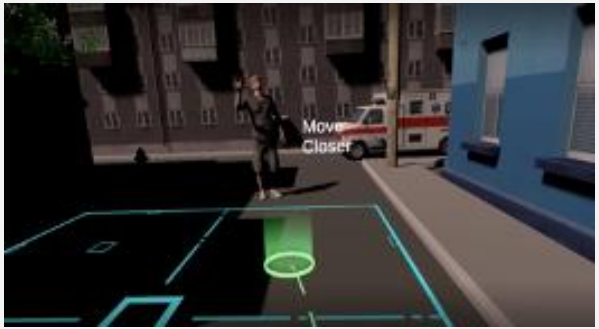






Prototype III





Final Product

06

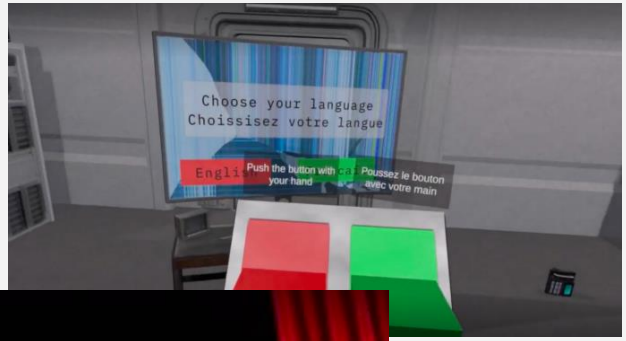
Customer Feedback

First Client meeting feedback

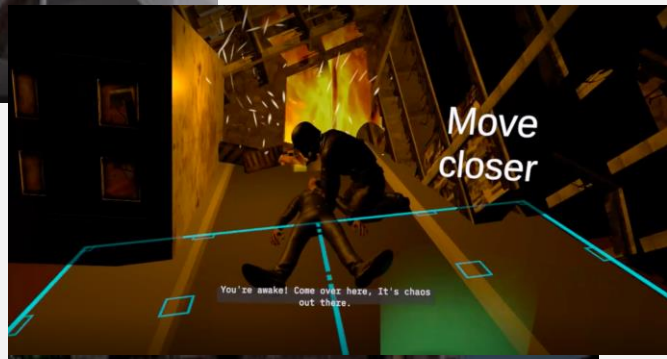
- Client requested changes to storyline
- Approved of all other subsystems

Customer feedback during design day was greatly positive

- Client appreciated changes integrated into storyline
- Most testers remarked on scene flow and ideas portrayed
- Judges that did play the game found it easy to learn and got the message.

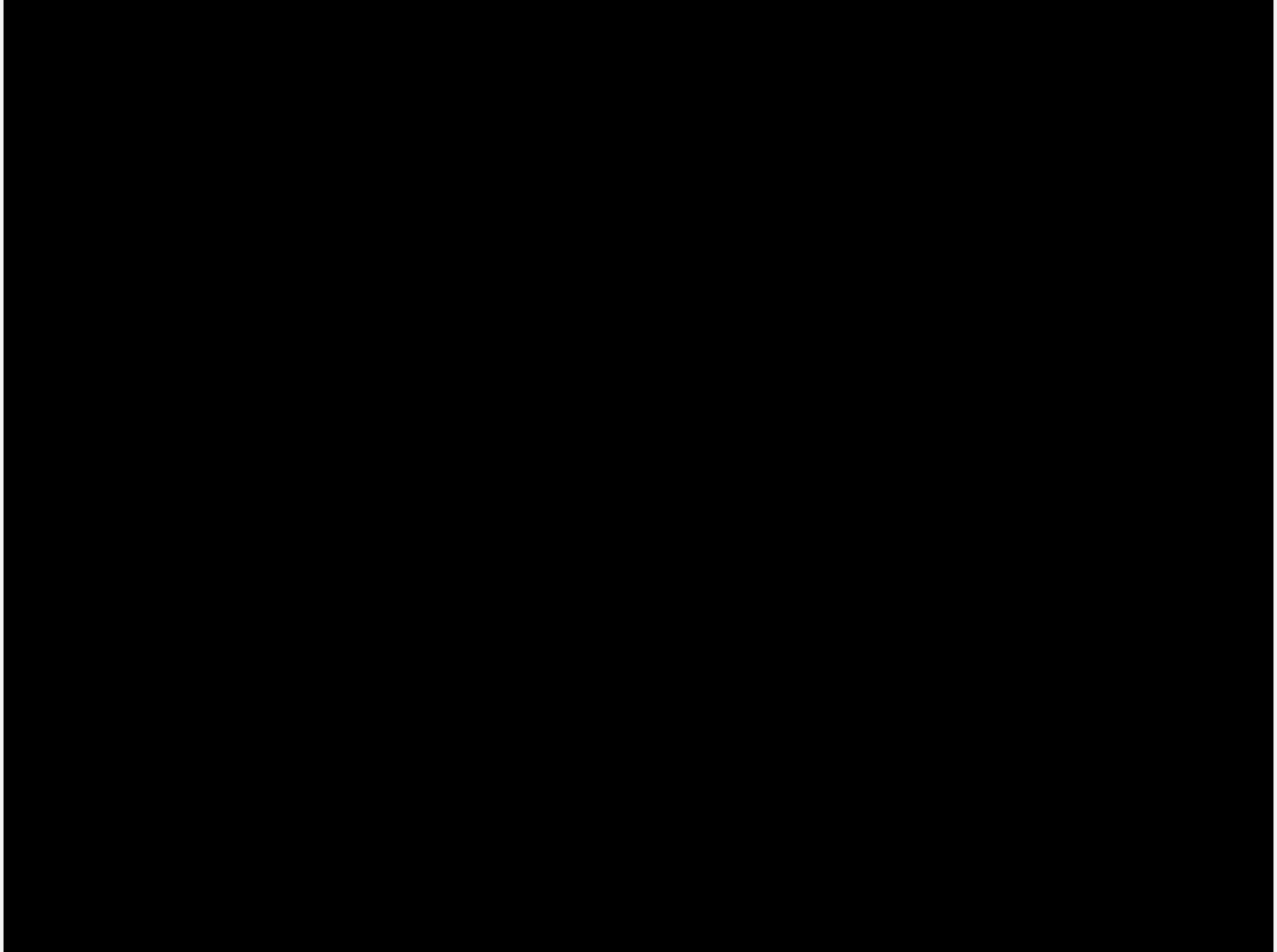


Final Product



Features of final prototype

- Each scene depends on player explicitly performing an action, ensuring player attention where needed.
- Fully bilingual, from voice acting to subtitles and tooltips. Language depends on player in game choice.
- No flashing animations, accessible to wide audience
- Avoids graphic imagery, while still showing seriousness of subject



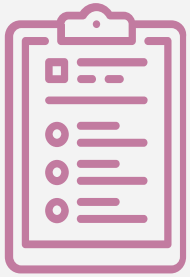
07

More

Challenges & Lessons Learned

- ➔ Most of us aren't experienced in coding
- ➔ Difficult to work on the school computers (unavailable)
- ➔ Time Management
- ➔ Uploading and copying our files took a lot of time
- ➔ Learning how to use Unity for the first time

- ➔ Communication is key
- ➔ Important to stay motivated & open-minded
- ➔ Patience is important
- ➔ Focus is a prime aspect in succeeding
- ➔ Organization is a must



Next steps

- Enhance storyline
  - Refine details (animations, UI, etc.)
    - Implement opinion survey
- Utilize budget more effectively
  - Fix various bugs in scenes
    - Add more guide instructions for players

Thanks

Do you have any questions?

Troubleshooters