

Deliverable G: Prototype II & Customer Feedback

University of Ottawa

GNG1103: Engineering Design

March 10th, 2024

Group 14

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Abstract

For Deliverable G, the group's plan centers on creating a targeted prototype to meet our project's set objectives from the previous client meeting. This step involves detailed testing, feedback collection from a wider circle beyond our third client meeting, and revising our project based on this input. The group will document our tests and results thoroughly, including images, and adjust our designs and specifications as needed. In the second prototype, no changes have been made to the bill of materials, and the group is still meeting its scheduling and budgets goals. With the second prototype completed and tested with third-party perspectives, the trajectory of our game has been deemed to be amazing, and therefore, the plan for the third prototype has also been created in order to tackle the last few criticisms that still lingered.

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1 Introduction

In the following deliverable, our group will go over:

- [Client feedback](#)

This includes a brief overview of all the feedback given to the group by the client during the second meeting, which is then followed by an analysis in relation to how it affects our project's effectiveness, how it meets our criteria, and possible constraints it puts on our group. With all these points analyzed, our group will conclude a brief set of improvements that we have enacted for the second prototype, and a set of other improvements for future work that we are realistically able to fit within our time frame.

- [Prototype 2](#)

This includes an in-depth overview in what objectives the group aimed to accomplish for the second prototype using feedback gathered from Deliverable F, along with a brief overview of what has been accomplished thus far by our group regarding prototype 2. This comprises of objectives that we have set and achieved for this second prototype, images, C# scripts, and videos of how the project is looking thus far, as well as an analysis of all critical components that we have used in our prototype and why they were implemented.

- [Prototype Analysis](#)

This section analyzes the components and subsystems within the prototype, along with the identified risks and potential failures that may arise in the development and presentation in our game and a set of stopping criteria and assessing system fidelity/feasibility.

- [User feedback](#)

This includes an overview of all feedback given to our second prototype from many parties, including our classmates (in regard to our presentation earlier in the week regarding our first prototype) and third-party users. This section comprises of all useful points that had been pointed out by these users, and steps that the group will take to implement these criticisms in our next design.

- [Prototype 3 test plan](#)

This portion includes the test plan for the next stage of the iterative phase of prototype and testing. Using all of the feedback that had been outline thus far in the deliverable, from client and user feedback, our group have devised a detailed plan as to how we will tackle and improve upon our current model for prototype 3.

- [Task plans for the final concept](#)

This section of the deliverable showcases the responsibilities of each group member for prototype two, and encompasses other responsibilities that the group had identified during development. The group will use this table to keep track of who does what task, and this table will be expanded upon in future deliverables.

1.1 Intro Summary

Firstly, our group will analyze the feedback given to us by our clients and conclude what the necessary steps will be to effectively implement their comments into the second prototype of our project, along with the objectives we have set to complete from the first prototype. Then, our group will showcase the prototype that we have developed thus far regarding the design criteria we had conceptualized in deliverable D and C, and with the feedback given to us in the second client meeting. Then, all components and aspects of our project will be re-evaluated in order to better understand their purposes in resonating with our clients demands, and to determine the importance to our story and message within our small time frame. With the second prototype done, our group had showcased our project to a handful of third-party perspectives, including a random sample of students found on campus and feedback results from our classmates from when we presented in class. Finally, our group will update the task list for the criteria necessary to complete the final project, which allocates responsibility and a team member to each specific task that has currently been identified thus far.

1.2 Related Work

Group 14 has already completed the 5 previous deliverables, which is key to understanding before continuing in reading the content of the following deliverable.

In [Deliverable B](#), which can be accessed through the hyperlink, outlined all the needs described by the clients that had to be taken into account when designing a conceptual design, with the needs being neatly organized into categories such as Accessibility, Storytelling, Communication, Logistics.

In [Deliverable C](#), which can be accessed through the hyperlink, all of the identified needs were subsequently divided into a list of functional requirements, non-functional requirements, and constraints. In part A) all needs are listed and organized into a chart that separates all requirements, then in part B), all of the groups findings in regards to these criteria were benchmarked with other groups project's and other public VR simulations. This helped the group to better understand where to focus and how to change our list of criteria, as well as to set target specifications for the optimization of our design.

In [Deliverable D](#), which can be accessed through the hyperlink, the group had brainstormed several different conceptual ideas in regards to the needs, requirements (functional, non-functional), and constraints identified from the previous deliverables, and merged ideas in order to create a global concept that best fit the client's expectations. The global concept chosen in the referenced deliverable is the one the group will continue to refer to for the duration of this Deliverable.

In [Deliverable E](#), which can be accessed through the hyperlink, the group reinforced what needed to be employed to complete the project by deadline day, which encompassed: when each task must be done, what must be acquired, and how much money can be spent to fit under budget while meeting the expectations of achieving an A+ grade and meeting the deadline. In addition, the final design was conceptualized and from that point forward the first prototype started development.

In [Deliverable F](#), which can be accessed through the hyperlink, demonstrates the first part of the iterative prototype and testing stage of engineering design process. In this document, Group 14 has emphasized the risks of autonomous robots. Deliverable F details the development process, incorporating client and user feedback and project planning. From initial objectives set after client feedback, the prototype was refined to convey the story and integrate characters within a one-minute duration. Feedback highlighted the need for emotional engagement, the challenge of animation reliance, and avoiding gender stereotypes, prompting narrative and design changes. The report plans for a second prototype with enhanced animation and interactivity, and future accessibility features. This demonstrates the team's ability to adapt, manage resources, and plan strategically, meeting objectives within budget and time constraints.

All of the previous deliverables build off each other, and with a key understanding in the needs of our client, all requirements to turn our conceptualized design into a finalized game, a proper system of task-sharing and task allocation, a budget, a task plan, and a global concept, the group can finally create the first prototype of our VR environment, "Echoes of Tomorrow".

2 Client's Feedback

2.1 Written Recordings of Feedback

From our 5-minute presentation during class, we had a limited amount of time to go over all of the components of our prototype and ask for questions. Therefore, the feedback that our group had received from the client was very basic, rudimentary, and aspects of our prototype that our group had planned to resolve. Nevertheless, the following points were said:

- Add player movement, camera movement, and animate characters into a timeline to match your story.
- The environment is well-designed and clearly matches the theme of an apocalyptic house.
- Avoid the cooking breakfast scene as that will take too many resources to accomplish and does not have a correlation to the theme of the story (Household paranoia) as it shows people are still able to cook a normal breakfast.
- Most of your story is empty, with the adult looking around the house for about 30 seconds blindly. Give the character a goal – such as defending his house from the robot which he spots near the start of the scene.

2.2 Feedback Analysis & Implementation

2.2.1 Importance of Implementing Client Feedback

Implementing client feedback is a cornerstone of any project's success, and for a VR group project aimed at showcasing the dangers of AI weapons in society, it is no different. Although the feedback received was basic due to the constraints of a 5-minute presentation, it remains crucial. Even rudimentary feedback, if accurately interpreted and implemented, can significantly elevate the quality and impact of the final product.

- Animating characters to align with the narrative is foundational. This feedback points toward a need for tighter integration between story progression and visual representation. Animation is a powerful storytelling tool that, when synchronized with the narrative, can enhance the viewer's immersion and emotional connection. By animating characters in a timeline that matches the storyline our team can properly ensure that we deliver out “call-to-action” message in regards to the dangers of autonomous weapons through emotional engagement and visual information. The implementation of complex visual element, such as elements, will also underscores and advances the theme of household paranoia created by the presence of AI weapons.
- Furthermore, the recommendation to avoid the breakfast scene is twofold in its importance. Firstly, it's a call for resource optimization, encouraging the team to allocate efforts to elements that directly contribute to the core message. Secondly, it suggests a deeper thematic coherence by ensuring that all scenes reinforce the central narrative. In a scenario where household paranoia should be palpable, ordinary activities like cooking breakfast may indeed detract from the tension and urgency required to convey the story's stakes. Removing this scene could allow for a more focused portrayal of the looming threat of AI weapons and their effect on daily life, which is what we plan to do.

- Lastly, the observation that the adult character's actions feel aimless for a significant portion of the story is particularly instructive. Giving the character a clear goal, such as defending his home against an imminent robot threat, immediately adds a layer of engagement and purpose to the experience. It transforms passive observation into active participation, both for the character within the story and the viewer experiencing the VR. Furthermore, this change significantly increases the lack of interactivity, which was clearly outlined in our last prototype by our user feedback to be a major concern. This suggestion doesn't just fill a narrative void; it creates an opportunity to directly involve the viewer in the central theme of the project, making the dangers of AI weapons more tangible and immediate.

Incorporating these pieces of feedback requires thoughtful consideration of narrative, pacing, and resource allocation. By doing so, the project not only becomes more cohesive and engaging but also more aligned with the client's vision and the audience's expectations. It's a process that demands creativity, flexibility, and a willingness to pivot as needed, but it's also a process that can transform a good project into the exceptional one that the client desires.

2.3 Changes to our Prototype according to Client & Previous User Feedback

The group is implementing several key changes to the story to ultimately improve upon the interactivity, storytelling, and time-management of the project.

2.3.1 Environment

- Our group has changed the lighting of prototype II to be much darker and we have turned the time-of-day to be at night rather than at the morning. In doing so, we eliminated all over-head lights (all ceiling lights) and replaced them with lanterns on the ground and made them dim in order to create a more unsettling and more uncanny atmosphere that matches with the theme of a "Looming Disaster"

2.3.2 New Script

- Our group will change the narrative of the story completely. Instead of the character being some random parent who is hiding away in a house listening to the events going on in the radio because they're scared, our group is going to make the father a retired nurse who worked at a certain specialized clinic who hears on the radio (as an amber alert) that there had been a mistake in the programming of the robots (yet again) that they're now targeting people of this description as they've mistakenly identified them as enemy conspirators. Upon hearing this, the father goes into panic mode and looks outside his window and sees the glowing eyes of a robot far in the distance. He frantically goes around the house and begins setting up barricades to prevent the robot from coming inside the house. While doing so, the innocent child asks about what is going on, while the father lies to him about the situation and tells him everything is going to be okay. The father looks around the house, and puts up barricades as he does so, while the radio starts receiving distorted feedback and faint crying and robotic noises – signifying that the robot has approached. Then suddenly, the father hears the door open. As he turns around, he sees the door open and his son run out screaming, "finally we have a friend visiting us after months!". Then as he goes close to the robot, he hugs him, just for a gunshot sound-effect to play and the screen to go black.

2.3.3 New Code

- Our group will be implementing new code to make our game more interactive, and to improve storyline. For prototype 2, we have implemented camera settings, player movement, and even a mechanism to jump. With this done, all the group needs to do is animate the child and robot according to the timeline of the storyline.

2.4 Application and Timeline

As the testing phase is iterative, the feedback can be applied throughout the project, from redesigning the setting and narrative to adjusting the development focus to emphasize emotional engagement through sound and simplified visuals. Given the refined scope and emphasis on using existing assets creatively, these adjustments should be incorporated into the development timeline as early as possible to allow for iterative testing and refinement. Realistically, setting these priorities early in the development process will enable the team to allocate resources and time efficiently, ensuring that the project meets its objectives and deadlines while adhering to the client's feedback. For the purpose of this deliverable, all of the above feedback has been implemented according to the methods outlined.

2.5 Feedback Conclusion

In summary, the client gave us important feedback that ultimately led our group to re-evaluate our entire approach the game. We changed the environment in accordance with the user feedback by making it night-time and implemented low lighting rather than overhead lighting. The group had also revamped the storyline entirely to make the game more interactive and engaging, as per the client feedback. Refer to the [referenced section](#) for the new script. Finally, we have incorporated camera and player movement into our second prototype, however, the group plans to implement the proper detailed animations of the mid and robot interacting with each other in regard to the timeline.

3 Prototype II

3.1 Prototyping Objectives

- Revamp the environment to look more apocalyptic and run-down
- Add additional assets such as an extra room and barricaded windows to the house design
- Add code for weapon movement and detection
- Add player movement
- Add camera movement
- Add character design (dummy props are being used currently)
- Discuss future tasks and extra additions to storyline.
- Add audio files for character dialogue, ambient noise, background music, weapons etc.

3.2 Prototype Images

3.2.1 Figure 1 | Kitchen



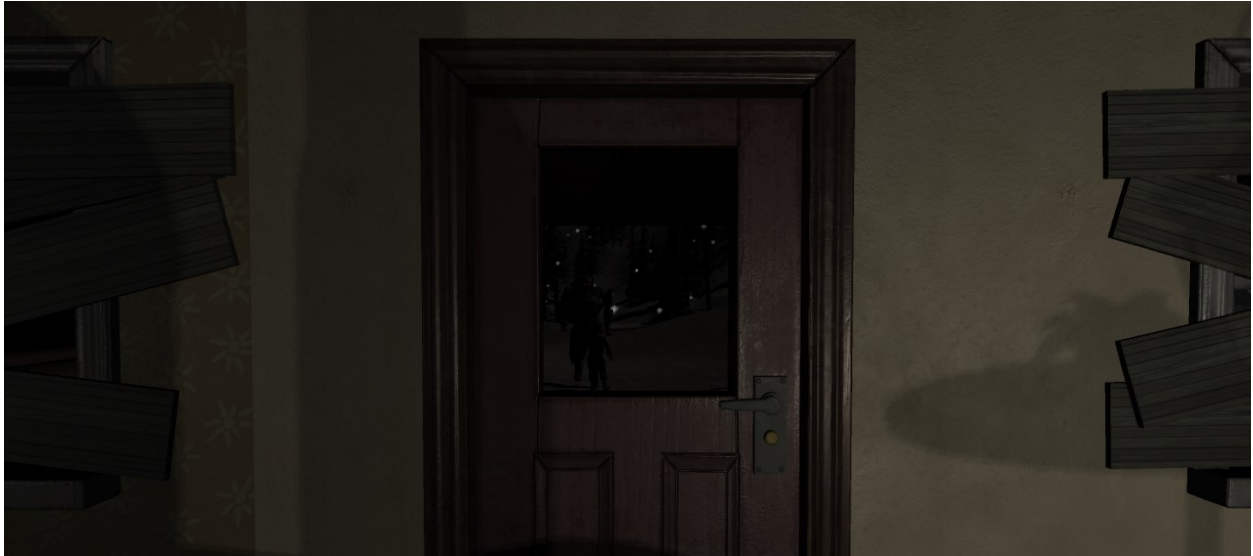
3.2.2 Figure 2 | Bathroom



3.2.3 Figure 3 | Living Room



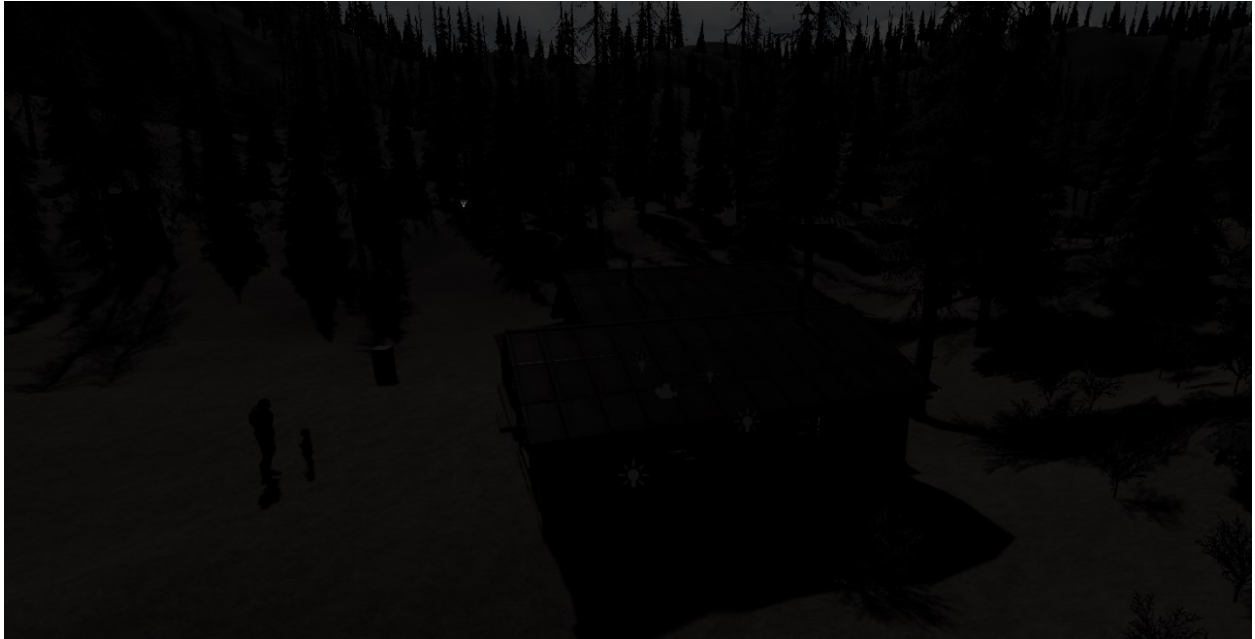
3.2.4 Figure 4 | Door with Robot Outside



3.2.5 Figure 5 | Dining Table with Radio



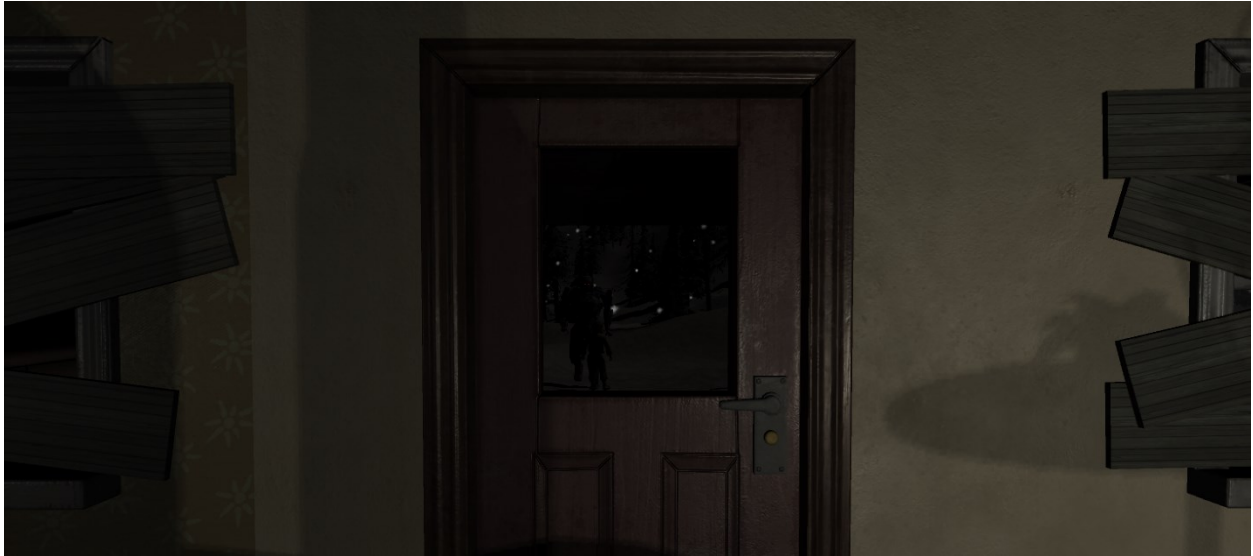
3.2.6 Figure 6 | Map of Outside Environment at Night



3.2.7 Figure 7 | Robot & Child Outside



3.2.8 Figure 8 | Character Starts Walking Towards the Door



3.2.9 Figure 9 | Barricaded Window with Robot Peering through



3.2.10 Figure 10 | Overview of House Entrance



3.2.11 Figure 11 | Living Room and Dining Room



3.2.12 Figure 12 | Another Angle of Dining Room



3.2.13 Figure 13 | Back-side of the House (Kitchen and Bathroom)











3.2.14 Video of Camera & Player Movement
[Camera & Player Movement.mp4](#)

3.3 Evaluating Prototyping Objectives

The following list evaluates whether the objectives for prototype 2 have been met.

In our case, all our objectives have been met, as demonstrated by the proofs of the prototype images.

- Revamp the environment to look more apocalyptic and run-down. 
- Add additional assets such as an extra room and barricaded windows to the house design. 
- Add code for child-detection (for the robot) and timed-events 
- Add player movement. 
- Add camera movement. 
- Add character design (dummy props are being used currently). 
- Discuss future tasks and extra additions to storyline. 
- Add audio files for character dialogue, ambient noise, background music, weapons etc. 

Our group has successfully completed most of the objectives set for deliverable 2, however, we have yet to complete the addition for timed events, specifically the child-detection code that triggers the robot to attack the child in an instant, play a gunshot effect, and force the screen to go black. Furthermore, the group has yet to finish adding all audio files for the game. The group is still undecided on what soundtrack to choose for the background music, as it takes extensive research to find a song that is: non-copyright, unsettling, and is not loud. Although the group has already recorded the dialogue for the game, the group has yet to implement them into the game itself as the timeline, along with the animations, aren't polished and have difficulties lining up. Therefore, these particular objectives will be tackled in the third and final prototype, and until then, the group will continually test the game before submitting prototype 3 to ensure it is to the best standards.

3.4 Experimental Modelling

The modelling process for this product has very little to do with the numerical or analytical methods of modelling meaning this product primarily employs the experimental method of modelling. This is made obvious by the fact that nearly all changes made to the project have been the direct result of peer feedback. There are 2 separate experimental models present in our development cycle for this product, these models are the prototyping test plan and the user feedback testing. Although seemingly very similar, these 2 models focus on 2 different aspects of the product. The user feedback testing aims to experimentally determine any issues with the user experience, worldbuilding and emotional message, the prototype test plan however, aims to experimentally determine any issues in the actual functionality of the VR experience (i.e. Movement, animations, story triggers). Both experimental models are crucial to the development of this VR experience and have aided us greatly to identify and fix major issues present in the experience.

3.5 Skills Learnt/Improved:

The group has learnt to share the Unity file through GitHub, allowing for simultaneous development and collaboration on the project. This in turn enables the following skills within team members:

3.5.1 Hard Skills:

3.5.1.1 *Unity Development*

Proficiency in Unity for VR environments, including scene construction, asset integration, and physics settings.

3.5.1.2 *3D Modeling and Animation*

Skills in creating and animating 3D models using software like Blender to bring characters and environments to life.

3.5.1.3 *Programming and Scripting*

Writing and debugging scripts in C# for Unity, enabling interactivity, character movement, and event handling.

3.5.1.4 *Version Control*

Using GitHub for source code management, allowing for collaborative development and version tracking.

3.5.1.5 *UI/UX Design*

Designing user interfaces and experiences that are intuitive and contribute to the narrative and engagement of the VR experience.

3.5.1.6 *Lighting and Texturing*

Crafting the visual atmosphere through skillful use of lighting and texture mapping to enhance the mood and realism.

3.5.2 Soft Skills

3.5.2.1 Collaborative Teamwork

Working effectively as a group, sharing tasks, and supporting each other through the development process.

3.5.2.2 Problem-Solving

Analyzing issues that arise during development and devising creative solutions.

3.5.2.3 Adaptability

Adjusting plans and designs in response to feedback and new insights, demonstrating flexibility.

3.5.2.4 Project Management

Organizing tasks, managing time, and keeping the project on track towards its goals.

3.5.2.5 Communication

Clearly and effectively discussing ideas, progress, and challenges both within the team and with clients.

3.5.2.6 Feedback Integration

Incorporating constructive criticism into the project to refine and improve the outcome.

By harnessing these hard and soft skills, Group 14 is equipped to address the remaining challenges in the development of "Echoes of Tomorrow" and ensure that the final product not only fulfills but also exceeds the expectations set forth by their client feedback and project objectives.

This achievement not only validates the feasibility of our project but also sets a positive trajectory for its development. It opens avenues for us to continue into exploring into our complex narrative and technical enhancements in future prototypes, specifically in animations, timeline-driven events, and character speech (As stated in our [User Feedback](#) section). The ability to integrate feedback and pursue an iterative design process will be crucial for refining the VR experience to ensure it meets its educational and emotional objectives.

4 Prototype Analysis

4.1 Analysis of Critical Subsystems MARC

The critical subsystems for this prototype are the different programs that were coded using C# as well as the animations. The movement of the player character is important as it is how we view the world, and a fixed viewpoint would not be able to convey the realistic experience that can be achieved with VR. The movement of both the child and robot are important as in a realistic world, people would not necessarily stay still and a robot that is tracking down a target would be moving as well. The animation of the movement adds to the immersive experience as you wouldn't be able to immerse yourself in the world if the models moved but with no movement from the body parts that would normally move when a person moves like legs when you are walking. The objects being interactive is also important as the story necessitates them to be, such as boarding up the door, which needs interactive material that will be used to board up the door. The same applies to the non-playable characters interacting with objects such as when the robot opens the door. The sound is important as if there is no sound from movement or from the radio, part of the immersion is removed and without the information from the radio, the context and reasoning for the events of the story do not make sense anymore.

4.2 Table 1 | List of all Critical Components

The following table lists all the critical components and their importance to the project's purpose.

Critical Components	Purpose (What)	Importance (1-4)	Why is this important?
Child	The child is there to show an innocent point of view and to die, causing an emotional reaction.	3	This is important as the emotional reaction caused by the death of the child is one of the main triggers of the prototype to convince people of the dangers of autonomous weapons and that even innocent children will be caught in the crossfire.
Robot	The robot is there as an object of fear, and the catalyst to the story.	4	This is important as the fear caused by the robot is our other main trigger to convince people of the danger posed by these killer robots, and its actions in this simulation are meant to demonstrate the horrible accidents that can happen that involve innocent people.
Radio	The radio is there to convey information about the world and how it has changed under the threat of autonomous weapons.	2	The radio is important as it is the main source of information about the world and the context of the situation, to give the viewers a better understanding of what is happening.
Door	The door is the one thing separating the playable character from the outside world, therefore the autonomous weapons, and when it gets opened, it means that tragedy has arrived.	1	This is important symbolically as it is the gateway between the safety of the house and the dangers of the outside world, and when it is opened, it shows that nowhere is safe from the killer robots.

4.3 Table 2 | Design/Target Specifications

The following table lists all of the prototype’s design specifications, including functional requirements, non-functional requirements, and constraints.

<u>Design Specifications</u>	<u>Relation</u> (=,<,>)	<u>Value</u>	<u>Units</u>	<u>Verification Method</u>
Functional Requirements				
Player Displacement (Area to Move)	<=	2	m ² (unity measurement)	Code testing in Unity Terrain Space
Robot Behaviour	=	Realistic	N/A	Unity coding command testing
VR Headset	=	HTC Vive	N/A	Continuous testing at Maker Space
Narrative Progression	=	100%	N/A	Audio test throughout VR experience
Language	=	English, French	N/A	Consult native French speakers in group
Environment Interactivity	<=	30%	NA	Beta testing prototype
Constraints				
Violence	=	None	N/A	Game analysis
Cost	<=	44	Dollars	Estimation and Final Balance
Operating Conditions	=	Restricted Environment	N/A	Interactive analysis
Platform Compatibility	>=	90%	Technology	Compatibility testing
Experience Duration	<=	5	Minutes	Estimate analysis
Gender Implications/ Racism	=	None	N/A	Visual/Physical testing

Delivery Time	=	3	Months	Estimate analysis
Non-Functional Requirements				
Performance/Reliability	=	100%	N/A	Consistency testing
Visibility	=	Yes	N/A	User Feedback
User Experience	>=	90%	N/A	User Feedback
Realism	=	Yes	N/A	User Feedback
Safety (Safe visual and movement effects)	=	Yes	N/A	Viewer experience testing
Accessibility	=	Yes	N/A	User Feedback

4.4 Table 3 | Bill of Materials

The following table includes a list of materials that will be used in the process of developing the VR experience. This table breaks down how the given budget will be used (tax not included).

<u>Item Number</u>	<u>Description</u>	<u>Quantity</u>	<u>Store</u>	<u>Price (CAD)</u>
#1	House Model with Interior	1	Unity Asset Store	\$25
#2	Footstep Sound Effects Outside , Inside	2	Unity Asset Store	Free
#3	Smartphone Model	1	TurboSquid	Free
#4	Radio Model	1	Unity Asset Store	Free
#5	Boarded Window Model	1	TurboSquid	Free
#6	Furniture Model Pack	1	TurboSquid	Free
#7	Gunshot Sound Effect	1	Unity Asset Store	Free
#8	Drone Model	1	TurboSquid	Free
#9	Gas Lantern Model	1	Unity Asset Store	Free
#10	Newspaper Model	1	TurboSquid	Free
#11	Book Stack Model	1	TurboSquid	Free
#12	Realistic Young Kid Model	1	Unity Asset Store	\$19
#13	Animation Script Walking Playing Sitting	3	Mixamo	Free
Total	-	-	-	\$44

System Integration

In prototype 1 we were successfully able to integrate:

- A small yet detailed environment to explore.
- Smooth camera movements that respond to the mouse inputs of the user.
- Moody lighting which accentuates the hopelessness of our story.
- The basic elements of our story.

The development of prototype 2 has two main focuses, being, correcting any current issues with the functionality of the experience, and further integrating our storyline. The largest functional issue present in prototype 2 was that the camera movement was restricted to mouse and keyboard since VR functionality had yet to be integrated. This has been remedied by the recent addition of camera movement that functions with the use of a VR headset as well as the integration of movement using the joystick on the Quest 2 controllers. Since sound design and animations are not a priority as of prototype 2, current developments in story integration are primarily done through the addition of triggers in the environment which will cause events such as the child going missing or the robot identifying the “player”. These triggers allow the experience to occur at the same pace as that of the user so that they are not in a rush to view all the experience has to offer.

4.5 Reducing Risk and Uncertainty

Due to this products nature as a VR experience, there are not many risks present regarding the usage of the products and any risks that are present affect us as the developers rather than the audience. 2 Primary risks have been identified which affect the development of this product, these risks are as follows:

- The VR experience could crash while being presented.
- The storyline elicits the wrong emotions or sends the wrong message to the audience.

To reduce the risk of the experience crashing during our presentation we have scaled down the number of models used in the environment while keeping those that serve a necessary purpose in the story and worldbuilding. This will help to reduce the strain on the computer while giving a demonstration of our VR experience which will help to renew the client's faith in the quality of our work.

To reduce the risk of the storyline sending the wrong message to the audience, some tweaks have been made to the story to make our stance on autonomous weapons more obvious. An example of these tweaks can be seen in the fact that the father being changed to a former nurse who is in danger due to a glitch in the programming of the autonomous weapons. This approach will allow for us to place less of a reliance on the interpretation of the audience leading to different audience members all understanding the story in appropriately similar ways.

4.6 Stopping Criteria

Defining a stopping criterion for our project is critical to efficiently determine when the testing phase can conclude because the testing objectives have been satisfactorily met.

The testing phase for Prototype II of "Echoes of Tomorrow" shall conclude when the following conditions are simultaneously met.

4.6.1 Functional Completeness

All critical components and interactions specified in the Prototyping Objectives (including player movement, camera movement, character actions, and audio integration) have been implemented and perform as expected without critical bugs or issues.

4.6.2 Narrative Integrity

The revised script resulting from client feedback is fully realized within the prototype, with character actions, dialogue, and visual elements cohesively presenting the intended story, particularly the new narrative involving the retired nurse and the approaching threat.

4.6.3 User Interaction Goals

The prototype must demonstrate a clear improvement in user interaction and engagement, as indicated by internal testing metrics, such as the average time spent on critical interactions or the completion rate of the main objective (defending the house).

4.6.4 Emotional Response

The prototype must evoke the intended emotional response associated with the dangers of autonomous robots. This can be qualitatively measured through user feedback surveys where a significant majority (to be defined by the group, for example, 80%) of responses must reflect that the experience impacted their perception of autonomous weapons.

4.6.5 Feedback Incorporation

All actionable items from user and client feedback that have been deemed critical for Prototype II's success are addressed, with tangible improvements visible in the prototype compared to the first version.

4.6.6 Test Completion

A set of predefined test scenarios that cover all functionalities of the game have been passed. These scenarios should include stress testing the game environment, ensuring narrative coherence throughout the gameplay, and verifying the robustness of interaction mechanics.

Once these conditions are met, and the results are documented, the team can confidently move on to the next phase of development or preparation for final delivery. It's important to note that while not every suggestion from user feedback may be implemented due to feasibility, the core user concerns should be adequately addressed in line with the project's objectives.

4.7 Accepting Fidelity

Fidelity in this context refers to the degree of detail and realism in the VR simulation, which affects how users perceive and interact with the environment. To define and measure acceptable fidelity for our prototype of "Echoes of Tomorrow," it's essential to align the criteria to the prototype's objectives and the intended user experience.

Therefore, an [acceptable fidelity](#) for Prototype II of "Echoes of Tomorrow" is achieved when the virtual environment, character models, interactions, and audio effects are sufficiently realistic to the following:

4.7.1 Convey the Story

The virtual environment must convincingly portray a post-apocalyptic setting, supporting the narrative of a society threatened by autonomous robots. This includes texture quality, environmental objects, and atmospheric effects that align with the dark and unsettling mood described in the feedback.

4.7.2 Facilitate Engagement

The interaction mechanisms, such as player movement and object manipulation, must be intuitive and responsive, allowing users to engage with the environment without undue distraction or frustration due to poor controls or unrealistic physics.

4.7.3 Elicit Emotional Response

The audio-visual elements must work in harmony to evoke the desired emotional response associated with the story's themes. This does not necessarily mean photorealistic graphics but rather a cohesive aesthetic that keeps the user immersed in the story.

4.8 Achieving Fidelity

To [Measure](#) whether the prototype has achieved acceptable fidelity, the following metrics will be used by the group:

4.8.1 User Feedback

Conduct surveys or focus groups to gather qualitative data on users' perception of the environment's realism and whether it effectively supports the story and desired emotional response.

4.8.2 Engagement Metrics

Utilize software analytics to track user interactions within the VR environment, such as time spent in key areas, frequency of interaction with narrative-driving elements, and completion rates of objectives.

4.8.3 Comparative Analysis

Benchmark the prototype against similar VR experiences in terms of visual quality, interaction design, and user engagement to ensure it meets industry standards.

4.8.4 Expert Review

Have VR/AR experts assess the fidelity of the prototype, providing insights into areas where realism and immersion may be improved.

4.8.5 Objective Checklists

Develop a checklist based on the prototype objectives that can be used to systematically evaluate every aspect of the VR experience for fidelity.

By using these measures our group can feasibly quantitatively and qualitatively assess the fidelity of our prototype to ensure it meets the objectives necessary for effectively demonstrating our goal.

5 User Feedback

In order to gather a lot of feedback for our second prototype, our group had conducted an online google survey and sent it to every group member's friends, of which consisted of friends who already have backgrounds in game development/video editing – specifically in Roblox, and TikTok creation.

Link to Google Survey:

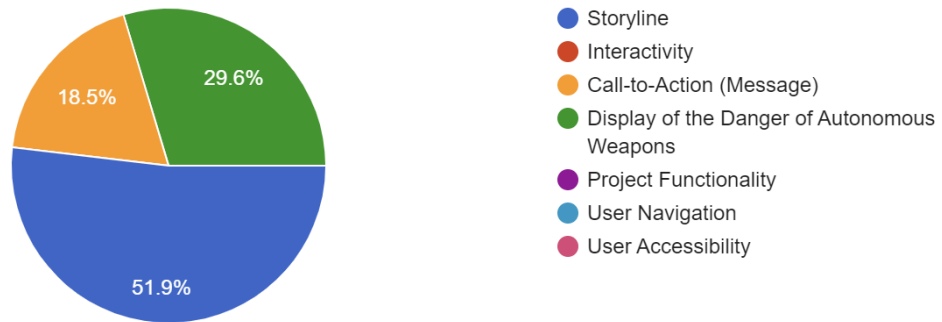
https://docs.google.com/forms/d/e/1FAIpQLSfxFx62qAHk1M5dBOLx1uEYk_00IG_F7Jp8VhYNpKWAvLWQRw/viewform

5.1 Results from Survey

5.1.1 Figure 14 | Strong Suits of Project according to the Survey

What is our project's strong suit?

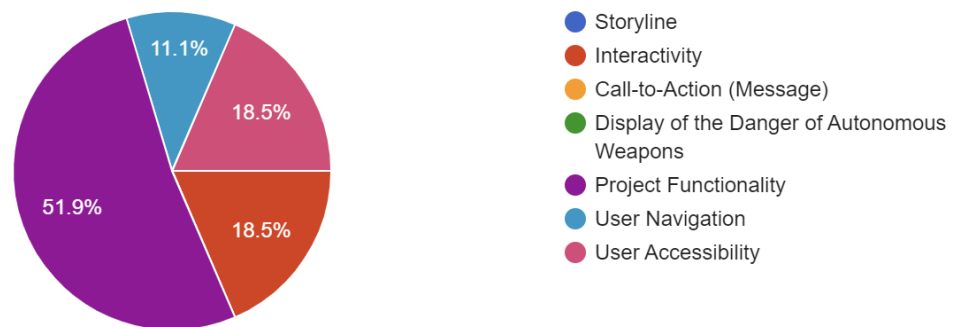
27 responses



5.1.2 Figure 15 | Which aspects of the Project needs to be improved upon, according to the Survey

What does our project need to improve on the most?

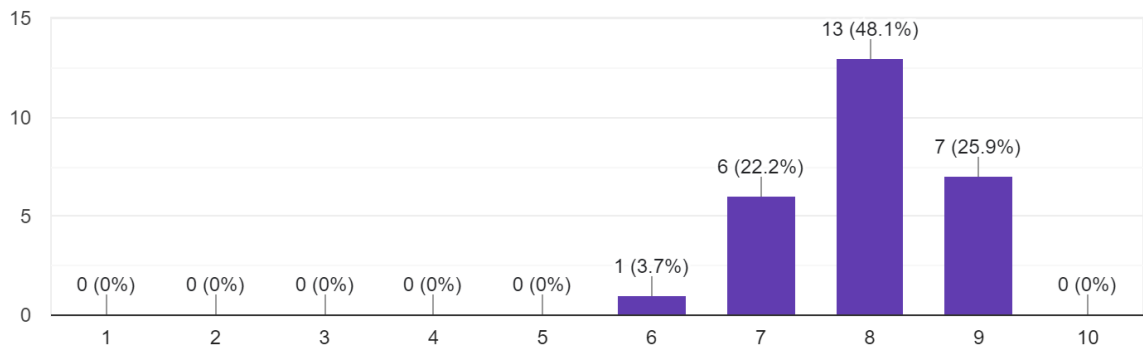
27 responses



5.1.3 Figure 16 | Impact of the Project according to the Survey

On a scale from 1-10, how much has this project changed your stance in regards to the Dangers of Autonomous Weapons.

27 responses



5.1.4 Analysis of Results

According to the results of the survey, which had a total of 27 responses (of which 26 participants reviewed the first prototype), it is evident that the strong suit of our project now lies in our group’s ability to convey our Call-to-Action effectively through our engaging storytelling. This is great feedback to hear because our main mission of capitalizing on our audience’s feelings through emotional engagement is working. This notion was further supported by the comment portion of the survey (which asked the participant to write a comment about criticism about our prototype) have yet to criticize the emotional engagement of the project. Furthermore, we had the good news that we significantly increased our interactivity, as that was the biggest criticism of our first prototype. This is supported by the drastic decrease in votes for interactivity in the second round of surveying. However, now the major concern is simply project functionality, which our group has been aiming to fix anyway. After consulting our participants, we discovered that the main concerns were the lack of polished animations, lack of dialogue, lack of a timeline, and that the story was yet to be under a minute long.

Therefore, our group has the incentive to maintain the integrity of our story as per our user feedback. We will not change the storyline, plot, or major points, rather, we must polish the overall functionality of our VR experience to bring the storyline to life without failure.

The range of values that all participants voted for regarding how the prototype changed their stance on autonomous weapons has increased from the range of 4-7, to 6-9, which is a significant increase. This is amazing news to the group as we are much closer to our goal of a 10/10, and it assures us that our changes to the storyline and environment that was given to us by the client was implemented properly. We now have the green-light to continue with the storyline and environment, and to simply tie the knot on the project by adding realism into the game through animations and character dialogue.

The group understands these concerns need to be addressed already, however, there was not enough time for the group members to include all these suggestions. For instance, recording dialogue and creating code for trigger events to initiate the dialogue takes a lot of time of learning and labor and the feedback from the client regarding the story and environment took priority.

To see the differences between the feedback for prototype 1 and prototype 2, refer to the [Appendix](#) for the results for the last survey.

5.2 Specific User Feedback and Group Adaptations

The following tables includes the significant comments left by our group’s classmates after we had presented our second prototype to the clients.

5.2.1 Table 4 | Feedback from Presentation

The following table includes a list of feedback from our classmates in regards to our second prototype.

Viewers (Numbered for each comment)	What aspect Does the feedback touch on?	Feedback Description	How will we adapt to this feedback?
1	Preparation and Detailed Pictures	Required more preparation for the prototype was needed, along with detailed pictures for better understanding.	We will develop a scheduled plan to implement for our next presentation, involving us to spend more time on an effective deliverance of our prototype. Additionally, we will add more engaging pictures that coincide with our script allowing the viewers to be well engaged in the presentation.
2	Visual Aspect	While the slides provided a visual appeal, it is suggested to incorporate more visuals to enhance the presentation's effectiveness.	We enhance the visual aspect/appeal of our presentation through the modifications regarding angles, quality settings, and lighting from our camera view in unity. Moreover, the layout of our presentation will have minimal points with clear objectives and informative diagrams. These changes will allow us to incorporate high-definition images, simplified points, and well-developed diagrams for the recent progression of our second prototype.
3	Time Management	Encountered issues regarding time management, indicating a need for better structured timeline to ensure all important points are covered within the allocated time frame.	We will establish a detailed timeline for the next presentation, allocating specific time intervals for each segment. This will ensure we can express each main point on time.
4	Engagement and Confidence	Presenters were spoke clearly and confidently. However, there are suggestions for improvement in terms of engagement, body language, and voice inflection.	We will work on increasing engagement by improving body language, varying voice tone, and actively involving the audience during the presentation. We can do this by rehearsing our presentation as a group and implementing many presentation skills taught in lectures (breathing techniques, script memorisation, revision of slides, etc.).
5	Feedback Interaction	We need to establish a larger time frame for questions and concerns regarding our prototype	This adds on to our time management feedback for our presentation. Through a well-structured timeline we can allocate more space for viewer interactions (questions, comments, etc.). Additionally, we can improve on our own questions to ask the clients. We will do this by brainstorming concerns and research that has not been addressed but could impact the experience of our prototype.

6 Prototype 3 Test Plan

6.1 Table 5 | Prototype 2 Test Plan

The test plan for prototype 2 has been shown below as a reference for what has changed for the [Prototype 3](#) test plan below it.

Test Objective (Why)	Description of Prototype used and of Basic Test method (What)	Description of Results to be Recorded and how to use them (How)	Estimation of Time needed for Testing
User movement (Determine if user movement can walk and have clear views while using the 360 camera)	Use keys associated with movement and movement settings for the camera (check if any glitches occur etc.)	All keys/movements will be individually evaluated where they will either be a success or a failure	15-20 mins
Determine usability of assets such as radio, house accessories, furniture etc.	Add assets to unity and play the game to interact with the assets to test their function	Functionality will be evaluated as success or failure depending upon the testing. If the assets function as planned, they will be labelled as success and if they do not, they will be labelled as failure.	30 mins
Determine compatibility of assets and check for compilation errors and any kind of error with the code added to the camera, characters etc.	Do a thorough analysis of all the code and use a debugger to check for errors and any problems with compilation. Use the camera options in the game and test it thoroughly	Functionality will be evaluated as a success or failure for the camera. The code will be divided into separate portions to make it easier for analysis and the success failure system will be used for these parts as well	40 mins – 1 hour
Verify proper functioning of assets when user interacts with them	Add assets to the game and make sure trial runs of interaction are done where every group member uses the asset. For example: User tries to switch on radio and radio plays the audio etc.	All assets will be evaluated separately to check whether any changes are necessary. Thought will also be given to any additional features the group might want to add to improve functionality. After every group member evaluates functionality, a group discussion will be held to discuss the results	30 mins
Test user response and usability of the game	Gather volunteers and ask them for reviews on what they think about our game (if not possible, all group members will take part in the user testing process)	Gather results from the survey and discuss about any potential additions from the reviews to improve the game as a group	15 mins per user/member
Test autonomous weapon functioning. I.e. the code for the targeting system	Multiple scenarios will be introduced using user testing to test whether the autonomous weapon can differentiate between humans and any other being	If weapons can target humans specifically no matter the form or shape, it will be a success. If it targets objects and animals, it is a failure. The goal is to make it target humans only	10 mins per user

6.2 Table 6 | Prototype 3 Test Plan

The following table describes the test plan for prototype 3, which is going to be completed March 24th.

Test ID	Test Objective (Why)	Description of Prototype used and of Basic Test method (What)	Description of Results to be Recorded and how to use them (How)	Estimation of Time needed for Testing
1	User Interactions	Add all code for accessibility and settings options and every group member must individually evaluate these additions by going into the game and conduct trials by using the settings and check the responses and reactions	The results will either be a success or a failure. The settings option is a separate pop-up window which will take some coding and there will definitely be errors. Once all errors including any type of glitches are ruled out, the trials will be marked as a success. Any type of problem will lead to the part being a failure	Around 1 hour
2	Character Actions	Add all code and move characters around the environment to check reactions and functions. Evaluations can be done by all group members and will be discussed in the group meetings.	Results will be success or failure depending upon successful movement of the character which includes moving in any direction and jumping. If the movement is seamless and viewing the environment is easy for the user, this part will be marked as a success. Any glitches and issues will be considered a failure	Around 1 hour
3	Character design	Add character design along with voice lines and conduct evaluations by running the story multiple times	Successful character functions and role enactment will be considered a success. Any glitches or issues with how the characters interact with each other hindering with the success of the story will be considered a failure	Around 2 hours
4	Test autonomous weapon functioning. I.e. the code for the targeting system	Multiple scenarios will be introduced using user testing to test whether the autonomous weapon can differentiate between humans and any other being	If weapons can target humans specifically no matter the form or shape, it will be a success. If it targets objects and animals, it is a failure. The goal is to make it target humans only	40 minutes
5	Environment intractability	Determine if all elements in the environment interact perfectly with characters and follow events in the story like trees getting destroyed etc.	If the code added for the environment functions properly (for example, when the robot shoots a little kid and the ball the kid is holding drops to the ground), the tests will be considered a success. Any unintended anomalies will lead to the tests being marked a failure	1 hour

6	Test audio functions with the radios, characters, and environment	Determine function by adding all files to the game and test functions by playing the game. All players will evaluate the usability individually and will discuss about the results during the meetings	If intractability works as intended, the tests will be considered a success and if the tests reveal any problems with the code, some of the tests will be considered a failure. Since evaluations will be done, the whole test will not be considered a failure	1 hour
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6.3 Why these test objectives?

6.3.1 Why the group chose these specific test objectives:

In the previous prototype, the plan was to finish as many of the core aspects of the project as possible. Unfortunately, due to time constraints, some of the listed goals were not completed. The unfinished tests were added to this test plan since they were very important.

6.3.2 Why these tests should be done by the end of prototype 2:

According to the current timeline, there is not a lot of time left to finish the project, so the group has decided to focus on quality of content. Since there were a lot of additions to overall content after the latest client meeting, there were a couple setbacks delaying certain portions of the work. Since there is more work to finish, a larger amount of the project must be finished by the end of the second prototype to have a comfortable period of time to make some final changes to finish the project.

6.4 How has the group planned to reach completion?

6.4.1 Current timeline

The current plan is to complete 99% of the project by the end of prototype 2 so that it will provide more time to focus on minute details and last-minute modifications to the project in case we must change something major after the next presentation.

6.4.2 How will delays affect the timeline and contingency plans?

Delays that occur at the end of the second prototype would result in the group following a tighter schedule since there is a lot of work that needs to be finished such as audio recordings for the storyline, weapons movement etc. Which usually takes a long time to finish. This would also give the group a smaller amount of time to add finishing touches to the VR environment.

6.5 Objectives for prototype 3 and next steps

6.5.1 Our goal for prototype 3:

- Finish weapons movement and targeting system code.
- Finish adding a second room to the house.
- Start work on character design.
- Start creating audio files for characters.
- Test user and character intractability.
- Test environment, radio, and character audio functions for movement.

6.5.2 Objectives to add according to our User Feedback for Prototype 2:

- Improvements to navigation (better menu usability)
- Improvements to project functions such as seamless movement

6.5.3 Prototype 3

The third prototype will have most/all the promised features along with the storyline. Users and group members will be testing out the game using the VR headset for last minute improvements.

6.5.4 Importance of the objective's layout

The objectives section above is a list of tasks that the group must finish which will improve ease of use. This section is just as important since the list was made using user feedback and this gives the group a general idea of what users expect when playing the game. This also helps update the quality-of-life aspects of the game which will make it easier to present and record content.

7 Project Plan

7.1 Table 7| Task List

The following table includes the tasks and allocated responsibilities that the team has identified from the first prototype to be accomplished by design day to be more organized with game-specific task-needs. As the project is continued, the task list will expand and update completed objectives.

Status	Estimated Task Duration	Task	Task Details	Member Working on Task
Asset Modelling				
Complete	2 hours	Snowy Trees	Place snow on the trees to match snowy climate	Marc Kalen
Complete	2 hours	House roof	Edit the roof of the house to be run-down	David
Complete	1.5 hours	Addition of autonomous weapons design	Insert the robot asset into the proper places around the map	Kalen
Background				
Complete	5 minutes	Gloomy sky	Find and insert a proper sky that matches the atmosphere	Kalen
Complete	1.5 hours	Snow Particles	Add falling snow from the sky to create fog and decrease visibility. This will produce a scarier setting.	Kalen
Complete	10 minutes	Land aesthetics (assets to make the ground)	Improve quality of the outside background by adding bushes, trees, and other assets.	David
Audio				
Incomplete	2 hours	Child Voice Acting	Write and record dialogue for the child and implement it into the game.	Rishabh
Incomplete	2.5 hours	Soundtrack	Find an appropriate song and implement it into the game.	Rishabh
Incomplete	45 minutes	Ambient Noise Insertion	Find appropriate sounds and implement them into the game according to trigger events.	Rishabh
Incomplete	30 minutes	Autonomous weapons sounds	Find appropriate sounds and implement them into the game according to how the robot moves.	Rishabh
Coding				
Incomplete	2.5 hours	Child Animations	Insert the code for the child animations into the game and change them according to trigger events.	Marc

Complete	1 hour	Camera Movement	Implement the 360-degree camera, and program it to be controlled by the user.	Marc
Complete	1 hour	User perspective movement (movement of the character being used by the user)	Implement proper user navigation controls that are easy for the user to learn and control. These should include solely walking and grabbing controls.	Marc
Incomplete	2 –3 hours	Autonomous weapons tracking system	Code the robot so that it tracks the people inside the house, and the son once he goes outside.	Marc
Setting Development				
Complete	1 hour	Arrangement of Furniture	Add furniture and adjust placement to appropriate rooms.	Kalen
Complete	20 Minutes	Addition of radio	Add radio to the appropriate place	Kalen David
Complete	30 Minutes	Addition of props such as kitchen appliances etc.	Add kitchen appliances to appropriate rooms.	Kalen

8 Verifying Feasibility

Verifying the feasibility of the project is crucial for ensuring we can collaboratively stay on track and meet our goals. Looking at the completion status, we've made good progress so far. Asset modeling tasks like adding snowy trees and modifying the house roof were completed within the estimated timeframes, showing our team's proficiency and ability to complete assigned tasks. Moreover, tasks such as inserting a gloomy sky and adding snow particles were also successfully accomplished, contributing to the game's atmosphere and emotional connection to the viewer. However, some audio tasks remain unfinished, like finding appropriate sounds and narratives for the game, which might require more research to complete. Similarly, coding tasks, especially implementing the autonomous weapons tracking system and character animations, are obstacles that require further attention to ensure they function correctly. With that being said, we aim to successfully conquer, but more importantly, complete these obstacles within the given time constraints. Overall, while we've made progress in several areas, addressing incomplete tasks, particularly in audio and coding, will be our primary focus for the third polished prototype.

9 Conclusion

In conclusion, Deliverable G encapsulates the comprehensive effort and progress made by our group in the development of Prototype II for the VR project, "Echoes of Tomorrow." Through meticulous analysis of client feedback, experimental modeling, and user feedback, the team has significantly advanced both the technical and narrative aspects of the prototype. The introduction of new scripts, code, and environmental adjustments has enhanced interactivity, storytelling, and emotional engagement to address key user feedback from Prototype I. The prototype's analysis demonstrates a deep understanding of critical subsystems and components, leading to refined design and target specifications. As the project moves forward, the outlined test plans for Prototype III aim to refine user interactions, character actions, and overall functionality, drawing closer to the project's completion. This deliverable demonstrates Group 14's commitment to integrating feedback, improving project fidelity, and achieving the educational and emotional objectives set forth by the client and user expectations.

10 Future Work

For the next deliverable, the group will develop a focused prototype that aligns with the objectives outlined in this deliverable (deliverable G), addressing the "why," "what," and "when" of our prototyping efforts. This final prototype will aim to fulfill targeted objectives through specific tests with measurable outcomes. To ensure a comprehensive understanding of our prototype's effectiveness, we will meticulously document our test plan, conduct thorough analyses, and record all findings, complemented by detailed images of the prototype, much like deliverables F & G. Following the third client meeting, we will implement their feedback and then proactively seek insights from potential clients and users, extending our outreach to friends and family for additional perspectives. Based on the feedback and test results, we will make informed adjustments to our target specifications, detailed design, and Bill of Materials (BOM) to refine our project further. With the final prototype completed, the game can be finalized.

11 Trello Links

Group Tasks:

<https://trello.com/invite/b/BVQUyzOo/ATTIffa561593f1eb68dd5f7bae366d91099C0403DE3/gng1103-group-14>

Group Deliverable Progress:

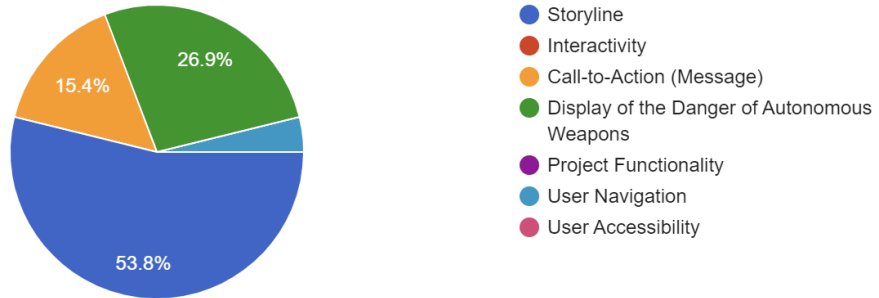
<https://trello.com/invite/b/nBKqHlud/ATTIedb77cf20bf59f8d9431a337a519c81e59084991/gng1103-project>

12 Appendix

12.1.1 Figure 16 | Prototype 1 Survey Results – Positive Feedback

What is our project's strong suit?

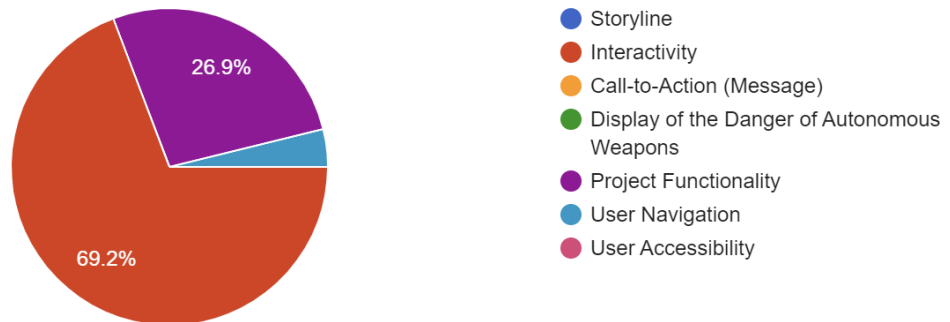
26 responses



12.1.2 Figure 17 | Prototype 1 Survey Results - Criticisms

What does our Project need to improve on the most?

26 responses



12.1.3 Figure 18 | Prototype 1 Survey Results - Impact

On a scale from 1-10, how much has this project changed your stance in regards to the Dangers of Autonomous Weapons.

26 responses

