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Prototype II and Customer Feedback

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Abstract

This deliverable offers a detailed analysis of the first prototype of our climate change awareness simulation based on XR/VR technology. The main aim of this project is to create an immersive and interactive platform that educates users about the dire consequences of climate change, with a specific focus on wildfires and their impact on ecosystems, wildlife, and human populations.

The report outlines the development methodology, technical requirements, and usability considerations relevant to the prototype. It also outlines the evaluation procedures used to test the effectiveness of the simulation and aggregates feedback obtained from clients and users. Based on this feedback, a strategic plan for future improvements and enhancements has been developed. This first prototype serves as a proof of concept, testing the combination of emotional storytelling with scientific accuracy to create awareness and inspire action.

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1.0 Introduction

The development of the VR simulation continues to evolve based on iterative prototyping and client feedback. Following the initial prototype, Prototype 2 was designed to address key areas of improvement, including user engagement, educational effectiveness, and technical performance. This stage of development focused on refining the storyline, enhancing interactivity, and optimizing system performance to better align with the client's goal of fostering empathy and education on climate change.

Client feedback played a crucial role in shaping the second prototype. By incorporating insights from the first review, the team implemented targeted adjustments, ensuring the experience remains immersive and impactful. This report outlines the purpose of Prototype 2, its key design modifications, and the feedback received from the client, highlighting how these insights will inform future development.

2.0 Prototype Development

The development of the prototype followed a structured, iterative approach to ensure that all components—narrative, interactivity, and technical feasibility—were aligned with the project's goals. The focus was on storytelling, environmental realism, and user experience.

2.1 Narrative and User Experience

The simulation is structured as follows:

- Opening Scene: The bird flies over a wildfire-ravaged town, observing the devastation—burned trees, collapsed homes, and smoke lingering in the air.
- Transition to the Girl's Perspective: The bird lands on the windowsill of a young girl's home. She listens intently to a radio broadcast detailing the increased frequency of wildfires due to climate change.
- Immersive Scene Shift: The user enters the girl's imagination, arriving in a lush forest in Alberta before the wildfire starts. The vibrant, untouched environment contrasts sharply with the post-fire destruction seen earlier.
- The Park Ranger's Story: The user follows a park ranger who monitors wildlife and the ecosystem. The ranger hears a bear cub's distress call and investigates.
- Wildfire Outbreak: The scene shifts dramatically as smoke emerges in the distance, the sky turns orange, and the fire begins spreading rapidly. The ranger must quickly rescue the cub and alert the authorities.

- Return to Reality: The user exits the girl's imagination and returns to her room. Inspired, she writes an article, petition, or message advocating for climate awareness.

- Final Scene: The bird takes flight once more, soaring above the town as the screen fades to black, leaving users with a lasting emotional impression.

The client provided meaningful feedback on the first and second meeting that has helped develop the simulation. Based on the first client meeting, the feedback was directed towards the storyline, aiding in choosing a destination and the direction of the storyline. Previously, the simulation was primarily focused on user interaction. However, the purpose is to develop a simulation to increase awareness and bring action to an ongoing issue.

To ensure the VR simulation effectively meets the client's goals of fostering empathy and education, we carefully gathered and analyzed feedback. This feedback provided valuable insights into user experience, educational impact, and technical performance, highlighting areas for improvement. Below is a summary of the key points raised by the client based on the second meeting and how they will shape the next phase of development.

- User Experience and Engagement

Based on the protypes developed, suggestions were made of adding more interactive elements to enhance engagement for the environment. Due to the climate issue being common amongst various groups, the simulation must have different interactive parts. Additionally, clients felt disconnected from the consequences of climate change too due to the lack of relation and the personalized impact scenarios.

- Educational Effectiveness

The narrative was informative; however, the storyline needs a clearer structure to guide users through the learning process. The client recommended to incorporate a clear transition from one scene to the next and to ensure that the user is not confused about the time the scene is taking place. The client highlighted the importance of projecting the story forward and the impact educationally.

- Technical Performance

Performance issues were noted, including occasional lag in high detail environments, and the difficulty in moving left and right once the user enters the simulation. Some interactive elements, such as object selection and environmental responses, had slight delays. Additionally, some textures took too long to load, causing temporary blurriness in the environment.

Modifications based on feedback:

To improve the next iteration of the VR simulation, the team will:

Enhance Interactivity: Introduce decision-making points where users can choose actions that impact the virtual world.
Strengthen Narrative Flow: Implement a guided storytelling approach, ensuring users receive structured yet immersive education.
Optimize Performance: Adjust graphics settings and optimize asset loading to reduce lag while maintaining visual quality.
Improve Accessibility: Integrate customizable control options to accommodate a wider audience.

Prototype Development: Purpose, Content, and Timeline

To refine the VR simulation and align it more closely with the client's goals, a targeted prototype will be developed. This prototype will focus on key areas identified through client feedback, ensuring measurable improvements in user engagement, educational effectiveness, and technical performance.

The goal of this prototype is to test and validate:

1. **Enhanced Interactivity** – Implementing more interactive elements to engage users and provide personalized impact scenarios.
2. **Improved Narrative Structure** – Creating a seamless transition between scenes to guide users through the storyline and maintain educational clarity.
3. **Optimized Technical Performance** – Reducing lag, improving movement controls, and enhancing object interactions.
4. **Increased Accessibility** – Ensuring smoother navigation and compatibility across various VR headsets.

Protype improvements:

1. Refined VR Scenario

- Personalized impact scenarios where user choices lead to different consequences.
- Guided narration and structured transitions to maintain clarity in educational messaging.

2. Technical Improvements

- Performance Optimization: Reduce texture loading times and improve frame rates.
- Improved Movement Controls: Address difficulties in left-right movement and enhance navigation.
- Interactive Object Response: Improve response time for object selection and environmental interactions.

TIMELINE

Week 1: March 9th - March 15th	Implement decision-making points and personalize impact scenarios. Develop a

	structured storyline with clear transitions. Finish developing the scenes.
Week 2: March 16th - March 22nd	Optimize graphics and asset loading to reduce lag. Improve movement controls and VR compatibility. Implement accessibility features. Implement survey in the beginning and end of the simulation.
Week 3: March 23rd - March 27th	Finalize User manual. Conduct user testing to evaluate engagement, educational effectiveness, and technical performance. Gather feedback and finalize improvements.

3.0 Analytical Model

The analytical model of our VR simulation surrounds various key components. These components consist of emotional impact, user engagement, technical performance, and scientific accuracy. We analyze user engagement by tracking decision making, navigation patterns, and engagement time. Tracking and analyzing this data helps us evaluate whether our simulation is effectively holding the attention of our users and is encouraging their participation. Furthermore, surveys and observations will allow us to measure how effectively our users consume the key climate change messages ensuring there was an educational benefit from our simulation.

3.1 Emotional impact

Emotional impact is one of the most important aspects of this model. This is due to our project aiming to create an immersive and long-lasting experience. Analyzing users' reactions to key events in our simulation allows us to measure the effectiveness of the visual aspects and storytelling of our project in influencing a feeling of empathy. Our feedback surveys help gauge whether our users are experiencing the destined emotional load of our story. By optimizing the realism of sound, visuals, and data of our simulation, we are able to strengthen the emotional engagement of users and improve overall success.

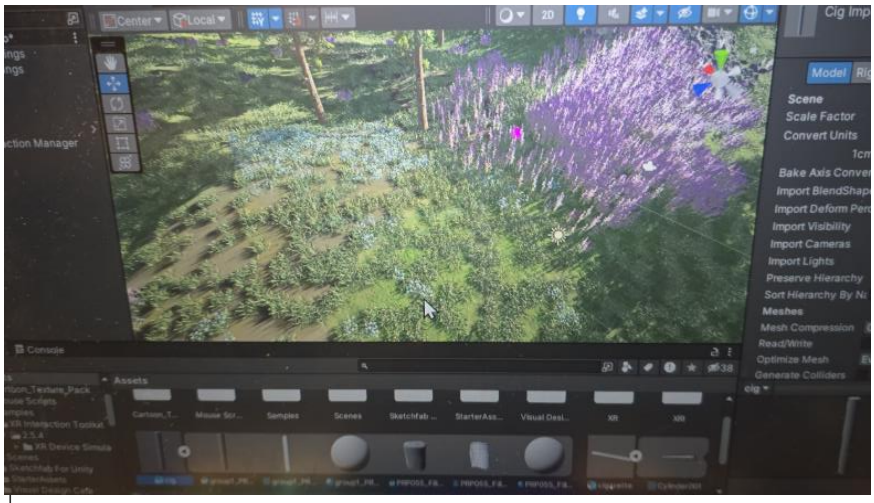
3.2 Technical performance

Technical performance and scientific accuracy are essential in ensuring our experience is immersive and realistic. Our performance testing consists of evaluating framerate optimization, minimizing lag, rendering efficiency etc. Our VR simulation uses real world climate data that we collected from NASA and the IPCC. This allows us to present accurate scenes of wildfire spread and ecological damage. We also have interactive data overlays to help users to connect visuals to real data and create better immersivity and understanding. Integrating these elements all improve the empathy, lasting impact, and immersive of our VR simulation.

4.0 Prototyping and Testing Plan

The test plan of the prototype in this image to the left was divided into two sections for better readability and organization. The first half outlines objectives, methods, and metrics, while the second

presents prototype fidelity, results, and feedback.



Design Concept:			Virtual Reality Simulation of climate change event: Wildfire			
Test Number	Probable critical issue	Test Objective (why)	Test Description (what)	Analysis Method (how and when)	Determine Measurables	Metrics
	What assumption are you testing?	*Communication, Performance Measurement, Risk Management, Learning/Understanding*	*What specifically will you test? What is your hypothesis?*	*Specifically how will you test, include things like duration, sequence of test, equipment, pass/fail criteria etc. How will the results be collected?*	*What are you testing with your concept (target measurable attributes)?*	*What metrics will you test? What are the associated units?*
1	The narrative is clear and the story is understandable	Communication (narrative clarity)	Weight capacity test: Putting weights on the joint between the partitions gradually	Interview post-experience: Evaluate users' descriptions for clarity, consistency, and accuracy; If the score is less than 7, The narrative fails the test for that participant.	Clarity and coherence of user narratives	Qualitative score: (1-10).
2	The objects in the environement are well sized and have realistic proportions	Performance Measurement (realism)	Visual realism test: Users rate realism and proportionality of environment objects	Post-experience realism survey (Likert scale 1-5); conducted immediately after simulation	Perceived proportionality realism	1-5 Likert scale
3	The gameplay path is intuitive and hard to get lost in	Performance Measurement (user experience/navigation ease)	Navigation test: Track number of times users become disoriented or lost in simulation	Observational testing: Record frequency of confusion or misdirection during the session; The average should be no more than 2 per participant session. It's a short simulation	Navigation intuitiveness	Instances of confusion per session.
4	The simulation runs at a good 60 frames per second	Performance Measurement (storage mechanism)	Frame rate performance test: Measure average frame rate during simulation playback	Frame rate benchmarking: Software/hardware analysis tools during 3-minute runtime; FPS >= 60	Frame rate stability	Frames per second (fps)

Level and Fidelity of Prototype (what)	Kind of Prototype (what)	Results	Interpretation and Feedback	Notes
HiFi/LoFi Focused, HiFi/LoFi Comprehensive	*Visual, Analytical, Physical*	*Observe and record results.*	*Pass or fail (include reason) and other feedback collected about prototype*	1. Include location of sketch, software libraries, reference materials, etc. 2. Take notes on how you can improve your next prototype 3. Other important things to remember
LoFi Focused	Analytical	6 passes; 4 fails 6/10 participants felt that the story was clear.	Fail (Narrative was not suffieciently understood by great majority >=7). The client felt that the story was back to front.	Refine narrative elements where users expressed confusion.
LoFi Focused	Visual	Average rating is 4.9/5	Pass (Navigation intuitive, minor improvements needed)	Address outliers where objects were rated unrealistically.
LoFi Focused	Analytical	1.48 average instances of confusion per aprticipant.	Pass (The average is no more than 2.	Clarify areas with recurring user confusion.
LoFi Focused	Visual	Average FPS: 62	Pass (Simulation meets target 60 FPS consistently)	Optimize for consistent frame rate under peak visual load.

Throught the interpretation of the results, it is evident that the narrative wasn't clear enough, as only 6 out of 10 participants could properly describe it, which meant it failed the test. Some users said the story felt backward or confusing, so for the next version, we need to rearrange or clarify certain parts to make it easier to understand.

The objects in the simulation were rated quite well for realism, with an average score of 4.9 out of 5. This means most users thought the object looked the right size and proportion. Even though it passed, a few objects still need some improvements to look more realistic.

Navigation was mostly intuitive, with users getting confused an average of 1.48 times per session, which is within the acceptable limit of 2. This means the design works well, but we should still make small changes to further reduce confusion in the next version.

The simulation ran at an average of 62 FPS, which is higher than the required 60 FPS, so it passed the performance test. However, we should still work on optimizing it to make sure it stays stable, even when there are more visuals on the screen.

5.0 Customer Feedback

User feedback was gathered through direct interactions and structured surveys immediately after experiencing Prototype II. Most participants found the simulation engaging and immersive, with the narrative effectively illustrating the impact of climate change and human activity. The realistic depiction of objects further enhanced the experience, and the navigation was generally intuitive.

However, some areas required improvement:

- A few users experienced confusion with certain parts of the storyline, suggesting a need for reorganization of the story's timeline.
- two environmental objects appeared a bit unrealistic or out of scale, slightly reducing immersion.
- A few participants recommended clearer visual or directional indicators to improve navigation.

To address these issues, refinements will be made to improve narrative clarity and ensure better user understanding. Objects that received lower realism ratings will be adjusted for more accurate proportions and greater visual fidelity. Additionally, navigation cues will be enhanced to reduce confusion and improve the overall experience.

The client also pointed out a key concern regarding the sequence of scenes. Since the story moves backward in time from Scene 1 to Scene 2, it may become difficult to present future projections effectively. This feedback highlights the need to reconsider the timeline structure to ensure that the intended message is clearly conveyed.

6.0 Task Plan Updates

6.1 Updated Target Specifications

Based on the previous round of testing, several issues were identified in the VR experience:

- **VR headset gyroscopes may be misaligned**, leading to inaccurate user perspective.
- **User inputs from the headset may not be transmitted correctly**, affecting interaction.
- **Coding issues** may cause incorrect or delayed input responses.
- **Users may stray from the intended scene**, reducing immersion.

To address these issues, we have updated the following target specifications:

- **Input Response Optimization**: Refined the code logic to ensure accurate and timely transmission of VR headset inputs.
- **Gyroscope Calibration**: Implemented an automatic calibration function to minimize misalignment.
- **Scene Navigation Guidance**: Added visual aids (e.g., arrows, pathway indicators) to help users stay within the designated area.
- **Enhanced Interactivity**: Introduced more interactive elements, such as virtual object touch feedback, to keep users engaged in the main environment.

6.2 Detailed Design Improvements

Based on feedback from testing, the following design adjustments have been made:

- **Added Box Colliders** to prevent users from leaving the intended scene area.
- **Improved UI Design**, optimizing the start menu prompts to make interactions more intuitive.
- **Enhanced 3D Asset Loading Efficiency** to reduce lag and ensure a smoother experience.
- **Optimized Environmental Collision Detection** to improve the interaction experience.

6.3 Updated BOM (Bill of Materials)

Considering budget evaluations, adjustments have been made to the BOM to balance cost and performance:

- **Virtual Reality Platforms & Development Tools**: Potential additions of new plugins or software tools ($0 - $50).
- **3D Assets**: Adjusted budget range ($0 - $100) to accommodate high-quality visuals.
- **Voice Recording & Audio Engineering**: Increased budget allocation ($0 - $50) to enhance immersion.
- **Visual Enhancements (Shaders & Textures)**: Budget maintained at $0 - $50 for improved textures and effects

7.0 Conclusion

The development of the first prototype has been a critical milestone in advancing our XR/VR climate change awareness simulation. The prototype has successfully demonstrated the power of immersive storytelling in educating users about the consequences of climate change. Through a compelling narrative, interactive elements, and scientifically accurate data, the simulation has effectively engaged users while fostering empathy towards climate-related disasters, particularly wildfires.

The test plan confirmed that the prototype meets the baseline expectations for usability, performance, and educational impact. However, feedback from users and stakeholders has highlighted key areas that require further improvements, including more interactive decision-making opportunities, refined storytelling transitions, and enhanced real-time climate data integration. These refinements will be implemented in the next iteration to increase engagement, realism, and educational value.

By incorporating this feedback, the next phase of development will focus on enhancing user agency, refining UI elements, expanding scientific explanations, and improving overall performance. The revised version of the prototype will offer a more polished, data-driven, and emotionally resonant experience, making it a valuable tool for climate education and awareness campaigns.

8.0 Future Development Considerations

8.1 Expanding User Interactivity

- Implementing branching narratives where user decisions affect the progression of the story and consequences of climate events.
- Adding hands-on tasks such as fire prevention measures, habitat restoration, and emergency response actions to make the simulation more engaging.
- Integrating a decision-tracking system, where users receive a summary of their choices and how they align with real-world climate mitigation strategies.

8.2 Enhancing Realism and Scientific Accuracy

- Improving wildfire propagation mechanics based on actual climate models and fire behavior studies.
- Implementing real-time climate analytics that allow users to see up-to-date wildfire risks in different regions.

- Expanding ecosystem damage visualization, showing the gradual recovery process post-wildfire, based on ecological research.

8.3 Accessibility and Multi-Platform Support

- Ensuring the simulation can be experienced on both VR and non-VR devices, increasing accessibility.
- Adding alternative control schemes for users with physical disabilities, including voice-controlled navigation and simplified UI interactions.
- Optimizing the simulation for low-performance devices to ensure broader availability, particularly for educational institutions and public awareness campaigns.

8.4 Multiplayer and Collaborative Features

- Introducing collaborative multiplayer modes, allowing multiple users to experience the simulation together and work through environmental challenges as a team.
- Enabling shared learning experiences, where educators or facilitators can guide users through the simulation while providing live discussions.

8.5 AI-Powered Dynamic Events

- Integrating AI-driven environmental changes, where climate conditions adapt dynamically based on user behavior.
- Implementing adaptive storytelling, where users receive different climate scenarios based on their prior interactions and learning preferences.
- By implementing these enhancements, future iterations of the simulation will increase its realism, accessibility, and overall educational effectiveness. These improvements will not only increase engagement for general users but also make the simulation a valuable resource for climate educators, policymakers, and activists.

9.0 References

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