Software Requirements Specification

for,

*A VR simulation for firefighters to simulate a burning building and allow trainees to practice firefighting techniques*

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# Introduction

## Purpose

This Document will provide all of the features and requirements for “A VR simulation for firefighters to simulate a burning building and allow trainees to practice firefighting techniques”. It will serve as a reference for the developers and customers during the development of the final version of system.

## Intended Audience and Reading Suggestions

In this project, we are mainly focusing the user group that will include firefighter trainee’s and firefighters. Also, the customer domain can be included such as users aspiring to be firefighters. This project is a VR model, it’s understanding might be differ to the different domain people but we tried to cover it.

## Project Scope

The scope of this project is to design and develop a virtual reality simulation for firefighter training that will allow trainees to practice firefighting techniques in a safe and controlled environment. The VR simulation will be designed to simulate a burning building scenario that will include fire scenarios such as structural fires.

# Overall Description

## Product Perspective

The VR simulation will be designed as a standalone product, to be used as a training tool for firefighting trainees.

## Product Features

The VR simulation will include the following features:

● Interactive Fire Scenarios: The VR simulation will allow trainees to practice firefighting techniques in fire scenarios such as structural fires.

● User-Friendly Interface: The VR simulation will have a user-friendly interface to allow trainees to easily navigate through the simulation.

● Feedback System: The VR simulation will provide real-time feedback to trainees on their performance.

## User Classes and Characteristics

The VR simulation is designed for firefighting trainees of all skill levels.

## Operating Environment

Currently we are developing a VR Model that’ll be able to work on the platforms Meta Quest 2 and an Android APK Version for VR Devices that support smartphone as the screen.

## Design and Implementation Constraints

The VR simulation will be subject to budget and resource constraints.

## User Documentation

<List the user documentation components (such as user manuals, on-line help, and tutorials) that will be delivered along with the software. Identify any known user documentation delivery formats or standards.>

## Assumptions and Dependencies

### Assumptions

*2.7.1.1 Trainees have basic knowledge of using VR technology and are comfortable wearing VR headsets and using VR controllers.*

*2.7.1.2 Trainers have experience and knowledge in firefighting techniques and are able to customize training scenarios based on specific training needs or hazards.*

*2.7.1.3 Trainees have access to VR hardware that is compatible with the VR simulation software.*

*2.7.1.4 The VR simulation accurately simulates a burning building scenario and realistic firefighting techniques.*

### Dependencies

*2.7.2.1 The VR simulation software requires a reliable and high-speed internet connection for online multiplayer capabilities.*

*2.7.2.2 The VR simulation software is dependent on the performance and compatibility of the VR hardware used by the trainees.*

*2.7.2.3 The VR simulation software may require periodic updates and maintenance to ensure optimal performance and functionality.*

*2.7.2.4 The VR simulation software may require support and training resources for trainees and trainers to effectively use the system.*

# System Features

## Functional Features

3.1.1 The VR simulation shall allow trainees to practice firefighting techniques in various fire scenarios.

3.1.2 The VR simulation shall provide realistic visuals to create an immersive training experience.

3.1.3 The VR simulation shall have a user-friendly interface.

3.1.4 The VR simulation shall provide real-time feedback to trainees on their performance.

## Non – Functional Features

*3.2.1 The VR simulation should have low latency and high frame rates to provide a*

*smooth and responsive experience for the trainee, ensuring that there is no lag or delay in the virtual reality environment.*

3.2.2 The VR simulation should be designed to handle a large number of trainees simultaneously without compromising on performance, providing an efficient and seamless experience.

3.2.3 The VR simulation should be secure and protect trainee data and personal information, ensuring that there is no unauthorized access or breach of confidentiality.

3.2.4 The VR simulation should be customizable, allowing trainers to tailor the training experience to specific training needs or hazards, or to adjust the level based on trainee performance.

3.2.5 The VR simulation should be easy to maintain and update, with clear documentation and modular design that allows for easy modification and expansion of the system.

3.2.6 The VR simulation should have adequate support and training resources available to trainees and trainers, ensuring that they can effectively use the system and get the most out of their training experience.

## Error Handling

*3.3.1 If the VR hardware used by the trainee malfunctions or fails, the simulation will automatically save the current state and notify the trainer, allowing for a quick resolution or for the trainee to switch to a different VR device.*

*3.3.2 If there is a network issue, such as low bandwidth or lost connection, the simulation will provide a warning to the trainee and attempt to reconnect automatically. If the issue persists, the simulation will save the current state and notify the trainer.*

*3.3.3 If the VR simulation software encounters an error, it will provide an error message with instructions on how to resolve the issue or contact technical support.*

*3.3.4 If the trainee makes an error, such as walking through a wall or falling from a height, the simulation will provide a warning and reset the trainee to a safe location.*

*3.3.5 If the VR hardware or software is incompatible with the VR simulation, the simulation will provide an error message and provide instructions on how to resolve the compatibility issue.*

*3.3.6 If the VR simulation experiences performance issues, such as low frame rates or lag, the simulation will provide a warning to the trainee and attempt to optimize performance automatically. If the issue persists, the simulation will save the current state and notify the trainer.*

*3.3.7 If the trainer encounters an error while customizing a training scenario, the simulation will provide an error message and instructions on how to resolve the issue.*

*3.3.8 If there is a security breach or unauthorized access to trainee data, the simulation will immediately stop and notify technical support and the relevant authorities. The system will also provide instructions on how to secure the system and prevent further breaches.*

# External Interface Requirements

## User Interfaces

4.1.1 The main menu of the VR simulation should allow the user to select a specific training scenario, access their training progress, or access training resources such as a user manual or support.

4.1.2 The VR simulation should allow users to select a specific training scenario from a list or a map, indicating the level of difficulty or the skills required to complete the scenario.

4.1.3 The VR simulation should allow trainers to customize a training scenario, such as adjusting the location or the hazards, and save it for future use.

4.1.4 The VR simulation should provide clear and intuitive controls for trainees to move around the virtual environment, interact with objects, and perform firefighting techniques.

4.1.5 The VR simulation should accurately simulate fire and smoke behavior, allowing trainees to practice firefighting techniques in a realistic environment.

4.1.6 The VR simulation should provide real-time feedback on trainee performance, such as the time taken to complete a scenario, the number of hazards identified, or the accuracy of firefighting techniques used.

4.1.7 The VR simulation should allow trainees to track their progress and identify areas that need improvement.

## Communications Interfaces

4.3.1 The VR simulation should communicate with the virtual reality headset to display the virtual environment to the trainee and track the trainee's head movements and interactions within the virtual environment.

4.3.2 The VR simulation should communicate with various input devices, such as controllers or gloves, to track the trainee's hand movements and interactions within the virtual environment.

4.3.3 The VR simulation should communicate with an audio system to provide realistic sound effects, such as alarms or crackling fires, to enhance the immersive experience. Other Nonfunctional Requirements.

4.3.4 The VR simulation should communicate with the network interface to allow trainees to collaborate and communicate with each other during multiplayer mode.

4.3.5 The VR simulation should communicate with a trainer interface, allowing the trainer to monitor trainee progress, customize training scenarios, and provide real-time feedback to trainees.

4.3.6 The VR simulation should communicate with a cloud interface to store and retrieve data, such as trainee progress or customized scenarios, from a cloud-based platform, ensuring data security and accessibility.

## Performance Requirements

4.4.1 The VR simulation should have a low latency response time to the trainee's actions and movements to ensure a realistic and immersive experience.

4.4.2 The VR simulation should have a minimum frame rate of 60 frames per second to prevent motion sickness and ensure smooth movement within the virtual environment.

4.4.3 The VR simulation should have high-quality graphics that accurately represent the real-world environment and simulate realistic fire and smoke effects.

4.4.4 The VR simulation should allow trainers to customize training scenarios according to the trainee's skill level and specific training needs.

4.4.5 The VR simulation should be able to store and manage user data, such as trainee profiles and training progress, efficiently and securely.

# Future Scope

## Future Scope

*5.1.1 Different fire types can be included like electrical fires and chemical fires.*

*5.1.2 Multiplayer element can be added where multiple trainees could practice their firefighting skills in the same virtual environment. This could help to simulate the chaos of a real fire scene and allow firefighters to practice working as a team.*

*5.1.3 Future VR simulations could incorporate artificial intelligence to create more dynamic and realistic scenarios. AI could be used to simulate the behavior of flames, smoke, and other environmental factors, making the simulation more challenging and realistic.*

*5.1.4* *The VR simulation could also be integrated with other technologies such as haptic feedback, which could allow trainees to experience the heat and pressure of a real fire. This could make the simulation even more realistic and engaging.*

*5.1.5 By collecting data on trainees' performance in VR simulations, it may be possible to use AI and identify areas where they need additional training and create personalized learning plans.*

Appendix A: Glossary

● VR (Virtual Reality): A simulated environment that is experienced through a VR headset or other immersive technology.

● Simulation: A computer-generated representation of a real-life situation, used for training or experimentation purposes.

● Firefighting Techniques: Methods and strategies used to fight and control fires, including the use of fire extinguishers, hoses, and other firefighting equipment.

● Latency: The delay between input and output in a system, such as the time between a trainee's movement and the corresponding movement in the virtual environment.

● Frame Rate: The number of frames per second (fps) that the VR simulation can display, affecting the smoothness and quality of the simulation.

● Feedback: Information provided to the trainee regarding their performance and progress, allowing for improvement and adjustment of training techniques.

Appendix B: Analysis Models

<Optionally, include any pertinent analysis models, such as data flow diagrams, class diagrams, state-transition diagrams, or entity-relationship diagrams.>