UNIVERSITI TUNKU ABDUL RAHMAN

FACULTY OF INFORMATION & COMMUNICATION TECHNOLOGY

UCCD3084: Graphics Programming for Extended Reality

Project Title: Fire Extinguisher Training VR Simulation in an Electronic Factory

Team Name: TungTungTungSahur

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Student Names	**IDs**
Melvin Chai Wen Da	2305823
Yap Zhong Yew	2206980
Tan Jia Yi	2104927
Loh Chjun Kitt	2404014

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Project Scope & Environment Design

The factory type for our project is High-Tech Electronics Manufacturing. This type of facility presents a unique and critical set of fire hazards, making it an ideal setting for a VR training simulation focused on fire safety. The environment contains energized electrical equipment, sensitive components, and a variety of materials, providing a comprehensive training scenario that is both realistic and challenging.

The VR simulation will feature a wide range of fire scenarios commonly found in high-tech electronics manufacturing, with a strong emphasis on energized electrical equipment fires. For instance, sparks from an overloaded control panel may ignite nearby wiring, while cardboard packaging boxes and stacks of paper can easily catch fire if exposed to heat. The simulation also covers more hazardous situations, such as gas leaks from compressed storage tanks that create explosive risks, and fuel-based hazards like spilled solvents or oils that can spread flames rapidly across the floor. These scenarios combine to provide a realistic and immersive training environment, helping trainees recognize and respond effectively to diverse fire hazards.

In the electronics manufacturing environment, each extinguisher will be fully interactive, requiring players to follow the P.A.S.S. protocol: pull the pin, aim the nozzle, squeeze the handle, and sweep the nozzle. The correct extinguishing agent will produce a visually distinct effect on the corresponding fire type. For example, a CO_2 extinguisher will blanket an electrical fire.

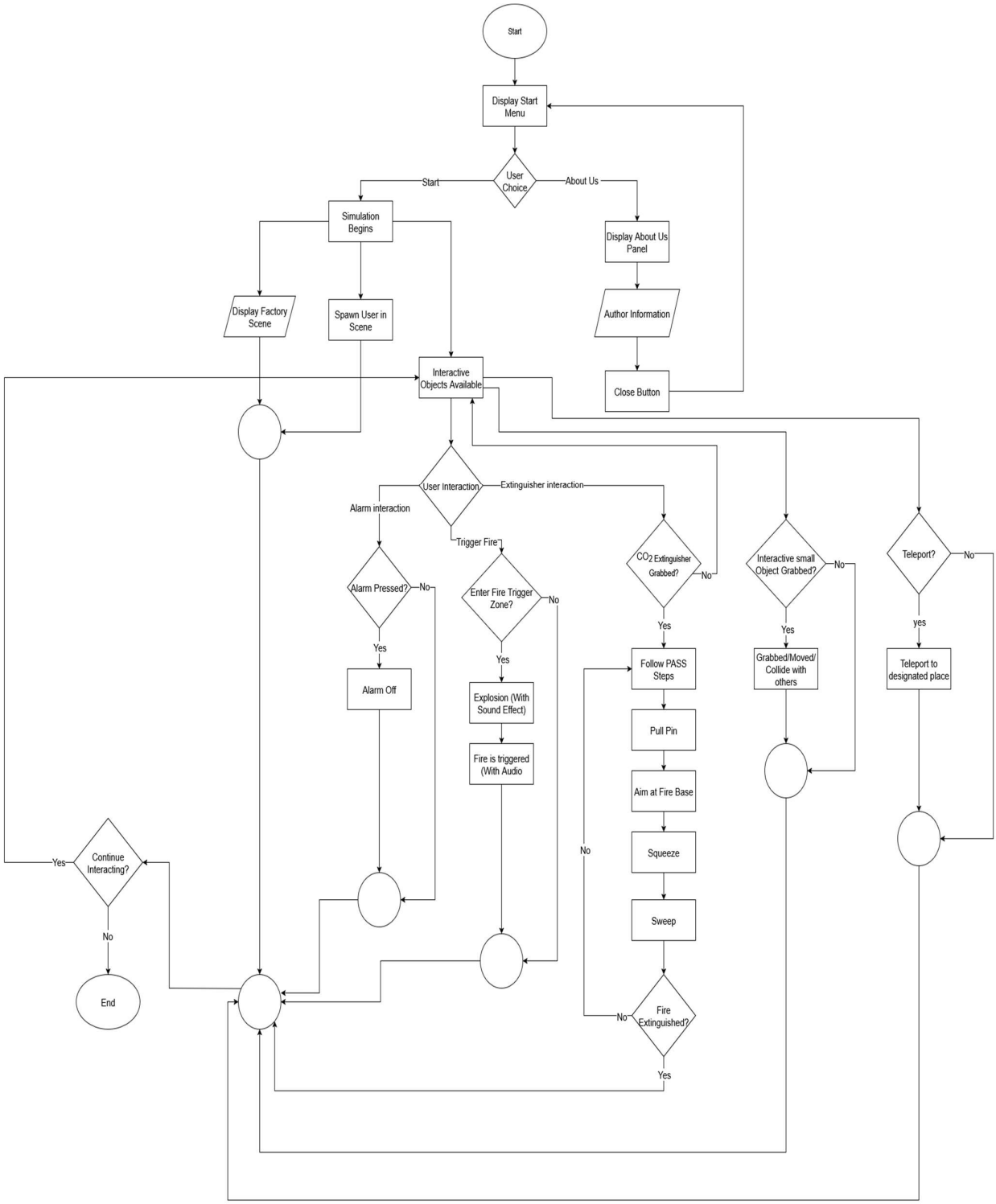
This simulation will provide realistic audio cues for each case, such as the buzzing of an electrical short and appropriate background sounds. Visual effects will include dynamic particle systems for flames that accurately reflect the nature of the fire. The simulation will also feature a teleportation system, allowing players to easily move from one location to another instead of walking.

In conclusion, the VR fire safety simulation set in a high-tech electronics manufacturing facility offers a highly realistic and immersive training experience. By incorporating diverse

fire hazards, interactive extinguishers that follow the P.A.S.S. protocol, and detailed audio-visual effects, the simulation ensures that trainees not only learn the proper techniques for fire response but also experience the urgency and complexity of real-world scenarios. The addition of user-friendly navigation features, such as teleportation, further enhances accessibility and engagement. Overall, this simulation provides a comprehensive platform for developing critical fire safety skills in a safe, controlled, and impactful way.

Visual Diagram

Flowchart



The Fire Safety Simulation VR training system is designed to provide users with an immersive and interactive environment to practice fire safety procedures. The fire simulation starts with a start menu, where users are presented with two options: to view the “About Us” section or to begin the simulation. In this context, the “About Us” section displays the author’s name and factory-related information, with the option to return to the main menu. On the other hand, selecting “Start” initiates the simulation where the factory environment will be rendered, and the user is spawned within the virtual scene. At this stage, a guidance panel is displayed to provide initial instructions on grabbing the key object, particularly the fire extinguisher.

Within the simulation, several interactive objects are made available, including alarms, fire extinguishers, smaller movable items such as bottles and boxes, and teleportation triggers. Interaction with the alarm allows the user to press the alarm which results in activation and deactivation if pressed once again. An emergency is simulated once the user enters a designated fire trigger zone, it will activate explosion particle effects and fires are formed, creating a realistic fire scenario with animation. In response, the user is required to retrieve a CO_2 fire extinguisher and follow the correct operating procedure, guided by the PASS method. This involves pulling the pin, aiming at the base of the fire, squeezing the handle, and sweeping from side to side until the fire is completely distinguished. In addition, there is a fill bar on the top that indicates the capacity remaining in the fire extinguisher. It functions as a press gauge or pressure indicator that shows the user how much charge the fire extinguisher has left. Successful completion of the PASS steps results in extinguishing the fire.

The system also enables other training interactions. The users can be teleported to various locations in the factory and also interact with the collision objects to allow exploration of different areas. The functionality to pick and drag the small objects further improves environmental interaction and realism.

In short, the Fire Simulation VR training process offers the users a systematic and thorough procedure to conduct fire safety training through a safe virtual environment. With the

incorporation of alarm handling, PASS method fire response, teleportation, and object handling, the system allows users to experience immersive fire simulation.

Allowed Assets:

1) https://assetstore.unity.com/packages/audio/sound-fx/bombs-and-explosions-220174

2) https://assetstore.unity.com/packages/vfx/particles/particle-pack-127325

3) https://pixabay.com/users/soundreality-31074404/

4) https://assetstore.unity.com/packages/audio/music/music-serenity-321727

5) https://assetstore.unity.com/packages/audio/sound-fx/electrified-sfx-library-2823

6) https://assetstore.unity.com/packages/3d/props/sci-fi-battery-barrel-packs-285735

7) https://assetstore.unity.com/packages/3d/environments/sci-fi/atm-95057

8) https://assetstore.unity.com/packages/3d/environments/industrial/unity-warehouse-276394

9) https://assetstore.unity.com/packages/3d/props/industrial/old-warehouse-116767

10) https://assetstore.unity.com/packages/3d/environments/realistic-fences-pack-211850

11) https://assetstore.unity.com/packages/2d/textures-materials/floors/floor-materials-pack-v-1-140435

12) https://assetstore.unity.com/packages/3d/props/electronics/hq-laptop-computer-42030

13) https://assetstore.unity.com/packages/3d/props/cigarette-lighter-pbr-106937

14)https://assetstore.unity.com/packages/3d/props/industrial/gas-cylinder-pbr-pack-free-194471

15)https://assetstore.unity.com/packages/3d/vegetation/trees/realistic-tree-9-rainbow-tree-54622

16)https://assetstore.unity.com/packages/tools/physics/optimized-ropes-and-cables-tool-287164

17) https://assetstore.unity.com/packages/3d/props/sockets-and-fuse-box-pack-148620

18) https://assetstore.unity.com/packages/3d/environments/industrial/barreloil-170128

19)https://assetstore.unity.com/packages/3d/props/industrial/customisable-simple-barrels-pack-318755

20) https://assetstore.unity.com/packages/3d/props/fuel-tank-10l-230694

21) https://assetstore.unity.com/packages/3d/props/petrol-chainsaw-74889

22) https://assetstore.unity.com/packages/3d/props/interior/simple-garage-197251

23)https://assetstore.unity.com/packages/3d/props/interior/free-sockets-and-switches-233085

24)https://assetstore.unity.com/packages/3d/environments/industrial/rpg-fps-game-assets-for-pc-mobile-industrial-set-v3-0-101429

Team Contribution Summary

Member	**Contributions**
Melvin Chai Wen Da	• Design the fire extinguisher through blender • Design the particle system of fire extinguisher • Logic for fire extinguisher • Combine the factory and fire extinguisher • Design the fire • Logic for the fire d
Yap Zhong Yew	• Logic for fire extinguisher • Auto trigger fire with audio (Audio asset from Unity asset store) • Gas pressure UI • Start Menu
Tan Jia Yi	• Explosion • Demo video • Environment design • Report
Loh Chjun Kitt	• Design the environment • Teleportation • Grab the GameObject • Alarm

Key of Scenes