

# Firefighter Simulation

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## **Goals and Objectives**

The goal of this project is to create a fire simulation fire drill. This simulation creates a sense of virtual reality presence for a young fire fighter. Real world fire drill is costly as it would require a physical building being destroyed and negative environmental impact. This simulation saves time and money as well as the environment as it can be accessed anywhere at any time.

This application will be useful for the firefighters in training themselves and to gain confidence to face a real fire hazardous situation. This simulation will provide an environment of a fire hazardous event whereas saving as many people as possible within a short time would be the goal. Playing this game would basically help especially firefighters that are new in to their career to build self-confidence and tap into their fire senses before they face a real hazardous event.

## **Modeling**

### *Planned geometry*

As per the modelling and the design of the project Unity was used to create and design the game. The terrain was customised modelled i.e. trees, grass and hills. Moreover, several buildings were added using the Asset Store in Unity and a Firetruck was added using a Sketchup model to the environment.

### *Use of Texture*

The virtual world uses great texture implementation. The grass is green and is animated (swaying in the wind). The world cast shadows and light using the sky map. The colors are appropriate for the objects.

### *Animation, Behavior and Functionality*

First person controller is used in playing the game so the game would be using the First Person-Controller camera to navigate through the environment. Textures were mainly used to create the grass as well as the mountains to give it a greenery view to the environment.

The fire truck that was taken from sketch up can be seen pulling up to the building. It has a looping animation to simulate it driving towards the fire.

The victim avatar can be seen running from the fire trying to escape the scene. The fire is animated and can be seen dancing as it burns

## **How the application will be used**

Once the game is started it will be controlled by the First Person-Controller and there will be fire added as triggers so once the player gets collided with the fire, the health of the player as well as the points of the player would be reduced. Therefore, the player has to avoid getting burnt by the fire and try to save as much people as possible from the burning building within a short period of time.

Upon getting close to the victim avatar (which simulates the saving of the avatar from the fire) the avatar would disappear which means the avatar was saved by the Player and the health of the Player as well as the points of the player would increase for saving the victim. The Player can be navigated using the arrow keys and the space bar is used for "Jump" action to avoid any fire triggers.

If the Player gets a complete score (180 pts), a new scene will be generated displaying the players certificate and a congratulations message. If the Player did not save all the victim he will be returned to the main menu where he can attempt again.

Overall, this application is a great way to train young fire fighters and will save the department money because real world fire drills are costly and destructive.

## Programming

Several C++ programming scripts were added when creating the game. Please find below the scripts that were used

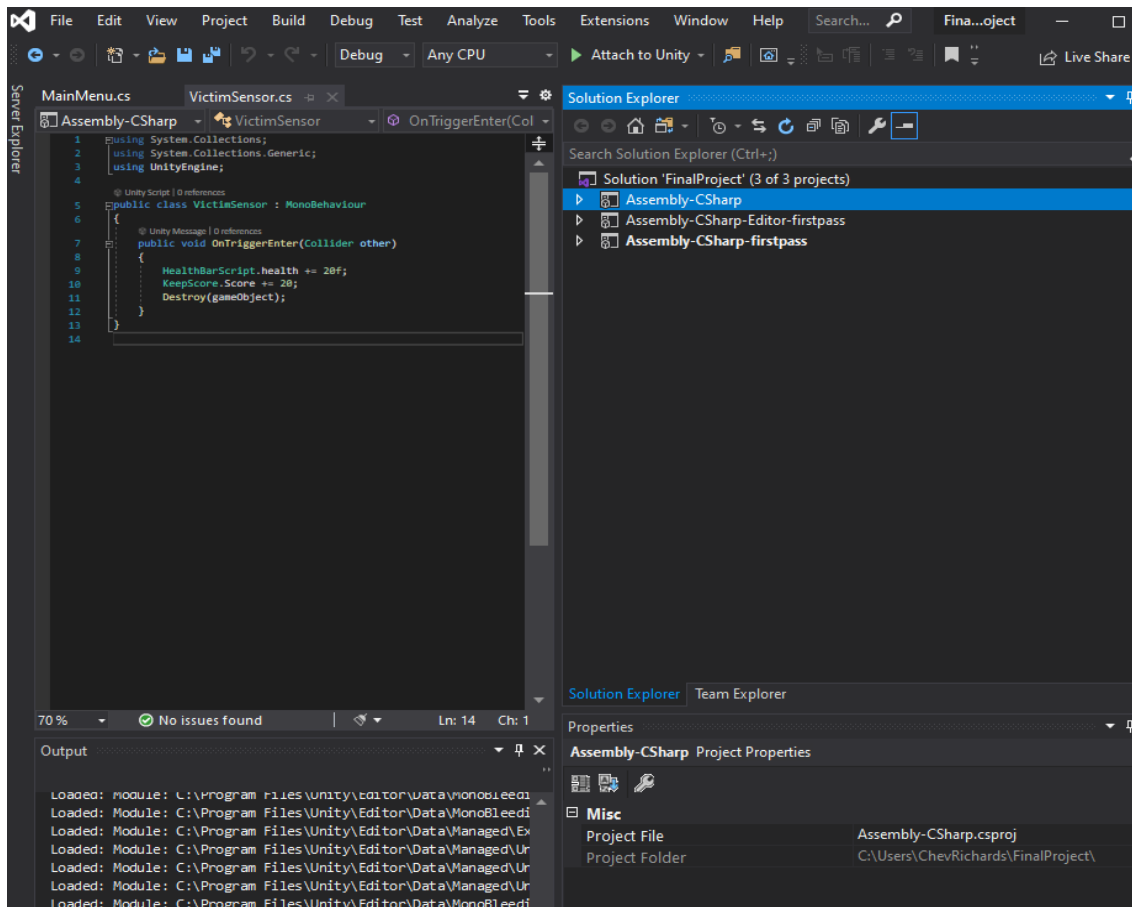


Figure 1.0 Victim Sensor Script

This script was used to create the victim sensor. It uses a box collider to sense when the FPS controller is close to the victim. After the FPS controller comes into contact with the victim, FPS controller receive points as well as health. After this process, the victim object is destroyed simulating that they were saved by the fire-fighter.

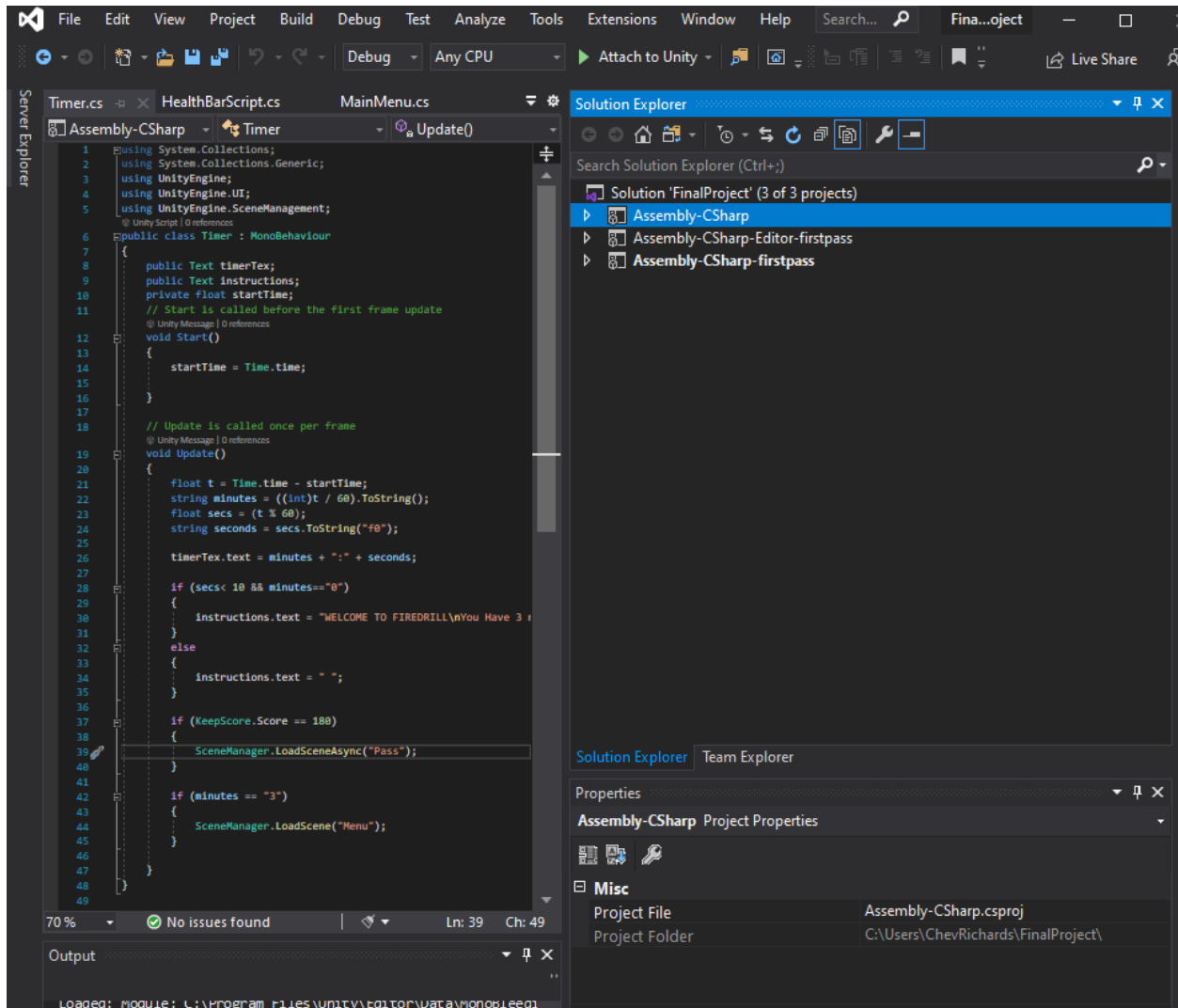
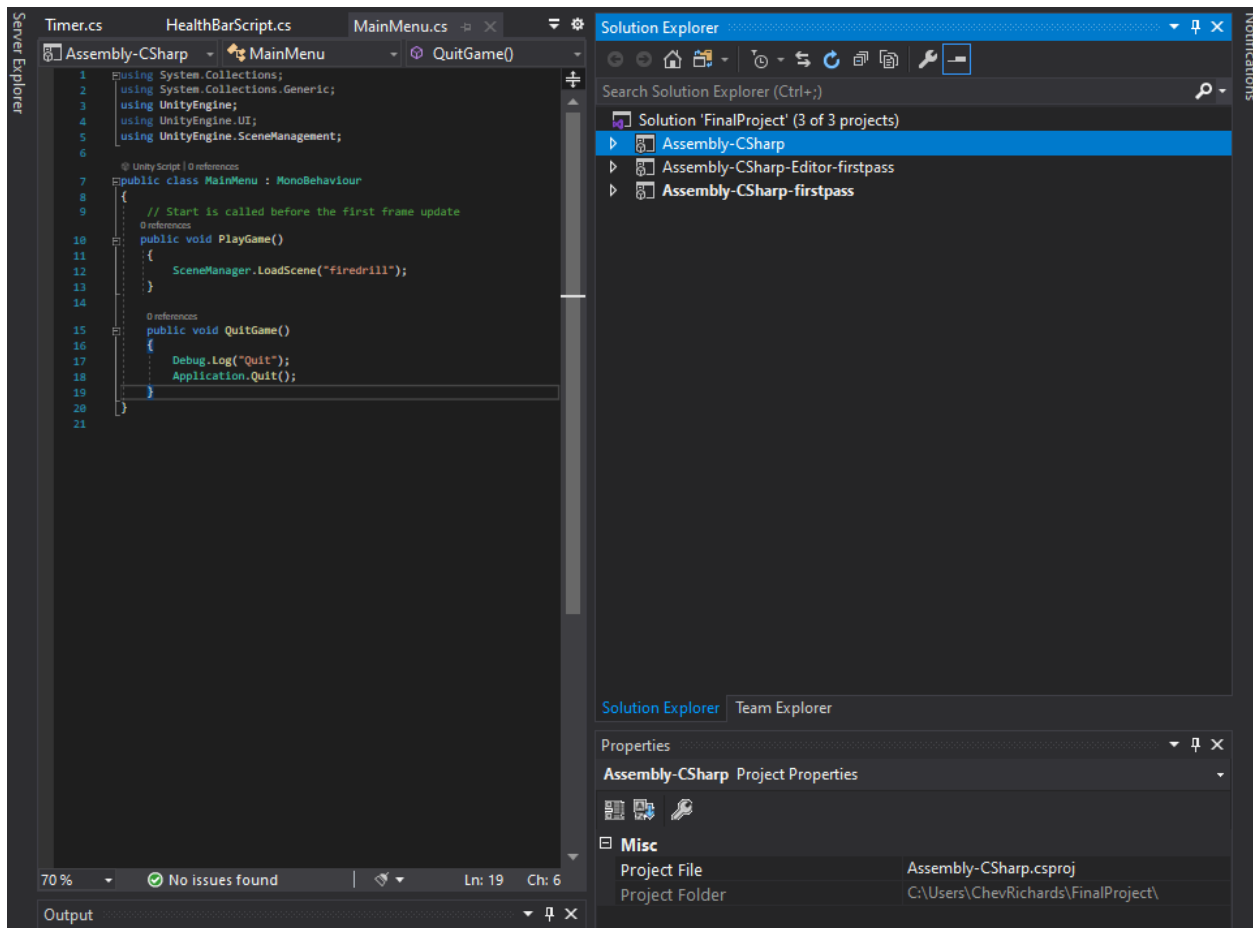


Figure 2.0 Timer Script

This script was used to create the timing element in the game. Once the time reaches 3 minutes the game ends. If the player saves all the victims (180 pts), the game will end with a congratulations certificate. Otherwise, the game returns to the main menu.

The script also controls the display of the gaming instructions and a welcome message. The message is displayed for 10 seconds then disappear from the scene.



*Figure 3.0 Main Menu Script*

This script was used to create the menu scene. It implements the Unity Scene Management library. The menu consists of two buttons, Play and Quit. Within the Play function, the scene manager loads the fire drill scene which is the interactive simulation of the fire fighter saving victims. Within the quit function, the application/game is exited.

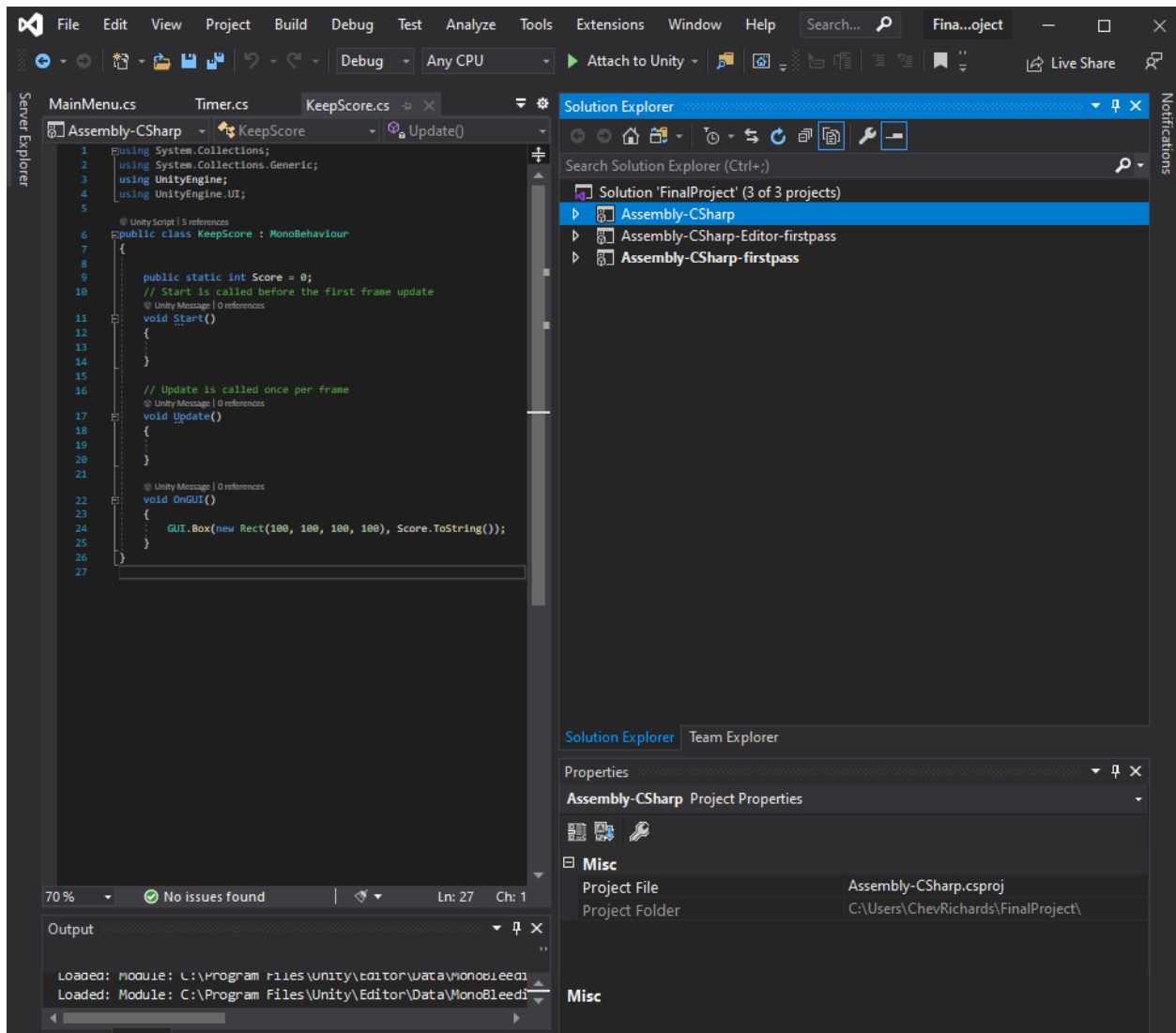
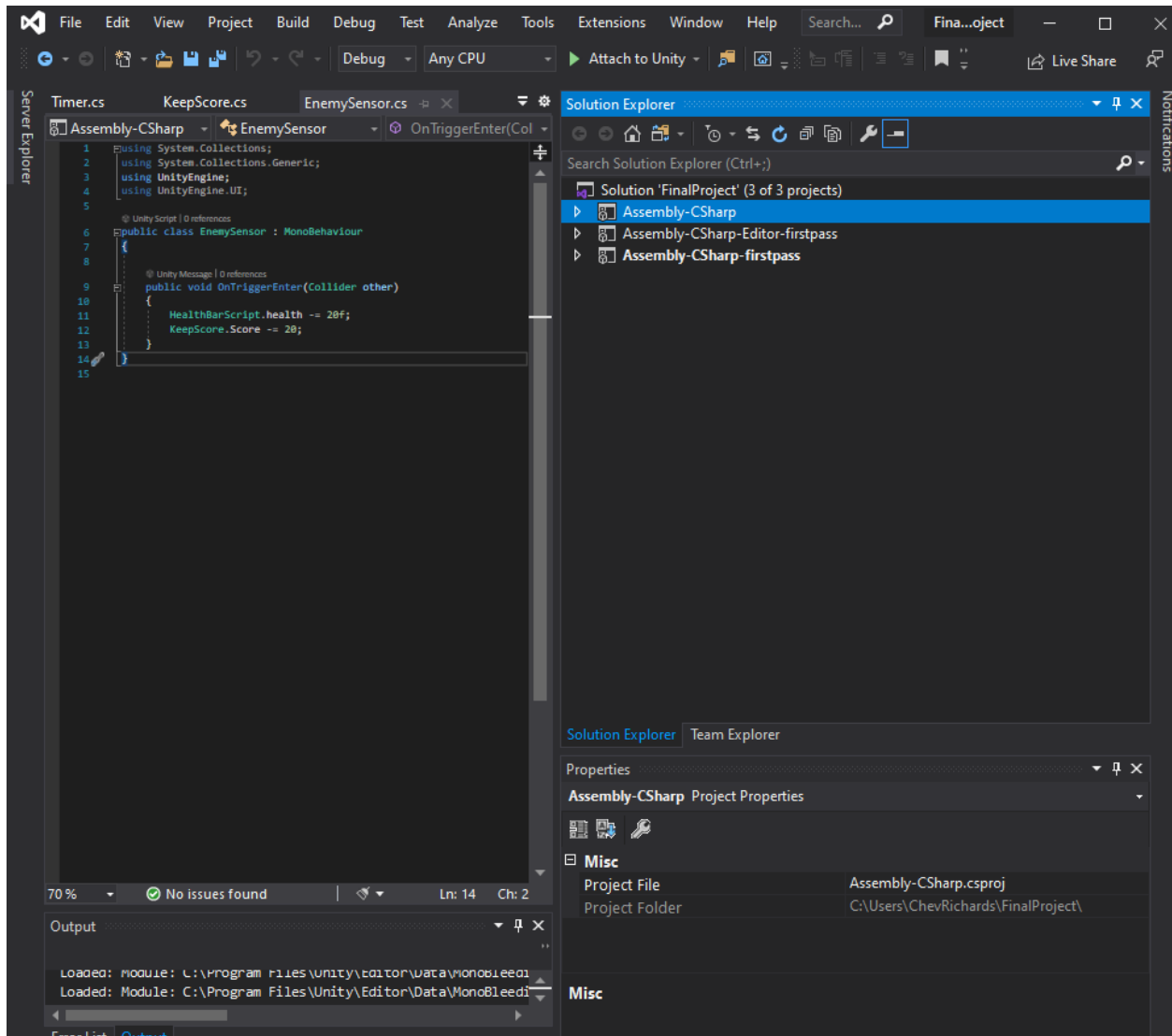


Figure 4.0 Keep Score Script

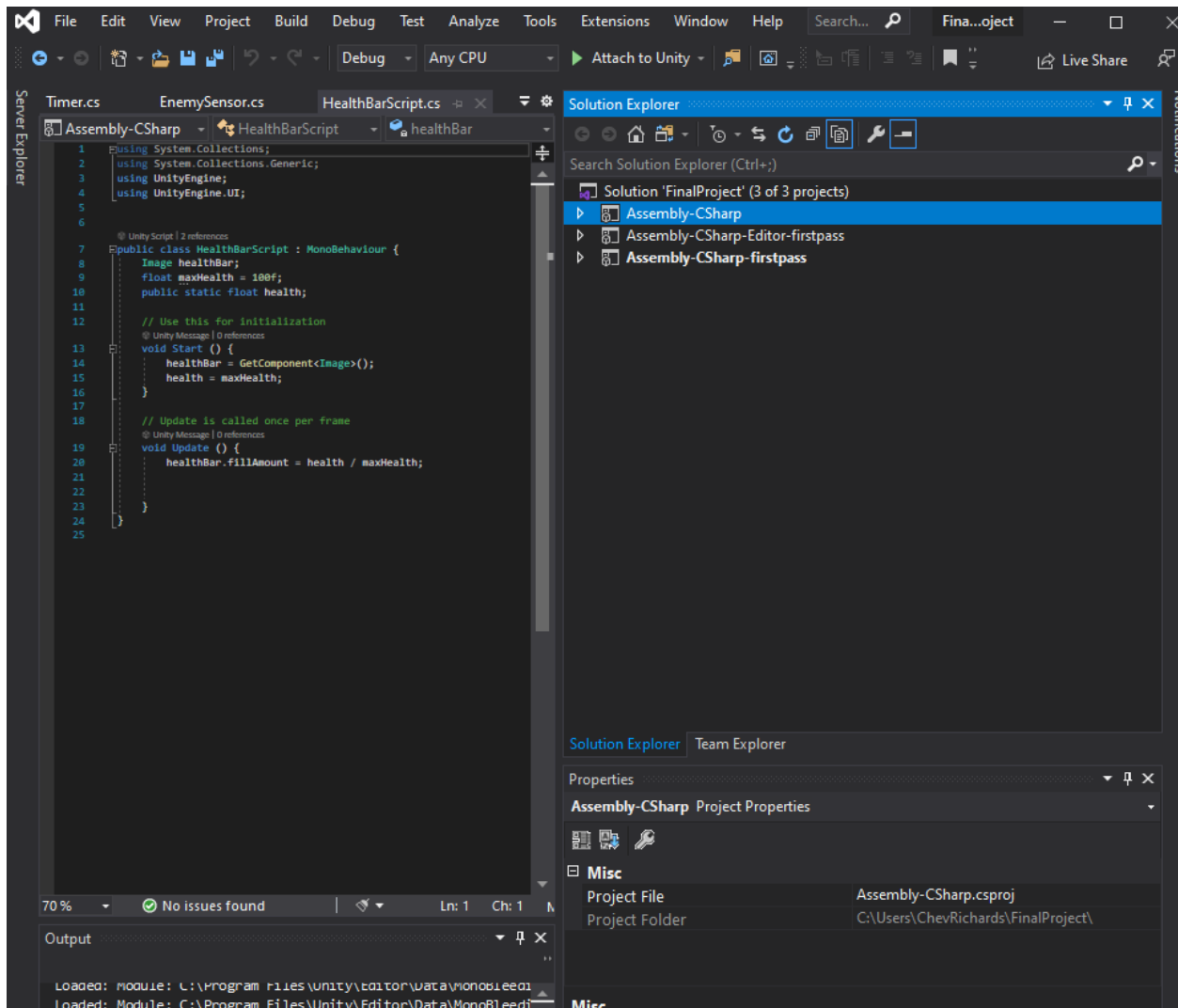
This script was used to create the in-game score board. This allows the user to see their score while playing the game. The score can be increase or decrease by 20 pts.



*Figure 5.0 Enemy Sensor Script*

This script is attached to the enemy (the fire). Once the FPS controller collides with the fire element, the player will lose health and point (simulating getting burnt).





*Figure 6.0 Health Bar Script*

This script is associated with creating the health bar UI. It uses two sprite images to simulate the increasing and decreasing of the FPS health.

## Functionality and Implementation

### Vision

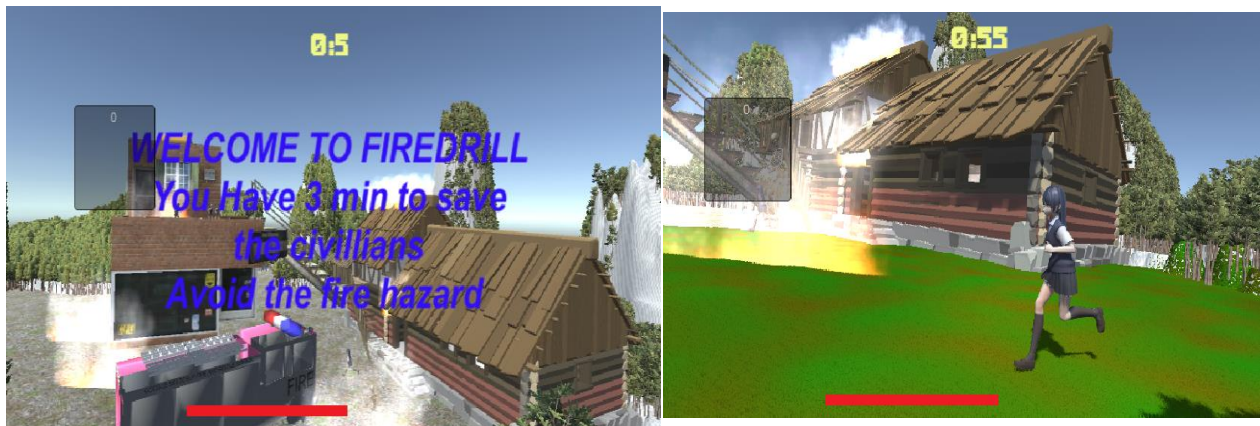


Figure 7.0 Environmental View

To make the environment more realistic, grass, mountains and trees were added. Also, several buildings were added to simulate a neighborhood. Fire truck was added to simulate that the firefighters arrived to the building fire using the firetruck. Fire was also added in several areas to simulate a fire hazard situation from an explosion. The fire is used as triggers in the game.

The game starts with an instruction that displays for 10 seconds then disappear. Victims can be seen running trying to get away from danger. The scoreboard is located to the left and the health bar is located at the bottom and the timer is located at the top.

### Sound

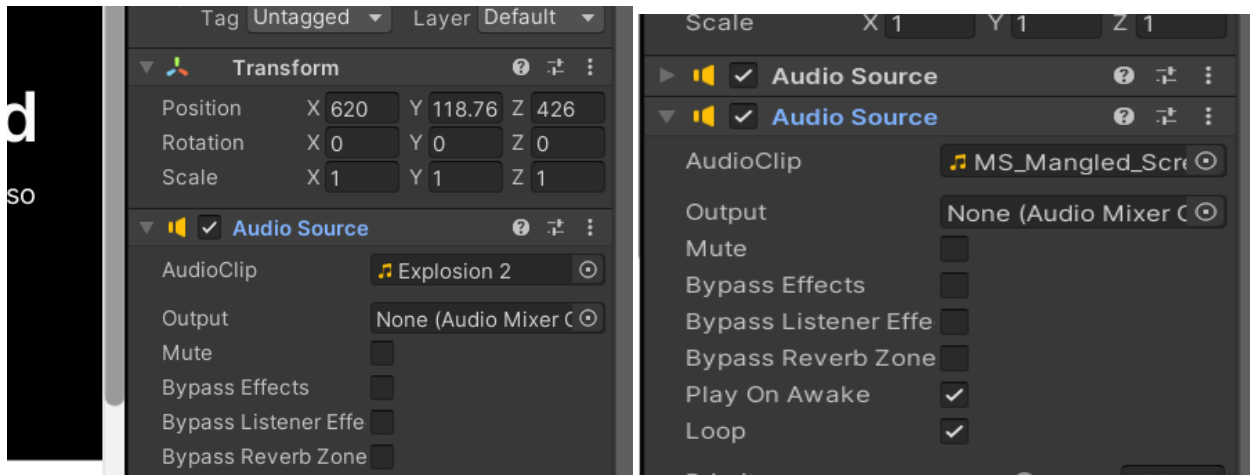


Figure 8.0 Audio Assets

Ambient sound of the Player walking and Jumping has been added to the game. Moreover, explosion sounds have also been added to simulate the fire hazard situation. Furthermore, people screaming sounds have been added to create a realistic hazardous environment.

## Animation

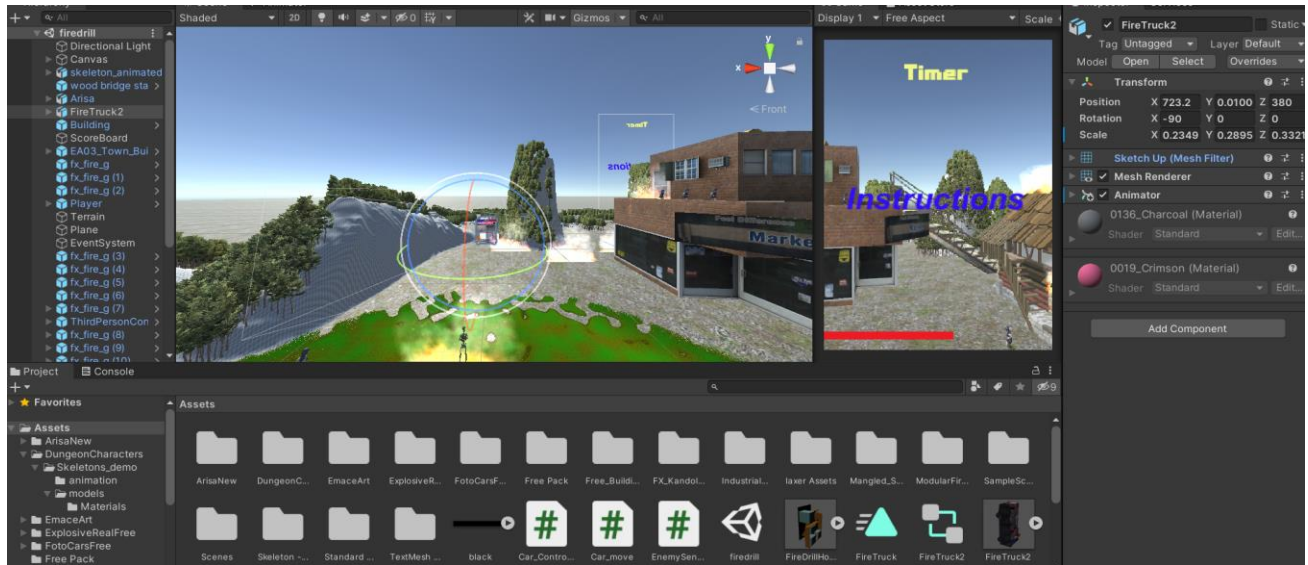


Figure9.0 Fire Truck Animation

A looping animating was added to the sketch up fire truck to simulate the fire fighters arriving. The fire has animations to simulate some and burning. The victim avatar all have running animation to show that they are fearful and trying to escape. The grass has animation to simulate them swaying in the wind.

## Interactivity

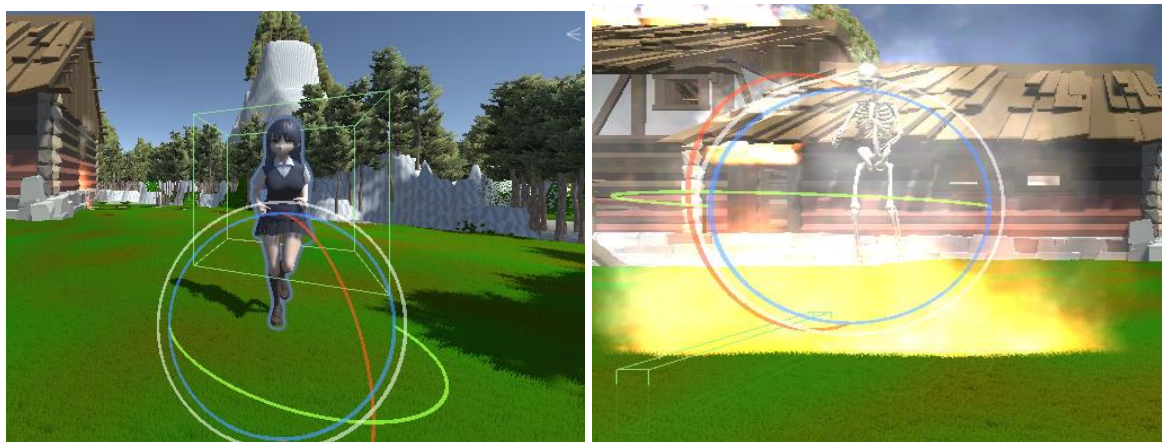


Figure10.0 Interactivity Objects

In terms of triggers, we have used the fire as a trigger in which if the Player goes very close to the fire the Player's health would reduce. Another trigger used is the victim trigger. When the Player goes close to the avatar which is the victim, the avatar would disappear which simulates that the avatar was saved by the Player and the health of the Player would increase at the same time whenever each victim is saved from the burning building.

## Sensors

**Time sensor:** added to this game mainly so that the Player could save as many people as possible within a short period of time. Because this is a fire hazard event, time plays a major role so the Player has to be fast in accomplishing his tasks.

**Score Sensor:** added so that the FPS player can see when they saved a civilian or being burnt by the fire. Score increases once a victim is saved and decreasing once they have entered into a blazing fire.

**Health Sensor:** added to show whether the FPS player is being harmed or not. Health increase when a civilian is saved and decrease when the FPS enters a fire.

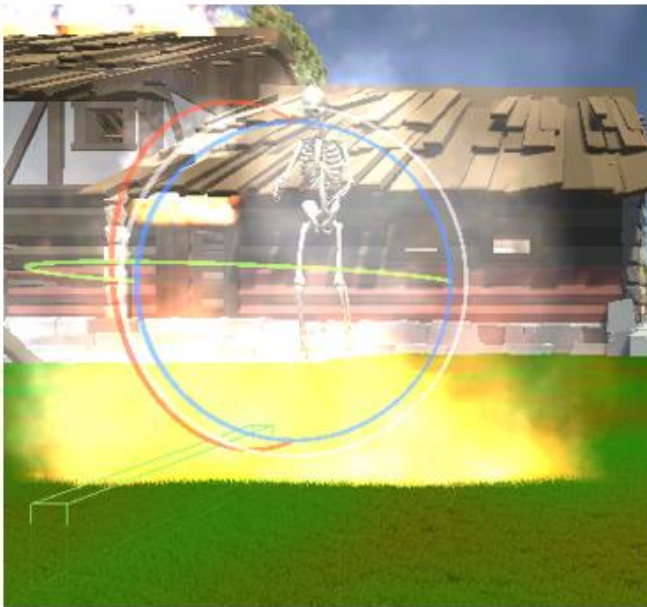
**Vitim Sensor:** adds health and score to FPS player

**Enemy Sensor:** decrease health and score for FPS player

## Avatars

Two types of avatars within the simulation are Enemy avatars as well as Victim Avatars.

Enemy Avatars has an enemy sensor attached while Victim avatars has a Victim sensor Attached.



Enemy Avatar



Victim Avatar

Figure 11.0 Enemy Avatar and Victim Avatar

## **Challenges Faced**

- Since we used Unity in creating the game, it was difficult to find some of the models that were needed because most of the models in the asset store was not free and you had to pay for it.
- The other issue faced was, when exporting certain models from SketchUp, the quality of the 3D models was not good, so it impacted the entire game quality
- Because of the time constraints, we were unable to add more features and animations to the game. A proper game creation usually takes more than one month to be perfected in designing. With the given time constraint, we were unable to add more interactive functionalities to the game.
- Since we are new to these 3D modelling software we had to work extra hard to learn some of the software functionalities by watching videos and reading external contents which took most of our time and energy
- Since the class was done virtually, we were not able to use the VR lab and there were some difficulties faced in using some of the 3D software since our computers were getting slower due to the installations done.

## **Future Improvements**

- Due to the time constraints, we were unable to add a functionality in adding a task list and once the firefighter finishes up a task a check mark would appear on the side of the task list and his points would increase. This would definitely be added in future improvements
- More levels to the can be added. Once the Player finishes one level the next level will be unlocked. That way, the Player would not lose interest in the game because different scenarios would be added to each level
- We wanted to add different level because we have the knowledge of creating and generating new scenes using the Scene Management library but time did not allow for that.

- Furthermore, if the game could be upgraded to the augmented reality version the Player would have a feeling of actually being in the hazardous environment and it would make the simulation of the fire hazard more realistic and exciting

### **Benefits of using virtual reality to implement this game**

- Can be designed in a way that it acts as a practical application, for example this firefighter simulation game can be used by new firefighters to learn about handling hazardous events and to build up their self-confidence
- It also provides the players with interactive virtual objects.
- It would give the player an experience and a feel of actually being in the virtual environment while playing the game
- Terrains and Textures that enrich the game environment and make it more realistic
- Gives the player an immersive experience