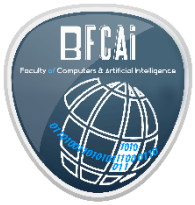

Faculty of Computers & Artificial Intelligence

Benha University

COVID-19 Desktop Game

A research project submitted
in partial fulfillment of the requirements for passing
the 2nd semester 2020 evaluation

In

Computer Graphics

by

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1. Abstract

Educational video gaming is a powerful tool in computer graphics. It can help a lot in the current quarantine. In this paper, we have introduced a desktop educational 3D video game that teach kids some instructions to take the necessary precautions during the period of living with COVID-19. The game was implemented using Unity3D platform. It can be run on Windows operating system. It is for a single player. The game put the player in some situations such: as sneezing, coughing or eating to teach him how to behave in those situations. There are two places in the game: the home and the city. When the player is at home, he can eat, wash his hands, watch TV, and move around in home. There are some situations happens and he can decide what to do in those situations. When the player is outside, he can move around in the city, but the enemy (COVID-19) chases him so, he should return home and stay at it to be safe. The enemy has 99 points so, the player should gain 100 points to win. The player gets more points when he behaves well. According to his choices, the points are calculated. The graphics and the animations are suitable for the age of a kid.

2. Introduction

At the end of 2019, COVID-19 (Coronavirus) was identified for the first time in Wuhan, China. During the past months, the world suffered from its impact. Many things in our life have been changed because of it. No treatment has been discovered officially until now so, many countries decided to live with the virus to reduce its impact on the global economy. It is hard to live with the virus so, people need to take some precautions to reduce chances of infection of the virus. The World Health Organization (WHO) offers some instruction that help people to take caution [1]. Reading those instructions may be boring for kids. They prefer graphical content over textual content. It is hard to convince a kid to read all these boring instructions so, we need an entertaining alternative method to teach him about Coronavirus. The picture is said to be more informative than speech. Here comes a turn of educational video gaming. It is a powerful tool to teach people how to do things in an entertaining and easy way. Playing is an essential thing for kids. It may be waste of time if the game is useless, but it remains an essential and important thing. Educational video gaming is useful and entertaining at the same time. A kid can invest his time to learn useful skills. Many schools rely on the graphical content to teach students in a fun way [2]. It is not only for teaching kids. Educational video gaming is growing more and more. It can be useful in various fields, especially during those difficult days. It can be used to teach students Math, Arabic, History, programming, as

well as, about the emergent virus. Video games makes the complex things easy. The main purpose of this application is teaching kids some instructions that can reduce the chances of being infected or spreading Coronavirus. These instructions are gathered from WHO website. This application can help a lot with kids. Instead of reading those instructions to them, the game teaches them some lessons in an entertaining way in the current quarantine. One more reason for developing this application is to test the extent of knowledge of kids about the precautions that must be taken to protect themselves and their loved ones. For example, many kids don't like to eat vegetables and fruits but, they are important to strengthen their immunity so, the game teach them to eat healthy food. Of course 3D objects is more realistic than 2D objects. For this reason, the game was implemented using Unity3D. It is a powerful easy platform for developing 3D games.

3. Literature review

3.1 Minecraft

Minecraft is one of the most famous educational games. It allows the player to build his own world using only squares [2]. The game teaches the player problem-solving, creativity, math, collaboration, self-direction, and more. Minecraft Education Edition is used in schools to teach the students some skills. It is written in Java language. It can be run on many platforms such as: Windows, Linux, Android, iOS, and more.

3.2 SICKO

Surgical decision-making is not easy. It requires experience, training, and many technical skills. SICKO is a web-based game designed to teach surgical decision-making [3]. The game improves the surgical skills of the player. The player takes care of many patients and he is responsible for treating them. It is a simulation of surgeons' real-world.

3.3 National Geographic Challenge

It is a challengeable quiz game [4]. It allows 4 number of player as maximum and choose your avatar. It tests kids' knowledge with multiple questions about countries in Continents of the world. It teaches students History and Geography.

3.4 Big Brain Academy

The game provides random puzzles and tests to improve some skills such as: thinking, problem solving, analysis, logic and memory [5]. After the test, the player takes a letter grade as an assessment. It is loved by kids and used in many schools to teach students valuable skills. It is a perfect game for teaching kids in a fun way.

4. Implementation

4.1 Story and Game Description

The game starts with the advice "Keep Distance". It is the first and the most important advice to tell. The enemy has 99 points and the player should get 100 points to defeat it. The player should follow the instructions to get more points. The play button starts the game. The sound button turns on/off sound. The exit button closes the game.

The second advice is to wear the medical mask to avoid infecting yourself and others. The cloth is doesn't protect people. The medical mask has 10 points, while the cloth mask has only 3 points. If the player chooses the cloth mask, a warning message appers.

Figure 1: (a) Game Menu and Advice 1, (b) Advice 2

The third advice is about washing hands before and after eating. The player chooses between washing his hands before eating or eating without washing them. If he chooses to wash them, he gains more to points, while if he refuses, he gets a warning message. The fourth advice is to wash hands with soap and running water frequently.

Figure 2: (a) Advice 3, (b) Advice 4

The fifth advice about eating healthy food. Healthy food has a huge impact on the immunity system [6] so, the player should eat only healthy food to gain more points. Eating healthy food has an important effect on player's points. The healthier food, the more points to gain. The table is full of food such as: fruits, vegetables, sweets, cheese, rice, meat and fast food. The player should eat fruits and vegetables to gain more points. After eating, the player chooses between washing his hands and using a tissue only. Washing hands has 10 points, while the second choice has no points. A warning is appeared when he chooses the second choice.

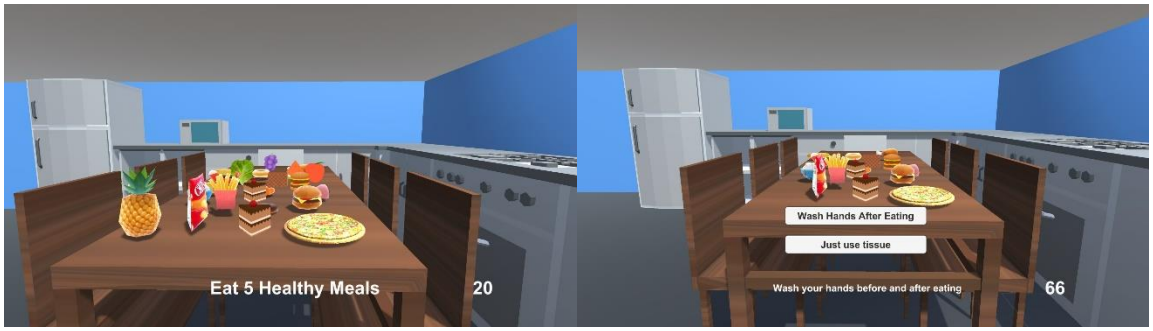

Figure 3: (a) Advice 5, (b) Advice 6

When the player coughs, he chooses between washing hands and doing nothing. Again, he should wash his hands after coughing. That is the sixth advice. Doing nothing is the worst choice. A warning message is displayed when he chooses the second choice.

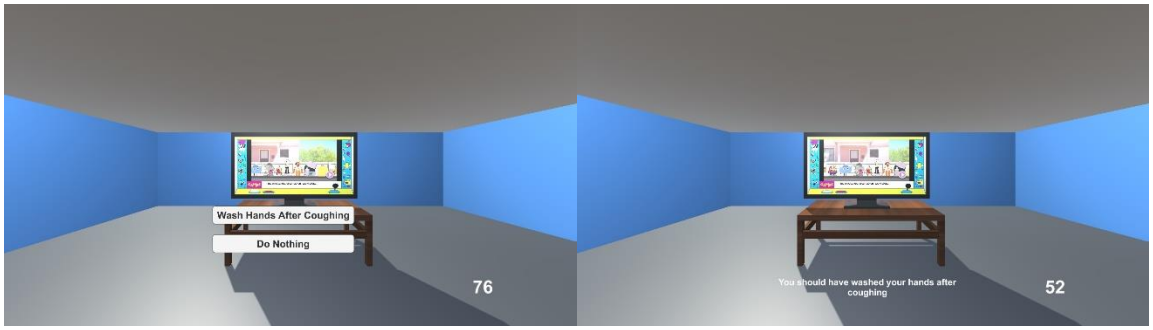

Figure 4: (a) Washing Hands Advice, (b) Warning Message

When the player is outside the home, he is in danger so, he should return home quickly before he gets sick. If he returns home safely, he gets more 35 points. The

seventh advice is to stay at home. That is a very important advice so, it has a large number of points. When he returns home, if his points is greater than or equal to 100 points, he wins. Certainly, the COVID-19 cannot be seen with the naked eye. It is exaggeration for illustrating the seriousness for kids.

Figure 5: (a) Stay at Home Advice, (b) Warning message

If the enemy catches him, he has two choices. The first choice is to seek for care. This choice will call the ambulance to come immediately to help him. The patient recovers not only randomly. He recovers also with his immunity and commitment with the previous instructions. His immunity and commitment are represented as the points in the game. If the current points are greater than or equal to 70 points and a random probability is greater than or equal to 0.4, he recovers with 25 points. Else, he doesn't recover and loses the game. The point of this level is to stay at home to keep safe and when you are ill, seek for care immediately. Those are the eighth and ninth advices respectively. The simple previous instructions can reduce the chances of infection.

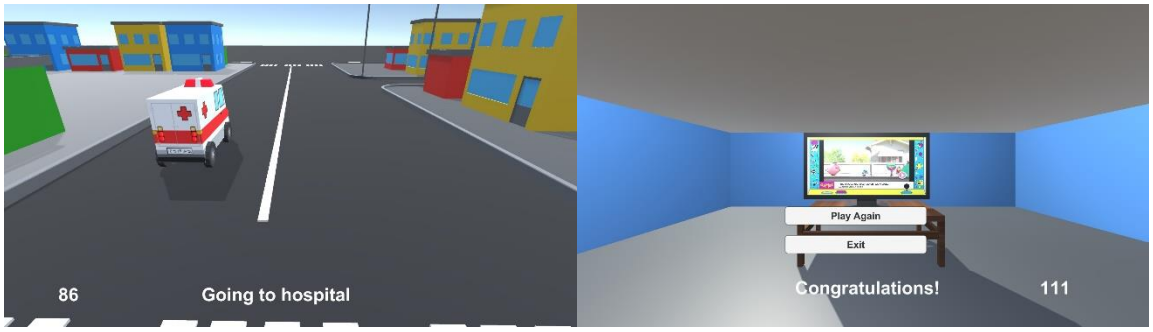

Figure 6: (a) Ambulance, (b) Congratulations Message

4.2 State Diagram

The following state diagram summarizes the described states of the player.

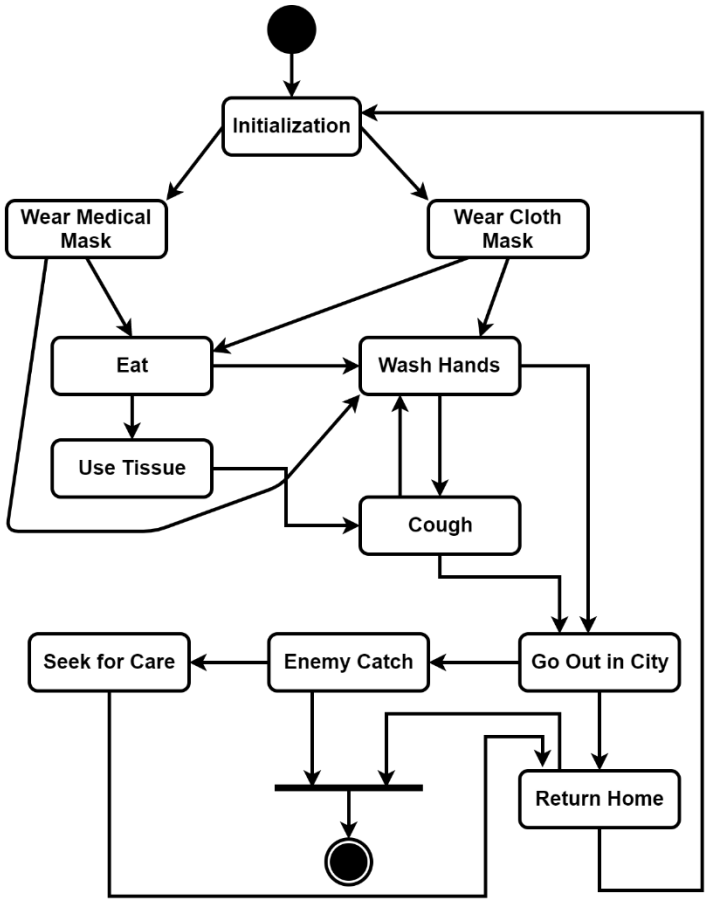

Figure 7 State Diagram

4.3 Cameras, Lights and Shadows

While washing hands, the camera is at fixed position and the player can't move it. While eating, the player is represented as a FPS controller. A mouse and keyboard can move it around in the home. While walking in the city, the player has the freedom to go wherever he wants and a camera follows him.

The previous figures illustrate the shadows of the game objects. Unity platform provides many types of shadows. Soft shadows provides high quality.

Directional lights and point lights are used to illuminate the scenes with different intensity amounts.

4.4 Scenes

There is a big city where the player can move around using keyboard arrows. The city is full of buildings, cars, trees and lights. Again, wherever he goes, the enemy follows him. The player can also move around in his home using keyboard and mouse. The city and home are downloaded from Unity free assets and modified to meet the requirements. There is also a scene for the menu.

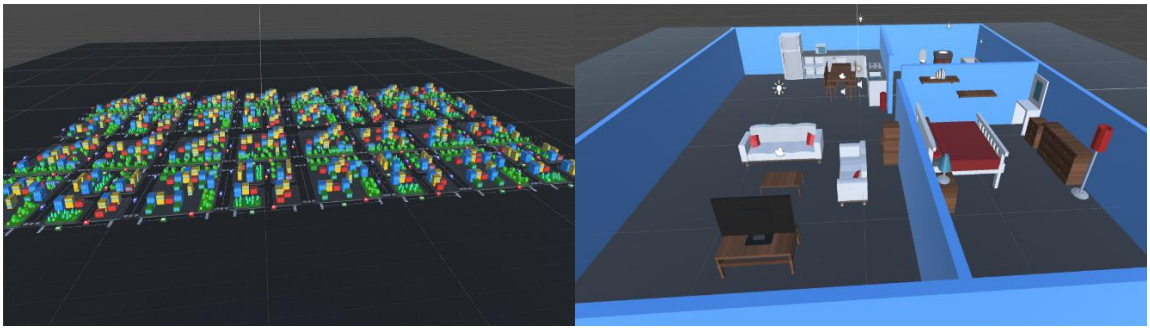

Figure 8: (a) City Scene, (b) Home Scene

4.5 Characters

The main characters in the game are the player and the enemy. The two characters' appearance are suitable for kids' age. The player's character is downloaded from Unity free assets. In some situations, the user can use the mouse and keyboard to move the player. The player can walk, rotate and jump. The enemy just follow him anywhere he goes to.

4.6 Animations

Unity platform provides many animations features. When the player calls for help, an ambulance shows up inside the game to transfer the patient to the hospital. Also when the player walks or jumps that is an animation.

4.7 Music and Sound Effects

The player can turn on/off music before entering the game. There are many sounds in the game such as: gaining points sound, coughing sound, eating sound, ambulance sound, and washing hands sound. Sounds are played when it is needed. The

water in figure I is implemented using particle system. It simulates water flow with appropriate real sound.

4.8 Scripts

The scripts are Witten in C# programming language. Each script is applied to an object or more to perform a specific function. The following scripts controls the game.

Table 1 Scripts Description

Script	Description
AmbulanceInGame.cs	Shows an ambulance when the player needs it.
CameraFollow.cs	Makes a camera follows the player.
City.cs, ToggleMusic.cs	Turns on/off the music of the game.
EatFood.cs	Assigns points to player when he eats.
EnemyMind.cs	Represents the mind of the enemy. His task is to follow the player wherever he goes to catch him.
ExitGame.cs	Exits from the application.
GameManager.cs	Manages the game by calculating the points scored by the player. It is applied to an indestructible game object. It adds, edits, refresh, and resets score.
HomeLevels.cs	Controls levels, tasks and objects in home.
JustLoad.cs, LoadNextLevel.cs	Loads and controls game levels.
MaskTask.cs, MedicalMaskPoints.cs	Assigns points to player when he wears a mask.
NullPoint.cs	Gives no points to the player and displays a warning message.
OpenWater.cs, WashPoints.cs	Controls water flow of the particle system.
PlayAgain.cs	Resets the game to play again.
ReturnHome.cs	Returns the player home safely.

4.9 Player

The game is designed for a single player. The player controls the character by using keyboard arrows and mouse as input devices. The following table describes the input buttons.

Table 2 Input Description

Key	Function
→	Turn right
←	Turn Left
↑	Walk forward
↓	Walk back
Space	Jump
Left mouse click	To select options

4.10 Tips and Messages

The player is given advices and instructions to choose the right choice. If he chooses the wrong choice, a warning message is displayed to teach him a lesson.

4.11 Block Diagram

The following block diagram illustrates the components of the game.

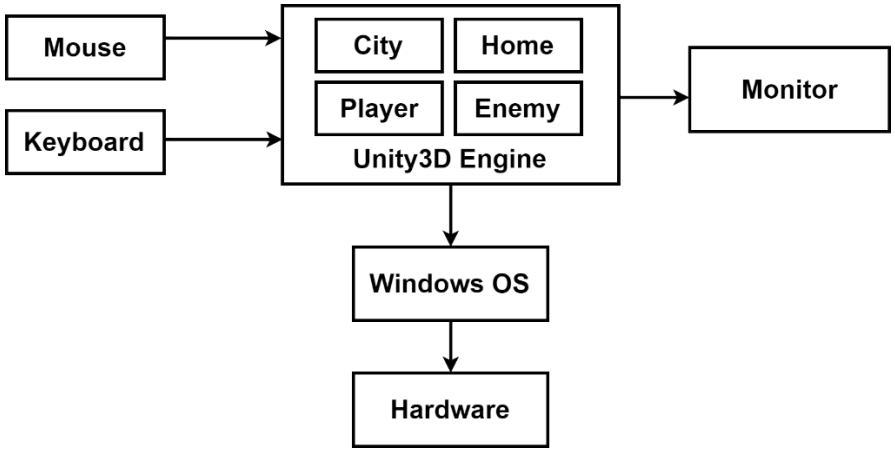

Figure 9 Block Diagram

4.12 Game Download and Configuration

You can download the game from https://bit.ly/2XJFrwU

You just download the game and open play.exe to select your configurations and start playing. Unity3D provides selecting screen size, graphics quality (very low, low, medium, high very high, ultra) and input buttons to fit many computers.

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