

MULTI-USER VIRTUAL REALITY ENVIRONMENT FOR RESPIRATORY THERAPY FOR COVID-19 PATIENTS

By:

Veronica Boateng

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OVERVIEW

- The project will create a multi-user virtual reality environment simulation for respiratory rehabilitation therapy for COVID-19 patients
- The project will show the respiratory rehabilitation training exercises videos and rehabilitation exercise practice for COVID-19 patient in a clinical environment



Goal and Objectives

- The aim of this project is to develop a simulation environment which can be used as a respiratory rehabilitation training on respiratory function for therapists and COVID-19 patients with for faster recovery and integration into the society.
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- To utilize the capabilities of unity3d multi-user virtual reality and forge networking development environment to develop an application that could be used by coronavirus patient's timely recovery.
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- To use technology to contribute to a societal need of speedy recovery of covid-19 patients.

Benefits

- The application can be used by the clinical therapy staff training recruits at rehabilitation centers
- The application can be used by the covid-19 patients for self-training on breathing techniques and exercises to improve their immune system for speedy recovery
- To use technology to contribute to a societal need of speedy recovery of covid-19 patients.

Modelling



Modelling

- **Main Building:** - Covid-19 Rehabilitation Center one-level building structure with sliding doors where patient training activities will occur. Other buildings in the environment will mimic the hospital complex buildings.
- **Roads-**
- The environment has roads and traffic joints for access into the buildings in the environment.
- **Carparks:**
- There are three car parks for parking before entry into the buildings on the hospital complex.
- **Medical Equipment:**
- There are temperature guns used by nurses, medical desks, medical beds, medical chairs, computers devices used by medical staff.

Modelling

- **Television Monitor:**
- For display of respiratory therapy video
- **Three Therapist Men:** - Observes patients whilst performing exercises, access the respiratory function of patients in the care room and train patients on body exercises.
- **Three Nurses:** Interacts with patients and check body temperatures.
- **Five Patients:** - One being accessed by a nurse before the therapy session, one whose temperature is checked, one undergoing the exercise, one watching video and practicing exercise movements.
- The patient practicing exercise body movement is a multi-player controlled patient.

Modelling



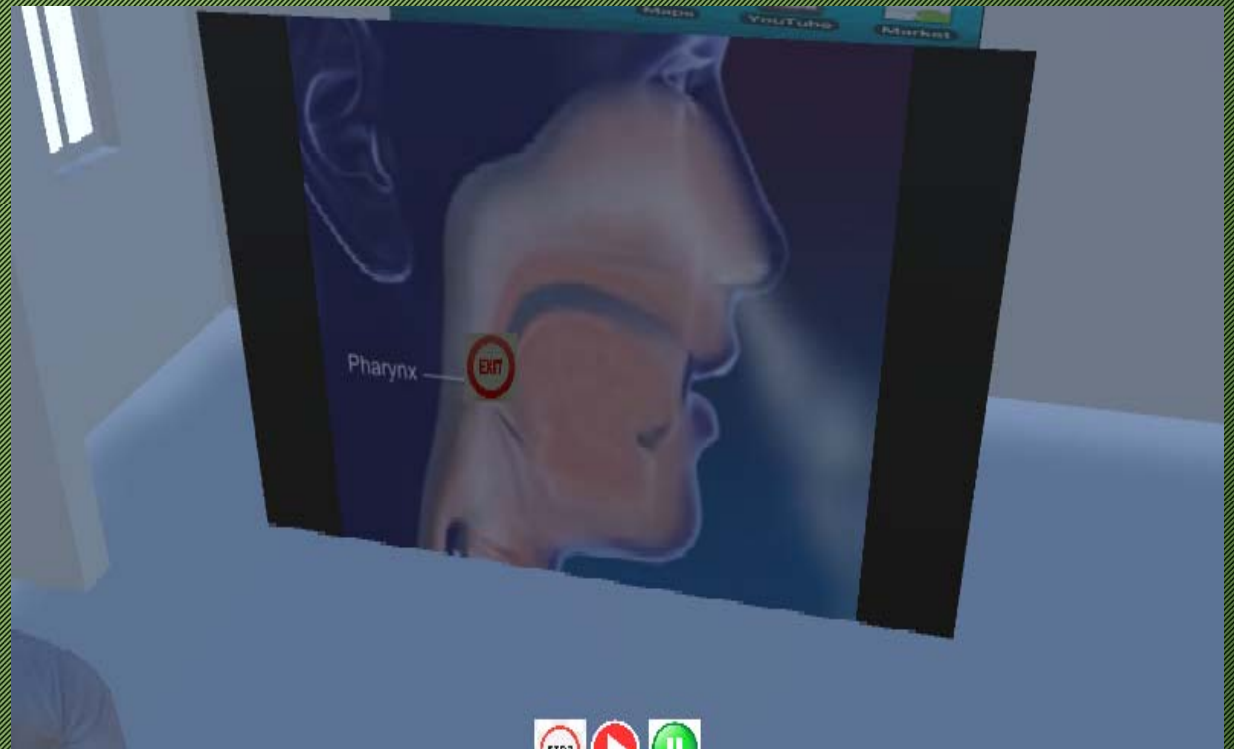
Operations Simulated - Performed Exercises

- Patient performing full body exercises before respiratory function checks are performed. Patient jumps, moves in various positions whilst being observed by therapist.



Respiratory Video Content Display

- Content on respiratory function and exercises that produces benefits in the immune and defense system of the human body. This includes body movements and breathing techniques with alternate depth of breathing to move mucus from small airways at the bottom of the lungs to bigger airways.



Practicing Body Movements

- Patient undergo exercise movement practices.
- The movements includes left, right, forward and backward moves whilst being observed by the therapist.



Patient and Nurse therapy assessments

- Nurse interacts with patient after which patient stands to perform initial breathing techniques before the therapy session.



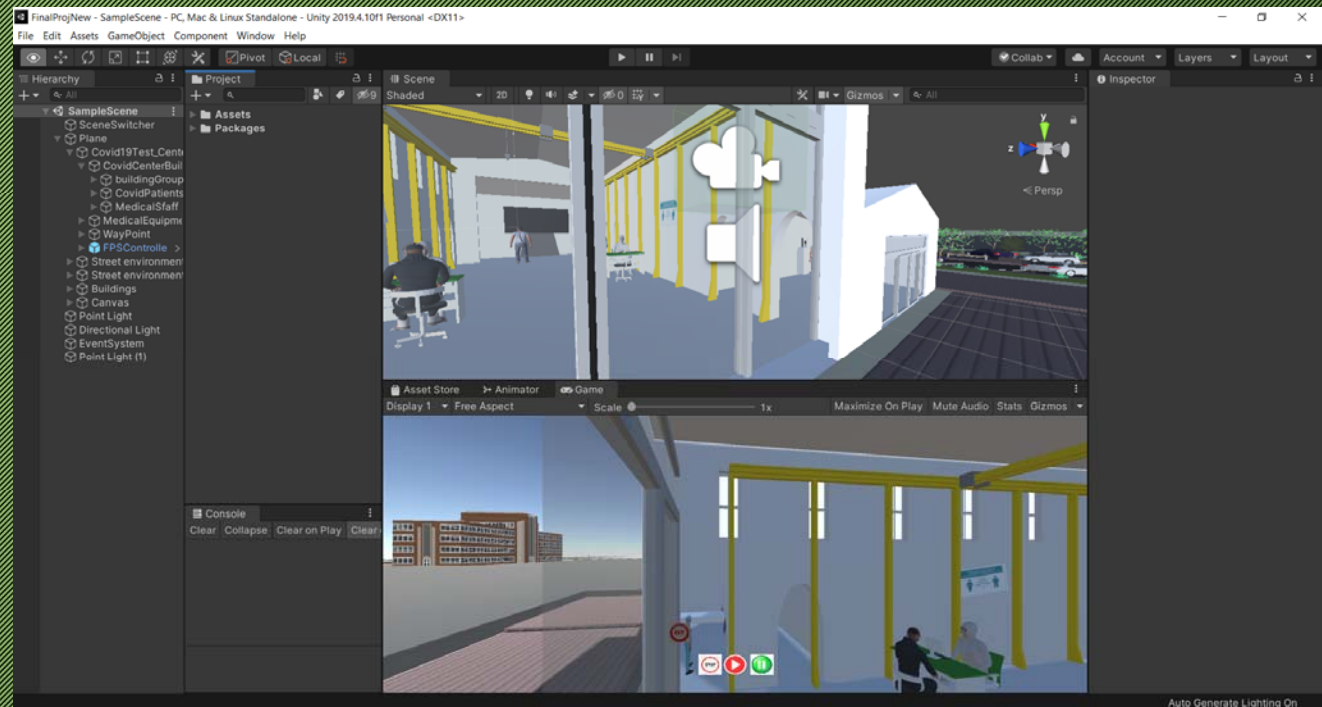
Breathing techniques observatory room

Doctor interacts with patient after performing exercise and observes breathing function of patient.

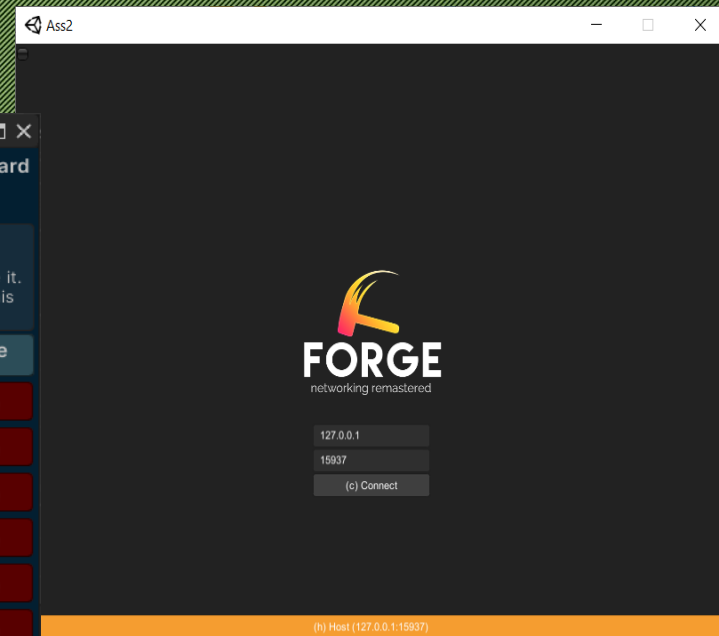
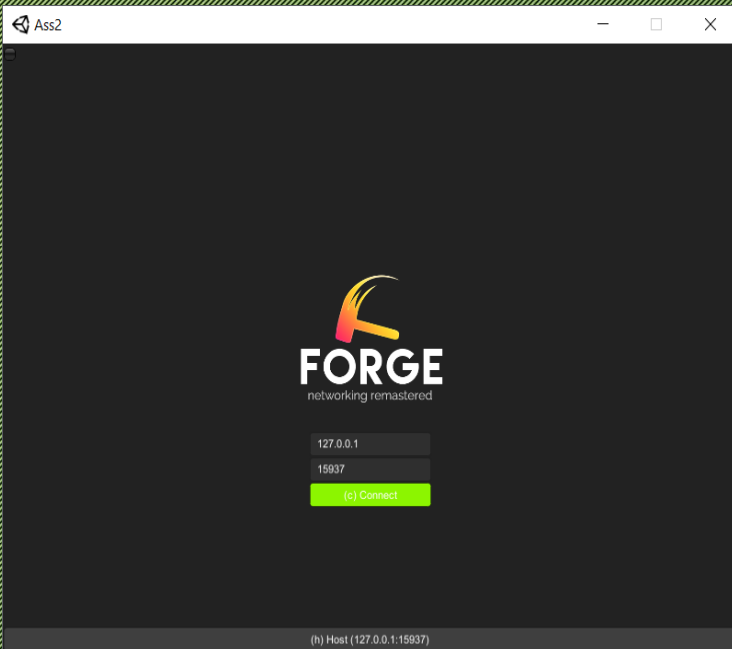


PROGRAMMING

- The simulator was built using Unity3D 2019.4.10f development engine with the C# programming language and Forge Networking engine to handle host or server and client connection for the multi-player environment development.



PROGRAMMING



FUNCTIONALITY

- **Sound** - There is a sound of the video playing. There is also the start, pause and stop buttons to play video.
- **Interactively** - The user starts stops video and navigate environment
- **Animation** - Animations in the virtual environment include therapist movements, patient movements.
- **Vision** - Models from Google Sketchup, Cgtrader and 3D Max where included in the environment.
- **Avatars** - 3 Therapists, 3 nurses, 6 covid-19 patients
- **Sensors:** Implemented is proximity, touch,

Control Keys - Flight Controls

- Vertical
 - Increase/positive: key code Up ↑
 - Decrease/negative: Key code Down ↓
- Horizontal
 - Increase: Key code **A**
 - Decrease: Key code **D**
- Yaw
 - Left: Arrow left key ←
 - Right: Arrow right key →
- Throttle
 - Increase: Key code: **W**
 - Decrease: Key Code: **S**

Flight Controls - Continue

- Restart
 - Key Code: **R**
- Light - Daytime/ Night-time
 - Key Code: **L**
- Flaps
 - Down: Key code **F**
 - Up: Key code **G**
- Engine Cutoff:
 - Key Code: **O**



•THANK YOU