# Virtual Reality Emergency Room Surgery Simulator for Medicinal Learners

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### *Abstract*

*The Emergency Room Virtual Reality (VR) simulator games are growing day by day. The System will create a graphical representation of the emergency room and surgeon simulator type experience. As most of the surgeries that are carried out by doctors are either life-threatening for patient and might lead to the death of patient. It is very costly and is particularly not possible for the hospital to have a body that they can be used for beginners like surgeons, dentists, and any other field of doctors, to not possibly make a mistake that can be very dangerous for serious patients. The System simulator creates a realistic depiction of how situations might take place in real life and how the decisions are made which will provide trainee doctors and beginner doctors with the experience required to carry out a successful surgery and will assure the patients' safety.*
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*Keywords: Surgery, Simulator, Patient, hospitals, training.*

## 1. Introduction

ER/VR is used to escape reality and enter into the graphics world which lets you have control over the environment elements and makes you feel like you are present there realistically. The VR surgeon simulator helps to create a real-world scenario where a doctor is provided with a patient to take out the required surgery. The players (surgeon) are provided with the required tools of surgery and are provided with a graphical human body to which the player(surgeon) will use to carry out the surgery. Throughout the gameplay, you can interact with the environment and the tools given in the VR surgeon simulator, which will depict the real-world environment to make the players (surgeon doctors) feel that they are carrying out real-world surgery of a patient. The quality of Surgical Instruments includes Scissors, Forceps, Clamps, Needle Holders, Electrodes, Knives, Blades, Retractors, and Fiber Optic Headlights [11]. This surgery instrument is already provided to the surgeon so that the surgery can be taken out with ease. The ER/VR gives the surgeon certain objectives to be completed so that the surgery can be successful. From checking to dissecting everything is done by surgeon in the Virtual Reality simulator. Based on the certain objectives that the surgeon has to complete the game will progress ahead and give the player the next required objective until a full surgery is carried out. After completing all the objectives the surgery will be completed and the surgeon will be provided with the score and data that will help them to analyze where they make their mistakes and what are the consequences for commending those mistakes. This End score data will help the surgeons to brush up on their mistakes and decisions so that it won't be carried onto the real-world surgery.[8]

## 2. Problem statement

*Surgery is very sensitive, delicate, and needs a lot of precision and patience to carry out. A small mistake can gamble with a patient's life. Surgeons need to be careful about small details and the level of precision and the time required to make quick decisions. This simulator helps them to refurbish their skillset in that field.*

## 3. Existing system

There are various types of VR and AR games and entertainment media present in our generation today.[7] The ER/VR is now also used as Simulation for training students from various fields. Doctors who are pursuing their career in surgery or in different doctorate fields use the Simulators which help them to gain access to the tools which are required or are out of their reach for taking out surgery. So basically Surgery Simulator creates various types of Surgery Scenarios which help Student Doctors and trainees to carry out their surgery without any worry.[1][6] As it is not feasible for hospitals and colleges to afford a dead body as it is very expensive and is not easy to find. And one cannot perform multiple surgeries on patient's body parts for multiple times. To ease out this burden from colleges and doctors, ER/VR helps them to Train the trainee and Students of colleges to perform their surgery without worrying about the dead body and mannequin to use multiple times. As players can perform surgery related to the specific body parts in simulator multiple times.

## 4. Proposed system and Methodology

The ER/VR surgery game is used to build to help the trainee and student Doctors to brush up their skills in a particular field they are pursuing.[10] This helps them to gain knowledge and do the practical execution at the same time. It will also give them a boost to perform quick decisions during emergency scenarios, where you have to make quick decisions about a particular operation while carrying out any surgery. It will contain all the different types of surgeries combined in one game but are allocated different slots in-game, which will be able to differentiate the different types of surgeries and operations that a player can carry out in-game. For Example, if a dentist wants to use the simulator game to carry out the dentist's work rather than to open a new game it will be available in this ER game simulator. The player(surgeons) will be provided with brief information about how the game plays its mechanism and its objective's depending on which Operation/Surgery the player(surgeon) has chosen to do their practice. Each scene and gameplay will be different as it will reflect on the choice's player made while Choosing his gameplay styles. The field, Room, gameplay, objectives everything will be changed depending on the Operation/surgery the player has chosen. The required toolkit and Information will be provided while carrying out any surgery. This will help the players to progress towards their objectives. And the players will have warning for taking any wrong action and the objective of the game will fail and game will End.[9] In the end, the summary of the operation/surgery carried out by the players will be displayed. What mistakes have been done and what should the player avoid while doing any surgery so that it won't reflect on a real-life Scenario. They can replay the game again to practice and correct the mistakes they had done on previous gameplay, which will help them to understand the dos and don'ts in such situations. And will also help them practice to improve their skills as they don't have to worry about being using the same body over and over again for different operations. And as it is graphically represented, So even if they commit a mistake it won't be life- threatening for the patient, and they can replay the same game often to become pitch-perfect at their work.
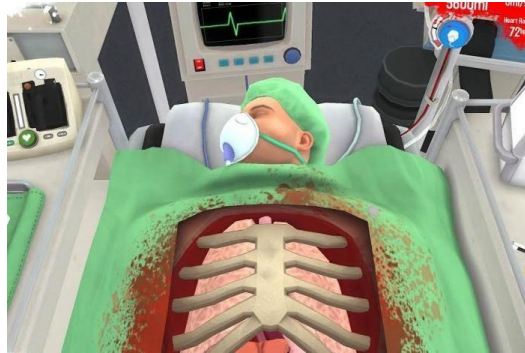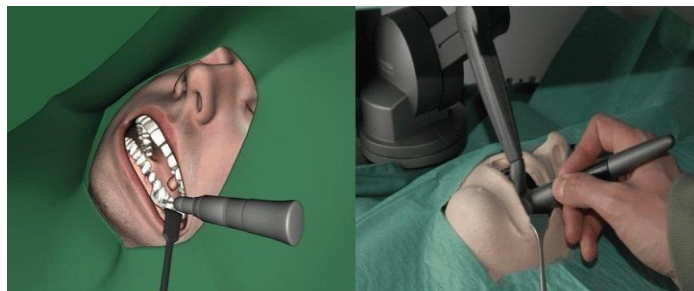
**Figure 1. Heart surgery simulator [6] (Source-Google)**



**Figure 2. Dentist Simulator [6]**

## 1. Scope of Proposed System.

a) The Trainee doctors and students will be able to learn and practice their practicals.
b) It is quite feasible as they don't have to worry about the real body.
c) It's a one-time investment and is within everyone's reach.
d) It doesn't require a huge amount as it is affordable at a favorable price.
e) It can be replayed again and again without worrying about the same body being used.
f) It gives great knowledge and is available at any time to use.
g) It is easy to learn and execute and is very informative.
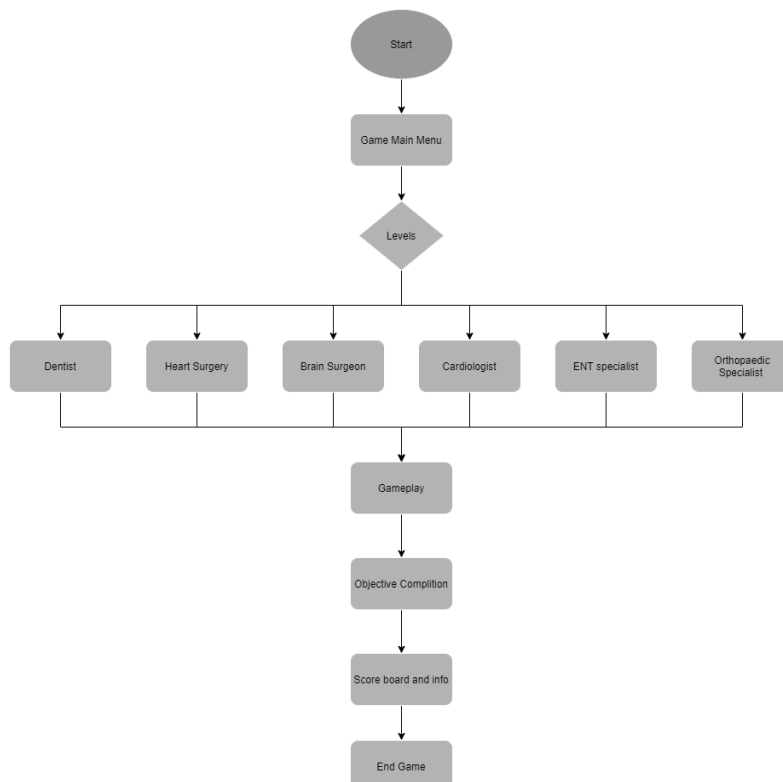
**Flowchart**

**Figure 3. Game Flowchart**

## 2. Technologies used and their Description

a) VR headset such as Oculus rift, HTC Vive, Dell visor, etc. are needed to play the ER/VR surgery game.[1]

b) For the development of the ER/VR surgeon game Unity Engine, Unreal Engine, and Android Studio is used.

c) Unity engine: The development of this VR game can be carried out in the Unity engine providing the assets and coding related to gameplay and design. It is quite simpler compared to the Unreal engine as unity is user-friendly and its interfaces are simple to understand and the coding part is done using c# language.[2]

d) Unreal Engine: The development of this ER/VR game can be carried in unreal too. The required assets can be produced in the game engine or can be imported using ay other application. It is quite complex than unity and its interfaces are a little bit difficult to understand. The coding part is done using c++ language.[3]

e) Android Studio: The development of the Simulator game can be carried out in the android studio as well with the help of SDK's, it is beneficial for mobile users also, assets are created in other application and are then imported into android studio for use. The coding part can be carried out in java and IOS (in objective-c) language.[4]

## 5. Conclusion.

In this proposed work, a successful ER/VR game for students and trainee doctors were made, to give them knowledge about how surgery operations are carried out. So that they can implement this knowledge in real-life world and bear fruitful results using it. As it is a repository of knowledge that gives the students and trainee doctors the freedom to practice and master their skills. As it is affordable by hospitals and universities to give newcomers an idea of how an operation works and how it is carried out.

The Software Virtual reality Simulator games will also have future updates it might be about the game mechanics or about the in-game knowledge the game provides.[5] It will be upgraded gradually as any further changes come to the study system or any bug fixes that might help to renovate or improve game insights.

## 6. Future scope.

In the future, Augmented Reality/Virtual Reality will take a leap towards providing knowledge and training in various fields. This System will be used in many universities and working areas so that they can give a brief and detailed idea about the concepts.[8] They can experience the unexperienced reality that is difficult to reach. Most people will adopt this technology in near future to simply understand and gain knowledge about how the world works and experience what is not within their reach to experience in reality. Any new ideas and updates can be appended to this so that it will be available for everyone who possesses this VR set in the future. Gameplay improvements, knowledge improvements, graphics improvements all can be done in this Simulator game. To make the experience more refreshing and detailed.

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**making it possible bringing this in light. It was a great journey to learn and explore new things that will now always be blessed in my mind and memory.**

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