# Final Summary: Virtual Reality Surgery Simulator
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Project Description

The goal of The Virtual Reality Surgery Simulator is to produce higher quality surgeons and improve the overall success rate of surgeries by providing our product as supplemental training to surgical residency and fellowship programs. Surgical residents and fellows will be able to practice and perform a variety of surgeries and manage surgical complication through the product's interactive virtual reality simulations.

Use Case Diagram
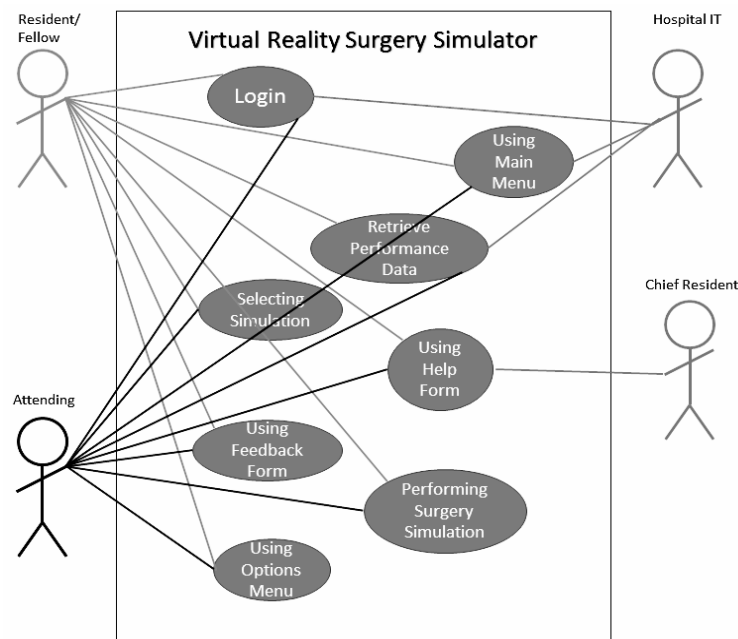
Key Functional Requirements

- The system must display a main menu with the following menu items: Surgery Simulations, Performance Data, Options, Help, Feedback, Exit.
- The system must display all available surgeries and a description of each surgery to the user.
- The system must be able to determine the correct output given the user's selected tool, location of interaction, and motion (i.e. performing incision on patient's chest with scalpel).
- The system must be able to introduce a complication if the option was chosen before the simulation was loaded.
- The system must display vitals of the patient on a virtual monitor.
- The system must be able to compute an evaluation score based on data captured during the simulation.
- The system must save the score and other data to the database.

Key Nonfunctional Requirements

- The frame rate for graphics for all surgery simulations must be a minimum of 90 frames per second to maintain seamless continuity. All interactions between the user and the automated system during a surgery simulation shall have a maximum response time of 0.1 seconds.

- The graphical construction of the human body will be at least 95% accurate in terms of the anatomy of a real human body.
- The product shall be available for use 20 hours per day, 360 days per year.
- The system should be used for a minimum of 10 years.
- The GUI must have a similar look and feel as the ACGME website.
- The product shall be distributed as a PC with software pre-installed, keyboard, mouse Oculus Rift headset, and virtual reality handset.
- Software updates will take place automatically without the assistance of a user according to a predetermined schedule set by the hospital IT team via wireless internet connection.
- The product shall be developed according to the agile method: Dynamic Systems Development Method (DSDM).

Select Design Goals
- **High Performance**: Surgery simulations should be seamless and highly responsive.
- **Accuracy**: Surgery simulations should be as close to reality as possible.
- **Ease of Use/Remembering/Learning**: Users should be able to navigate and access all menu options (i.e. simulations, data, etc.) without any support. Also in line with accuracy, since the product should be as close to reality as possible, residents and fellows should be able to perform surgery simulations with less than one week of training and minimal to no support thereafter.
- **Modifiability**: The surgery simulator should be modifiable to easily add new surgery simulations, surgical tools, and performance data metrics.
- **Reliability**: Our data backup should be fault tolerant to simulation failure and database backup link failure.

Test Plans
Our software development team will be testing most of the requirements necessary to provide the best product to our medical professional in training. Some testing requirements will be left out due to feasibility, cost or time constraints. Our test development team will work on some tests independently such as performance tests. On other tests, they will develop them with the help of the surgical and anatomy consultants to meet our accuracy requirements such as virtual body construction or surgical procedures. Our testing team will employ a variety of testing approaches including functional testing, unit testing, and integration testing. Testing will be an ongoing process since surgery simulations will continue to be updated or new ones added over the life of our contract.

Key Project Issues
- In reference to off-the-shelf solutions, we will be using data from The Visible Human Project and other virtual reality products such as The Body VR, Anatomyou, Inside the Human Body, and VirtaMed to help in the graphical construction of the virtual human body.
- One of the challenges our product faces in its integration to surgical training programs is the time limitation. Residents and fellows are already extremely busy and it will be difficult to make our product a regular part of surgical training.
- We must create an interface with current database system to provide our data to the hospital. We must also modify existing reports to include resident simulation data where needed.