Development of a Virtual Platform using Haptic Devices for Surgical Training

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Introduction

Today medical students play an observer role in hospitals during their training. On the other hand, the practice is very important for a surgeon to be successful during surgery in the operating room but the cost is too high. Surgical skills are usually evaluated subjectively in relation to the operating room time activity that the physician has, especially when assessing the capability and experience of a surgeon. Hence the importance of providing tools to make training better and simulate the various surgical processes. To address this dilemma, the research has been aimed to develop a virtual reality (VR) platform using haptic systems for planning, evaluation and training of surgical operations.

Main objective

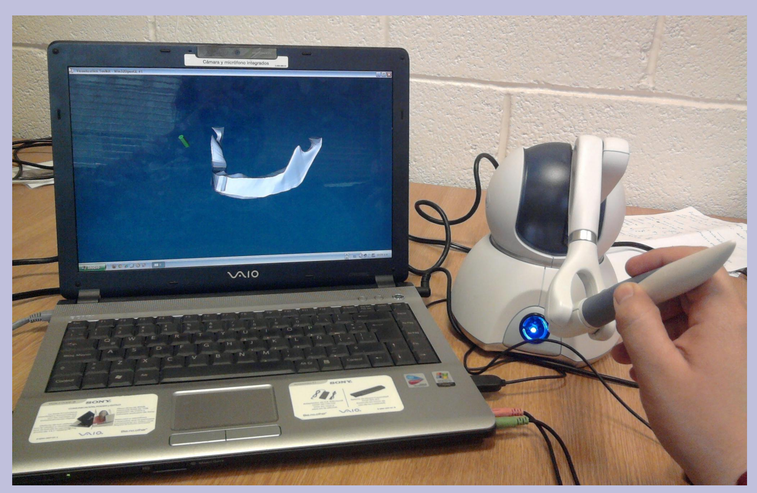
The purpose of this project is to develop and investigate a system of virtual reality (VR) using a haptic system for training of surgical operations, which will use the properties of the haptic system, particularly the sense of touch, to achieve a virtual surgery.

Virtual Platform

The term haptic refers to everything referring to the touch, haptic interfaces typically stimulate the sensory channel of touch via a force feedback. Thus a "haptic system" refers to devices that allow a user to touch, feel and / or manipulate objects in simulated environments and virtual environments.

The virtual environment is developed using C++, VTK (The Visualization Toolkit) libraries to control the display of 3D objects and H3DAPI (Open Source Haptics) haptic. In addition, the platform supports the use of different haptic devices such as "SensAble Phantom Omni ™" or "Novit Falcon ™"

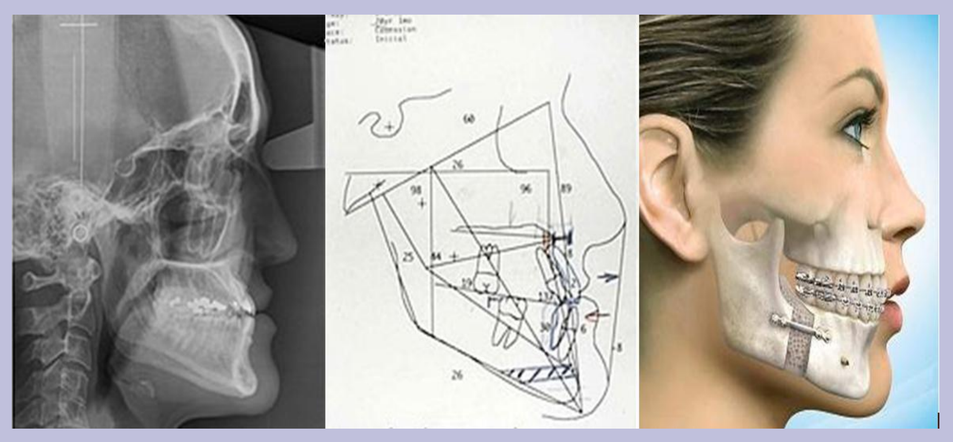
Haptic Devices available 1) Omni Phantom 2) Falcon



Haptic-virtual platform

Development

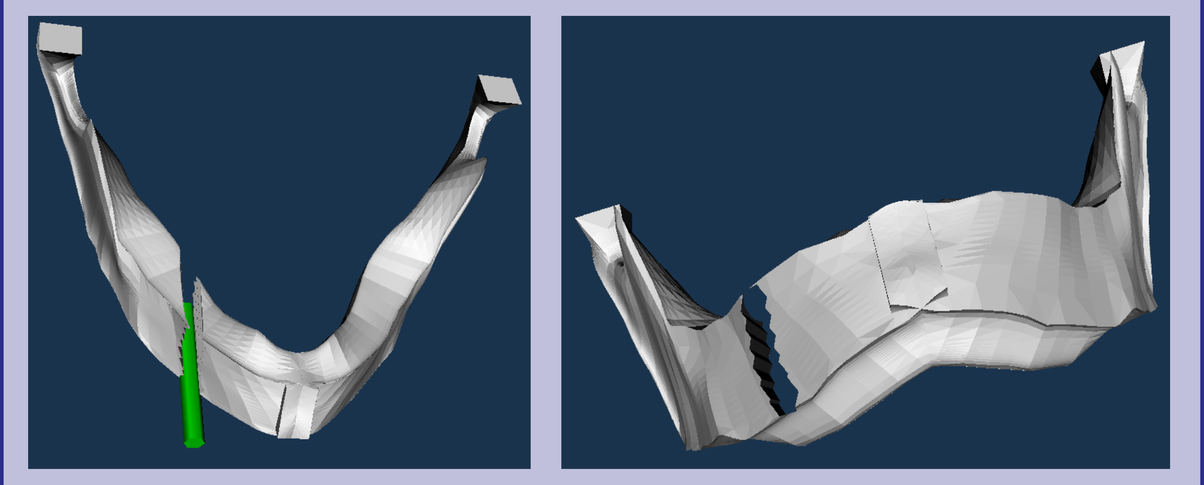
The project will focus on maxillofacial surgery and intends to work with patient information obtained by means of X-rays or CT scans and automatically evaluate the axisymmetric parameters of the facial features of the patient through the process of cutting bilateral mandibular osteotomy.



Usual process of osteotomy

The development of the platform has two lines of interaction, the ***Visual Rendering*** used to display on the screen the user the jaw and cutting tools and ***Haptic Rendering*** which allows the user to touch the jaw in real time and move the cursor with haptic device.

The stock manipulation on the platform is done using the buttons on the haptic device using the first one to change the tool and the second button for the cutting operation.



Virtual osteotomy

Conclusions

- Successful development of a visual and tactile environment for the patient's physical data and cutting of bone.
- The haptic rendering and visual rendering is successful because the mesh is modified for each cut made and may touch it.

Future Work

- Need to increase processing speed in the cutting process
- Need to manipulate objects when the cut separates the jaw in several places

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