# Review of a Simulation Method of Soft Tissue Cutting In Virtual Environment with Haptics

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***Abstract* - Currently, virtual simulation has an increasing role in the medical field. Now virtual surgery simulation has been largely explored in medical field. Virtual surgery is a good complement to traditional Surgical Training. Modeling effects of soft tissue during cutting is quite complex , hence the concept of virtuality is used to develop realistic surgical instruments for providing exact force feedback to the surgeon during surgical operation and simulation of soft tissue processes. Scalpel is a basic instrument required for soft tissue simulation. Hence we will design a virtual organ to cut by using Scalpel in Haptic Environment.**

***Keywords* - Surgery Simulation, Haptic feedback, Virtual Environment, Virtual Surgery, And Haptic Environment**

## I.INTRODUCTION

### *Haptic technology*

Haptic technology or haptics is tactile feedback technology which creates the sense of touch by applying motions , vibrations or forces to the user. We are using haptics in virtual surgery simulation for obtaining force-feedback.

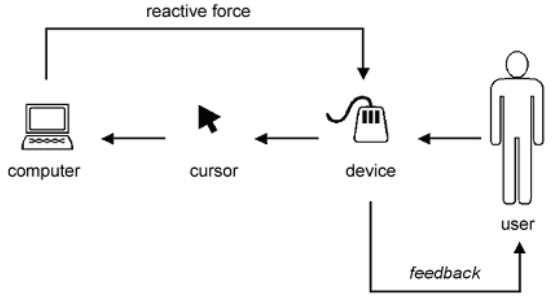


Fig 1

### *HapticForce Feedback*

There are several haptics devices by using it one can feel force feedback from computer machine ex. Phantom Omni , Phantom Omega , Novint Phalcon etc.

Generally, Surgeon use cadaver, animals or other teaching equipment for surgical simulation training but this way is limited due to its cost. However establishing Virtual surgery simulation can effectively solve this problem. Virtual surgery simulation includes some fields like robot and human-computer interaction and so on. In general, virtual surgery system includes physical modeling, collision detection and haptic force feedback.

In summary, current work faces many problems like poor knowledge, poor deformation and lack of haptics. Research on these mentioned problems is still in primary stage, so surgery simulation quality is not improving. Especially cutting operation of soft tissue is facing huge problems. We are constructing a system for ear cutting simulation, which is to simulate the cutting process of virtual ear with a virtual instrument.

In this paper we are summarize our efforts to make advance in simulation of soft tissue cutting.

## II.LITERATURE REVIEW

Jun WU, R.WESTERMANN and Christian DICK have described haptic cutting of high resolution soft tissue. They described how a user manipulates a haptic device that is mapped to a scalpel, in order to cut a liver model in the virtual environment. To employ this method of virtual surgery training, haptic force-feedback is used into the simulation. Here damping force model is used to obtain an efficient feedback force. To compute the obtained force, the scalpel is discretized into its small segments[9]. The collision detection algorithm is used to detect collision between organ and the scalpel. Here, the velocity of the manipulated scalpel is estimated from the position information provided by the haptic device. This information is known to be haptic device by means of vibration. They have presented a highly efficient and physically accurate real-time cutting simulation method. They demonstrated that by using method, cutting of soft tissues at a resolution of about 170,000 finite elements that can be simulated at rates of 15 frames per second.

Lingtao Yu, Tao Wang, Wenjie Wang, Zhengyu Wang, Baoyu Zhang ICCSEE 2013. "A geometric modeling method based on OpenGL in virtual gallbladder surgery." Here a 3D model of virtual gallbladder is created in 3Ds Max order to do surgerical

simulation. This paper select 3D software-3Ds Max to create gallbladder model. The C++ program is written to read the contour vertexes and facets data of gallbladder model and Open Graphics Library is used to repaint this information. For reconstructing a gallbladder includes three parts: First Obtain the information of gallbladder after that three-dimensional reconstruction of gallbladder and at last rendering of gallbladder. Due to the powerful curve modeling capabilities of 3Ds-Max software, this is chosen to build the original Model of Gallbladder. Firstly the Gallbladder model is created in 3Dsmax Software after that it is saved as 3DS file in 3ds Max. Then using software VC++ writes the program to read the data of gallbladder. Though VC++ read all data about 3DS file is directly and interactive control. But many of the data is not required, like as materials, lighting, and texture and so on. In general, repainting a gallbladder only need the data of model vertexes and polygons facets vertexes with the OpenGL software, and other information can be ignored[6].

Adam Faeth, Michael Oren, Jonathan Sheller, Sean Godinez, Chris Harding,-Iowa State University "Cutting, Deforming and Painting of 3D meshes in a Two Handed Viso-haptic VR System[11]". The construction and manipulation of 3D model is at the heart of many 3D modeling applications. Commercial Software such as Maya, 3D Studio Max, Cinema Blender and 4D. Here for haptic force feedback two SensAble Phantoms are used, which accept 6 (DOF) input from through user and provide a 3 DOF output to the user via the point at the tip of the stylus.

Here, firstly cutting approach is taken into consideration, which simulates a scalpel that immediately cuts the mesh at the point of contact.

## III.PROBLEM IDENTIFICATION

Surgical Dissection requires proper handling and understanding of instruments like Scalpel, Scissors etc for operation purpose. Hence the User must be expertise in dissection operation for proper surgical activity. Currently students are educated in soft tissue cutting techniques in the operating room or in lecture. This work will help to illustrate their knowledge in Virtual World in more Simple Way.

## IV.OBJECTIVE

Our main objective is to create a 3D organ (Ear) in Virtual World and also to create 3D Scalpel associated with it. After that we will perform the Operation of Soft Tissue Cutting in Virtual Environment.
**Software Requirement**: We are using 3DsMax software for developing 3D modeling, VC++ for creating virtualenvironment and Unity software for performing Cutting operation.
**Hardware Requirement**: We will use a Phantom Omni as haptic force feedback device to connect with the virtual world.
During the cutting of soft tissue user will also experienced the force feedback from the haptic device. In this way the user can interact to the virtual world with the help of haptics.

## V.CONCLUSION

Today, Virtual surgical simulation is getting more and more interest from all over the world. It is a good complement to old surgical training, it provides a safe, economical way in medical training in which the surgeons can control the haptic devices to interact with the virtual 3D organs, acquire the tissues pathological information from some phenomena like surface rendering.

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