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Review of Haptic Technology

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ABSTRACT-Haptics technology is used for the illusion purpose for user from which they can touch and manipulate the genuine corporeal objects and a intelligence of contact with the practical surroundings. In this document we have studied the types of Haptic technology like 'Cyber Glove' and 'Phantom'. We all discussed that how sensor and actuators provide the guideline to the haptic system. We are going to discuss diverse type of power rendering algorithms. The document explains the current blocks.

Keywords- Haptic, Cyber glove, Virtual environment

I. INTRODUCTION

1.1 What is 'HAPTICS'?

Haptic technology means that we are going to provide effective environment to our user via this they can sense of touch by applying services, motions to the operator. These mechanical systems will help to support the design of virtual objects for control of these effective objects, and going to develop the remote control of machines and devices. This advanced technology promises to have varied reaching applications as it already used in various fields. For example, haptic technology made it possible that we can explore the detail of the human sensation of touch by which we permit the creation of controlled haptic virtual objects.

These things are beneficial for user to going the judge the probe human haptic abilities, otherwise, they would be challenging to achieve. These new research tools are only for the understanding purpose of user by which they can learn that how touch and its underlying brain functions work.

1.2 History of HAPTICS

Haptic history for the 20th century when psychophysicists announced the word haptic. And it will helpful for brand subfield for their studies and they conclude that lecture is based on Contextual search-based exploration and multiplication. In the 1970's and the 1980's, haptic is completely different fields from other research field. by using of this technology robotics can also prepare for focus and influence and perception of touch. Initially researchers can concerned that building separate robots is another field of search and researchers earlier find out that building a deft robotic hand was very much complex and then their initial simple steps for that technology are going to be suggested.

In this time two societies are leading for user required understanding purpose and other one that desired to create devices which are leading the handiness of human ability. Common interest in subjects such that sensual strategy and processing, comprehension control and manipulation, object illustration and haptic information encoding, and grammars are only applicable for the identifying their physical tasks towards .

In the 1990s a new era of haptic is going to begin to appear. The merging of several emerging machineries made the virtualization possible for haptics user, or computer haptics imaginable user. Much like computer illustrations, computer haptic are supports to the display of duplicity of any objects for humans in a co-operating manner. Still, computer haptics is that it can also be uses for display technology by which objects can be physically understandable.

II. WORKING OF HAPTICS

2.1 Fundamental structure construction.

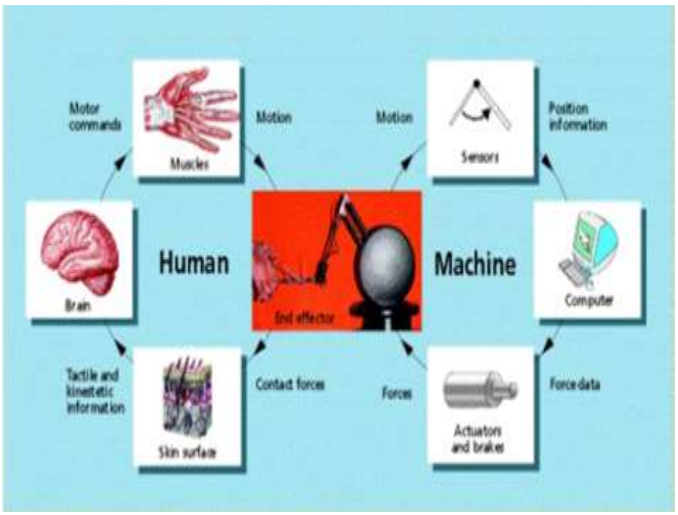

Fig 1 Fundamental organization of Haptics

Still a haptic system going to consist of two main parts which are namely as- the human part and the machine part. Above figure shows that the first part (left) is used for senses and controlling the position of the human hand, while the other one (right) is used for the exerts forces which are establish the connection between hand contact with a virtual object. Both these methods provide the schemes for essential beams,

processors and actuators. If we talk about human body system then nerve receptor perform the operation of sensing ,brain perform the operation of process of things and muscles perform the motion operation which is held by our hand . Now, if we talk about machine part then above operations is completed with the computer, the encoder and the motors.

2.2 HAPTIC Information

Haptic technology gives us information that is through the system and this information is the combination of

(i) Tactile information (ii) Kinaesthetic information.

Tactile information tell us that in this we have proof that the sensors are connected by the skin of the human body with a particular location which is related to the spatial circulation of pressure and mostly powers which are across the contact area.

If we take an example of handle flexible materials like fabric and paper, we can intellect with Pressure variation on the fingertip. This is basically a type evidence of tactile information and refer the basis of complex perceptual work which is likely the medical palpation, where physicians are going to locate hidden functional structures of tactile and evaluate the tissue properties by using their hands.

2.3 Creation of Virtual environment (Virtual reality)

Some advanced technologies are used in this like tactile evidence, known as force feedback, medical and gaming zone. Users can relate physical world to imaginary world and for this we use input devices like keyboard mouse and multi modal devices such as wired gloves Polhemus boom arm, and unidirectional treadmill. For example, if we consider VR games then in this reality is change due to combat training.

Most of the users are friendly with the use of virtual reality which is related to the computer created 3-D simulators. Pilots use flight simulants and these air travel simulants are considered as a flight deck on the plane or helicopter. The monitor in frontage of the navigator create a lot of fundamental environment. Many trainers are following external simulators instructions and we can adopt the simulator changed mode. Pilots are very much trained control the planes in difficult conditions and emergency landing. Simulators cost are in millions of dollars. Virtual reality games are also very cost effective in the same way. Players, which are going to play these video games required to wear special input devices like gloves, headphones, goggles etc. In this situations player deal with the real environment. The special spectacles are used to monitor the players' activity. The whole environment will change according to the player's moment. These games are extremely costly because of its high quality devices.

2.4 HAPTIC feedback

Virtual Reality (VR) are operate with those devices which can simulate between real and virtual world and observe the effect in the real world scenario. Ideally the user relates the things with the replication via all five senses. Now a day typical VR applicationsare trustable on a very smaller set which consist the properties like typical vision, hearing and more recently touch.

Applications are:

1) Simulation engine are very much responsible for figuring the virtual environments and behaviour over time.
2) Transducer convert visual signal, audio signal and force signal in the form of computer signal that operator can identify these signal.

. Bi-directionality is a main function of the haptic communication modality.

III. HAPTIC DEVICES

These devices can be broadly classified into:-

3.1 Devices based on virtual reality / tele-robotics: -.

3.1.1 Exoskeletons and Stationary devices

These devices are wearable devices that cover the whole human body as an individual. Present haptic devices are as exoskeletons which consist large and immobile systems that are assign to him or her.

These devices consist a lesser part of an artificial external supporting structure device. Since the main objective to built a haptic arrangement is capable to connect a consumer with the effective and imaginary environment.

3.1.2 Point sources and specific task devices

This job is done by periodically to make the plans to carry out a given job. The design of a apparatus means achieving a single type of work that limits many applications that are related to the least number of jobs, and allows the designer to give emphasis to the device to carry out a mission really on form. These devices are particular-point boundaries and precise responsibilities.

3.2 Feedback units

3.2.1 Force feedback devices

Force response input devices are not completely connected to laptop system that's why they consider as apply forces is to be pretending the sensation of weight and resistance to provide accurate a information to the user. Feedback hardware is used to represent an additional elegant form of input / output devices such as keyboards, mouse or trackers. The post is in the user's hand or other body part or related to the other input devices which are connected through computer. These devices are used to translate digital information in the form of physical sensations.

3.2.2 Tactile display devices

Recreation of task involving the active that investigate or delicate process of a virtual environment which is necessary for the addition of feedback data that is used to donations an object's apparent geometry or texture. Such type of feedback is providing for the tactile systems or tactile display devices. Tactile systems are differ from the haptic systems because it is creating forces. A fixed feedback applies on the sensation of the skin.

3.3 Commonly used HAPTIC interfacing devices

3.3.1 PHANTOM

A company named Sensible Technology manufactures haptic interfacing system. This device is very high determination device in which the user grasps the motor controlled articulated arm. One of the key features of this technology is that it can float in 3 dimensional objects.

3.3.2 Cyber glove

The source of a Cyber glove is very simple. It is used to differing the progress of the hand in the similar method that an object is enfolded between the fingers that prevents the movement of the hand. The glove should be very much skilled, in the nonappearance of a actual item which is used to re-forming the functional force with (1) the identical strength and (2) the identical path.

The advantages of this structure are as follow:-

1. Adapted to the dissimilar dimension of the finger
2. positioned should be on the backside of the hand
3. relate forces on each adduction joint

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3.3.3 Construction of a Cybernetic glove

The glove consists of 5 fingers and has 19 degree of freedom that is not receptive. The miniature structure consists of only 2 closed contacts, for 3 degree of freedom which one is not active. All the folds were slightly exposed to a minimal shortage to reduce the shortage.

There are two important benefits to this mechanical system

The first aspect is to adjust the different sizes of the human hand. In addition to the latter, we can facilitate the break between the fingers in the palm.

The second benefit is that we can stop the material in the way that the user completes the safety of the operator. The power device is placed in the repairs on the upper part of the body. All these cameras are made of metal lining.

3.3.4 Control of Cyber glove

Cyber glove control with 14 torque motors which have permanent current which is able to generate a maximal torque which is equal to 1.4 Nm and continuous torque of 0.12 Nm. On other hand each motor we are fix by a pulley with an 8.5 mm radius which cable is spiral. Motar can apply maximal torque equal to14N which is a sufficient value for the movement of figure.

IV. HAPTIC RENDERING

4.1 Principle of HAPTIC interface

During these interfaces in everyday environments the haptic interface relies on sensory signals which arise from mechanical signals. The user is connected to the main nervy system and the interface is connected to the computer. The 2 system are precisely balanced and feel that the surroundings create decision regarding the manage performance and offer automatic units to the interface through the movements.

The quality is considered popular for HAPTIC interface plans*:*

[1] Uses the inertia and roughness of the low disc.

[2] Kinetics devices imposed mimal moyion.

[3] Symmetric inertia, friction, stiffness, and resonant frequency properties are used in haptic interface device.

4.2 Creation of an AVATAR

An avatar is the virtual depiction medium by which the users are actually interacts with the virtual environment. Avatar depends on what is to be stimulated and on the haptic device's capabilities. The operator controls the avatar's locus inside the virtual situation. The avatar's geometry and the type of contact supports control forces. For example, a surgical tool can be treated as a volumetric object of switching forces, and the user locations are in a 6D space.

4.2.1 System architecture for HAPTIC rendering

In addition, the haptic interpretation algorithms confirm that the haptic device correctly reduces such forces in the human operator. A typical haptic cycle consists of the following sequence of events:-

[1] Low level of control algorithms that test the position sensor establishes the haptic tactile device's joints.

[2] The collision-detection algorithm uses for the position information to find collisions between objects and avatars.

4.2.2 Computing contact-response forces

Human body only connect with real object when sensors are located with their skin. We make a straightforward difference among the information that these 2 types of sensors can achieve. Temporary information and Chinese aesthetic information are interaction systems based on tools that provide simplification because these systems reduce the power and help create a good interaction between the avatar tools and the object. Therefore, haptic limits usually use a physical tool interface for the user.

To give an experience of tactile imitation, we think that our systems re-form the contact forces. Haptic boundaries are used to measure the users position to differentiate that contact occur or not and it is able to collect correct evidence for interface force, Although responsible user motion is easy for determining suitable display forces and this is a complex progression and a subject of much enquiry. Modern haptic technology invented a force for simple case but this phenomena is only apply when physical response is available .haptic technology differentiate 2 types of force:-object geometry force and object surface force.

V. APPLICATIONS, LIMITATION & FUTURE VISION

5.1 Application

5.1.1 Graphical user interfaces

Graphical user interfaces, like those that describe the Windows and Mac operating locations, will also be beneficial and importantly for the haptic connections. Image be able to feel graphic buttons and receive power feedback as it barely reduces.

5.1.2 Surgical Simulation and Medical Training

. If we are talking about future aspect then physicians may work for a central terminal which performing operations in several places with machine setup and patient preparation is achieved by the local nursing staff. Rather than that doctor travelling to an operating room and the surgeon instead becomes a telepresence.

The particular benefit of this type of work is that the surgeon can operate many more operations.

5.1.3 Military Training in virtual environment

Along with the entertaining industry, the military is responsible for that it aware the user from the most dramatic evolutionary leaps in the VR field. In present era the military uses VR methods for working out and safety improvement, but also provide military exercises and battlefield positions. If we talk about the numerous trainers which gives training in military they use all the original VR technology applications.military vehicle copies have probably been the most successful application. Trainers use cultured computer models to duplicate a vehicle's abilities and confines within a stationary and safe computer station.

5.1.4 TELEROBOTICS

In a telerobotic system, a human operator controls the actions of a robot that is far from the robot. Some teleported robots are limited because they perform very simple tasks, such as. To control a camera and send it back visual pictures. Haptic technology makes it possible that we include touch signs in addition to audio and visual cues.

5.2 Limitations of HAPTIC System

Limitations of haptic device systems are given below:-

[1] Haptic applications are very complex so it will be require highly specialized software.

[2] Haptic device place sensors have finite resolve.

[3] Implementation is very expensive.

[4] It has very limited magnitude which is not equal in every direction.

[1] A third issue is that haptic procedures operate in discrete time whereas users operate in next time. Then, when it comes to being a virtual person at a time, when the user needs to do less work and when leaving the user, the fantasy income that is more valuable for the real value of the world will be returned. In other words, the power to touch the virtual menu.Haptic device have finite resolve sensors.

[2] Implementation is very expensive.

[3] It has very limited magnitude which is not equal in every direction.

5.3 Future Vision

As haptics moves outside the box, technology will allow them to gradually authentic and show a complex physical collaboration with virtual or real objects. In the field of VR there is so much work for do and many companies do their job. Efforts focused on tool and software tools have provided us with the tools we need to get out of the plane, but we need new business representatives. For example, can we create devices with the satisfaction and conviction that make technology appealing?

It will Enhanced accuracy and richness in object modelling by which we can improve our understanding of how to represent and how to reduce psychophysically and cognitively connected characteristics of objects. Haptic visual and audio appointment gives us a better communication due to multimodel workspace. Hopefully we could get positive solutions for all the queries in the future.

VI. CONCLUSION

Finally, we could not forget that the virtual and physical interfaces are the essential ways by which we can understand our world and by this effect we alterations in it. This is true on the basis of including the rate of evolution. "In the end, the new physics enters this brain, under the control of hands and changes in behavior," says F. Wilson, "the new way of representing and representing behavior in the new brain." The precise system test involves test and test results, and each level either it is starting or ending.Our efforts to interconnect with evidence by rendering that how items feel through haptic technology, and the enthusiasm in our recreation, might be reflect a deeper desire to speak with an inner, physically based language that has yet to be given a true voice.

REFERECNCE

[1]. Haptic Rendering: Introductory Concepts-Kenneth Salisbury and Francois Conti Stanford University. Federico Barbagli Stanford University and University of Siena, Italy

[2]. Laboratory for Human and Machine Haptics: The Touch Lab-Dr. Mandayam A. Srinivasan, Dr. S James Biggs, Dr. Manivannan Muniyandi, Dr. David W. Schloerb, Dr. Lihua Zhou

[3]. https://haptics.lcsr.jhu.edu/Research/Tissue_Modeling_and_Simulation

[4]. http://74.125.153.132/search?q=cache:7bpkVLHv4UcJ:science.howstuffworks.com/virtualmilitary.htm/printable+haptics+in+virtual+military+training&cd=9&hl=en&ct=clnk&gl=in&client=firefox-a

[5]. http://portal.acm.org/citation.cfm?id=1231041#abstract

[6]. http://www.psqh.com/julaug08/haptics.html

[7]. http://www.informit.com/articles/article.aspx?p=29226&seq