Understanding Haptic Technology: Revolutionizing Human Interaction in the Virtual World

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ABSTRACT

Haptic is the science of applying touch (tactile) sensation and control to interact with pc programs. Haptic tool gives people a feel of contact with pc generated environments, so that once virtual objects are touched, they appear real and tangible. Haptic technology refers to era that interfaces the user with a digital environment via the experience of touch with the aid of applying forces, vibrations, and/or motions to the consumer. This mechanical stimulation can be used to assist in the introduction of virtual items (gadgets existing most effective in a laptop simulation), for control of such virtual objects, and to beautify the far flung manipulate of machines and devices. This paper consists of how haptic era works, about its devices.

Keywords:-Human sense of touch, Tactile feedback, Virtual object creation and Control, Phantom,

I. INTRODUCTION

Haptical generation or haptics is tactical feedbacks that take benefit of person experience of contact with the aid of making use of forces, vibration and motion to the person. Haptics refers to sensing and manipulation via touch. The word Haptic is derived from the Greek word "haptesthai" [1]. Allows customers to feel ("feel") and manipulate 3 dimensional virtual objects with respect to such features as shape, weight, floor textures, and temperature. by the use of Haptic gadgets, the user can not only feed facts to the computer but can get hold of records from the pc in the form of a felt sensation on some part of the body. In our paper we give an explanation for the basic standards of 'Haptic generation and its application in Surgical Simulation and medical schooling'. PHANTOM is small robot arm with 3 revolute joints every related to a computer-controlled electric DC motor. Cyber hold close is used together with a role tracker to measure the location and orientation of the fore arm in 3 dimensional area. Phantom and Cyber draw close are Hapic devices [2].

II. WORKING OF HAPTICS TECHNOLOGY

2.1 Basic system configuration**.**

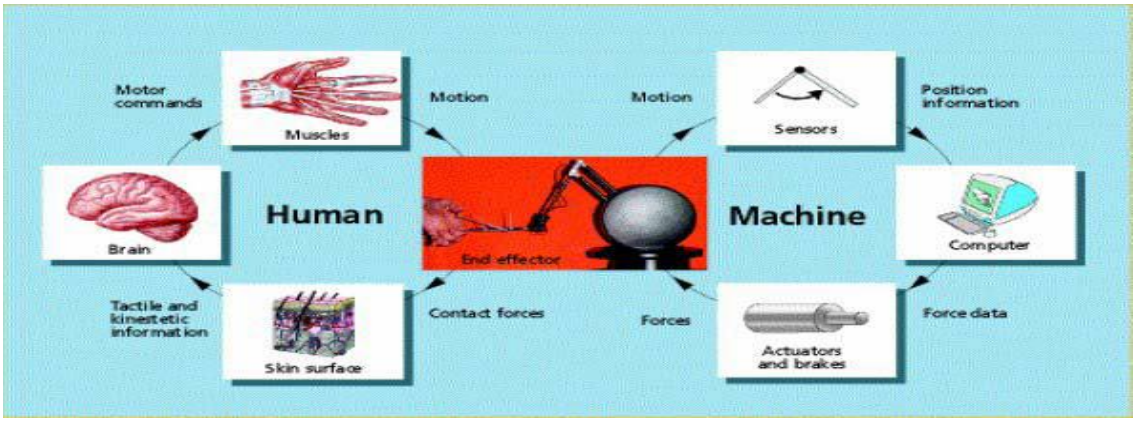

Fig1: Basic configuration of haptics

From the above determine 1, human element (left) controls the location of the hand, while the device component (proper) exerts forces from the hand to simulate touch virtual item. also both the systems might be supplied with necessary sensors, processors and actuators. Inside the case of the human gadget, nerve receptors plays sensing, mind plays processing and muscle tissues plays actuation of the motion carried out by means of the hand at the same time as in case of the device machine, the above stated capabilities are executed by means of the encoders, pc and vehicles respectively [3].
Basically haptic system consists of two parts:

- Human part
- Computer part
- Machine part

Human Haptics
Human haptics is the examine of human sensing and manipulation through touch. Human haptic system includes subsystems: motor subsystem and sensory subsystem. each the structures are strongly connected with each different. Human use to exceptional forms of haptic exploration: energetic and passive. [4].

Computer Haptics
Laptop haptics is a swiftly emerging place of research that is difficulty with the strategies and the technique related to generating and showing the touch and sense of digital items to a human operator via a force reflecting tool. It consists of software architecture needed for haptics interplay and synchronization with visible and other display modalities.

Machine Haptics
System haptics refers to design, creation and use of gadget to replace or augment human contact. Haptic interfaces are devices composed of mechanical additives in bodily contact with the human frame for the purpose of replacing data with the human anxious gadget. In acting duties with a haptic interface, the human person conveys desired motor movements with the aid of bodily manipulating the interface, which in turns presentations tactual sensory data to the user by as it should be stimulating his or her tactile and kinesthetic sensory systems [4]. Consequently in standard, haptic interfaces can be considered as having basic capabilities:
 To measure the positions and contact
Forces of the user's hand
 To display contact forces and positions
To the user.
2.2 Haptic information
Basically the haptic information provided by the system will be the combination of

A. Tactile information
Tactile records refer the information acquired with the aid of the sensors which can be truly connected to the skin of the human body with a particular reference to the spatial distribution of pressure or greater usually, tractions, across the touch region.

B.Kinesthetic information
Kinesthetic records refer back to the records acquired thru the sensors in the joints. Interaction forces are typically perceived thru a combination of these two facts'**.**

2.3 Creation of Virtual environment (Virtual reality)
virtual fact is the technology which permits a person to have interaction with a computer simulated environment, whether that surroundings is a simulation of the real international or an imaginary global. most current virtual fact environments are more often than not visual reports, displayed both on a laptop screen or via unique or stereoscopic shows, however a few simulations consist of extra sensory facts, such as sound via audio system or headphones. some advanced, haptic structures now include tactile statistics, commonly referred to as pressure comments, in scientific and gaming applications. users can have interaction with a digital surroundings or a digital artifact (VA) both via the usage of widespread enter gadgets consisting of a keyboard and mouse, or through multimodal gadgets along with a stressed glove, the Polhemus growth arm, and omnidirectional treadmill. The simulated surroundings can be similar to the actual global, as an instance, simulations for pilot or fight education, or it is able to range appreciably from fact, as in VR video games. In exercise, it is currently very difficult to create a high-fidelity digital truth revel in, due largely to technical barriers on processing electricity, photo decision and verbal exchange bandwidth. however, those obstacles are predicted to eventually be triumph over as processor, imaging and information communication technology become greater effective and price-powerful over the years. virtual reality is frequently used to describe a huge kind of packages, typically associated with its immersive, enormously visual, 3-D environments. The development of CAD software, portraits hardware acceleration, head established displays; database gloves and miniaturization have helped popularize the motion. The most successful use of digital truth is the pc generated three-D simulators.

Fig: 2 Virtual environment

2.3 Haptic feedback

Virtual fact (VR) packages attempt to simulate actual or imaginary scenes with which users can engage and perceive the effects of their moves in actual time. Ideally the person interacts with the simulation via all 5 senses. Determine under suggests the structure of a VR utility incorporating visible, auditory, and haptic feedback.

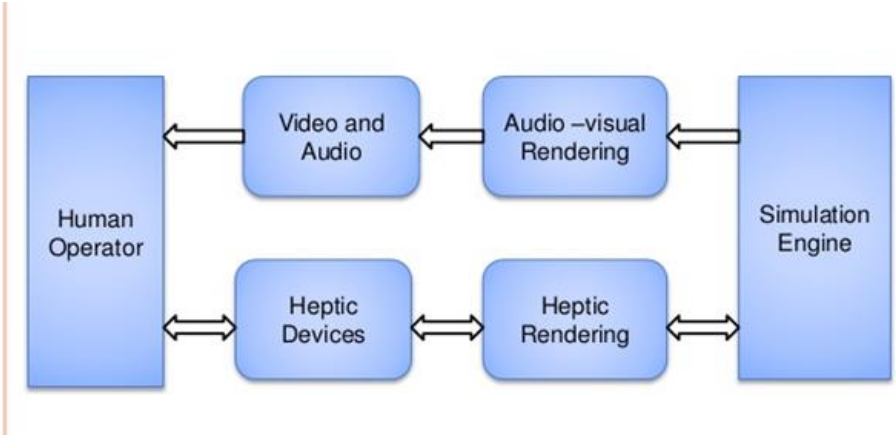

Fig: 3 Haptic Feedback Block Diagram.

III. HAPTIC INTERFACE AND DEVICES

A. Haptic Interface

Haptic Interface includes a haptic tool and software-primarily based computer control mechanism. It enables human-device communiqué although the sense of contact. by means of using a haptic interface, a user can not best feed the records to the computer however can also get hold of statistics or feedback from the laptop within the shape of a felt sensation on some parts of the body

B. Haptic Device

A haptic tool is the only that provides a physical interface between the consumer and the digital environment by way of a laptop. This can be carried out via an input/output device that senses the frame's motion, which include joystick or facts glove. By the usage of haptic gadgets, the person can't most effective feed information to the pc but can also get hold of information from the laptop within the shape of a felt sensation on a few a part of the frame. This is known as a haptic interface.

There are two main types devices:

• Device that allow users to touch and manipulate **3-dimentional** virtual objects.

• Devices that allow users to "retextures of **2-dementional** objects.

Phantom

Fig: 4 Phantom (Haptic Device)

it's far a small robot arm with 3 revolute joints every related to a computer-managed electric powered DC motor. This haptic interfacing device is evolved by means of realistic technology and is the main haptic tool used in studies. It is frequently used for imparting a 3-d touch to the digital items. That is a totally excessive resolution, six stages of freedom (DOF) device wherein the person holds the stop of a motor-managed, jointed arm. a programmable experience of contact that permits the user to feel the texture and form of the digital items with a totally excessive degree of realism. Certainly one of its key features is that it could model unfastened-floating 3-dimensional objects

Cyber Grasp

Fig 4: Cyber glove (Haptic Device)

The precept of a Cyber glove is easy. Cyber glove consists of opposing the motion of the hand within the same way that an object squeezed among the palms resists the movement of the latter. The glove should consequently be capable, within the absence of a real item, of recreating the forces carried out with the aid of the object on the human hand. the 2 situations may be simplified by requiring the glove to apply a torque equal to the inter phalange joint.

(1) The same intensity.
(2) The same direction.

IV. ADVANTAGES

- Communication is centered through touch and the digital world can behave like the real world.
- Working time is reduced since objects can be captured, manipulated, modified and rescaled digitally.
- Surgeons can practice digitally, gaining confidence in the procedure before working on breathing patients.
- Allow rare, fragile or dangerous objects to be handled.
- Improve access for visually disabled people.
- Allow long distance visitors.
- Increase the number of artifacts on display.
- Time Saving.

V. APPLICATION

There has been good sized development in haptic era however the incorporation of haptics into virtual environment continues to be in its infancy. A extensive variety of the new society's human sports inclusive of verbal exchange, training, artwork, entertainment, commerce and technology might all the time exchange if we discovered how to seize manipulate and reproduce haptic sensory stimuli that are almost indistinguishable from fact. for the sector to move ahead, many business and technologically boundaries need to be triumph over

Graphical User Interface (GUI)

Online game makers have been the use of passive haptics. They took the benefits of vibrating joysticks, controllers and guidance wheels to beautify on display hobby however future video games will allow player to enjoy and manipulate virtual solid fluids device and avatars.

Tele Robots

In telerobotic machine, a human operator controls the instant of a robotic this is placed same distance away. Tele-operated robotic are limited to quite simple assignment along with aiming adigital and sending again virtual pics. Haptics now makes it viable to encompass touch cues in addition to audio, video and visual cues in telepresence model [5]

Geo Science

In petroleum exploration, growing correct fashions of subsurface surroundings is complex and difficult trouble. Novint has developed custom designed software program to make it viable to work in 3-d with 3D information through including haptic feedback and providing real time 3-d interaction to present visualization technique.

Medicine

Haptics is manipulating micro and macro robots for minimal invasive surgical procedure (laparoscopy) and remote surgical treatment using tele-operators. it is using in remote prognosis for telemedicine. It gives aids for the disabled such as haptic interfaces for the blind and rehabilitation robotics. In ophthalmology,"haptic" refers to a supporting spring, two of which keep and artificial lens in the lens capsule (after surgical removal of cataracts)[6]. Haptics in medicals allows education of destiny medical doctors in surgical operation without the of actual human frame.

Military

Military uses flight simulators to train pilots the usage of haptics. Education missions can also encompass how to fly in struggle, a way to get better in an emergency, or a way to coordinate air support with ground operations. The army makes use of several particular haptic gadgets to educate squad dies to pressure vehicles like tanks or the closely-armored Stryker car[7]

VI. CONCLUSIONS

Ultimately we are able to say that the haptic generation is used for the solution of interacting with the digital surroundings and used extensively in many packages Haptic tool acts as an enter and output tool monitoring man or woman physical manipulations as an input and imparting realistic touch sensations as an output coordinated with onscreen occasions. As era evolves and pc electricity grows, haptic devices and effects evolve and get more realistic. this era has proved that digital objects can also be touched, felt and controlled. This generation need to be made to be had for the low price rate and the haptic devices want to be made easier and less complex to use

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