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HAPTIC TECHNOLOGY

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Abstract: Haptic technology, or haptics, is a material criticism innovation which exploits a user's feeling of touch by applying strengths, vibrations, as well as movements upon the user. This mechanical stimulation might be utilized to help with the formation of virtual articles which means objects existing just in a computer simulation, for control of such virtual items, and for the upgrade of the remote control of machines and gadgets. It has been depicted as "for the feeling of touch what computer design accomplishes for vision". Although haptics gadgets are fit for measuring mass or receptive strengths that are connected by the user, it should not to be mistaken for touch or material sensors that measure the weight or drive applied by the user to the interface.

Keywords: Tactile, Sense of touch, Phantom, Cyber Grasp, Haptic Rendering, Haptic Perception, Haptic interfaces, Virtual Objects Creation and Control.

I.INTRODUCTION

Haptic is defined as the "study of applying material sensation to human cooperation with computers" and it is derived from Greek word "hapathesai". Haptic gives users to feel and control 3-dimensional virtual items concerning elements. By utilizing haptic gadgets, the user can encourage data to the computer as well as can get data from the com as a felt sensation on some part of the body. This is alluded to as a haptic interface. In this paper we clarify the essential ideas of 'Haptic Technology and its Application'.

Fig: PHANTOM, which is a small robot arm with three joints each connected to a computer-controlled electrical DC motor.

Fig: Cyber Grasp, which is used in conjunction with a position tracker to measure the position and orientation of the fore arm in three-dimensional space. Phantom and Cyber Grasp are Haptic devices

II.LITERATURE REVIEW

Haptic interfaces are divided into two main categories:

- Force feedback
- Tactile feedback

Force feedback: These interfaces are used to explore and modify remote/virtual objects in three dimensions in applications including system-aided design, computer assisted surgery, and computer-aided assembly.

Tactile feedback: These interfaces deal with surface properties such as roughness, smoothness and temperature.

Working of haptics:

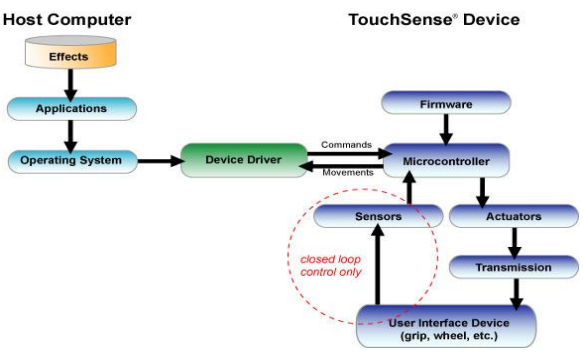

Fig1: Basic configuration of haptics

Commonly haptic system consists of two parts:

- Human part
- Machine part

From the above figure 1, human part (left) controls the position of the hand, while the machine part (right) exerts forces from the hand to simulate connections with a virtual object. Also both the systems will be provided with necessary sensors, processors and actuators. In the case of the human system, nerve receptors performs sensing through brain and it performs processing and muscles performs actuation of the motion performed by the hand while in case of the machine system, the above mentioned functions are performed by the encoders, computer and motors respectively

III.HAPTIC TECHNOLOGIES

Material signals incorporate surfaces, vibrations, and knocks, while kinesthetic prompts incorporate weight, affect, and so on. In the accompanying segment, we display some significant ideas and wording identified with haptics.

Haptic: the investigation of applying material, kinesthetic, or both sensations to human computer associations. It alludes to the capacity of detecting and additionally controlling articles in a characteristic or manufactured environment utilizing a Haptic interface.

Cutaneous: Identifying with or including the skin. It incorporates impressions of weight, temperature, and torment.

Material: Relating to the Cutaneous sense, however more particularly the impression of weight as opposed to temperature or torment. Kinesthetic: identifying with the inclination of motion. It is identified with sensations beginning in muscles, ligaments, and joints.

Compel Feedback: Identifying with the mechanical creation of data that can be detected by the human kinesthetic framework.

Haptic correspondence: The methods by which people and machines convey by means of touch. It for the most part concerns organizing issues.

Haptic gadget: It is a controller with sensors, actuators, or both. An assortment of haptic gadgets has been produced for their own motivations. The most well known are material based, pen-based, and 3 level of-opportunity (DOF) drive criticism gadgets.

Haptic interface: It comprises of a haptic gadget and programming based PC control instruments. It empowers human–machine correspondence through the feeling of touch. By utilizing a haptic interface, somebody can bolster the data to the computer as well as get data or input from the computer as a physical sensation on a few sections of the body.

Haptic observation: The way toward seeing the attributes of articles through touch.

Haptic rendering: The way toward computing the feeling of touch, particularly compel. It includes inspecting the position sensors at the haptic gadget to get the user's position inside the virtual environment. Haptic rendering is, in this way, a framework that comprises of three sections, a crash location calculation, an impact reaction calculation, and a control calculation.

Sensors and Actuators: a sensor is in charge of detecting the haptic data applied by the user on a specific question and sending these constrain readings to the haptic rendering module. The actuator will read the haptic information sent by the haptic rendering module and change this data into a shape discernible by people.

Tele-haptics: The investigation of transmitting haptic sensations from a remote investigated question/environment, utilizing a system, for example, the Internet, to a human administrator. At the end of the day, it is an expansion of human touching sensation/capacity past physical separation limits.

Tele-nearness: the circumstance of detecting adequate data about the remote assignment environment and imparting this to the human administrator in a way that is adequate for the administrator to feel physically display at the remote site. The user's voice, developments, activities, and so on might be detected, transmitted, and copied in the remote area. Data might go in both headings between the user and the remote area .

Virtual Reality (VR): It can be depicted as the computer reproduction of a genuine or virtual (nonexistent) world where users can collaborate with it progressively and change its state to build authenticity. Such associations are some of the time did with the assistance of haptic interfaces, permitting members to trade material and kinesthetic data with the virtual environment.

Virtual environment (VE): It is an immersive virtual reality that is mimicked by a computer and fundamentally includes varying media encounters. In spite of the way that the wording is developing, a virtual domain is primarily worried with characterizing intelligent and virtual picture shows.

Community oriented virtual situations (CVE): It is a standout amongst the most difficult fields in VR on the grounds that the recreation is conveyed among geologically scattered computers. A potential CVE application differs broadly from therapeutic applications to gaming.

Communitarian haptic varying media environment (C-HAVE): Notwithstanding conventional media, for example, picture, sound, and video, haptics – as another media – assumes a noticeable part in making virtual or true protests physically obvious in a CVE. A C-HAVE permits various users, each with his/her own particular haptic interface, to cooperatively as well as remotely control shared

protests in a virtual or genuine environment and is appeared in fig2.

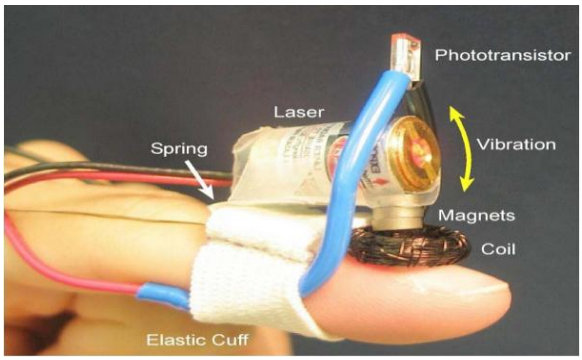

Fig2: Haptic Visual Environment

It is a procedure of applying strengths to the user through a constrain criticism gadget. Utilizing haptic rendering, we can empower a user to touch, feel and control virtual items. Upgrade a user's involvement in virtual environment. Haptic rendering is procedure of showing artificially created 2D/3D haptic boosts to the user. The haptic interface goes about as a two-port framework ended on one side by the human administrator and on the opposite side by the virtual environment.

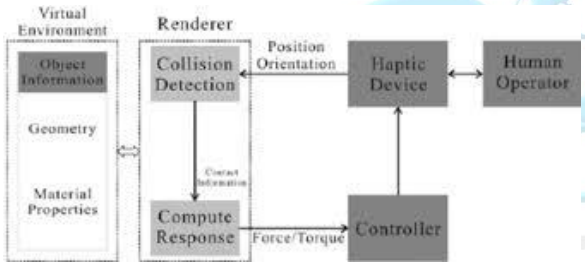

Fig3: Haptic structure

Contact Detection: An essential issue in haptics is to distinguish contact between the virtual items and the haptic gadget (a PHANTOM, a glove, and so on.). When this contact is dependably distinguished, a drive comparing to the cooperation material science is created and rendered utilizing the test. This procedure normally keeps running in a tight servo circle inside a haptic rendering framework.

Surgical Simulation and Medical Preparing:
Haptic is normally named:-
Human haptics: Human touch recognition and control.
Machine haptics: Worried with robot arms and hands.
Computer haptics: Worried with computer intervened.

An essential application zone for haptics has been in surgical recreation and restorative preparing. Haptic rendering calculations distinguish crashes between surgical instruments and virtual organs and render organ-compel reactions to users through haptic interface gadgets. With the end goal of haptic rendering, we've thoughtfully separated insignificantly intrusive surgical devices into two non specific gatherings in view of their capacities.

1. Long, thin, straight tests for palpating or puncturing the tissue and for infusion (cut and infusion needles and palpation tests)

2. Explained instruments for pulling, cinching, holding, and cutting delicate tissues, (for example, biopsy and punch forceps, snare scissors, and getting a handle on forceps).

Haptic Science operational structure is appeared in taking after fig4.

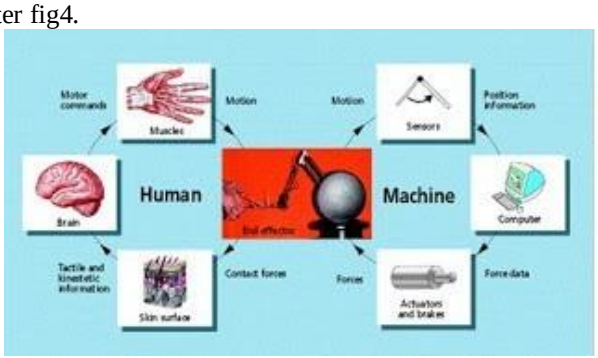

Fig 4: Haptic Science operational structure

Gathering of surgical instruments is utilized for reproducing device tissue communications. Bunch An incorporates in length, thin, straight tests. Bunch B incorporates apparatuses for pulling, cinching, and cutting delicate tissue which is appeared in fig5.

1. Users feel torques if a legitimate haptic gadget is utilized. For instance, the user can feel the coupling minutes created by the contact strengths at the instrument tip and powers at the trocar turn point.

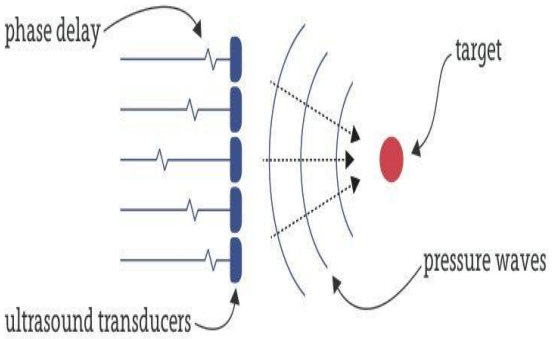

Fig 5: Haptic gadget Interaction with human

2. Users can identify side impacts between the recreated device and 3D models of organs.

3. Users can feel different layers of tissue if

the beam speaking to the reproduced surgical test is for all intents and purposes stretched out to identify crashes with an organ's inner layers.

4. Users can touch and feel different questions at the same time. Since laparoscopic instruments are regularly long thin structures and communicate with different items (organs, veins, encompassing tissue, et cetera) amid a MIS (Minimally Invasive Surgery), beam based rendering gives a

more characteristic route than a simply point-based rendering of hardware tissue collaborations. To mimic haptic communications between surgical material held by a laparoscopic device (for instance, a catheter, needle, or suture) and a deformable body, (for example, an organ or vessel), a mix of point-and beam based haptic rendering techniques are utilized which are appeared in fig6.

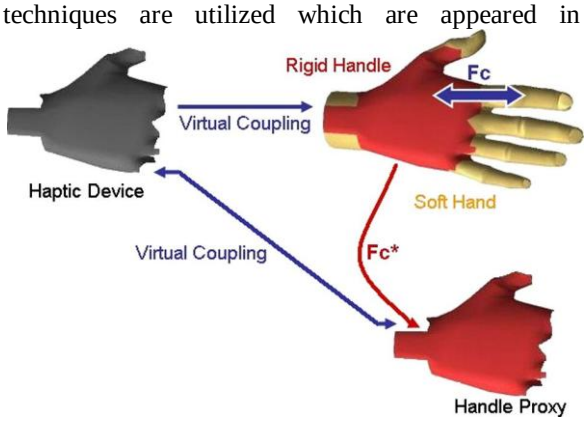

Fig 6: Haptic rendering structure

If there should be an occurrence of a catheter inclusion errand appeared over, the surgical devices utilizing line portions and the catheter utilizing an arrangement of focuses consistently disseminated along the catheter's middle line and associated with springs and dampers. Utilizing our point based haptic rendering strategy; the crashes between the adaptable catheter and the inward surface of an adaptable vessel are identified to register connection powers.

Deformable Objects:

A standout amongst the most imperative parts of computer based surgical recreation and preparing frameworks is the advancement of sensible organ-constrain models. A decent organ-compel demonstrate must reflect stable strengths to a user, show smooth misshapenness, handle different limit conditions and requirements, furthermore, indicate material science based practical conduct progressively .

Tool–tissue associations create dynamical impacts and cause nonlinear contact communications of one organ with the others, which are very hard to recreate continuously. Besides, recreating surgical operations, for example, cutting and coagulation requires as often as possible upgrading the organ geometric database and can bring about constrain singularities in the material science based model at the limits. There are at present two principle approaches for creating power reflecting organ models:

1. Molecule based strategies.

2. Limited component strategies (FEM).

In molecule based models, an organ's hubs are associated with each other with springs and dampers. Every hub (or molecule) is spoken to by its own particular position, speed, and increasing speed and moves affected by powers connected by the surgical instrument.
Catch, Storage, and Retrieval of Haptic
Information:

The most up to date zone in haptic is the look for ideal strategy.

IV.WAY TO BRINGING MULTIMEDIA HAPTICS:

In a virtual domain, a genuine situation is reenacted by a computer created application where a portion of the user's faculties are keenly spoken to with the end goal for them to collaborate and see boosts that are fundamentally the same as the genuine environment. Customarily, human–computer interfaces have conveyed sorts of jolts that depend on two of our faculties, specifically vision and sound. Notwithstanding, with the expansion of the feeling of touch through material and drive criticism, the computer based applications get to be distinctly wealthier in media content through better mimicry of genuine circumstances and assignments or remote genuine situations. The detecting of strengths is firmly combined with both the visual framework and one's spatial sense; the eyes and hands work all in all to investigate and control objects. In addition, analysts have shown that haptic methodology lessens the apparent musculoskeletal stacking that is measured through torment and uneasiness in finishing an assignment. In this way, there is a pattern in the plan of interfaces toward multimodal human– computer connection that fuses the feeling of touch.

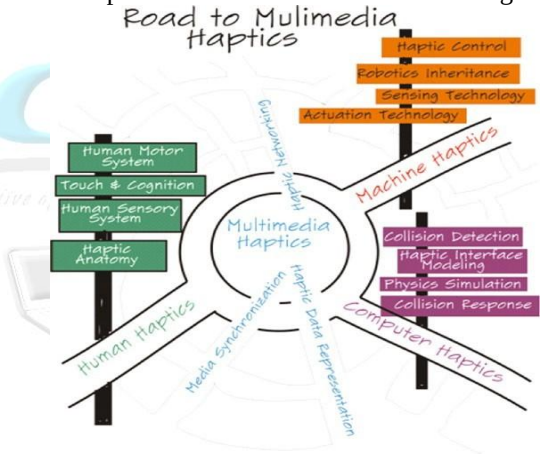

Fig7: Roadmap to sight and sound haptics

Be that as it may, the catchphrase here is "observation", so if the cross-modular data is not all around synchronized and steady, the additional tactile data may degenerate the expected jolt. For example, analysts have found that when strife between tangible prompts (for example, between the hands and eyes) emerge, the cerebrum adequately parts the distinction to create a solitary mental picture, and the general recognition experienced by the subject will be a tradeoff between the two detects. Thusly, visual prompts must be synchronized with haptic co operations to build the nature of recognition.

Uses of Haptic Technology:

Haptic Technology applications are Training and instruction, Surgical reenactment and Medical preparing, Physical recovery, Painting, chiseling and CAD, Museum

show, Scientific Visualization, Entertainment and Military application.

V. COMES ABOUT

We presume that Haptic Technology is the main arrangement which gives high scope of communication that can't be given by virtual reality. The touch get to innovation is essential till now. Be that as it may, haptic innovation has completely changed this pattern. These innovations make the future world as a sensible one. Haptic Technology empowers users to reenact touch and use another contribution and in addition yield innovation Large potential for applications in basic fields and in addition for restful joys. Haptic gadgets must be scaled down so they are lighter, less difficult and simpler to utilize.

VI. MY PROJECT

Torch for blinds: User (person with visual disabilities) can feel the objects in front of them which is present as obstacles which can indicated by vibration or by some other medium. This can be done with the combination of,

- Arduino
- Ultraviolet sensor
- Servo motor
- Battery
- Common torch components

VII.FUTURE ENHANCEMENT

Holographic Interaction: The feedback allows the user to interact with a hologram and actually receive tactile response using acoustic radiation pressure

Medical Application : Use of a central workstation from which surgeons would perform operations in various locations; with machine setup and patient preparation performed by local nursing staff

Textile Industry: User could study and feel the texture and quality of material during the sale of cloth through internet

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