HAPTIC TECHNOLOGY

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ABSTRACT

A tactile feedback technology, haptic technology is one of the fastest expanding fields of technology. Technology for virtual reality is another name for it. Haptics is the study of touch-based computer interaction. Additionally, it is the science of using control and touch to interface with computer applications. Future encounters in virtual reality will be heavily haptic. Haptics use force, vibration, moment, and motion to manipulate the user's sense of touch. When computer-created virtual objects are touched, they appear genuine, which allows users to control those virtual objects and improves remote control of machines and devices. Haptic devices work by giving users a sense of touch with computer-generated environments. Training for jobs demanding hand-eye coordination, including operating on spacecraft or performing surgery, uses haptic technology or haptic gadgets. The medical industry and our military forces both utilize this technology. This essay discusses the principles of haptic technology as well as its applications, devices, technologies, and benefits and drawbacks.

Keywords: Haptic Technology, Human Sense Of Touch, Tactile Feedback, Virtual Object Creation, Haptic Devices, Limitation, Working, Application, Advantages, Disadvantage.

I.   INTRODUCTION

A new meaning for the word "haptic" started to take shape in the early 1990s. The Greek word haptesthai is the source of the haptic term. Haptesthai is the Thai word for touch. Scientists referred to the area of their research that dealt with human touch-based perception and manipulation as haptics. Haptics is a significant component of technology that is rapidly expanding. It is employed in various fields, including education, medicine, defense, neurology, computer science, etc. Users that employ haptics may feel and manipulate three-dimensional objects about factors including shape, weight, surface, textures, and temperature. Within the muscles and joints, haptic sensation connects to sensory nerves in the brain. The sensor that gauges the user's force on the interface may be supplemented by haptic devices. Using haptic devices, you can feel and watch how you interact with visuals (objects).

II.   LITERATURE REVIEW

The implementation of haptic technology involves a variety of connections between a haptic device and the control system. Haptic The feedback or information that the computer or system provides combines the following two categories of data:

- Active Haptic Devices
- Passive Haptic devices

Haptic Active Devices

Active haptic devices are those that are computer-controlled and use electronic means to give the user tactile or kinesthetic input. This equipment has actuators that actively produce the force. Phantom and Cybergrasp are two examples.

Passive haptic Devices

Devices that are controlled by humans and use passive actuators that produce torque only in opposition to motion are referred to as passive haptic devices. telerobotic-based equipment, for instance.

Haptic System Types:

Currently, a variety of industries use three main haptic systems: It is easily graspable, wearable, and touchable

1.Graspable

Our nerves, joints, and muscles receive kinesthetic feedback from these devices. like on a joystick.

2.Touchable

Touchable Whether they are aware of it or not, customers use touchable haptic technology. A screenshot from a smartphone

3.Wearable

Wearable haptic systems use tactile stimuli, such as pressure, temperature, or vibration, which are controlled by nerves in the user's skin, to provide contact feelings.

Working of haptic devices:-

The work of the haptic technology system Basically, the system consists of capacitive touch sensor devices, a processor, a driver circuit, actuators, a real-time algorithm, a library of haptic effects, an API, etc. The system needs input to function, which can be provided by touching or pressing the capacitive buttons on the screen. It sent a single input to the system upon touch. The device's sensors track variations in the amount of force exerted and the angle of the input and transmit that data to the CPU.
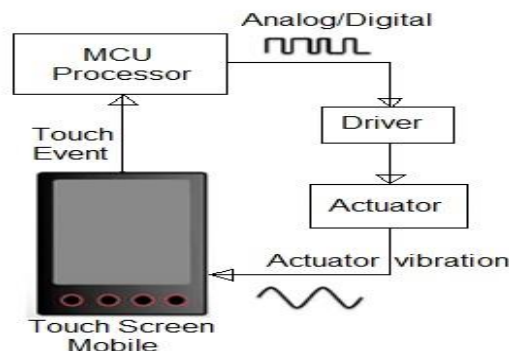
The data is then processed further to produce a waveform, which may be digital or analog, that serves as an input to the driver circuit and specifies the instructions supplied to the actuator to construct a pattern that causes a vibration. This actuator feedback, which is returned to the touchscreen devices, serves as force feedback. Thus, the user virtually experiences this force feedback.
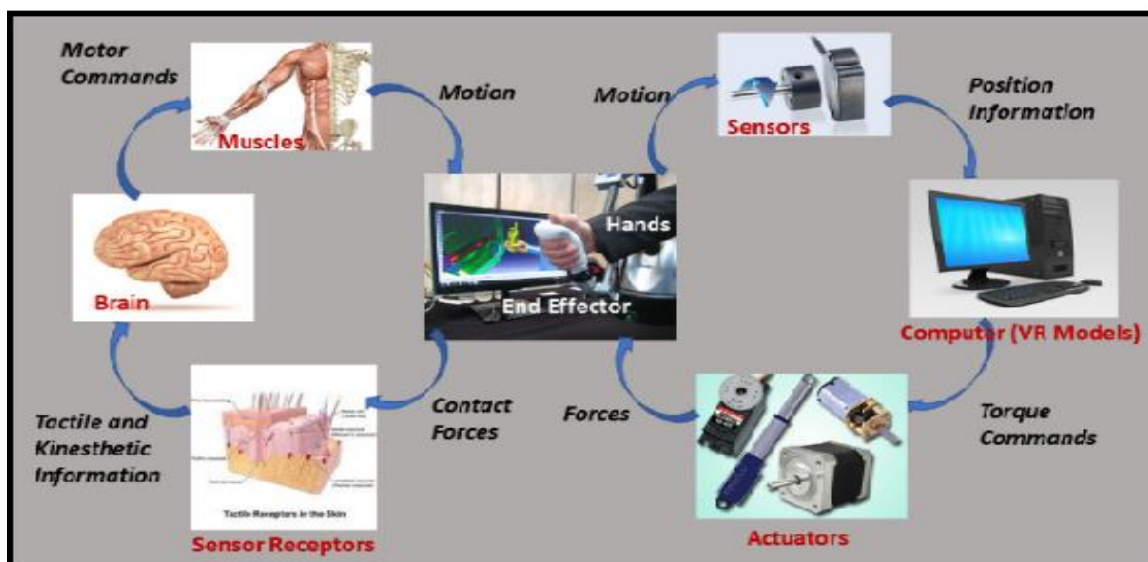
Physical limitations

- Obtaining millimeter accuracy is difficult or impossible. The accuracy is intrinsically limited by the 8.5-millimeter wavelength associated with 40 kHz ultrasound.
- Because the mid-air tactile force is only a small portion of the force threshold of hardware buttons, the strength of the outcome is a concern. An excessive array of transducers improves the outcome, but not linearly, because of the transducers' limited directionality.
- Large arrays make the gadget larger, more expensive, and heavier.
- Novel hardware arrangements for arrays could improve the outcome. A hybrid focus comprised of a 40 kHz and 70 kHz array had a greater impact than each one by itself.
- They harmonize at a frequency of 200 Hz, which can only be felt in the palm.

Application of haptic technology

- Military

It is used to provide flexibility in the military field, which includes training in a virtual reality environment. Additionally, it uses a graspable haptic technology for bomb disposal.
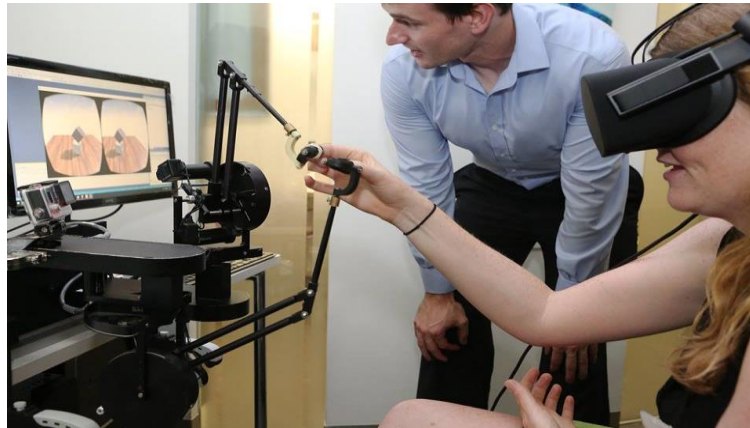
- Nasa

Astronauts in space utilize robotic tools with graspable haptic technology to fix damaged satellites or external spacecraft equipment.

- Medical

Haptic interfaces are used in medical applications such as remote surgery and virtual training for healthcare professionals.

- Education

It is frequently used to grasp concepts in educational fields such as chemistry, arithmetic, physics, and engineering, as well as in medical training. They employ virtual reality environments mostly.

- Gaming

This technology is used in video games by the gaming industry.

Haptic technology has the following benefits:

- High levels of accuracy and precision.
- Ease of access and ease of operation.
- Anyone can experience and perceive a digital environment.

Haptic technology has the following disadvantage :

- There are significant upfront investment costs.

III.   CONCLUSION

Finally, we conclude that haptic technology, which is frequently applied in many applications, is the best method for engaging with a virtual environment. Haptic devices serve as input and output devices, sensing user physical input manipulation and producing a realistic touch output in time with the onscreen event. as technology advances and becomes more practical. technology that can be felt and manipulated. The haptic devices need to be simpler and easier to operate, and this technology needs to be made accessible for a reasonable price.

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