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Haptic Technology in Education

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Abstract: Haptic technology provides a form of human-computer interaction. Haptic technology is an important part of today's world. Haptic technology allows humans to feel vibrations, movements and movements. Haptic is a sense of touch that controls interaction with computer applications. People can feel real through touch devices and virtual environments. It Describe the working principle of user touch by allowing the creation of a touch-controlled virtual environment. It refers to the technology that connects humans and the virtual environment through touch by applying action or movement, force, and vibration to the user. Haptic refers to manipulation and perception through actions, movements, and touch. This article includes the meaning of haptic technology and its principles of operation, haptic devices and technologies, their applications, and their advantages and disadvantages.

Keywords: To fasten response, Sense of Touch, Virtual Environment creation, Haptic rendering.

INTRODUCTION

The word haptic comes from the Greek word haptics, which means "to be able to reach" and "to speed up the reaction". Haptic recreates the sense of touch by applying action/movement or force to the user. It is more effective than watching or listening. Haptic technology can be used to train users to complete tasks that require hand-eye coordination, such as training in surgery and aircraft mechanics.

Haptics is an important term that describes the technology that humans experience through touch or movement. It has many common applications, such as vibration from mobile phones and game controllers, but alternative methods such as sound waves and wind can also be used tocreate tactile feedback.

Although haptic devices can measure the quality of the action or force exerted by the user. Through the virtual environment, humans can interact with computer applications through the touch of sensation and movement. Haptic technology allows users to see and feel virtual objects.It is very useful for blind or visually impaired people.

By using touch devices, we can touch, feel, and manipulate objects, as well as see and hear objects. Haptic devices communicate by touch or movement. There are many types of touchdevices, such as ghosts, finger pads, joysticks, gloves, steering wheels, etc.
Haptic devices are input and output devices, which means that they track user actions or actions as input, and provide a real touch that is coordinated with screen events (such as output).

A haptic device is a communicate device between the user and the computer.
Tactile/Haptic devices allow users to touch, feel, or manipulate objects in a virtual environment. The most common computer interface devices, such as the default mouse and joystick, are input-only devices. That is, tracking the user's body movements and movements has no manual feedback. The interaction of objects can be people, machines or combinations and objects and environments can be real, virtual, or combinations.

HAPTIC IN EDUCATION:

This article researches and presents some ideas for applying haptic technology to the field of education. Advances in technology are rapidly increasing the viability of touch sensations in e-learning interfaces. We believe that the haptic technology of touching and feeling virtual objects and power improves the existing teaching methods and procedures, and is a valuable tool forstudents and students to understand certain aspects of knowledge.

The immersion provided by Haptics technology can improve Effectiveness of educational apps for school-age children. In the proposed tactile application, children can use input devices, such as gloves, force feedback devices, etc., to experience natural laws, forms, and behaviors. Objects that appear visually on the screen also physically exist virtually to give the impression that they can be touched and operated as real objects.

In the field of education, haptic and mandatory feedback can greatly improve existing teaching methods, thereby

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improving the quality of educational procedures. Haptic education applications are a developing research field, and some non-commercial applications have been developed for the above-mentioned tactile interfaces. In our research and learning, applications and devices face each other, and both are for educational purposes.

In education, the use of haptic devices should be particularly beneficial in any situation that requires students to experience a real simulation of the force. However, for most current virtual reality displays, if the user attempts to touch the object virtual, there is no non-visual indication for the user to know that the object is in contact with the user's hand. Furthermore, there may not be a mechanism to prevent the user's virtual hand from passing through the viewed object using the virtual reality display.

Haptic technology can be used to 'close the loop' between sight and touch. In other words, uses touch screen technology, Students can feel all the forces that can touch the surface of a virtual object and act on it, and all the forces that a virtual object can exert on other objects displayed in the simulation.

The use of haptic technology should facilitate a series of tasks related to the learning process. For example, imagine the task of trying to teach the 4,444 students to reach behind the virtual device to repair or replace parts. Without the touch, this task is very difficult. In this case, the virtual hand of the student may pass through the device due to the lack of tactile feedback whenthe hand reaches the surface of the device.

When teaching students to repair and maintain equipment, even if the visual channel such as theoutput (of the computer) is the primary, touch and strength are also very important. In fact, haptic feedback has proven effective for many tasks.

Examples of haptic in education and training:

- Medical training
- Chemistry
- Manipulating molecules
- Physics and engineering

HAPTICS AND E - LEARNING:

Haptic technology has been widely studied in the medical training industry, and many applications have been applied to medical procedures, rehabilitation is targeted. The gaming industry uses application fidelity to improve user convenience. The tactile relevance to e- learning interfaces is growing rapidly in fields and disciplines that require the understanding of abstract concepts, especially those involving complex forces, with advances in haptic technology over the past decade and falling prices.

Haptic interfaces can maximize the potential of Web-based 3D graphics using specific Web3D standards, typically implemented alongside visual interfaces. Although it did not achieve large-scale integration with the learning management system, visual and haptic interfaces are being evaluated in various fields where they have been proposed. such as: Physics is used to illustrate difficult and abstract concepts, such as the law of hydraulics, provide comfort for students to understand basic concepts, while allowing them to actively participate in the learning process. Complex forces, such as concepts such as precession and static and dynamic coefficients of friction, as well as electromagnetic concepts that are difficult to explain. (for example, the force that acts on electrons when they pass through an electromagnetic field).

Chemical visual tactile interface, used to simulate forces at the molecular level to better illustrate the interactions between molecules and the behavior of atoms. Biology can better understand cell biology and related phenomena by simulating the forces in biological structures and nano manipulations. Projects can particularly benefit from touch interfaces due to the large amount of forces and interactions occurring in such systems.

Last but not least, allowing interaction with ancient artifacts in a virtual museum can benefit from learning history and culture. Although haptic simulation has not yet been implemented ona large scale, its possibility is increasing rapidly. Widespread adoption of web-based learning management systems and inexpensive haptic devices popularized at home for games are shaping the next generation of industry. In the near future, we will see that in the multi-modal intelligent

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user interface implemented in the next-generation e-learning system,tactile(the sense of touch) will replace the sense of sight and hearing.

How does haptic technology work in Education?

Education has acquired new teaching methods to improve the developmental learning process. In learning, the process involves acquiring knowledge without interacting with the means of providing it. One of the methods is that after reading the book, the student accepts the knowledge, but there are limited ways to test whether he fully understands the knowledge. But now, with the help of haptic technology, the learning process is proceeding on a practical basis.

Falcon was actually made into a video game controller, but it's a very effective classroom tool. It is a futuristic device in metal and plastic, composed of a support and three arms connected to a spherical handle. These arms are placed around the base at 12, 8 and 4 o'clock. Therefore, when the handle moves, the three arms move simultaneously. Each arm is coupled with a motor, and the arm's position is updated every millisecond. It weighs six pounds and measures nine by nine by nine inches. Compatible with Windows 95 or later Connect to a computer via USB and plug the power outlet into an electric outlet.

To feel the virtual object, hold the handle of the ball with your main hand and move all five fingers up / down, left / right, inside / outside towards the circumference of the ball. Can detect 3D objects. It is like a Cartesian diagram in mathematics, where the x, y, and z planes are processed. Using Falcon to feel virtual objects is different from using touch in reality. With a realistic touch, the entire surface area of the hand is brought to the object to identify texture, size and shape. However, Falcon can feel the grip in small pieces at once, so you have to move the grip to put these pieces together to identify the whole object.

For example, imagine extending two fingers

toexplore the surface area of an apple, find the top, move to the bottom, and then walk around the circle. Falcons can represent virtual objects that are 4 x 4 x 4 inches or less. For reference, the circumference of the virtual bowling ball is about 4 inches, and the circumference of the virtual peas is about 1/8 inch. Two pounds is the maximum virtual weight of an object, so this number is used when displaying the weight of heaviest thing/item. Then the lighter(less weight) ones are scaled to this number.

Education Benefits:

- The combination of kinesthetics and sensory perception creates
- Touch involves active and intentional actions
- Particularly powerful neural pathways in the brain
- Students can sense nanomaterials, such as viruses photographed under an atomic force microscope.

FUTURE ENHANCEMENT:

It is expected that in the future of, advances in haptic technology will bring more portable, higher bandwidth, and lower cost simulators to assist educators at all levels in their learning.

Virtual reality is expected to change the future of education. Without proper haptic technology, you can't fully navigate virtual reality. In fact, technologies such as virtual reality, augmented reality, mixed reality, artificial intelligence, and tactile feedback are showing signs of working together to shape our tomorrow.

What if we could delve deeply into all kinds of quantum and molecular particles that have evolved over the past 3.8 billion years, from single-celled organisms to modern-day Homo sapiens? Normally you might be read articles of the coin system or the clothing styles of ancient civilizations.What if you can experience it directly in front of you here? You can see the Sword of William Wallace or the Territory of the Great Empire.

The rise and fall of civilization, dynasties, historic sites, the birth of languages, currency systems, transportation, and communication systems. Everyone is waiting for your interaction. In short term, the past will be interactive in the future.

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CONCLUSION:

Educators continue to face challenges and need to provide students with physical examples to make the course materials more interesting and easier to understand. Standard teaching methods such as experiments, software simulations, and demonstrations will help cultivate students' ability to connect theoretical principles with physical reality.

However, even with these auxiliary tools, when students cannot feel their influence, the concepts of eigenvalues, instability, and time constant are often mysterious. In order to provide an intuitive connection between the physical world and mathematical concepts, haptic technology is currently being integrated into the curriculum. When considering the extraordinary ability of human hands, the benefits of tactile technology to education are obvious.

In other words, the Human Hand is a multi- functional system capable of pressing, grasping, squeezing, and stroking objects. In addition, human hands can be used to explore the properties of objects, such as the texture, shape and smoothness of the surface, and can be used to manipulate tools to repair equipment or perform delicate operations.

The haptic technology is also an excellent training tool that can help scientists explore the structure from the nano-world to the macro-world of daily life.

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