SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
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DEPARTMENT OF INFORMATION TECHNOLOGY

16IT AUGMENTED REALITY AND VIRTUAL REALITY

III YEAR – V SEM

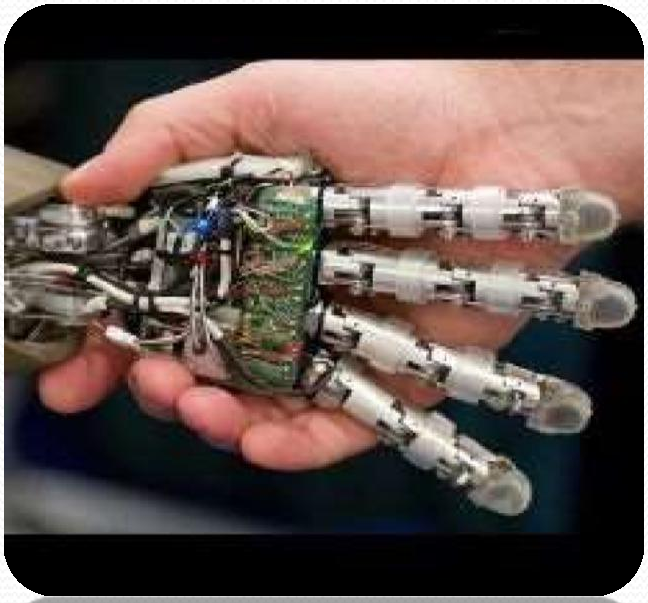
UNIT 4 – INTERACTIVE TECHNIQUES AND TOOLS

TOPIC 4 –Haptic feedback

HAPTICS: A TOUCH FEEDBACK

- ‘Haptics’ is derived from the Greek word ‘haptikos’ which means – ‘being able to come into contact’.

- Haptics is the science of applying touch (tactile) sensation and control to interact with computer applications.



HISTORY

- In the early 20th century, psychophysicists introduced the word *haptics* ,that addressed human touch-based perception and manipulation
- In the 1970s and 1980s, robotics also began to focus on manipulation and perception by touch.
- In the early 1990s a new usage of the word *haptics* began to emerge. The confluence of several emerging technologies made virtualized haptics, or computer haptics possible.

Virtual Reality

Virtual reality is a form of human-computer interaction providing a virtual environment that one can explore through direct interaction with our senses.

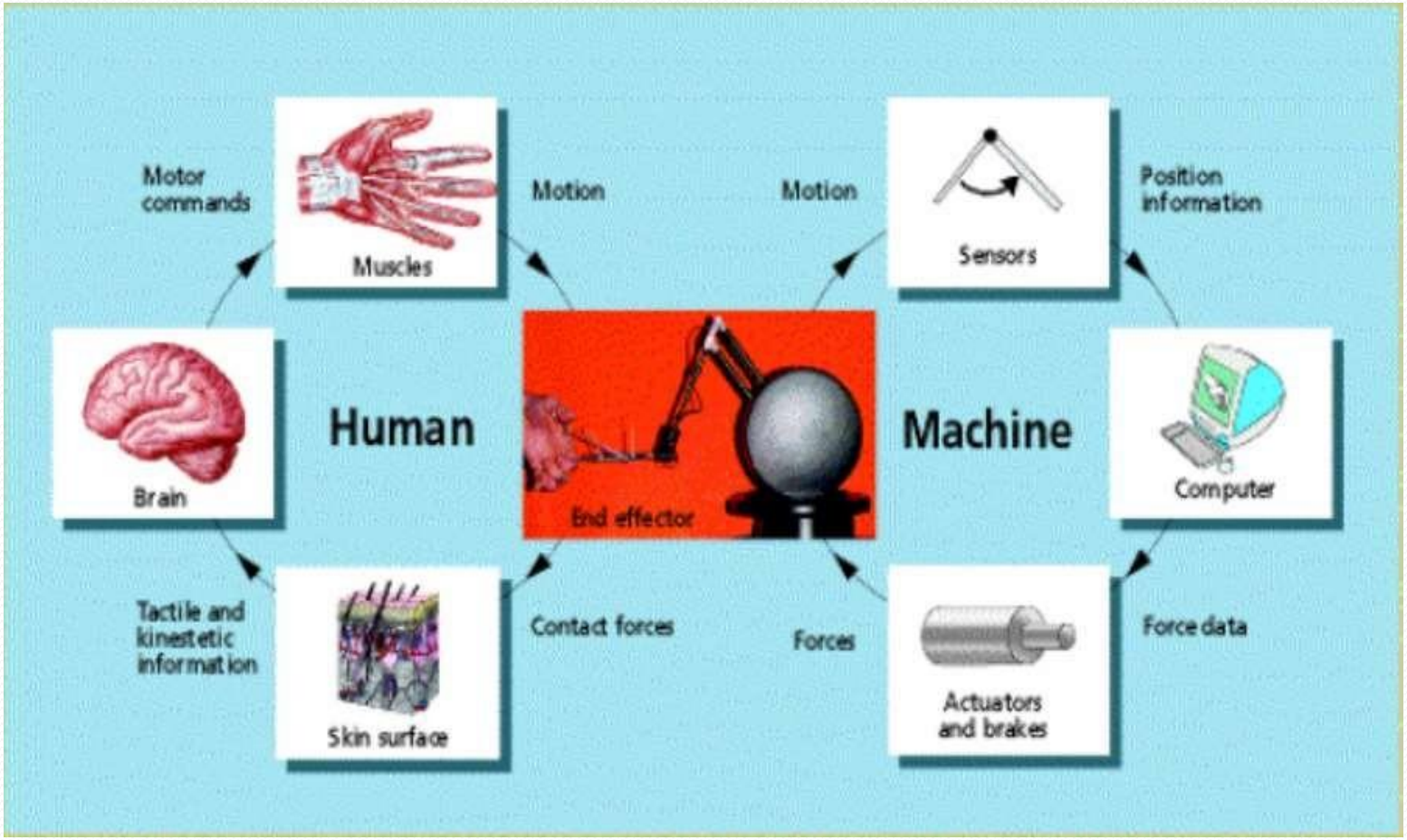
The Real World

- User should be able to touch the virtual object and feel a response from it.
- In order to complete the imitation of the real world one should be able to interact with the environment and get a feedback.
- This feedback is called Haptic Feedback.

Haptics Technology

- **Haptic technology** is a tactile feedback technology which takes advantage of the sense of touch by applying forces, vibrations, or motions to the user.
- A haptic device gives people a sense of touch with computer-generated environments, so that when virtual objects are touched, they seem real and tangible.

Basic system configuration

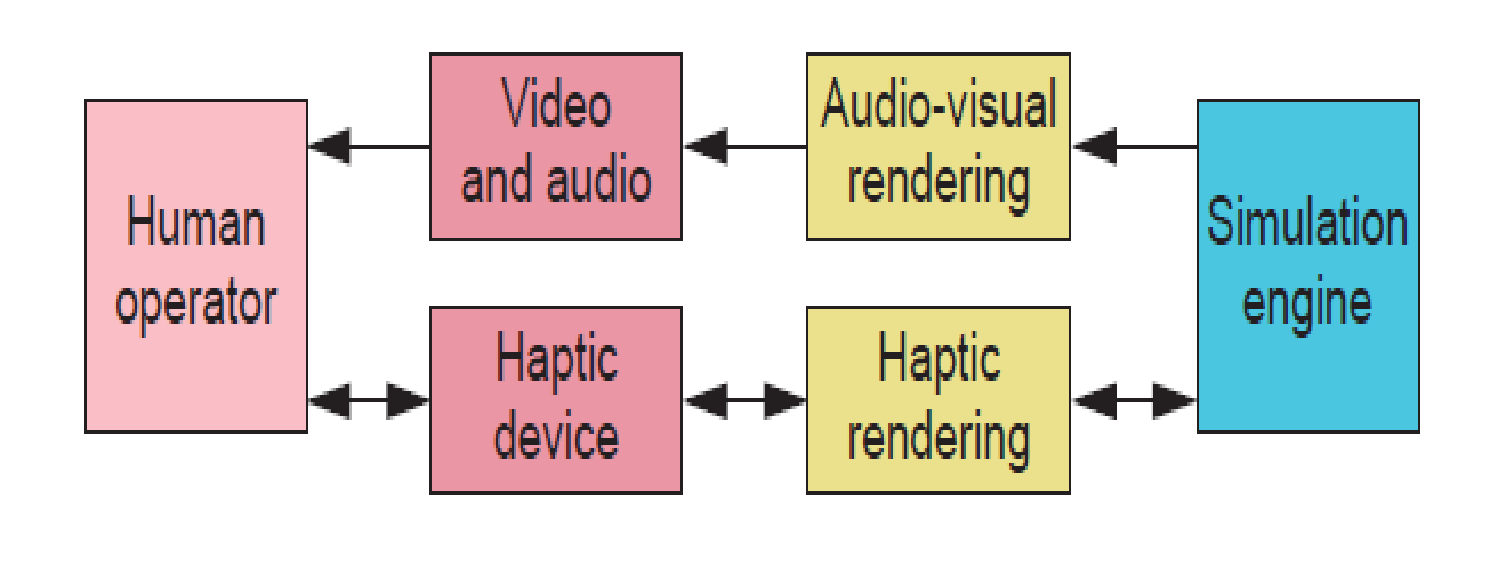


Haptic information

- It is the combination of:
  - Tectile information
  - Kinesthetic information

- *Tectile Information*: It refers to the responses of the receptors of the skin in contact with an object.
- *Kinesthetic Information*: It refers to the information acquired through the sensors in the joints.

Haptics Feedback



The human operator typically holds or wears the haptic interface device and perceives audiovisual feedback from audio and visual displays

The technology

- Haptics is implemented through different type of interactions with a haptic device communicating with the computer. These interactions can be categorized into the different types of touch sensations a user can receive:
  - Tactile Feedback
  - Force Feedback

Tectile feedback (touch)

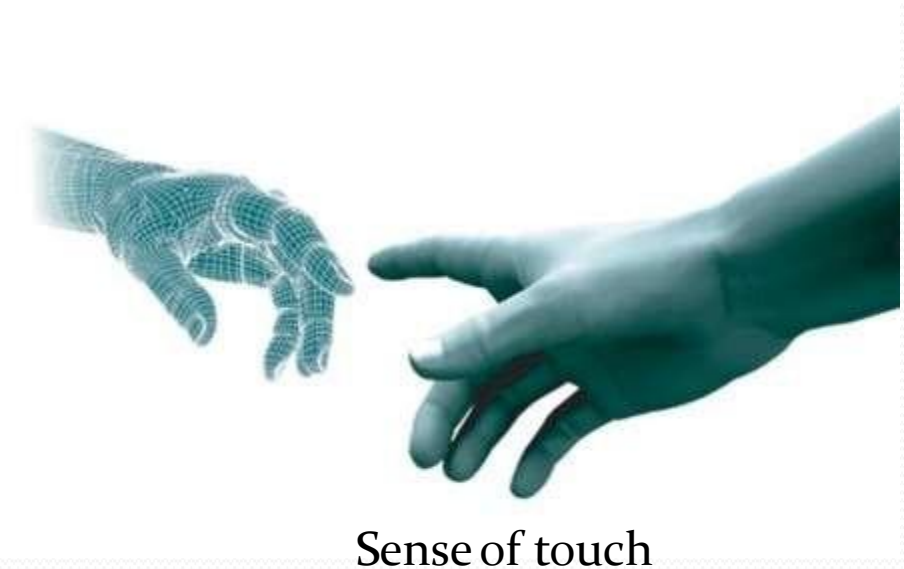
- Refers to the sensations felt by the skin.
- It allows the user to feel things such as the texture of surfaces, temperature and vibration.

Force feedback (kinesthetic)

- It reproduces the directional forces that can result from solid boundaries.
- E.g. the weight of virtual objects, inertia, etc.

Sense of touch in haptic feedback technology

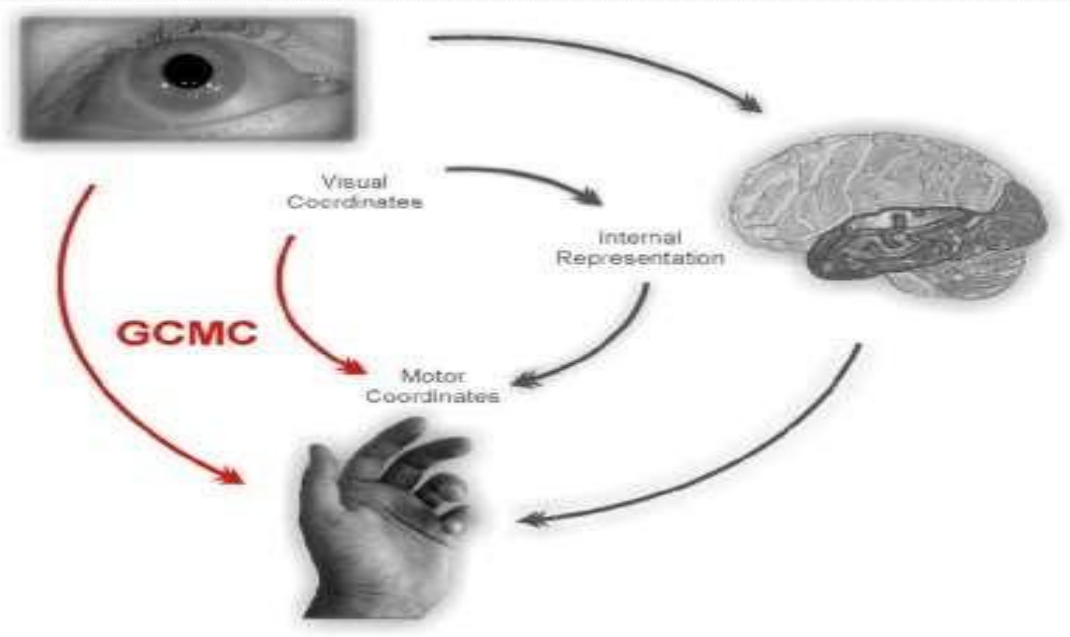
- In ***Haptic Feedback*** there are three types of ***Haptic Sensations*** to feel with our ***Sense of Touch*** and that is why we call that technology as the ***Science of Touch***.



Sense of touch

1. Kinesthetic (Force) Sense :

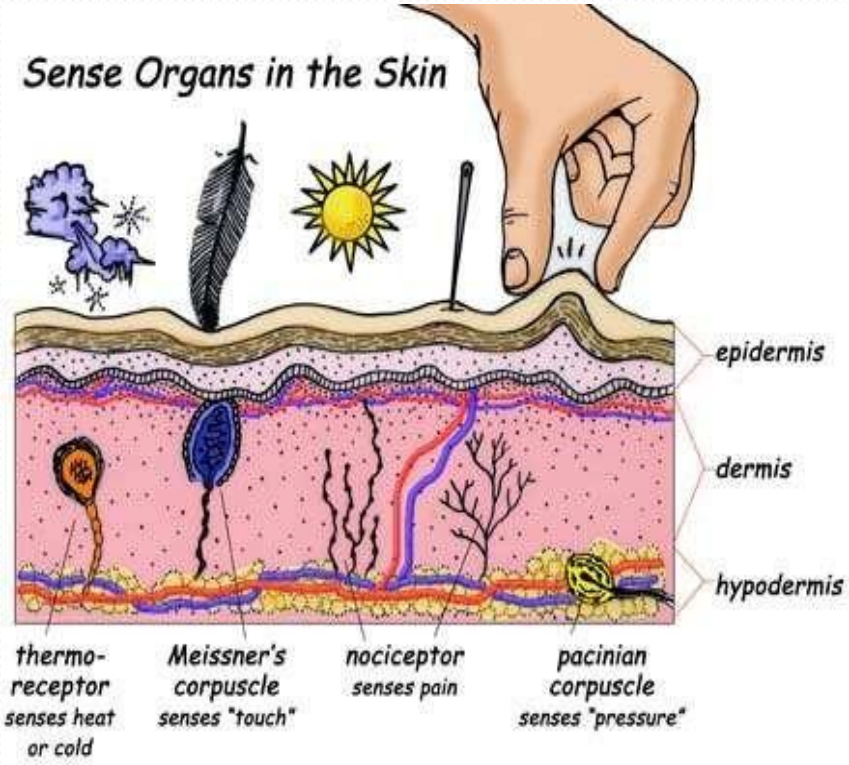
- It is the feeling of power and force.
- The motor system constantly informs about the position of arms, and the efforts made to move them.



MOTOR SYSTEM

2. Tactile (Touch) Sense :

- This is the sensation of textures.
- At our fingertips (and more broadly on our skin), we have pressure sensors which gives us information on the relief of the object.
- This is what allows us to easily differentiate a smooth object of a rugeux object.



Touch Sense

3. Temperature (Thermal) Sense :

- It is the sensation of cold or heat.
- This sensation tells us about two points:
  - First, the temperature of the relative object to our finger (when our finger is cold, warmer objects appear to us).
  - Second, the nature of the object. Even if a piece of wood and a piece of metal are at the same temperature, we perceive them differently

Temperature sense

Key advantages of touch feedback

- Creates the perception of touching physical buttons and switches.
- Works with a wide range of touch screen sizes and technologies.
- Provides fast, tactile response synchronized with sound and graphics.
- Enhances usability, particularly for noisy or distracting environments.
- Helps improve user performance, productivity, and safety.
- Programmability can be used to further enhance usability.

Design of Haptic System

- Haptics are enabled by **actuators** that apply forces to the skin for touch feedback.

- Haptic feedback use electromagnetic technologies such as **vibratory motors**, like a vibrating alert in a cell phone or a voice coil in a speaker, where a central mass is moved by an applied magnetic field.

Design of Haptic System

- The actual process used by the software to perform its calculations is called **haptic rendering**. A common rendering method uses polyhedral models to represent objects in the virtual world.

- The job of conveying haptic images to the user falls to the interface device.

Haptic devices

- It allows users to touch, feel and manipulate 3-D objects in virtual environments.

How are Haptic Devices Different?

- Common interface devices like mouse and joystick are only input devices. No feedback.

- Haptic devices are input-output devices.

Classification of haptic devices

1) Virtual reality/ Telerobotics based devices

i) Exoskeletons and Stationary device

ii) Gloves and wearable devices

iii) Point-sources and Specific task devices

iv) Locomotion Interfaces

2) Feedback devices

i) Force feedback devices

ii) Tactile displays

Exoskeletons

- Large and immobile systems that the user must attach him or herself to.
- Their large size and immobile nature allow for the generation of large and varied force information.

Gloves and wearable devices

- The user can move naturally without being weighed down by a large exoskeleton or immobile device

- E.g.Hand Master

FORCE FEEDBACK DEVICES

- Connected to computer systems applying forces to simulate the sensation of weight and resistance providing information to the user.

- Input from the user in the form of hand, or other body segment whereas feedback from the computer or other is in the form of force or

TECTILE DISPLAYS

- Tactile feedback tells us the texture of the surfaces.

- Using this we can feel different surfaces and slipping sensations can be produced

Areas of Haptics

- **Computer Haptics-** It helps to enable a user to feel something happening in the computer's mind through a typical interface.

- **Human Haptics-** It tells us how humans and living beings experience touch.

- **Machine Haptic-** It tells us how mechanical devices touch and feel their environment

Applications of Haptics Technology

- ***Computer and video games:*** Haptic feedback is commonly used in arcade games, especially racing video games.

- ***Mobile devices:*** Tactile haptic feedback is becoming common in cellular devices.

Applications of Haptics Technology

- ***Personal computers*:**

  Apple's MacBook and MacBook Pro started incorporating a "Tactile Touchpad" design.

- ***Virtual reality*:** Haptics are gaining widespread acceptance as a key part of virtual reality systems.

Applications Of Haptics Technology

- ***Medicine*:**Haptic interfaces for medical simulation may prove especially useful for training in minimally invasive procedures such as laparoscopy and interventional radiology as well as for performing remote surgery

Applications of Haptics Technology

- ***Robotics*:**Haptic technology is also widely used in teleoperation, or telerobotics.

- ***Arts and design*:**Haptics is used in virtual arts, such as sound synthesis or graphic design and animation

Future of haptic technology

- Future applications of haptic technology cover a wide spectrum of human interaction with technology.
- Current research focuses on the mastery of tactile interaction with holograms and distant objects.
- Which if successful may result in applications and advancements in gaming, movies, manufacturing, medical, and other industries.[

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Future of Haptic Technology

What the world is waiting for?

Future of haptic technology

- The medical industry stands to gain from virtual and telepresence surgeries, which provide new options for medical care.
- The clothing retail industry could gain from haptic technology by allowing users to "feel" the texture of clothes for sale on the internet
- Future advancements in haptic technology may create new industries that were previously not feasible or realistic.

conclusion

- Haptic devices must be miniaturized so that they are lighter, simpler and easier to use.
- Large potential for applications in critical fields as well as for leisurely pleasures.
- Haptics is the future for online computing and e-commerce, it will enhance the shopper experience and help online shopper to feel the merchandise without leave their home

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Thank You