Virtual Reality (VR)

Outline

- Pengertian Virtual Reality (VR)
- Lingkungan VR
- Elemen VR
- Aplikasi VR
- Sejarah VR
- Sistem VR
- Teknologi VR

What is virtual reality?

- a way to visualise, manipulate, and interact with a virtual environment
- visualise
  - the computer generates visual, and auditory outputs
- manipulate
  - manipulate objects in this virtual world
- interact
  - real time manipulation, feedback from the environment

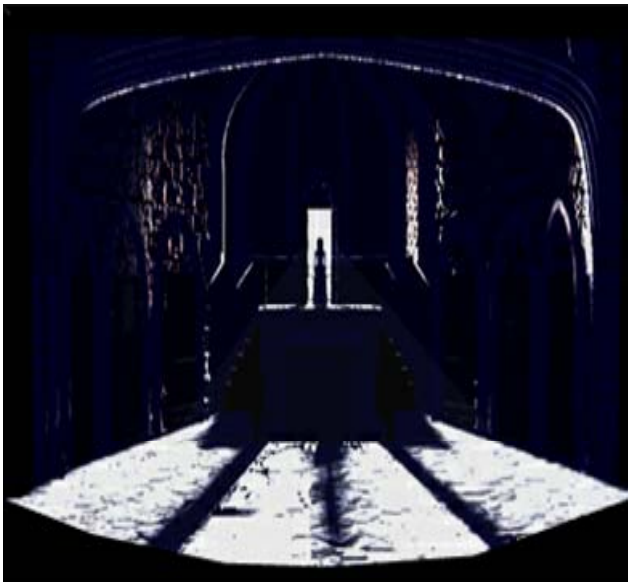
What is virtual reality?

- In virtual reality you have a sense of and interact with three-dimensional things as opposed to pictures or movies of things.

- VR is the use of computer technology to create the effect of a 3-D environment (virtual environment) containing 3-D objects which have a strong sense of spatial presence with respect to the user.

The environment could be

- simulated real world
- fantasy world
- data, research



Key Elements

- Real-time graphics
  - framerate: 30 frames/sec
- Interactive
  - manipulation possible?
  - response times
- Multi-sensory
  - vision
  - sound
  - force feedback

Real-time graphics:
- You do it really fast
- You do it slightly slower
- You do it ok
- You do it badly

Real-time programming:
- You do it = you succeed
- You don't do it

Applications

- Architectural walkthroughs
- Rapid prototyping
- data visualisation
- medical modelling
- weather simulations
- sound simulations
- traffic simulations
- true 3D user interfaces
- communication (virtual meetings)
- high risk job training
- entertainment

History

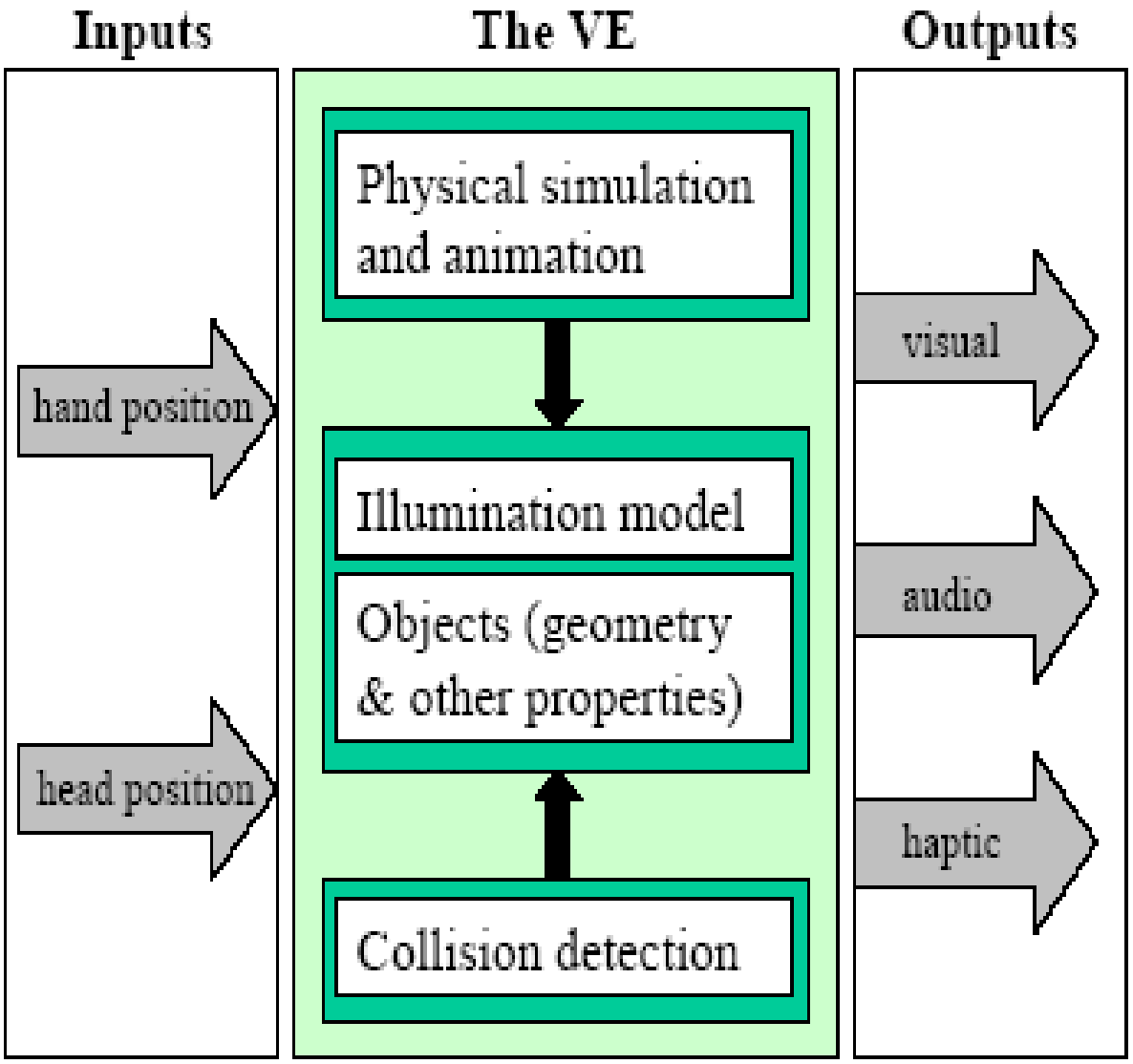
- 1957
  - Morton Heilig invented the ‘Stereoscopic TV Apparatus for Individual Use’. (Patented 1960)
- 1960
  - The Boeing Corporation coined the term *computer graphics*.
- 1963
  - Ivan Sutherland submitted his doctoral thesis ‘SKETCHPAD: A man-machine graphicalcommunication system’.
- 1965
  - Ivan Sutherland published ‘The Ultimate Display’.
- 1968
  - Ivan Sutherland published ‘A Head-mounted Three Dimensional Display’.
- 1989
  - Jaron Lainer coined the term *virtual reality*.
- 1993
  - SGI announced the *Reality Engine*.

VR Systems

- VR Systems can be divided into three groups
  - non-immersive systems (like workstations)
  - immersive systems (like HMD)
  - hybrid systems (graphics on top of real world)
    - also called: augmented reality systems

- The following conditions are important to experience full immersion:
  - Full field of vision display, usually produced by the wearing of a Head Mounted Display.
  - Tracking of the position and attitude of the participant's body.
  - Computer tracking of the participant's movements and actions.
  - Negligible delay in updating the display with feedback from the body's movements and actions.

A Generic VR System



VR Technology

- Input devices
  - 3D Trackers
  - 3D Mice (or Joystick)
  - Data gloves

- Output devices
  - Head-mounted displays
  - Headphones
  - Haptic devices

Rendering

- visual rendering
  - 20 to 60 frames per second required
  - shading, lighting, surface texture
  - computer intensive
- auditory rendering
  - sounds get louder as get closer
  - sounds come from apparent source
- haptic rendering
  - generating the sensation of touch
    - chemical reaction simulations
    - telepresence, robot arms
    - current research
- motion rendering
  - simulators

A Simple VR System

You can experience a virtual environment using a typical personal computer and a few items of specialized hardware:

– for a non-immersive system:
  - a 3D graphics card,
  - a 3D sound card,

– an immersive system also requires
  - a head-mounted display (HMD)
  - a 6D tracker.
  - Some force feedback input device

Image Generation Problems

- Only 1/60 of a second available per image.
- The geometry of realistic VR is very complex.
- New approaches needed:
  - Image-based rendering
  - Organization of scene data
  - Hidden surface removal

VR Research

- VR is a convergence of many disciplines
- Important subjects
  - Interactive devices
  - Man-machine interaction
  - Distributed virtual environments
  - Real-time rendering algorithms
  - Simulation
  - Collision detection
  - Database design
  - Artificial life

The Future of VR

- Virtual Reality is a growing industry
- PC and specialized hardware are getting – better, faster and cheaper
- Maybe 3D user interfaces will replace the windows based ones?
- Far reaching ideas
  - The retinal display
  - Tracking based on the nervous system

VR and the Internet?

- Virtual Reality Modeling Language (VRML)
  - VRML97 has been accepted as an ISO Standard
- VRML neither requires nor imposes immersion.
  - Not VR?
- What is VRML?
  - A 3D interchange format
  - A 3D analog to HTML
  - A technology to integrate 3D, 2D, text and multimedia into one coherent model.

Referensi

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