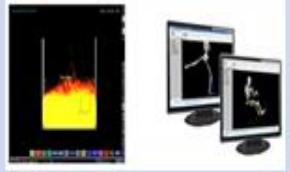
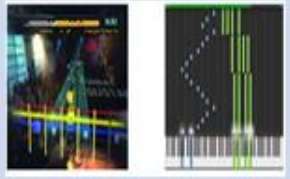
Multimodal Interfaces in Virtual Training Systems

2019.7.29

SIGGRAPH Web3D Korea Chapter
Kwan-Hee Yoo
Chungbuk National University

Examples of Virtual Training System

Medical	Defense	Manufacturing	Safe	Education	Sports
Endovalscular Training System	F-22 Full Mission Trainer	Manufacturing Process	Accident response	Virtual Science 	Health
Hip,Knee,Shoulder Training System	Shooting Trainer		Fire Training	Playing musical instruments 	
	Pilot trainer		Traffic Safety	Vehicle driving	

Virtual Training System

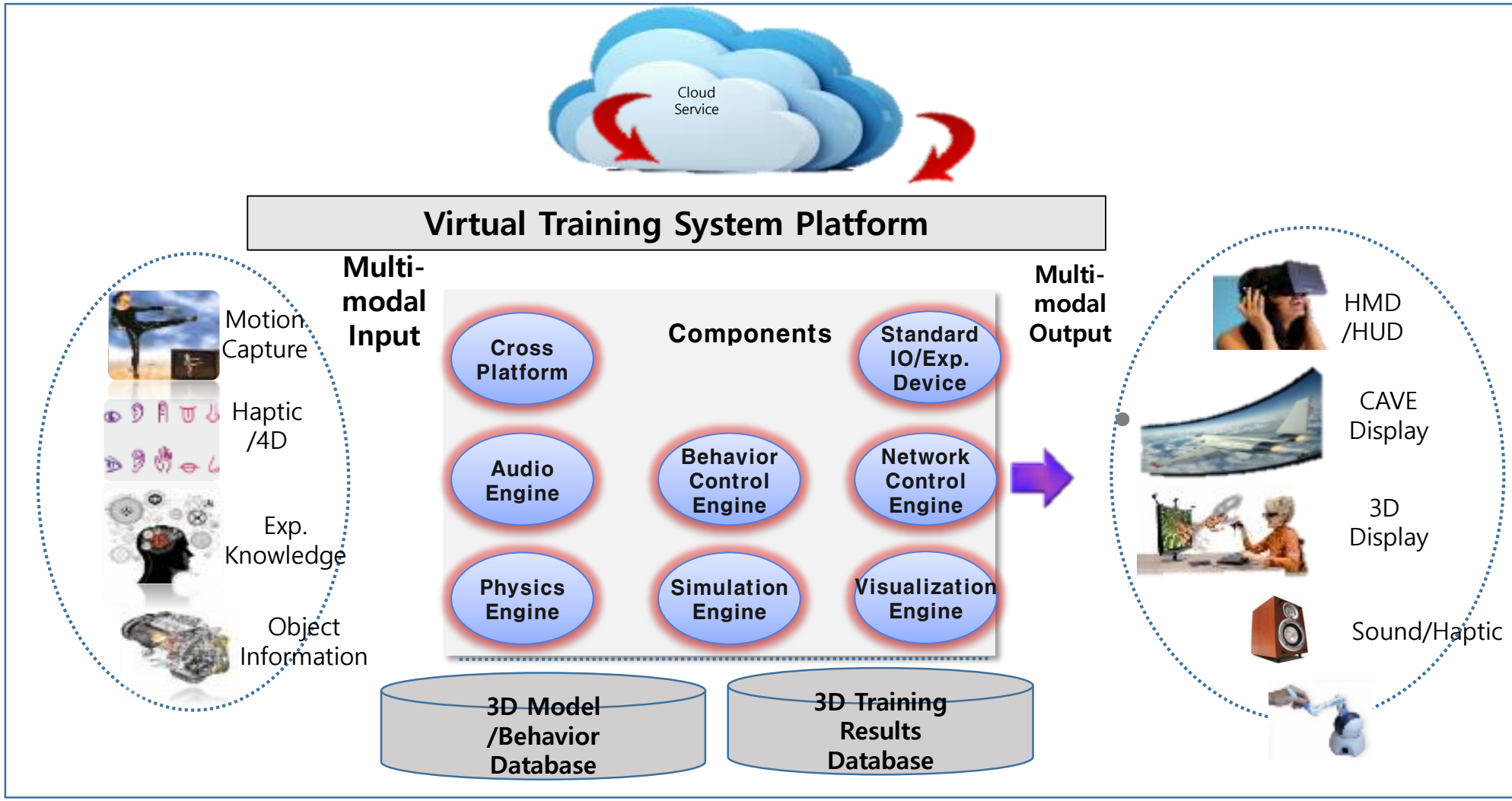
- **Definition**
  - A training system that provides a safe and inexpensive education and training more effectively than actual training while realizing immersive experiences by computer simulation under virtual environment similar to actual manufacturing / defense / medical / disaster scene.

  - It is possible to overcome temporal and spatial limitations by minimizing the risk of work environment

Virtual Training Systems

- Task specification
- Training program
- Performance measures
- Feedback and knowledge of results
- Transfer of training

Virtual Training System



Original Source by Dr. Jeong

Multimodal Interfaces in Virtual Training

- Two aspects
  - Transparency: the condition for the human operator to perform the task in VE without perceiving the effect of presence of the mediating system generating the appropriate stumuli
  - Fidelity: the ability of the VE interface system to generate appropriate stimuli without being affected by disturbing effects during time.

Three sensory modalities in Virtual Training

- Vision
- Audition
- Haptics

Three sensory modalities in Virtual Training-Vision

- Vision: a large number of perceptual primitives.
  - ✓Cortical visual pathways: where(dorsal) stream, what(ventral) stream
  - ✓What: the analysis of form and color
  - ✓Where: the analysis of motion and spatial relations
  - ✓Perception: color, space, motion
  - ✓HMD(head mounted display)

Three sensory modalities in Virtual Training – Hearing (audition)

- Audition: the localization of sound in 3D spaces.
  - ✓auditory analysis of scenes
  - ✓Music and speech perception
  - ✓Sound feedback

Three sensory modalities in Virtual Training - Haptics

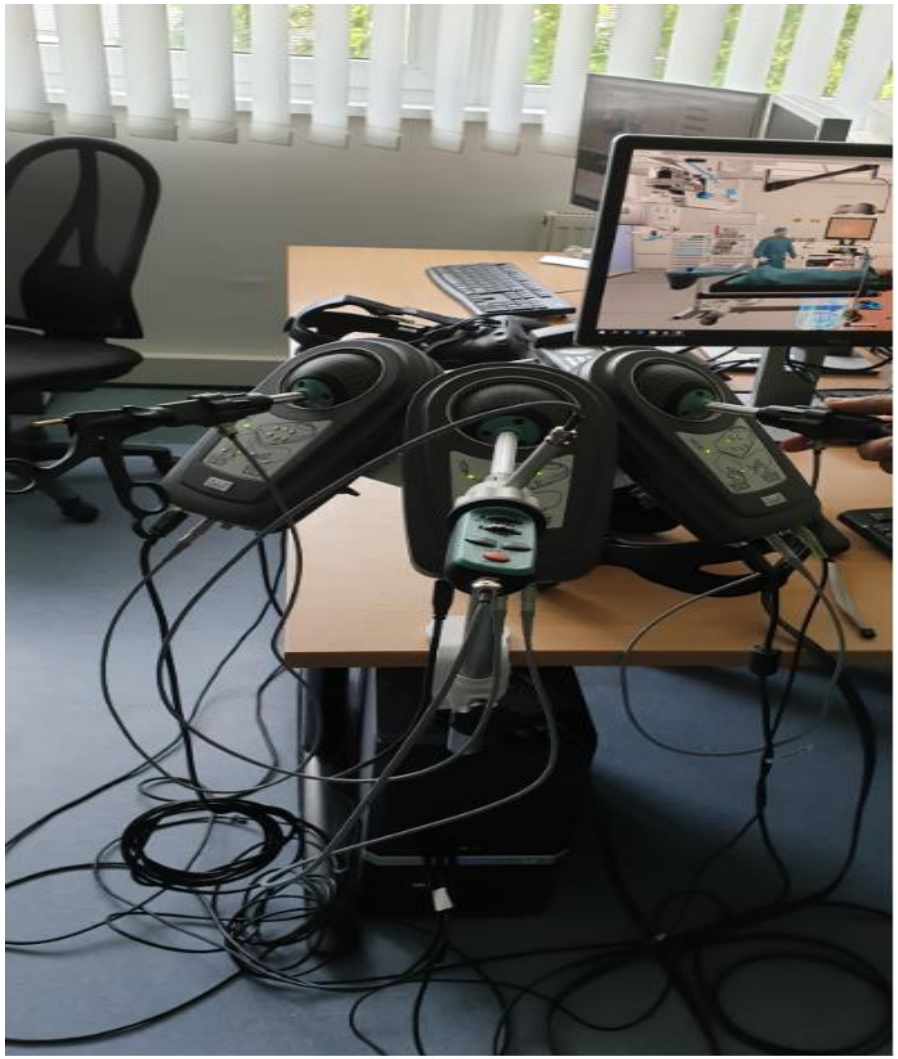
- Haptics: exploits tactile and kinesthetic stimuli to acquire information from contact condition of the user with the external environment.
  - ✓Kinesthetic: the sense of balance, sense of touch
  - ✓Somato sensation
  - ✓What stream: perceiving objects and their properties
  - ✓Where stream: the localization of objects with respect to a user's frame of reference.
  - ✓Perception-action loop

Multimodal Interfaces in Medical Training

- Foot-based interaction: Navigation, Sensor Floor
- Eye+Foot: Hands-free interaction in the operating room, (foot: navigation, eye: panning and zooming)
- Projector-based augmented reality system for interventional visualization inside MRI scanners

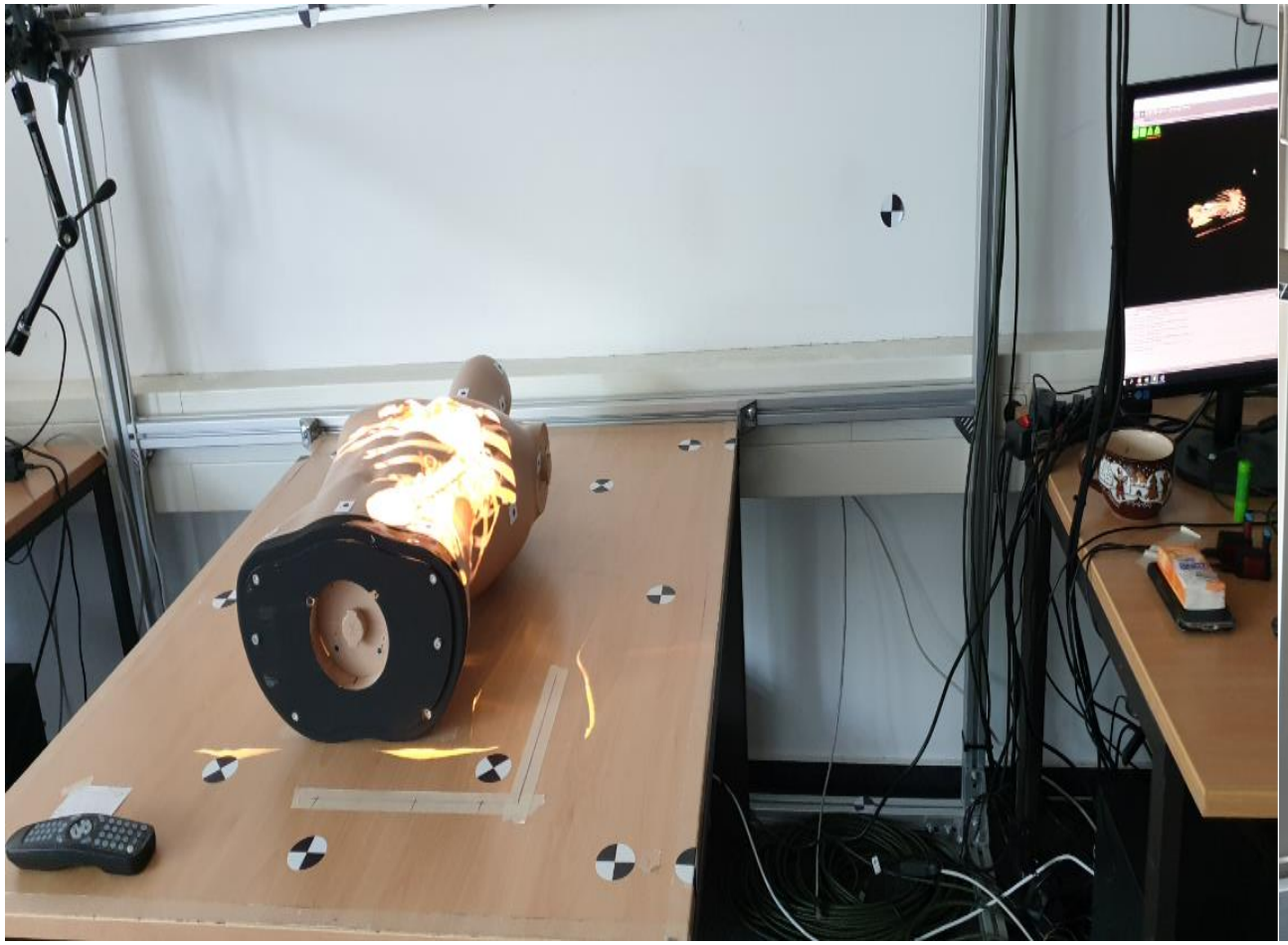
Multimodal Interfaces in Medical Training

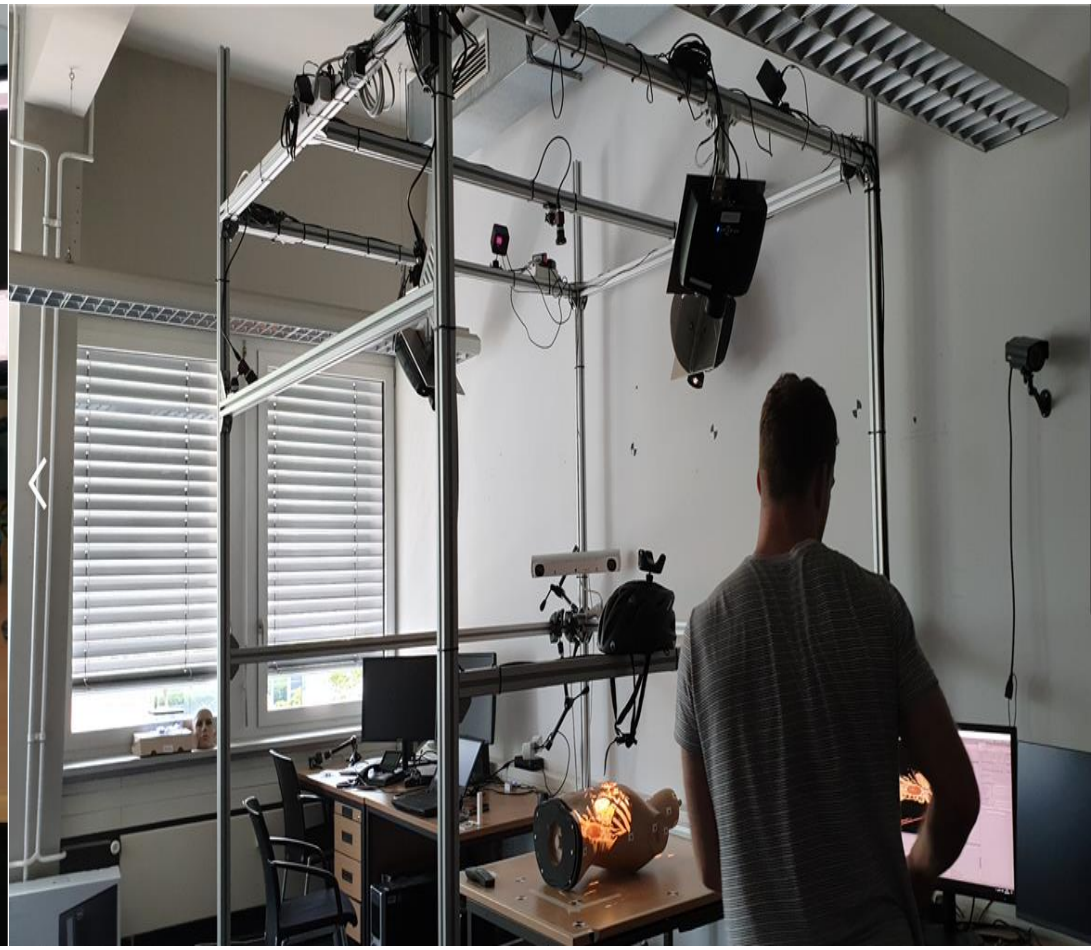
Multimodal Interfaces in Medical Training



Multimodal Interfaces in Medical Training

Multimodal Interfaces in Medical Training





Multimodal Interfaces in VR projections

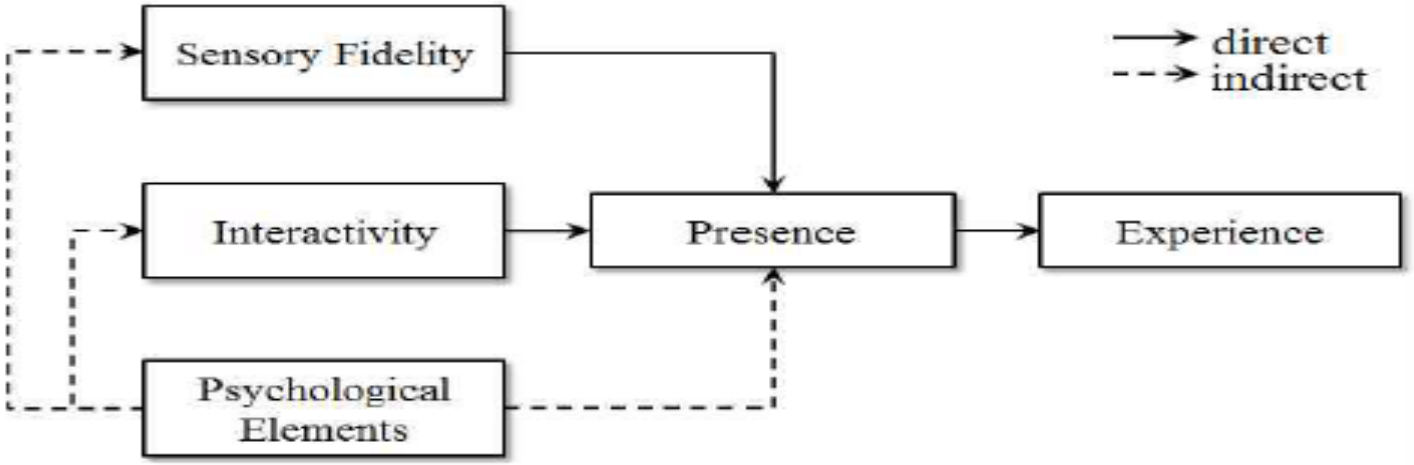
- Cameras
- Interaction
- Audio & Sound

Multimodal Interfaces in Virtual Vehicle Maintenance System

- Foot-based interaction: Navigation, Sensor Floor
- Phased disassembling implementation using a plier and a flare-nut-open-wrench
- Finger-based navigation

Multimodal Interfaces in Virtual Submarine Simulation

- Sensory fidelity, Interaction), Psychological elements

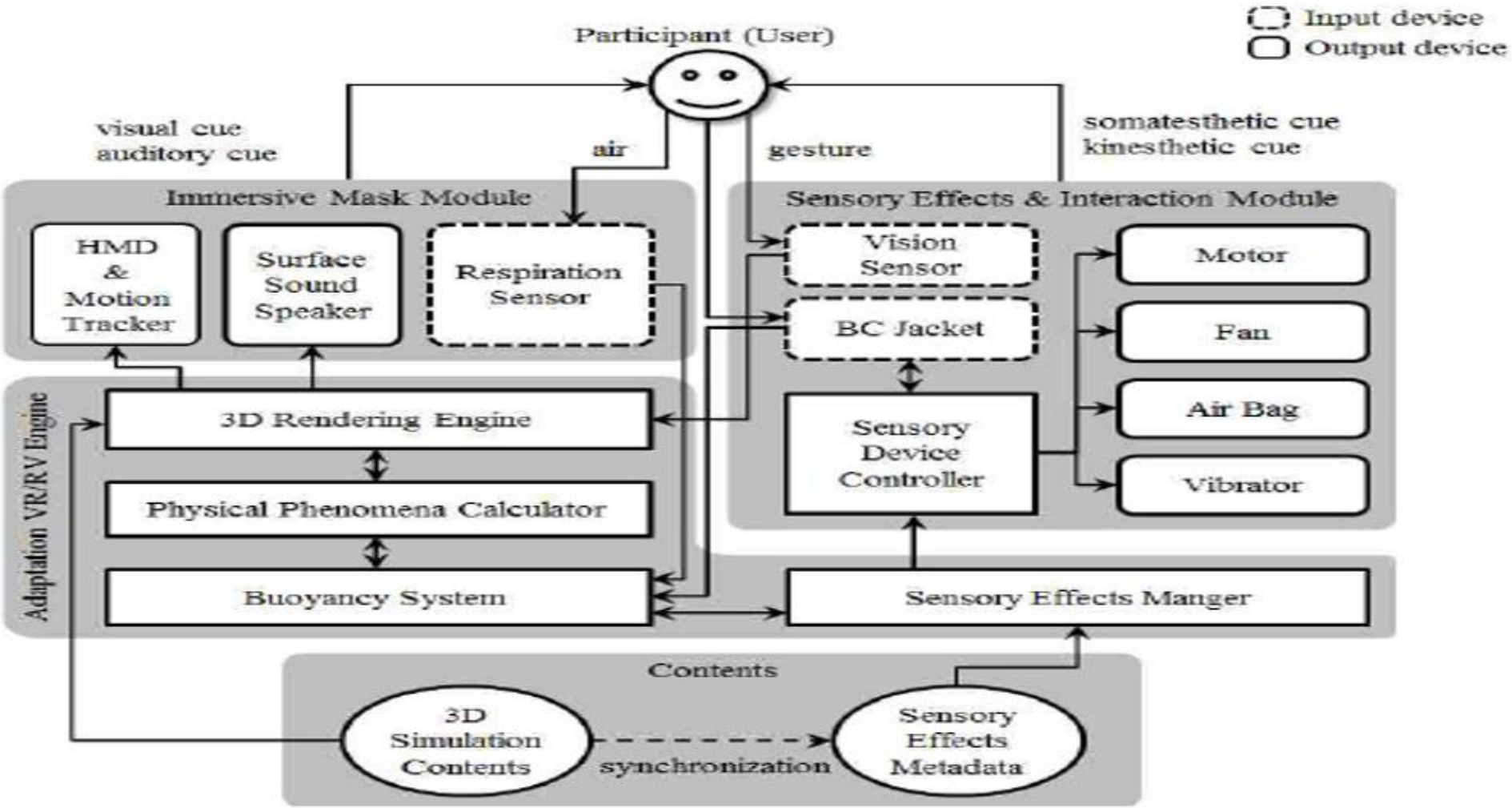


Multimodal Interfaces in Virtual Submarine Simulation

Factors of physical sensory effect of submarine environment

- Buoyancy
- Pressure
- Temperature
- Collision

Multimodal Interfaces in Virtual Submarine Simulation



Examples of Virtual Training System

- **Vehicle Driving Simulator**

https://www.youtube.com/watch?v=uOMmlfXTUNc

Examples of Virtual Training System

- **Ship Flight Simulator**

https://www.youtube.com/watch?v=kPKRDfRDLU8

Examples of Virtual Training System

- **Excavator Simulator**

Three sensory modalities in Virtual Training

- Vision
- Audition
- Haptics
- Combination of three items