An Augmented Reality system for training medical students

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Introduction

- The project covers two topics:
  - Computer Vision
  - Education
- The project focuses on:
  - Medical Domain

The System

- Goals:
  - helping first-year medical students in learning anatomy and surgical skills
  - enhancing the learning experience of students during anatomy classes
- Strategy:
  - Interactive system that makes use of Augmented Reality (AR)

Motivation

- Learning and teaching procedures need to evolve to take into account new technologies[1]
- Education is suffering from reduction of course hours and emphasis of early clinical experience[2]
- Medical education should not compromise patient safety[3]
- AR is already used in surgery[4]

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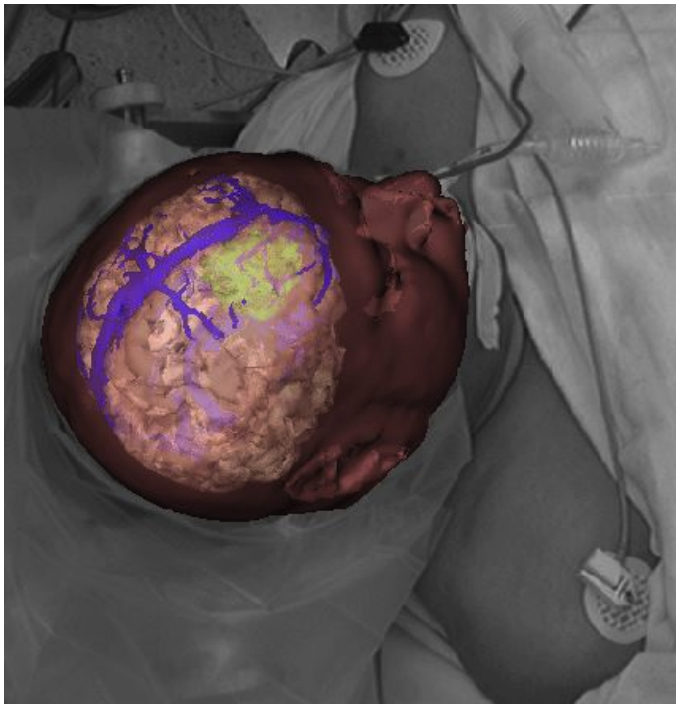
[1] Gutierrez et al., *Evaluating the Usability of an Augmented Reality Based Education Application*, 2010

[2] Chien et al., *An Interactive Augmented Reality System for Learning Anatomy Structure*, 2010

[3] M. Good, *Patient simulation for training basic and advanced clinical skills*, 2003

[4] Sielhorst et al., *Advanced Medical Displays: A literature review of Augmented Reality*, 2008

What is AR?[5]



A combination of a real scene viewed by a user and a virtual scene generated by a computer that augments the scene with additional information.

[5] Ronald Azuma. *A survey of augmented reality*. Presence, 1997.

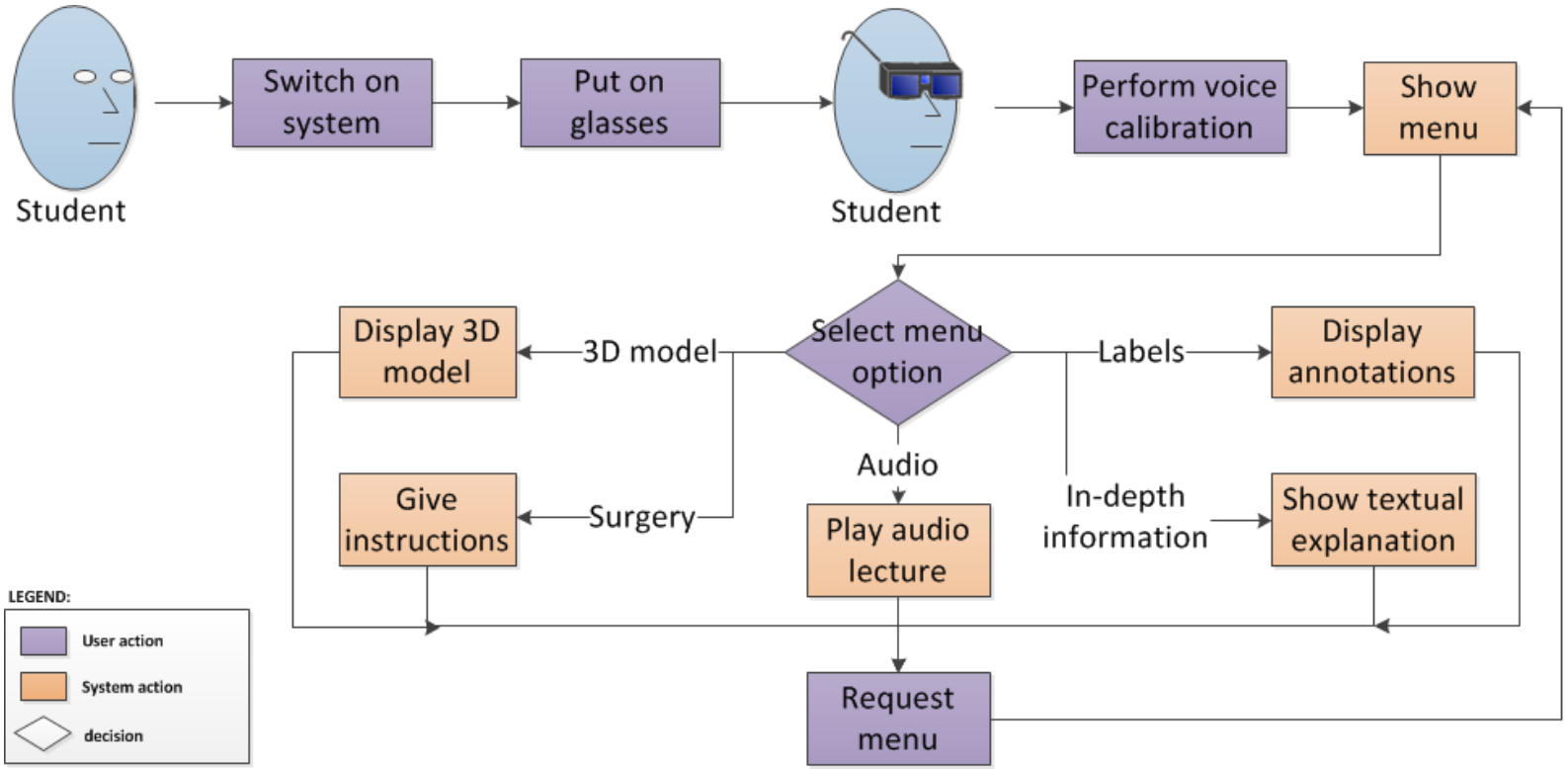
Benefits of AR for our system

- Enhances the students perception of the anatomy of the human body
- Can guide students in their exploration
- Provides more effective learning
- Offers interaction with displayed information

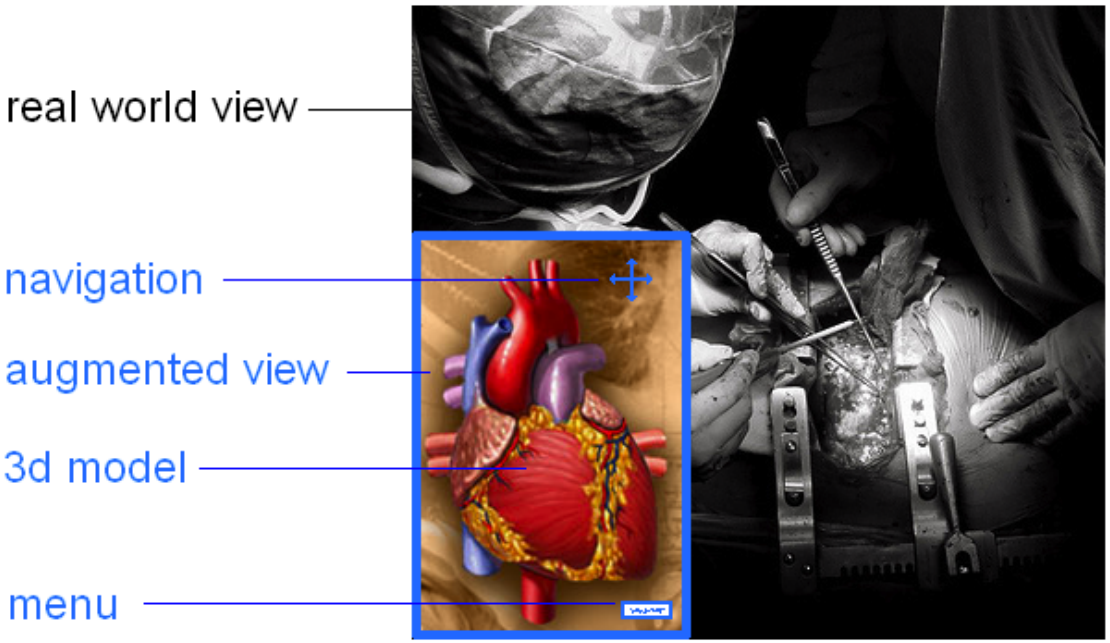
Interaction

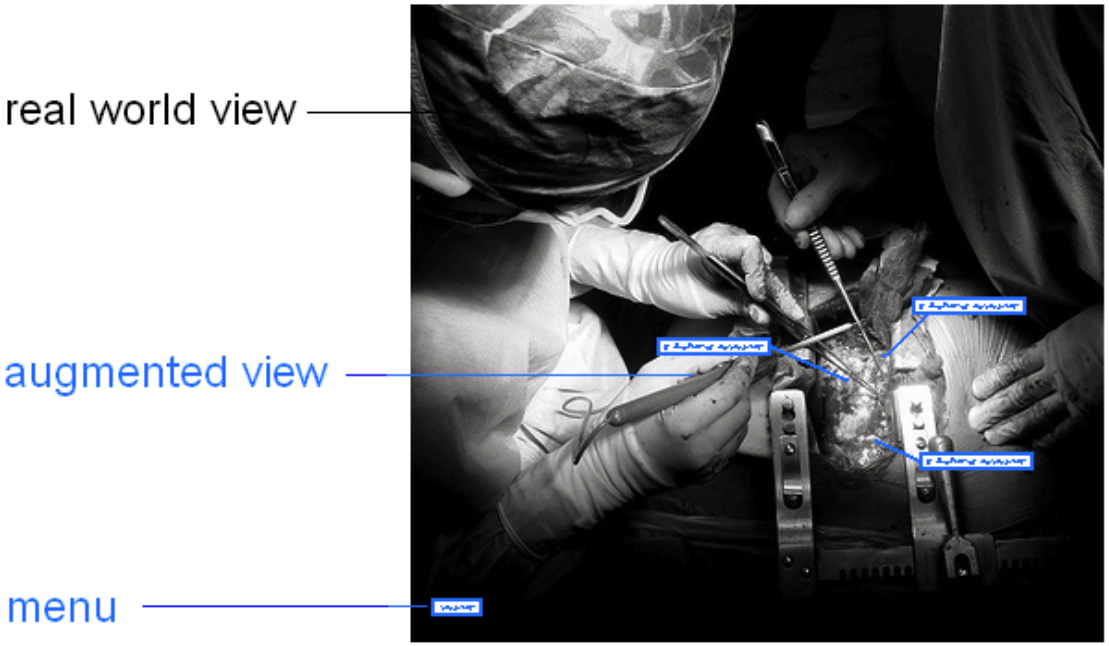
- Input modalities
  - Visual:
    - Images of the real world
    - User's gestures
  - Speech:
    - Voice commands
- Output modalities
  - Visual:
    - Different layers of augmented information (labels, in-depth textual information, 3D model, surgery instructions)
  - Audio:
    - Audio lecture

Interaction Process



Interface

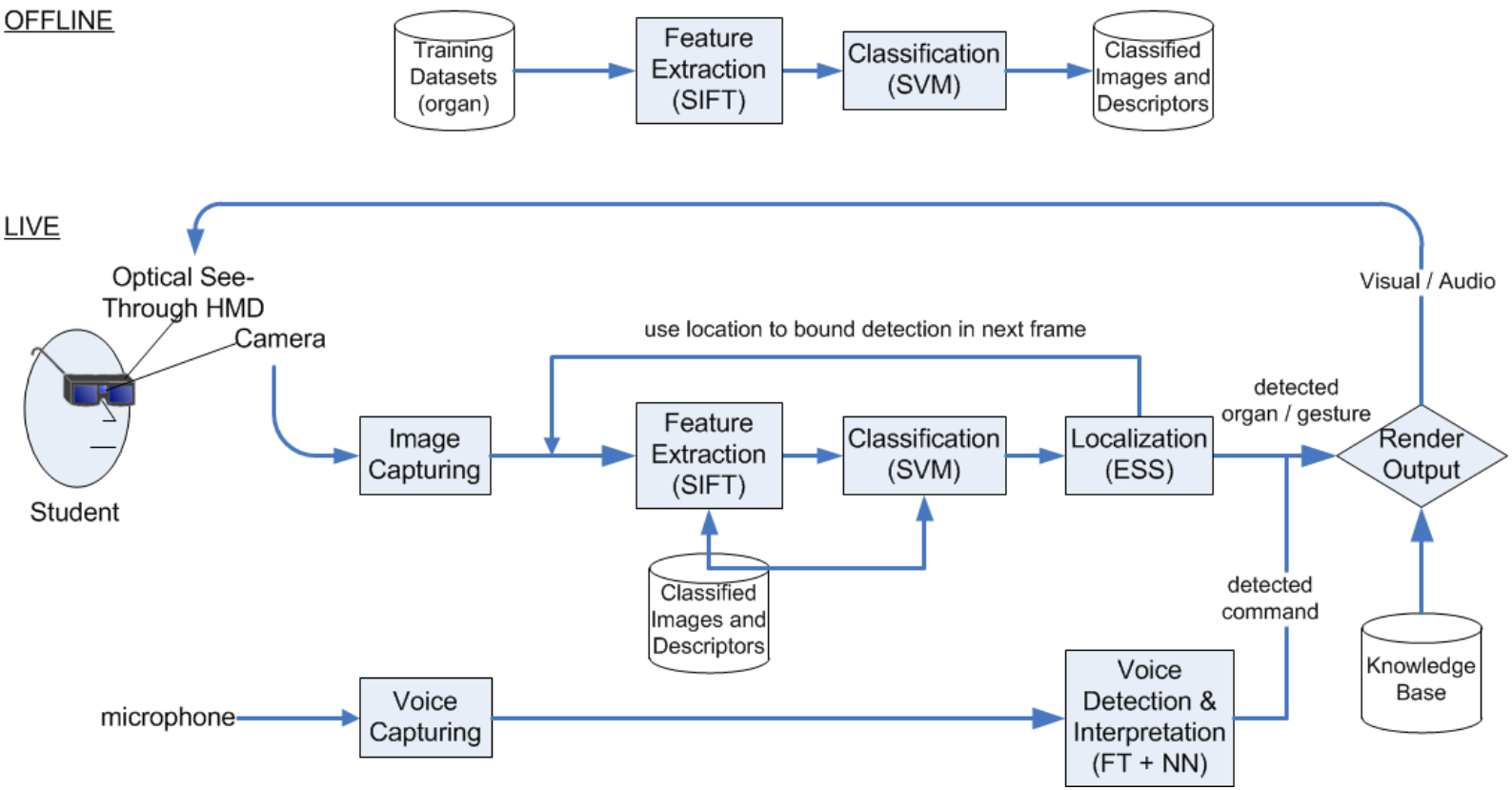

real world view
navigation
augmented view
3d model
menu


real world view
augmented view
menu

Hardware

- Input/Output devices
  - Head-mounted display (HMD)
  - Camera
  - Earphones
  - Microphone
- CPU + data storage unit
- Wireless communication

System Description



Issues

- How to explore? - free vs. pre-defined task
- Amount of information provided - audio vs. textual
- Non-invasive way of displaying information
- Processing in real time

How to evaluate the system?

- We would consider the following aspects[6]:
  - The *technical aspect* (usability issues)
  - The *orientation aspect* (relationship of the user and the virtual environment)
  - The *affective parameter* (users engagement, likes or dislikes)
  - The *cognitive aspect* (identifies any improvement through this learning experience)
  - The *pedagogical aspect* (concerns the teaching approach)

[6] H. Kaufmann. *Collaborative augmented reality in education*. In Keynote Speech at Imagina Conference. Citeseer, 2003.

Conclusion

- We presented an interactive AR system which aims at:
  - Improving anatomy knowledge
  - Assisting in obtaining surgical skills
  - Enhancing the learning experience
- The system could be transferable in other learning domains

Future Work

- Faster machines/technologies would allow:
  - A more computationally efficient system
  - A more sophisticated interaction
- Combining images from multiple HMDs would achieve faster detection
- Group interaction could be introduced
- New layers of information could be added
- Automatic evaluation of student performance could be provided