Virtual and Augmented Reality Applications

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Objective

The course presents a review of current Virtual Reality (VR) and Augmented Reality (AR) technologies and provides a detailed analysis of the engineering, scientific and functional aspects of VR systems and the fundamentals of VR modelling and programming.
The course also will introduce to the development and building of virtual environments and simulators and presents some force feedback devices and newer visualization and interaction interfaces.
Will be acquired knowledge in the main application of VR and AR technologies in medicine and surgery, cultural heritage and games.
The learning outcomes Will be the acquisition of knowledge in VR and AR technologies in terms of used devices, building of the virtual environment, modalities of interaction and modelling and design of an AR application.

Course description

Introduction to Virtual and Augmented Reality technologies

- Introduction to Virtual Reality technology
- Introduction to Augmented Reality technology
- Visualization devices
- Building of the virtual environment
- Graphics rendering
- Interaction in the virtual environment (with and without force feedback)
- Physical modelling
- Haptic interfaces
- Marker-based and markerless applications of Augmented Reality

Virtual and Augmented Reality in Medicine and Surgery

- Virtual Reality in medicine and surgery
- Building of the virtual environment from patient's medical images
- Visualization modalities
- Image-guided surgery
- Augmented Reality in medicine and surgery
- Applications of VR/AR (diagnosis, rehabilitation, surgical pre-operative planning, intra-operative surgical procedure)
- Virtual simulators for surgical training

Virtual and Augmented Reality in Cultural Heritage

- Virtual Reality in Cultural Heritage
- Virtual Reality for edutainment in Cultural Heritage
- Augmented Reality in Cultural Heritage
- Augmented Reality applications on mobile

Virtual and Augmented Reality in Education

- Virtual Reality applications in education
- Augmented Reality applications in education

Human-Computer Interaction

- Introduction to human-computer interaction
- Gestural touchless interactions
- Virtual touch-screen
- Applications of WiiMote, Kinect and Leap Motion for gesture control

Modalità d'esame

The final exam consists of two parts:

1) the discussion on a project developed by the student;
2) the presentation of a lecture on new devices or technologies chosen by the student.