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A Natural and Immersive Virtual Interface for the Surgical Safety Checklist Training
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SURGICAL CHECKLIST SIMULATION

Surgical-care is a central part of health-care throughout the world, counting an estimated **234 million operations** performed **every year**.

In 2009, the **World Health Organization** published a set of guidelines and best practices in order to reduce surgical complications and to enhance team-work cooperation. The WHO summarised many of these recommendations in the **Surgical Safety Checklist.**


Three main phases are identified during the execution of an operation: "before the induction of anaesthesia", "before the incision of the skin", "before the patient leaves the operating room". In each phase, the surgical team has to complete a list of tasks before it proceeds with the **procedure**.

The system

The proposed simulation system is a **natural interface** that exploits a realistic 3D interface and natural interaction paradigms in order to train users to correctly execute the SSC. Users stand in front of a large-sized screen or projection and can interact without using any wearable or handheld device. Contrariwise they can use their voice and body as interface controller.

The interaction between users and the IVE is obtained tracking movements and identifying users' actions by exploiting the **Microsoft Kinect sensor**.
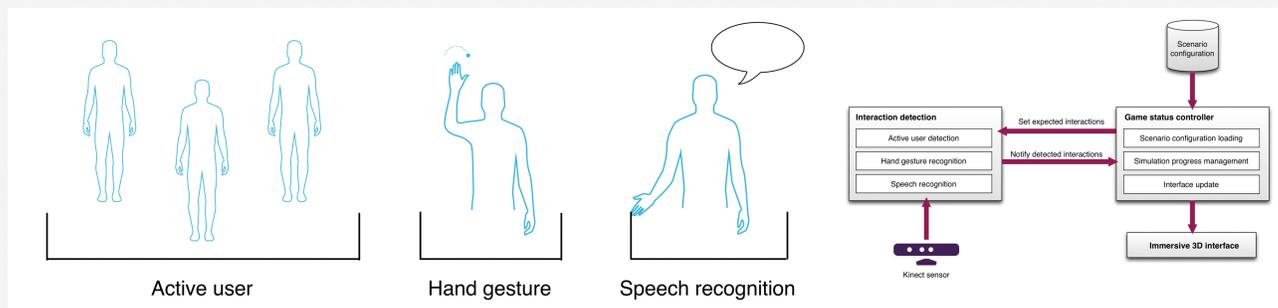
In details, the **Interaction Detection Module (IDM)** is able to detect:

Active user.: when a trainee performs one step ahead, resulting in a reduction of the distance on the z-axis, the module notifies a change of the active user.

Hand: skeleton tracking is exploited to detect active user movements and to track his/her **hand position** in the space. When the user needs to 'activate' some virtual element on the interface, he/she must perform a **push gesture** with the open hand. Furthermore, a **swipe gesture** has been provided that allows the user to open a virtual 2D overlay on the interface containing the patient case history and clinic card.

Speech inputs: the IDM tries to understand the active user specific **audio signal**. Background noise removal algorithms are applied and the Kinect microphone array is exploited to determine the direction from which the signal is coming. The IDM checks if the **angle** from where the vocal input is coming corresponds to the direction from where the active user is standing.

Natural Interface and Immersive Scenario

The virtual simulation allows the three health professionals to complete the SSC, with respect of their **professional role**. Interactions can be performed both by voice and hand gestures.

Professionals (i.e. trainees) stand in front of the simulation interface. The simulator associates users with a professional role on the basis of their **position in the physical space**. When one of the user is active, the environment is shown from his/her **first-person point of view (POV)**.

Hand gestures (e.g. hand pointing and push) are used for interactions, such as to touch the patient, to check the state of the medical equipment or to activate virtual menus.

Voice-based interactions are used during the SSC when one of the professionals is expected to communicate with the patient or with another team's member.