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Robotic surgery made safer

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Surgeons-to-be no longer have to practice on cadavers but can use "organ phantoms" instead. They may also practice with "virtual surgical simulators" and operating room monitoring systems. Those and other methods for improving patient safety in robotic surgery are the results of the large scale EU funded SAFROS project.

On May 29, the SAFROS project (7th Framework Programme) successfully passed its final review. Its research revolved around improving patient safety in robotic surgery through new methodologies and technical improvements.

Patient safety is a broad term, touching upon several areas spanning from medicine training to surgical procedures and engineering. In this field the SAFROS experts made some key contributions:

- New algorithms for the **automatic recognition of organs** in ultrasound and CT imaging, useful for improving robot guidance during the surgery.
- Methods to produce inexpensive **organ phantoms**, i.e. gelatinous substances that replicate the texture and other properties of real organs, often modelled based on data from actual patients. These would prove beneficial to train surgeons, as now training is done on cadavers or animal organs.
- A **virtual surgical simulator**: a computer environment for training robot operators focused on physical realism. Here a trainee could improve their skills in manipulation and dexterity in a variety of simulated environments and have an objective measure of their improvement, thus contributing to the standardisation of a curricula for robotic surgery.
- An integrated **operating room monitoring system**, collecting data from non-invasive sensors and cameras in order to provide a working environments where humans and robots can interact safely. The set-up has been tested on two sets of surgical robots and can provide semantic understanding of robot safe-areas as well as basic collision avoidance features.
- Improvements on **controlling** surgical robots, like semi-automated methods to insert the trocars into the patient's body and control algorithms able to limit the robot's movements to improve its precision and reliability during unforeseen events.
- New research in **ergonomics** and **perception** applied to the surgical operator interface and its telepresence. For example, we learned how holographic visualization devices could improve the doctor's perception of the inner patient environment.
- Steps toward the development of a **safety interface**, i.e. a central system that collects data in the operating theatre and is able to prioritize it for the OR staff. This offloads the cognitive overload of the surgeon, letting them focus on the surgery, thus lowering the chances of attentional mistakes.
- A prototype standardised **training curriculum** for robotic surgery, based on sound educational

paradigms applied to the latest evaluation tests for laparoscopic training. The curriculum was tested with the surgical simulator developed within the project.

Lastly, the SAFROS researchers showed a full integration of all of the above through the extension of current safety framework paradigms. Their research was successfully tested in a coherent set-up, showing no conflicts and a potential improvement of patient safety in robotic surgery.

SAFROS - an acronym for “Patient Safety in Robotic Surgery” was funded with nearly 4 million euros through a DG CONNECT Seventh Framework Programme. It lasted 36 months, was coordinated by University of Verona (Italy) and involved partners from several other European countries (Germany, Greece, Hungary, Estonia, France and Switzerland) as well as the World Health Organization.

More info on the project website: www.safros.eu [1].

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