TECHNICAL DATASHEET
Innovation need
"Technological development of the imaging in surgical assistance and support systems"

Background

During any kind of surgical procedure, both the surgeon and his/her team have to work in a sterile field. Therefore, they have very limited visual access to any external monitor and can not have tactile access to everything outside this sterile field.

Then:
The patients' clinical history acquisition and the visualization of their diagnostic tests have to be performed before the surgical intervention itself. The recovery of this information during the intervention, which is necessary in complex cases when it is useful to review the imaging and compare it with what is found in the intraoperative phase, can be difficult and often requires the detachment of the surgeon from the operating field.
The physiological parameters that are continuously monitored during surgery (e.g. arterial pressure, heart rate, oxygen saturation, electrocardiogram) are only displayed on the anesthesiologist's monitor, and are not directly viewed by the surgeon.
Any additional diagnostic procedure performed during an open surgery (e.g. intraoperative ultrasound, indocyanine green fluorescence) is displayed on a monitor outside the operative field, forcing the detachment of the suregeon's sight from the field, making the correlation between the two visions much more complex.
Mini-Invasive Surgery procedures, such as laparoscopy, allow complex interventions to be carried out minimizing incisions and reducing trauma for the patient but still do not allow to aggregate all anatomical, physiological and imaging information related to the patient.

Objectives

The main objective of this project is to increase the overall vision of the surgeon during a surgical operation, without having to divert his/her sight from the sterile field,
Allowing a rapid and effective access to preoperative clinical information (e.g. clinical history, radiological reports, blood tests, etc.)
Allowing the visualization of the imaging performed in the pre-operative phases (e.g. CT, MRI, PET, etc.)
Allowing the visualization of all the physiological parameters that are continuously monitored during a surgical intervention
Allowing the visualization of any additional diagnostic procedure performed during the surgical intervention
Allowing the surgeon to superimpose on the visual field any virtual images, obtained through the electronic synthesis of other outputs typical of medical imaging such as TAC, MRI and ultrasound, which can broaden the perception and vision of those anatomical parts that are difficult to observe during Minimally invasive surgery such as laparoscopy

Research activities

Research activities should be oriented towards the development of a system capable of:
Integrating all the softwares that generate and store the patient's information, acquired before and during the intervention.

Presenting those information on a specific device that allows to visualize them in the surgeon visual field (e.g. Augmented Reality viewers).
Responding in real time and in reaction to an explicit request from the surgeon (e.g. voice command)
Developing interfaces that allow the superimposition of virtual images to the real environment in order to extend the surgeon overall vision.
Identifying acquisition methods and format of all the different inputs to the system to quickly and correctly process them, according to the subsequent step of merging.

The functioning of the device should be based on techniques, such as Augmented Reality, capable of enriching reality with additional and interactive information (e.g. virtual keyboard), and must allow its application in any surgical field.

Functional Specifications

From the functional and performance point of view, the technology:

Must be testable on site, easily transportable, easy to handle, wearable and light-weight
Must include an easily understandable user interface and must be integrated with the various hospital softwares and with all the high-resolution imaging systems
Must be easily linkable to wireless transmission systems (e.g. wi-fi, bluetooth)

Moreover, it must be possible to easily and cheaply replace the components in the maintenance phase and to activate in-house interventions and remote assistance.
Finally, the components must be disposable.

Furthermore, it is noted the importance of developing a system capable of avoiding time lag (latency) between the real scene and the virtual objects placed inside it, ensuring to a relative displacement between the surgeon and the real scene correspond the timely movement of virtual objects, without delay or jerky movements.