SMart weArable Robotic Teleoperated surgery

Newsletter #7

Inside this issue:

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 732515

SMARTsurg Graphical User Interface

This interface is the basic GUI (Graphical User Interface) of the SMARTsurg system used for initializing and managing the high-level functions and it will be based on standard interaction with mouse and keyboard for input and 2D monitor for the visualization.

Interface for communication with system configuration

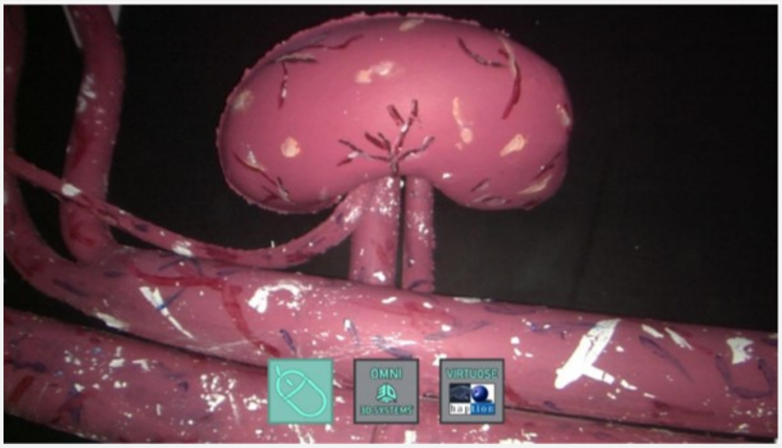
The interface for communicating with the system is shown below. The intraoperative GUI displays the intra-operative image model with four buttons at the corner of the screen that can be used to interact with the system.

Interface for communicating with system

Interface with command device

The interface with the teleoperation is shown in the following image, where there are three modes for selecting the type of commands. The three modes are:

a. Command with mouse b. Command with Omni phantom c. Command with Virtuose 6D Haption



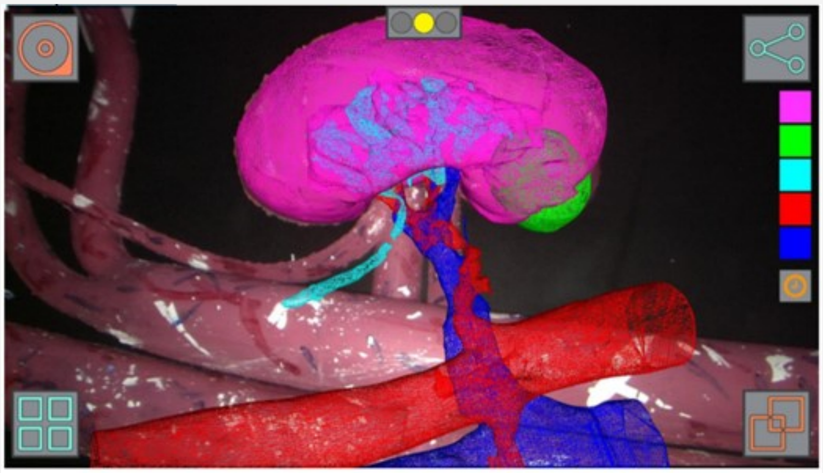
Interface for selecting the mode of GUI command

SMARTsurg Graphical User Interface

Interface with local repository

Main function of the GUI for what regards the interaction with Local Repository is the upload of patient data (preoperative models) and selection of vital signals to be represented in the intraoperative HRI. The image shows an example of the superimposition of the pre-operative model with the intraoperative scene using the tumour's depth characteristics that are identified. Green for tumour, pink for kidney, cyan for calyces, red for renal arteries and blue for renal veins are used. Using contrast colours makes it easier to sense different parts in the kidney. Thanks to this strategy, it is possible for the surgeon to understand the exact location of the tumuor. Moreover, calyces and renal arteries that go through the kidney can be detected easier. The organ (e.g. kidney) can be uploaded to work in two modes:

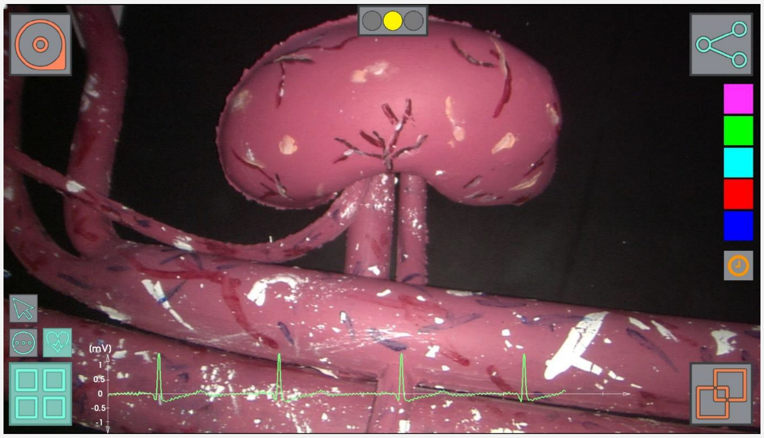
a. Organ to be superimposed for supporting surgery based on preoperative images (e.g. showing where a tumour is supposed to be)
b. Active constraint (e.g. the kidney body without the tumour will keep tools away from kidney while allowing tumour removal).



Example of preoperative model superimposed on an intra-operative model to have a better understanding of tumor location and depth

Vital Signals

This module is used to display the vital signs specified by the surgeons. The surgeon can set the preferred signals during an initialization procedure where s/he can log in his/her personal profile. Vital signs are received from ROS via messages via a rostopic. In this rostopic signal data in miliVolt's that are produced by related sensors are being published. A vital signals example during a procedure can be seen in the image here. This graphical representation of Vital signals can be activated and deactivated by using a GROUP-type of buttons (heart shape) that was developed.

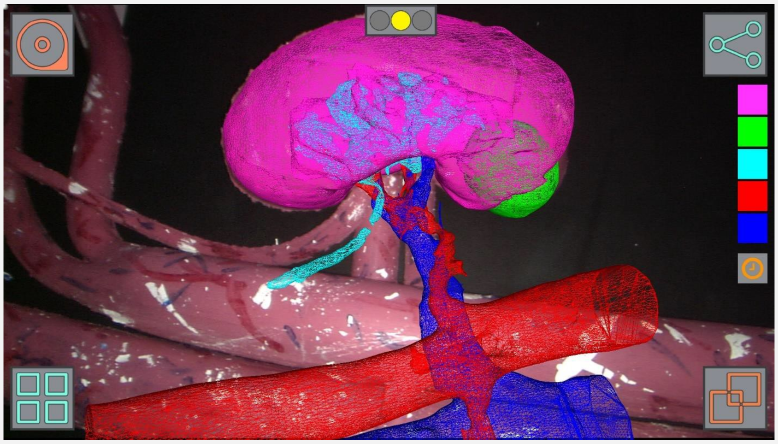


Real Time ECG display, enabled by using vital signal visiblity button.

SMARTsurg Graphical User Interface

Interaction of intra-operative and preoperative models

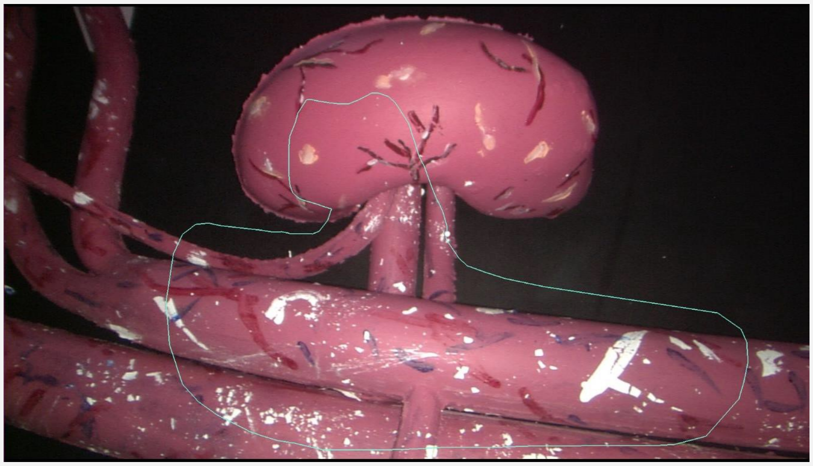
Following, the image shows a view of the GUI managing both pre-operative and intra-operative information. Model projection could serve both for guiding the point cloud point selection procedure and in order to show directly on the operating scene the pre-operative information (e.g. tumor position).



Interaction between preoperative model and endoscope images. Kidney, tumor and calyces are superimposed to the real scene. Tumor is more detectable by using the pre-operative model in comparison to null endoscope images.

Intraoperative constraint drawing

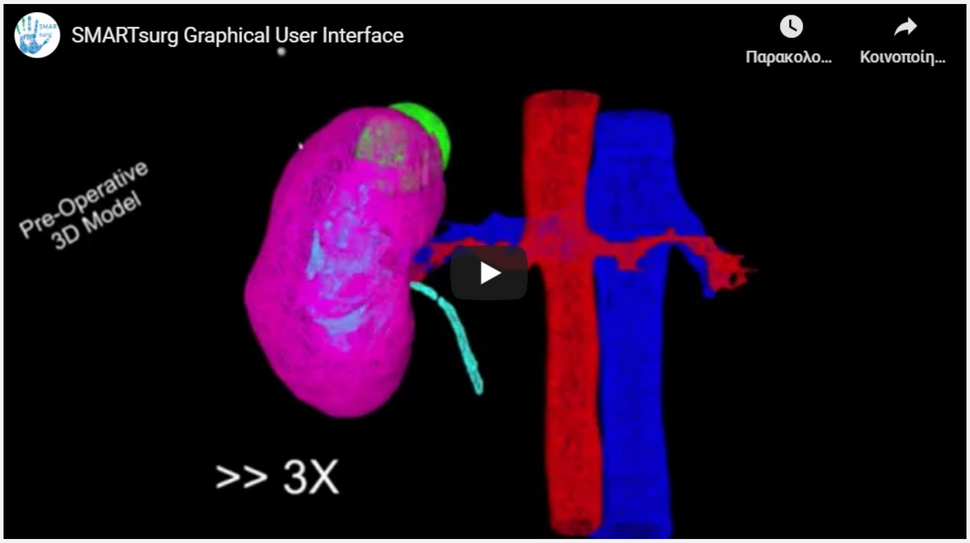
Here the interaction with the user is reported. Interaction is undertaken through an input device (mouse, Omni -phantom, Virtuose 6D which moves a pointer on the screen) where one projection of the two cameras, that created the 3D point cloud is shown. When a button (generic, mouse, Omni-phantom, Virtuose 6D, pedal) is pressed the pointer draws its trajectory on the 2D projection. The user is supposed to delimit an area, which is going to be used as AC. This area is converted into a surface patch over the 3D point cloud once the delimitation ends (the line is supposed to delimit a closed area) the system automatically closes the trajectory and computes the 3D patch.



A patch of the 3D point cloud is delimited on its projection on the display. A cursor is moved and the trace of the delimited area remains on the visual field. In the end, a 3D patch projection appears.

SMARTsurg Graphical User Interface Video

Find more information about SMARTsurg GUI development and features on the explanatory Youtube video. Click here to watch it and don't forget to subscribe to our YouTube channel!



Main Contributors

Researchers/ Technical Team

Prof. Sanja Dogramadzi, UWE Bristol/ BRL *(Project coordinator)*

Prof. Giancarlo Ferrigno, POLIMI

Prof. Elena De Momi, POLIMI

Dr. Dimitrios Tzovaras, CERTH/ ITI

Dr. Ioannis Mariolis, CERTH/ ITI

Mr. Nima Enayati, POLIMI

Mr. Salih Ertug Ovur, POLIMI

Mr. Enrico Karim Siena, POLIMI

Mr. Xristos Papadopoulos, CERTH/ ITI

Mrs. Georgia Peleka, CERTH/ ITI

Mrs. Angeliki Topalidou – Kyniazopoulos, CERTH/ ITI

Mr. Konstantinos Tsiolis, CERTH/ ITI

Mr. Luca Vantadori, POLIMI

Mr. Martin Vasilkovski, POLIMI

Mr. Giorgos Zampokos, CERTH/ ITI

Surgeons

Prof. Raimondo Ascione, University of Bristol

Prof. Raj Persad, Bristol Urological Institute

Dr. Michele Catellani, Istituto Europeo di Oncologia - IEO

Dr. Aris Sideridis, TheMIS Orthopaedic Center

Mr. Anthony Koupparis, Bristol Urological Institute

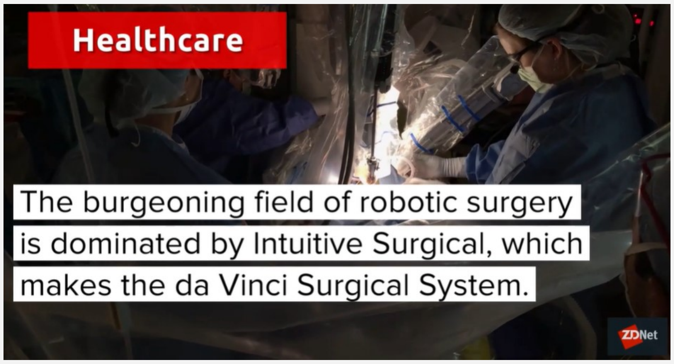
Into the World of Robotics

Robotics in business: Everything humans need to know

Greg Nichols

ZDNet

You've probably been hearing a lot more about robots and robotics over the last couple years. That's because, for the first time since the 1961 debut of GM's Unimate, regarded as the first industrial robot, the field is once again transforming world economies. Only this time the impact is going to be broader. Much broader. That's particularly true in light of the COVID-19 pandemic, which has helped advance automation adoption across a variety of industries as manufacturers, fulfillment centers, retail, and restaurants seek to create durable, hygienic operations that can withstand evolving disruptions and regulations. More and more, robots are cropping up in offices, hospitals, and schools -- decidedly non-industrial environments -- as well as in warehouses, fulfillment centers, and small manufacturing centers. More and more, they are on our roads and flying overhead.



This guide, written with the enterprise in mind, will address the big questions. And it'll give you the context to make up your mind about others. It'll also give you a handle on an industry that's poised to hit $210 billion by 2025 (a CAGR of 26%), one whose relevance to commerce and day-to-day life in the coming decades cannot be overstated.

The Increased Role of Robots Post Pandemic

Robotics Tomorrow Magazine

As the novel coronavirus reshapes the economy, it's also having a significant impact on how we work. The crisis seems to be accelerating a number of work trends that existed before the pandemic. We're shopping online more often, working from home more than ever and also adopting new tech. As contact becomes more dangerous, and people pivot to working from home, robots have emerged as a powerful tool for businesses and organizations wanting to keep everyone safe. Here is how COVID-19 has pushed robots into the spotlight and the likely impact they will have, even after the pandemic ends.

Into the World of Robotics

Automation nation: 9 robotics predictions for 2021

Greg Nichols

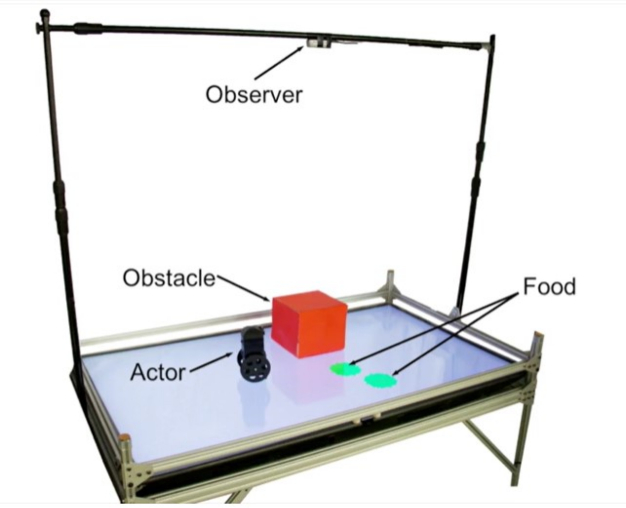
ZDNet

The pandemic has offered challenges and a major opportunity to robotics firms in the logistics and grocery spaces. Unforeseen stresses to supply chains and runs on products have emphasized the need for greater supply chain efficiencies. Workforce constraints due to safety protocols and illness have also hammered various sectors.

The lessons of 2020 can help us read the tea leaves for the priorities and trends in the robotics sector in 2021. Predictions are always to be taken with a grain of salt, but this year's batch come with the benefit of a lot of hindsight and hand wringing.

Robot displays a glimmer of empathy to a partner robot

Columbia University School of Engineering and Applied Science



Like a longtime couple who can predict each other's every move, a Columbia Engineering robot has learned to predict its partner robot's future actions and goals based on just a few initial video frames. When two primates are cooped up together for a long time, we quickly learn to predict the near-term actions of our roommates, co-workers or family members. Our ability to anticipate the actions of others makes it easier for us to successfully live and work together. In contrast, even the most intelligent and advanced robots have remained notoriously inept at this sort of social communication. This may be about to change.

The study, conducted at Columbia Engineering's Creative Machines Lab led by Mechanical Engineering Professor Hod Lipson, is part of a broader effort to endow robots with the ability to understand and anticipate the goals of other robots, purely from visual observations.

smartsurg-project.eu

info@smartsurg-project.eu

@SMARTsurg

@SMARTsurg Project

Prof. Sanja Dogramadzi
Bristol Robotics Laboratory
University of the West of England
Frenchay Campus, Coldharbour Lane
Bristol, BS16 1QY, United Kingdom

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 732515