University of Verona (coordinator):
control of the surgical actions, management

Fondazione Centro San Raffaele:
knowledge acquisition, reasoning and validation, dissemination;

Tallinn University of Technology:
organ model calibration and registration

Oslo University Hospital:
intra-operative sensing and reasoning

Swiss Federal Institute of Technology Zurich:
robotic instrument analysis and development

Yeditepe University:
surgeon-robot communication

I-Sur
INTELLIGENT SURGICAL ROBOTICS

PROJECT COORDINATOR:
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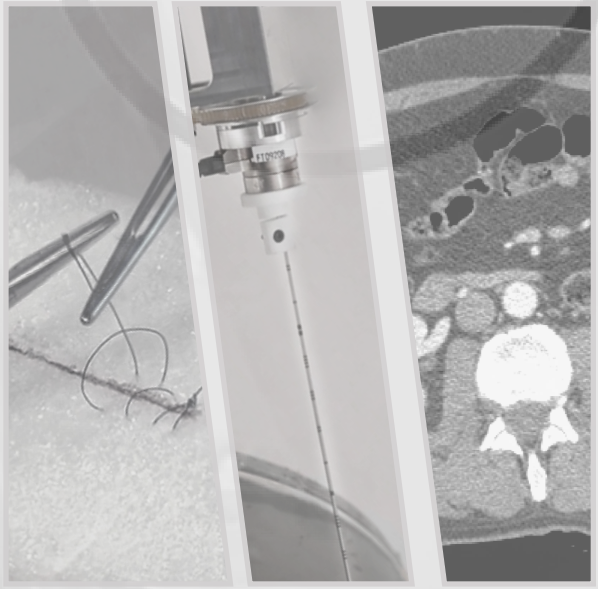
SEVENTH FRAMEWORK PROGRAMME

project reference: 270396
call (part) identifier: FP7-ICT-2009-6
funding scheme: collaborative project
timetable: from 3/2011 to 8/2014
total cost: 3,929,667.00
EC funding: 2,980,000.00

I-Sur
INTELLIGENT SURGICAL ROBOTICS

AUTOMATION IN SURGERY



I-SUR

INTELLIGENT SURGICAL ROBOTICS

THE PROJECT

Precise surgical robots endowed with cognitive abilities will permit surgeons to focus on the most critical aspects of a surgical procedure, e.g. planning and monitoring, leaving routine actions to the machine. The I-SUR Project has used surgical knowledge to develop mathematical models that allowed robots to autonomously perform simple tasks.

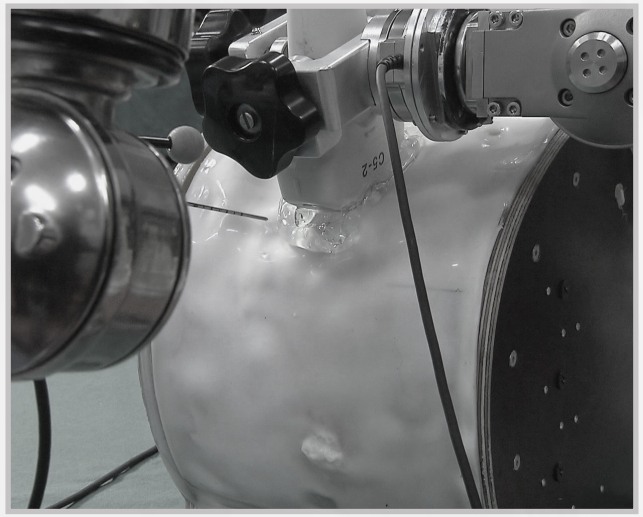
For the first time an autonomous robot has performed surgical actions requiring high precision and dexterity.

SURGICAL TASKS

- ***Needle insertion:*** The robot is able to execute a few critical steps of a cryoablation procedure (treatment of tumor through cycles of freezing and thawing), i.e. identification of the optimal target point and trajectory, insertion of the needle and the on-line identification of adverse events.
- ***Suturing:*** The robot is able to close an incision in a biological tissue by means of a thread, i.e. it defines the optimal number and position of the stitches, carries out the needle insertion and thread pulling, and ensures the preservation of the tissue.

AUTONOMOUS ROBOTIC SYSTEM CAPABILITIES

1/ Translate surgeon's knowledge into robotic primitive actions;
2/ Plan the surgical action, subject to surgeon's final approval;
3/ Execute and monitor the surgical actions;
4/ Detect possible problems and communicate them to the surgeon;



PROJECT OUTCOMES

1/ New methods for the acquisition and the representation of surgical knowledge;
2/ New methods for intra-operative sensing and data collection in time-varying environments focusing on echographic images;
3/ Innovative on-line reasoning process for integrating a-priori and intra-operative data and for intervention re-planning;
4/ New mathematical algorithms for robot control ensuring stability during the switching between autonomous and teleoperated operation modes;
5/ New robotic system specifically designed for the automatic execution of needle insertion and suturing;
6/ Effective surgeon-robot interface for information transfer and communication of the autonomous procedure flow minimizing the cognitive load of the surgeon;
7/ Identification of the legal barriers currently preventing the application of autonomous robots into the surgical scenarios and of possible corrective actions.

BENEFITS OF THE I-SUR APPROACH

The developed methodology will lead to:

- Improved patient safety due to better image guided control that will reduce the number of CT scans for patient undergoing cryoablation;
- Better procedure accuracy due to the advance information processing and sensor fusion available to the surgeon;
- Reduced workload, fatigue and the risk of human error thanks to the autonomous action and medical situation monitoring