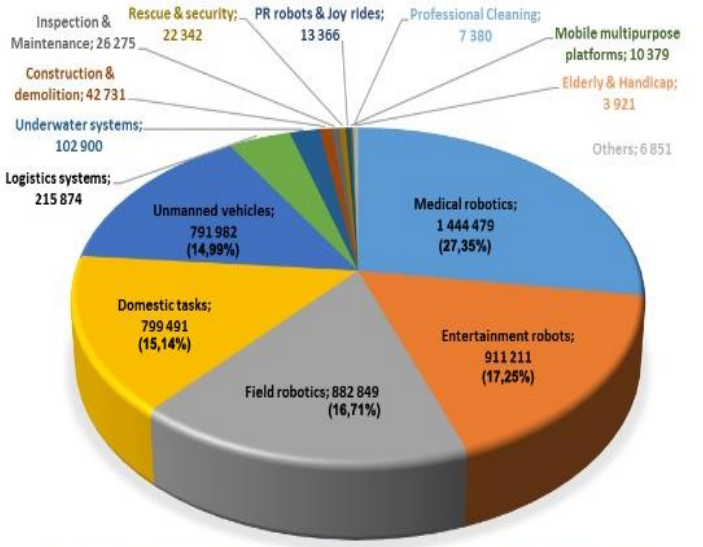
SMart weArable Robotic Teleoperated surgery

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

Context

- Minimally Invasive Surgery - MIS (a $50 billion market by 2019) has become an established alternative to the conventional open approaches due to its
  - Effectiveness
  - Patient satisfaction
- Teleoperated robotic surgical systems have been increasingly used in MIS procedures over the past ten years
  - This increase is reflected in the use of service robotics for medical applications
  - Medical Robotics correspond to 28% of the $5.2 billion market of service robotics



A $5,2 billion market in 2013 - High growth rate expected : $7,4 billion in 2017

Motivation

To assist and enhance further the surgeon's performance during MIS we need to:

- Develop more sensitive robotic systems with new teleoperation interfaces:
  - Improve their efficacy
  - Expand their applicability to more complex surgical procedures
- Develop advanced technologies that will reinforce R-A MIS dependability

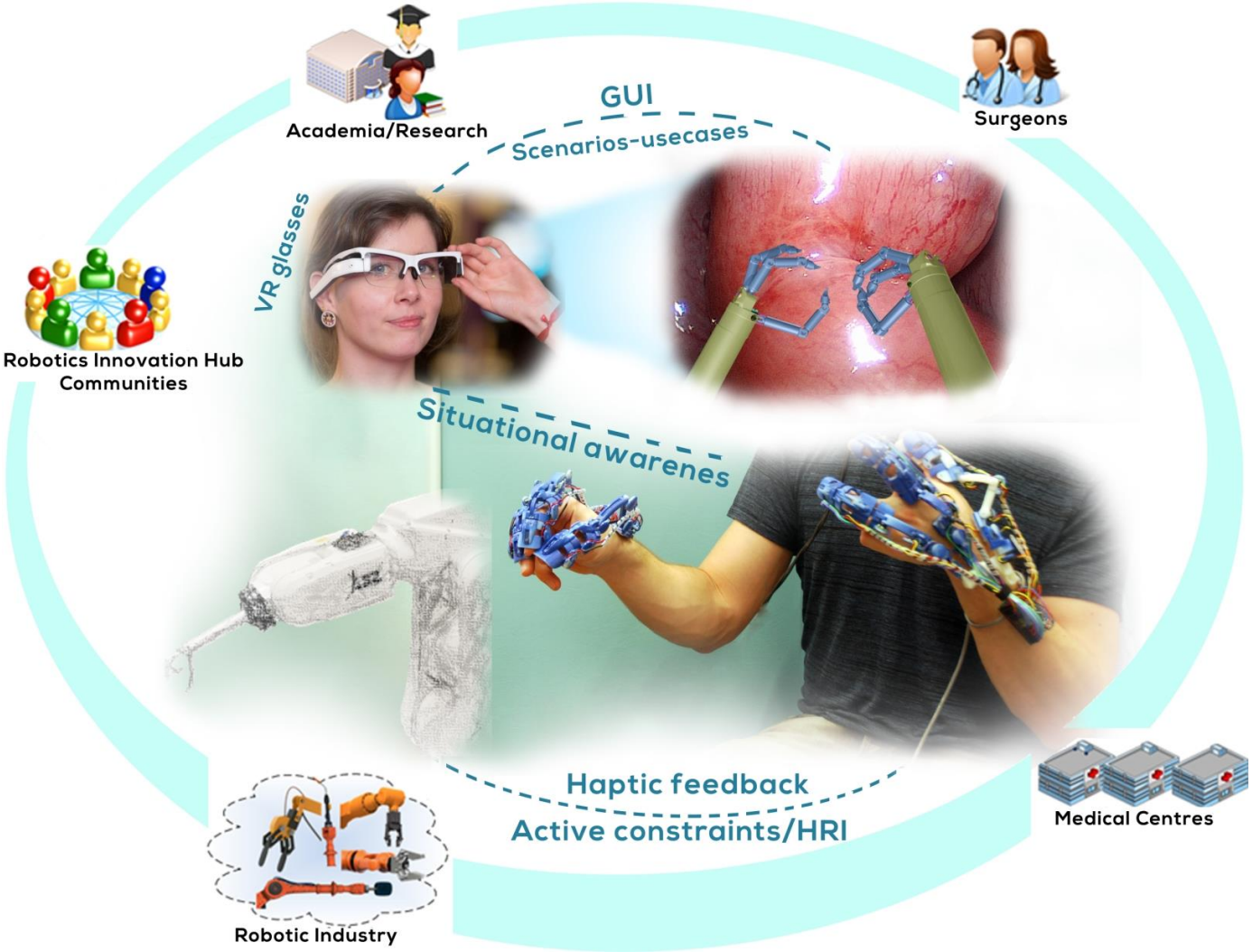
Breakthrough

- SMARTsurg project aims to develop an advanced system for performing Robot-Assisted MIS that will:
  - Reduce surgeon's cognitive load (shorter training time)
  - Increase accuracy and safety
  - Reduce MIS procedure time
  - Expand applicability
- A wearable surgical interface will be designed and developed:
  - Highly dexterous anthropomorphic surgical instruments
  - Wearable hand exoskeleton with haptic feedback for controlling the surgical instruments
  - Wearable smart glasses for augmented reality guidance of the surgeon based on real-time 3D reconstruction of the surgical field
- Real-time dynamic active constraints will be applied restricting the surgical instruments' motion to safe regions
- Short prototyping and testing cycles will be employed supported by focused end-user and commercial requirements

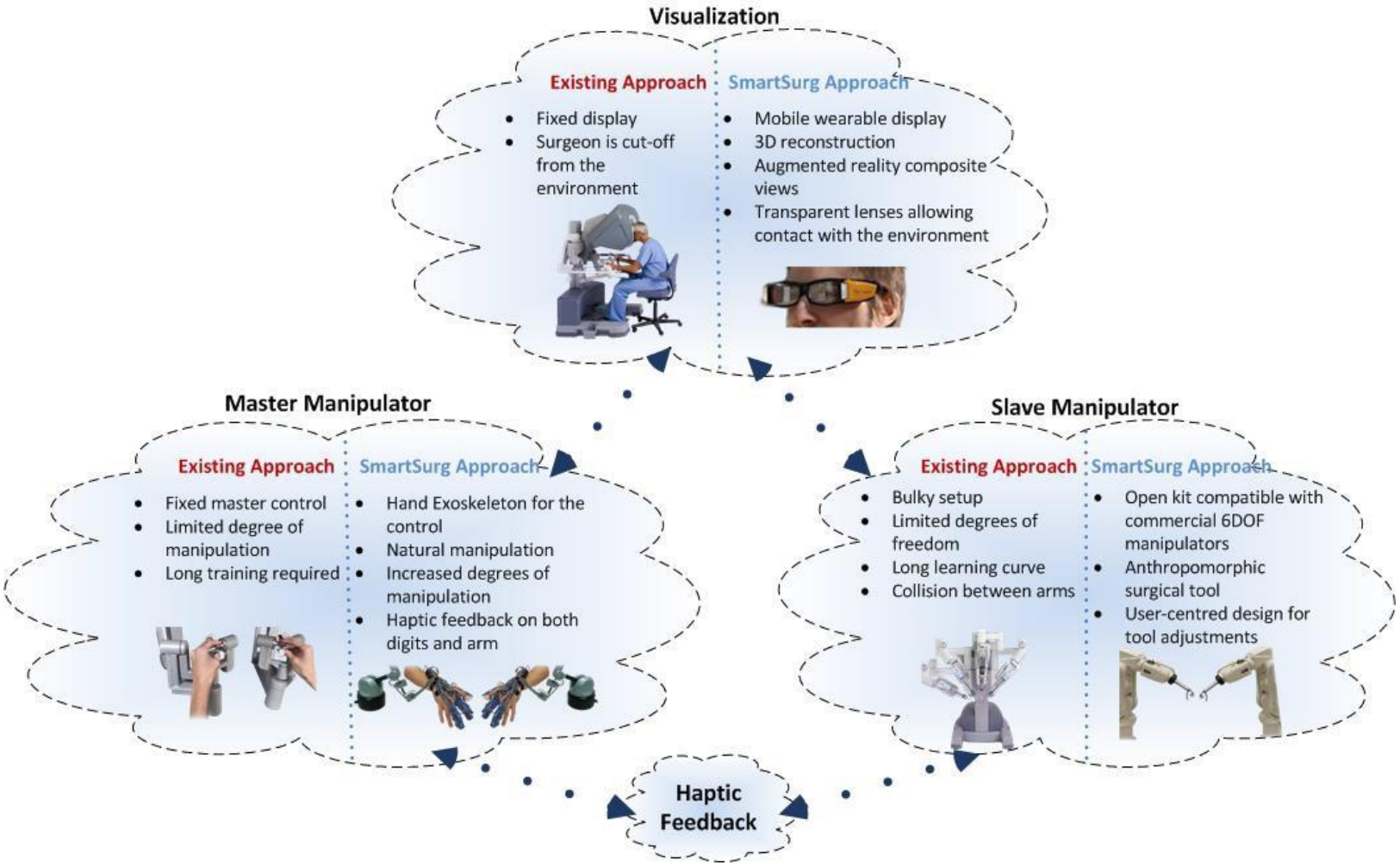
Objectives

- Develop a dexterous, adaptable, anthropomorphic surgical instrument
- Build a framework for providing haptic feedback from the surgical instrument to the surgeon
- Deploy strategies for dynamic active constraints construction and their guaranteed satisfaction
- Develop advanced cognition and perception abilities to achieve the real-time and on-the-fly reconstruction of the operation area
- Validate SMARTsurg project results in realistic scenarios involving procedures on different surgical domains

Vision


Academia/Research
Surgeons
GUI
Scenarios-usecases
VR glasses
Robotics Innovation Hub
Communities
Situational awarenes
Haptic feedback
Active constraints/HRI
Medical Centres
Robotic Industry

SMARTsurg System vs Existing Surgical Technologies



Impact

- Address healthcare issues that have a widespread applicability and at the same time reduce high cost on national healthcare systems
- Improve patient outcomes through a much wider offer of MIS
- Reduce surgeons' effort by improving their ergonomics and information flow between them and the surgical field (through visualisation, haptics and novel controllers)
- Propose a cost-effective system that is built on top of commercial 6DOF robotic manipulators
- Provide a more dexterous, natural to use system with:
  - Improved interfaces that would render fast learning and acceptance by surgeons
  - Increased cognition abilities and dependability

Envisioned Use-Cases

- Use of phantoms and swine cadavers
- Urologic minimally invasive surgery
  - Multiple quadrant surgery
  - Prostate adenomectomy
  - Partial nephrectomy
- Cardiovascular minimally invasive surgery
  - Handling and suturing a cardiac valve
  - Replacing a 0.5 to 3cm in diameter segment of artery
- Orthopaedic minimally invasive surgery
  - Treatment of the meniscal tear injuries in the knee

Project Partners

University of the West of England/ Bristol Robotics Laboratory
United Kingdom

Centre for Research and Technology Hellas/ Information Technologies Institute (CERTH/ ITI)
Greece

Politecnico di Milano
Italy

Bristol Urological Institute (BUI) - North Bristol National Health Service Trust (NBT)
United Kingdom

University of Bristol
United Kingdom

European Institute of Oncology
Italy

TheMIS Orthopaedic Center
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