Proposal for AMADEE-20

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Institute for Systems and Robotics (ISR-Lisbon)
http://isr.tecnico.ulisboa.pt/

• RD&I institution, affiliated to Instituto Superior Técnico (IST), the engineering school of University of Lisbon

• Multidisciplinary advanced research on the areas of Robotic Systems and Information Processing

• Research domains: Systems and Control Theory, Robotics, Signal Processing, Computer Vision, Optimisation, AI and Intelligent Systems, Biomedical Engineering.
Facts and figures

Foundation: 1992

# Faculty: 33
# Post docs: 20
# PhD students: 65
# PhDs awarded (2013-17): 62

Evaluation (2015-17): Excellent

Funding (2013-17):
FCT: Institutional 3.5M€
    Projects: 1.6M€
    Grants: 2.8M€
International: 4.6M€
Other: 0.24M€
Total: 12.9M€
**LARSyS - Laboratory of Robotics and Engineering Systems**

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<tr>
<th>Computer and Robot Vision (VisLab)</th>
<th>Institute for Systems and Robotics (ISR) - Lisboa</th>
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<tbody>
<tr>
<td>Dynamical Systems and Ocean Robotics group (DSOR)</td>
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<td>Evolutionary Systems and Biomedical Engineering group (LASEEB)</td>
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<td>Intelligent Robots and Systems Group (IRSG)</td>
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<td>Signal and Image Processing group (SIPg)</td>
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**Madeira Interactive Technologies Institute (M-ITI)**

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<th>Laboratory for Energy and Environmental Studies (LEES)</th>
<th>IN+ Center for Innovation, Technology and Policy Research</th>
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<td>Laboratory of Technology Policy, and Management of Technology (LTPM)</td>
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<tr>
<td>Laboratory of Thermofluids, Combustion and Energy Systems (LTCES)</td>
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**Marine Environment and Technology Center of IST (MARETEC)**

- A – Urban sustainability: the water-energy nexus and urban metabolism
- B – Aeronautic and Space Systems
- C – Oceans Exploration and Exploitation
- D – Engineering for and from the Life Sciences
- E – Cognitive Robots and Systems for Assisted Living and Working
- F – Distributed information processing and decision making
Immersion Teleoperation Interfaces

Human-robot interaction with field robots using augmented reality and interactive mapping

FCT project 2010-2013

R&D topics:
• Visual SLAM-6D
• 2D and 3D combined mapping
• Augmented reality

Evaluation:
• RoboCup Rescue scientific competitions
• Joint exercises with real Urban Search and Rescue teams
Multi-modal user interfaces for teleoperation of remote robots

• Explore novel ways of interaction using multi-modal user interfaces.
• Increase system clarity and operator’s situation awareness.
Improve Situation Awareness

• **Challenge**: Lack of Situation Awareness (SA) during teleoperation.

• **Goal**: Improve human judgment and decision making during teleoperation tasks.
Improve Situation Awareness

- **Approach:** Haptic Feedback
  - Avoid overloading the visual channel
  - Explore other human senses
Teleoperation Architecture

Institute for Systems and Robotics
Traction Awareness Through Haptic Feedback for the Teleoperation of UGVs

- **Detection of Traction Losses (Stuck, Sliding):**
  - prone to general disorientation and often leads to cognitive mistakes

- **Haptic Feedback:**
  - Exploring different tactile stimuli:
    - texture (tactile tablet)
    - friction (rotating cylinder)
    - vibration (wearable glove)
Haptic attitude feedback Device

- **Development of an Attitude Haptic Feedback Device**
  - Enhance the operators awareness of UGV spatial attitude

- Allows operators to perceive:
  - Dangerous orientation angles
  - Sudden changes in terrain inclination

- Preliminary field trials showed operators could also feel the roughness of the ground
Haptic attitude feedback Device
Proposed contribution to AMADEE-20

Research objectives:
• Evaluate our haptic teleoperation interface to command a rover on a realistic planetary environment
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• Evaluate our haptic teleoperation interface to command a rover on a realistic planetary environment

Possible use cases:
• Inspection of base condition from the exterior (e.g., after a dust storm/devil)
• Carry / deploy / recover scientific instruments
• Vicinity area exploration
Questions

Q1: collaboration with other research groups, namely with the need of mobility of scientific instruments?

Q2: costs involved in the participation?

Q3: how astronaut training is carried out?