

## Proposal for participation to 2015 RAS MNRA Mobile Microrobotics Challenge

### Team: UVT (Romania)

#### 1. The individuals contributing to the team.

- Mr. Florin Dragomir, lecturer, control systems, team logistics coordinator
- Mr. Ioan Alexandru Ivan, associate professor, micromechatronics, team senior supervisor
- Mrs. Mihaela Ivan, postdoctoral researcher, microtechnology
- Mr. Valentin Gurgu, PhD student, electronic and mechanical design and testing

#### 2. E-mail, telephone, and postal contact information for the team Primary Contact.

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#### 3. The facilities available for fabrication, operation, and characterization of microrobots.

This microrobotic project is funded under a national postdoctoral grant called A New On-Chip Magnetically-Actuated Mobile Microrobotic Agent and Embedded Control System. This grant is coordinated by Florin Dragomir at Valahia University of Targoviste. To this University is affiliated a research institute called ICSTM where several different facilities are present for microfabrication (metal deposition, FIB), characterization (AFM, SEM, videomicroscopes) or real-time testing. A part of the micromanufacturing tasks are performed or sub-contracted to the MIMENTO technology central of the French FEMTO-ST Institute under an external (Exogène) project which was put in place. Alex Ivan has worked with FRMTO-ST institute until 2013 from where he also successfully participated to some past NIST microrobotic challenges (2010, 2011).

#### 4. An overview of the microrobot design.

The team seeks the design and development of a magnetically-actuated mobile microrobotic system based on a magnetic agent actuated by a net of integrated, microstructured coils. These coils are under a millimeter wide and distributed in an XY array configuration over the arena surface. Several

advantages are straightforward: the bulky and power-consuming external coils are thus avoided (on-chip concept) and a simpler control strategy.

#### 5. An overview of the intended capabilities of the microrobot.

The microrobot control is wished to operate in a small open-loop control scheme thanks to its array of integrated coils. The use of external coils would be the last alternative in case the internal coil design would fail to operate properly. The expected movements are translations along the X or Y axis. Fast coil switching would allow high displacement speeds. Control is intended to be embedded in a small form-factor microprocessor or FPGA.

#### 6. An overview of the fabrication process to be used.

The microrobot fabrication is straightforward, consisting of precise dicing of bulk magnetic materials (neodymium alloys) into rectangular parts of less than 500 $\mu$ m.

The arena manufacturing is trickier and based on clean room photolithographic processes, due to its array of coils patterned over the entire top area. Fabrication consists of alternate sputtering and etching steps to achieve several layers of conductors (gold) and insulators (SiN).

The agent and its arena will be hermetically packaged into a small glass assembly to avoid any physical contamination. The required landmarks will be eventually patterned on the bottom side of the glass top layer.