Abstract

Telepresense laboratory for autonomous swarm of robots on Mars Yard

Robotics are becoming globalized, and as such there arises a need for teleoperated robots to autonomously achieve objectives with humans a small part of the intuitive control loop. The telepresence development at IDMARS is an element belonging to a larger project. Teleoperation will take place on simulated Mars terrain, or "Mars Yard", that fulfills its purpose for statewide education and outreach. The project will encompass three phases:

Phase 1: Swarm or multi-agent behavior. The robots themselves need to be capable of tackling various objectives autonomously. Since most swarm bots begin as homogenous and evolve into heterogeneous bots through emergent behavior the scope of this project deems it necessary to begin with the later. Considering the purpose of this project, the collective team will be pre-programmed with a self-reconfigurability and formation. More high-level algorithms will be left to the operator for data logging and analysis. For navigational, recognition, and communication purposes all bots will be configured with the following sensors.

- Memsic 2125 Dual-axis accelerometer
- Hitachi HM55B Compass Module
- Photoresistors
- IR range detectors
- IR Buddy (fusion of communication)
- Tactile Sensors

Individual agents will be outfitted with:

- Boe Bot Gripper (transportation)
- Sensirion Temperature/Humidity Sensor
- 433 MHz RF Transceiver (range fusion of communication)
- Toothpick Device (local reprogramability alternative)
- Bluetooth EB500 (local fusion of communication)
- SRF05 Sonar (10ft range detection)
- PIR sensor (20ft motion detection)

Phase 2: Wireless communication. There lies an opportunity within this project to coin a new term, "Fusion of Communication." Given the uniqueness of the communication requirements with teleoperated multi-agent robots, capable of peer recognizability, new algorithms can be applied to create a network with redundancy and distributed loops. The three areas of communication again are: PC interface to master node via RF, local communication via Bluetooth, and identification coupled with data exchange via IR. All activity will be monitored with a 2.54 Ghz wireless camera.

Phase 3: Interface For Control and Analysis. Currently options are being looked which will allow compatibility. LabVIEW and Parallax native software both have their weaknesses and will be compared before making a final decision. The interface will be a combination of terminal and GUI. It will allow reprogramability, control, and data acquisition.

Phase 4: Make Interface Available by the Web. Learning and creating html will be the final and most time consuming phase of the project. This process will possess proper security protocol and authentication as well as user friendliness for ease of control.