COURSE DESCRIPTION

The theoretical component of this course is designed to expose the students to the concepts underlying the design of robust and secure heterogeneous wireless networking of mobile robots (i.e., Internetworking, Security, Wireless Communication, Embedded Development, Mobile Phones Platforms). The course is mostly laboratory oriented with the goal of designing, and building rescue-mission oriented heterogeneous wireless systems operating in adversarial environments.

The class will be organized into small teams of 4 students. Each team will be provided with some equipment, and a small budget to extend its system. Each system will consist of three mobile robots based on "monster trucks" and/or "robosapien" (http://www.robosapienonline.com/) or other of the shelf robot kits (e.g., http://www.roboticsconnection.com), a low-power control and sensing embedded system (designed by the teams with the guidance of the instructor), and a low-power digital radio frequency communication network. The embedded system will most probably consist of Texas Instruments' MSP430 ultra low-power micro-controller and Chipcon 2.4GHz transceivers (ZigBee compliant). The teams will also make use of a coordination unit connected to the internet and capable of communicating with the mobile robots. The course will culminate in a competition, where each team has to find and rescue an "object" that is hidden within the competition perimeter and might be located under some rubble. The object is what we call an RF-Egg or Ultrasound-Egg depending on the technology used to localize it. One robot does not have the capability to succeed in the mission alone, but needs the co-operation of at least another robot. For example the range of the radio interface will not allow single-hop communication from the coordination unit to the object to be rescued. Each team is allowed to jam the communication of the other teams (at the expense of depleting its batteries), or carry other physical or cyber denial of service attacks. During the competition the teams can only interact with the robots through a smart phone cell phone. The team members can establish data connections using the Bluetooth/GPRS/EDGE cellular network to their internetworked central node. The central node will process the inputs to help coordinate the mobile nodes actions and securely relay it over the sensor network to the mobile robots.