Robots Taking Risks

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EXTENDED ABSTRACT

The 2011 IEEE SoutheastCon hardware competition challenges students to simulate autonomous robots taking risks in lieu of rescue workers in the wake of natural disasters. In effort to save more lives, the rescue processes must be hastened, but expediting the rescue process has disadvantages. Currently, search speed is limited by the number of personnel involved in the effort. Increasing the speed of the search introduces a greater number of people to the risk of falling debris, chemical spills, or radiological hazards.

The competition uses models to simulate victims, debris, and potential hazards to rescue workers. Victims will be represented by a plastic plumbing cap with a light-emitting diode (LED) that will depict health status and an electromagnetic signal that can be used to locate the victim. Debris will be modeled with sections of lumber that must either be avoided or traversed. Finally, the radiological hazard will be simulated by a coil beneath the course that will emit an electromagnetic signal. The challenges presented by this competition are to detect and report the location and status of victims and hazards while navigating over and around obstacles.

The design team was selected from Citadel Electrical Engineering students based on abilities. Michael Bernico is responsible for circuitry and aiding with assembly. Matthew Luby is responsible for programming and robot positioning. Matthew Rentz is the developer of victim detection scripts and an assembly plan. Nathan Sinclair is developing the overall code structure and is accountable for autonomous navigation.

The robot uses a variety of sensors that are interpreted by a PIC32 microprocessor that issues control commands to motors and indicators using instructions written in the C++ programming language. Infrared and ultrasonic sensors are used to aid with navigation and obstacle avoidance, while antennae are used to detect the presence of victims and hazards. In the event that a victim is found, a camera determines its status using the victim's LED. Infrared rangefinders then determine the location. Victim status and location data is then provided to the indicators in text and audio formats. Similarly, when a hazard is detected, the robot will provide audio and text indication of the location of the hazard.

Over the course of two semesters, the team has met the individual needs as described by the rules of the competition. The robot has traversed and avoided obstacles, has discriminated between victims and hazards, and has provided location data. The robot is capable of interpreting victim status and providing visual and audible confirmation of victim and hazard data. These results provide promise that autonomous rescue robots may one day be saving lives while protecting the lives of their human counterparts.