Preliminary SoutheastCon 2011 Student Hardware Competition Rules [Draft 3.0]

Please send questions and comments concerning the Hardware Competition to ieeesb@tntech.edu. Final rules are expected to be posted on the SoutheastCon 2011 web site at http://orgs.tntech.edu/ieee by September 13, 2010.

I. Introduction

Natural disasters such as the 2004 and 2009 tsunami as well as the most recent earthquake on the island of Haiti and in Chile motivates engineers to use modern technology to help save lives. The survival of human victims is strongly related to the amount of time required to respond to the victims; therefore, emergency responders need accurate, timely information about the scene. The theme of the SoutheastCon 2011 hardware competition is autonomous response to natural disasters. Autonomous emergency response robots can safely evaluate the situation and relay vital information to emergency response teams.

II. Objective

The objective of this competition is to locate the victims trapped in a building, determine their status, and report this information to the emergency responders. The following information is known:

- Floor plan
- Types of obstacles which may be encountered
- Methods to locate victims and determine their health status

III. Course Layout

A. The course is a 2.4 m x 2.4 m square containing rooms and hallways.
B. There are four rooms, one in each corner of the course. Each room is 1 m x 1 m square. Refer to the appendix for a diagram.
C. Hallways are 40 cm wide.
D. Interior walls are 2 cm thick.
E. All walls are at least 20 cm high.
F. There is an invisible ceiling at height 25 cm, so robots must not try to climb or look over the walls.
G. Obstacles may exist in the hallways but not in the rooms. (Subject to change objects may exist in rooms)
H. Obstacles will never completely block access to rooms or hallways; however, the robot may need to navigate over or around obstacles in order to achieve an objective. Obstacles are either 2 cm wide x 2 cm high or 4 cm wide x 9 cm high and have an unspecified length.

I. Obstacles may be placed at any angle on the course.
J. Placement of the 9 cm high obstacles will be such that there is at least 25 cm of clearance on one side of each obstacle for robot navigation.
K. Floors and walls are purple. The paint brand and shade of purple is unspecified.
L. As an aid to navigation there are lines on the course. The lines are yellow, 2 cm wide, and centered in the hallways. The paint brand and shade of yellow is unspecified.

IV. Robot

A. The robot must not exceed a size of 20 cm x 20 cm x 20 cm at any time during the competition.
B. The robot must have a start button which will activate the robot at the beginning of a round.
C. The robot must be completely autonomous once the round begins.
D. Substances which may pose a hazard to persons or property are prohibited.
E. There are no weight restrictions.

V. Victims

A. Each room contains from 0 to 3 victims.
B. Physical characteristics: 10.1 cm diameter x 5.8 cm height (Subject to change)
C. The victims are in one of three states: Conscious, Unconscious, or Dead.
D. All victims emit a low frequency electromagnetic field. Details TBD.
E. Conscious victims have a blinking IR LED (λ = 940 nm), it is run by a square wave at 100 Hz.
F. Unconscious victims have an IR LED that is always on.
G. Dead victims have an IR LED that is always off.

VI. Rules of Play

A. Wireless communication with the robot is prohibited during a round.
B. At the beginning of a round the robot is placed in the start location. The team must then finish initializing the robot and completely disconnect all communications such that the only remaining task to activate the robot is pressing the start button. At this time obstacles and victims may be placed or moved by the referees. The time keeper will then signal for the team to press the start button, activating the robot.
C. The team may declare, without penalty, that the robot is finished searching for victims at any time they deem appropriate. This will terminate their portion of the round and determine the elapsed time for tie-breaking purposes.

VII. Mission and Scoring

A. *Upon locating a victim, the robot should output, in spoken form, the room, position, and state of the victim. This must be loud and clear enough to be easily heard and understood. A once per round award of 150 points will be given for clear audio.*

B. *A PA system will be used to convey the audio signal to the judges and audience.*

C. *A display on top of robot will display the room, position, and state of the victim. A once per round award of 50 points will be given for a working display.*

D. *Each correct position report of a victim will result in a score of 60 points. Points will be deducted for incorrect position based on the amount of error. 15 points will be deducted per grid space away (using Manhattan Distance) from the correct position, with a minimum position score of 0.*

E. *A penalty of 30 points will be assessed for each nonexistent victim reported.*

F. *Reporting the correct status of a victim is worth 40 points. Position error must be less than or equal to two grid spaces away to earn points in reporting the status of a victim.*

G. *In the case of two teams with identical point scores, time is used as a tie breaker.*

VIII. Competition Format

A. *The competition consists of multiple rounds.*

B. *All robots must be checked in before each round.*

C. *All teams have a randomized position for each preliminary round.*

D. *The maximum duration of each run is 4 minutes.*

E. *Preliminary Rounds: One run per team is given for each of the two preliminary rounds. Location of the obstacles and victims may be different for each run.*

F. *Each team's top score from the preliminary rounds will be used for determining placement in the final rounds.*

G. *Final Rounds: The top eight teams from the preliminary rounds compete in the final rounds. A single elimination tournament format is used for the final rounds. Obstacles are identical for both tracks.*

IX. Tolerances

- $\pm$ 5% Tolerance if not specified

- Other Tolerance Levels TBD

X. Appendix

Course Layout (not to scale):

Legend
Start Location: ■
Walls: ▨
Painted Lines: ■
Painted Grid Lines:　■
Grid Space (Not actually on the course): ▢

2.4 m

2.4 m

1 m

40 cm
Doorway

40 cm
Hallway

25 cm

Start