ASABE Robotics Student Design Competition 2009

Committee P127

Challenge Subcommittee:

Tony Grift, past chair, University of Illinois
Jacob van Bergeijk, AgCo
Lie Tang, chair, Iowa State University
Slava Adamchuk, University of Nebraska
Michio Kise, Secretary, Washington State University

All dimensions are given in cm (English unit)
Challenge

The schematic above shows an artificial forest in which trees are planted. Not all trees have emerged, you have the task to send in one or more machines that detect which trees are present. Secondly, you must wirelessly communicate the location of the present trees in row/column format to an offline recording device which must display the row/column information in real time. The recording device is a standalone unit that shows the locations of the present trees in row column format where row 1 is the bottom tree row and column 1 is the right tree column. For instance if the top left tree is present, the forest machine sends the string ‘4,5’ which is displayed on the recording device.

The trees are represented by red painted rods with a diameter of 2.54 cm (1 inch) and a length of 25.4 cm (10 inches). They are held in position on the board (painted white) with a small protruding cylinder that fits in a hole; it is however possible to knock them over. The number of trees that are present and their locations will be random. The objective is to complete the task in the least amount of time.

The challenge board is 243.84 cm (8 ft) square and it has a border that is 5.08 cm (2 inches) tall and 2.54 cm (1 inch) wide. The borders are mounted on top of the boards, so the inside area is reduced by 1 inch all around the circumference. The board surface will be painted flat white.

The guidance path is as shown in the schematic represented by black electrical tape with a width of 2.54 cm (1 inch). The forest lanes will be terminated with T sections made of the same tape. The T section itself is 10.16 cm (4 inches) wide.

Rules

1. It is not allowed to make changes to the challenge arrangement such as moving/adding of guidance lines, change coloring of background. Nothing can be affixed to the trees and they cannot be marked.

2. Multiple vehicles are allowed and in fact encouraged. Although not recommended, vehicles are allowed to collide with each other.

3. The vehicle(s) starting location is in the right bottom corner, and they have to be returned to this location although not necessarily in the same order, or in the same direction. When the vehicle(s) have returned and are stationary, the clock stops.

4. The vehicle volume is limited to 40*40*40 cm at the start and end of the run. During the run the dimensions may exceed these values.

5. There are no limitations on costs or technologies.

6. The total time allotted per trial is 5 minutes.
Presentation

Each team will present their design in a 15 minutes PowerPoint presentation discussing details of design, algorithms, and effectiveness of mechanical, electrical and software components. The presentation session will be held separately from the competition.

Scoring

There will be three judges and a separate time keeper present during the competition.

1. Performance: The total performance is a function of a) the number of tree locations that are correctly sensed (either present or not present), b) the total time spent and c) the functionality of the recording/indicator device.
   a. For each correctly sensed tree location 10 points will be earned.
   b. The time points are inverted. Each team starts with 300 points and every second that is spent on the challenge costs 1 point. If the team takes more than 5 minutes (which represents 5*60 = 300 points), the clock will be stopped and no time points will be earned.
   c. If the recording device works flawlessly, 100 points are earned. If it malfunctions no points are earned, if it works erratically, the judges determine the points in the [0,100] range

2. Elegance of design. This is a qualitative indicator that adds to the total score at the judges’ discretion (up to 100 points).

3. Points will be deducted if the team manually assists a machine (10 points for each assistance).

4. The presentations will be scored by the judges based on the teams’ a) presentation performance, b) report. The total points available to the judges are 200 for the presentation and 200 for the report.

Example scoring table:

<table>
<thead>
<tr>
<th></th>
<th>Sensing points</th>
<th>Time points</th>
<th>Recording points</th>
<th>Elegance of design</th>
<th>Assistance deductions</th>
<th>Presentation</th>
<th>Report</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max</td>
<td>200</td>
<td>300</td>
<td>100</td>
<td>100</td>
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<td>200</td>
<td></td>
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<tr>
<td>Team</td>
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<td></td>
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</tbody>
</table>
Rules arbitration

Although the rules presented here have been developed to be as encompassing and unambiguous as possible, it is possible that questions, the need for clarification and concerns arise up to and during the competition. Rules have been defined by the P127 Challenge Subcommittee and they will make the final decision regarding any and all concerns as well as ruling when a team violates the rules. Unless otherwise specified, any rules violation or attempt to bend the rules will result in disqualification of the team.

However, teams are very much encouraged to develop ‘out of the box’ solutions as long as those solutions are within the rules. If the team is in doubt whether a proposed solution is legal, contact the Challenge Subcommittee with detailed explanation by emailing Dr. Tony Grift, grift@illinois.edu.