FIELD ROBOT EVENT

VENLO * THE NETHERLANDS 2012

Program
Booklet

Fontys

Disciplines for the 2012 contest

The tasks for the FieldRobotEvent 2012 are related to the tasks of all previous events, except for the maize. Instead of maize, potted roses have been chosen, positioned on grass on so called container fields. The tasks consist of navigating through straight, curved and partly fragmented rows of 'plants', recognition and detection of different types of plants, as well as orientating in the field: these are the same key aspects as in the previous events.

Furthermore, there will be a 'Freestyle' task for the teams to demonstrate their own designs. This task will also be set within an agricultural setting.

Finally, there will be a special cooperation task (co-op task) to work together with another team. For example: one team's robot detects the missing plants whereas the other team's robot seeds new plants. For these tasks it is absolutely necessary to cooperate, with another team. The team with whom you are to cooperate will be announced in the morning on day 3!

General rules

- Because we are developing autonomous robots, it is NOT allowed to follow the robot with laptop, controller or other devices. One person is allowed to follow the robot, without any electronics. This person only can reposition the robot in case the path is not followed or in case of emergency press a button on the robot.
- Before the start every team has to explain to the officials, which kind of hardware they are using. If they are using simple hardware (e.g. infrared or ultrasonic distance sensors combined with cheap microcontrollers) instead of high end equipment (e.g. embedded PCs, laser range finder), they will get more points.

- During the tasks the robots will have to wait in a Parc Fermé, so that no further testing or modification is possible. Between the tasks there will be a 10 minute break for the teams to prepare their robots for the next challenge (change batteries, etc.).
- From the moment a robot is given permission to start, it must start within one minute. If the robot doesn't start within this time, it has one more chance to start after all other teams. If it does not start within one minute for the second time, the robot is disqualified for that task.
- Large robots and/or robots with a probability of destroying the field will always start after the other robots have performed their tasks AND after all second chances restarted.

Awards

- There will be jury points for the basic, advanced and professional tasks. Not only will the "hard facts" be considered by the officials, also the execution of the tasks.
- There will be an award for the first three ranks of each task. The basic, advanced and professional tasks together will yield the overall winner of the Field Robot Event 2012.
- If two or more teams have the same number of points for the overall ranking, the team with the better placements during all three tasks will be ranked higher.

Task 1 "Basic"

Within three minutes the robot has to navigate through long curved rows in a container field of potted roses. The goal is to cover as much distance as possible. On the headland, the robot has to turn and return in the adjacent row. There will be no plants/pots missing in the rows. This task is all about accuracy and smoothness of operation within the rows.

At the beginning of the match it will be told whether starting is on the left side of the field (first turn is right) or on the right side (first turn is left). This is not a choice of the team but of the officials. So, make sure your robot is able to perform both options!
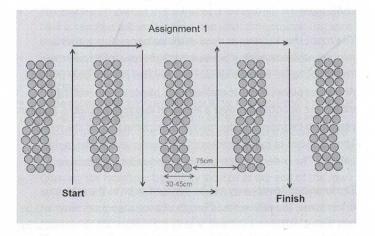
Assessment:

- The distance travelled in 3 minutes is measured. If the end of the field is reached within 3 minutes, the total time counts. Distance and time are measured by officials;
- Manual intervention within the rows results in a penalty of 3 meters (per touch). The number of touches is counted by the officials;
- A manual intervention at the end of a row to help the robot entering the next row will be punished with a penalty of 5 meters. The robot should make the turn by itself;
- The robot is allowed to touch a potted plant, however, when a potted plant is tipped over, this will result in a penalty of 2 meter (per fallen plant). The officials will count the number of pots that were tipped over.

The calculated distance and time result in a team ranking. Numbers 1 to 3 will be rewarded with a price for their achievements in this task. This task, together with tasks 2 and 3, contributes to the

overall FieldRobotEvent2012 Championship. Points will be given as follows (similar to Formula1 point system): First place in this task: 10 points - Second place: 8 points - Third place: 6 points - ...5-4-3-2-1-1-1-1... points. Participating results in at least 1 point. Not participating in this task results in 0 points.

Task 2 "Advanced"

In practice, some potted roses are taken out of the field of roses because of customer orders. The effect will be that the rows contain gaps, moved plants, etc. Navigating through such a field is a challenge!

The robot should cover as much distance as possible within 3 minutes while navigating between straight rows of potted roses. The robot has to follow a certain pre-defined pattern over the field. At various places in the container field, plants will be missing in either one or both rows over a length of maximally 1 meter. Further plants can be moved IN the rows and block the path of the robot. The robot has to move backwards and continue with the coded pattern. The coded pattern takes blocked paths into account.

The headland border may not be perpendicular to the crop row orientation. The difference in length of two subsequent rows will be less than 1 meter. A headland of only 1.5 meters will be available for turning.

Coding of the row-pattern through the container field is done as follows. S means start, L means left-hand turn, R means right-hand turn and F means finish. The number before the L or R represents the row that has to be entered after the turn and the single number 0 means return in the same path. So, 2L means: enter the second row after a left-hand turn. 3R means: enter the third row after a right hand turn. The code row-pattern will be given as (example): S - 3L - 0 - 2L - 2R - 1R - 5L - F.
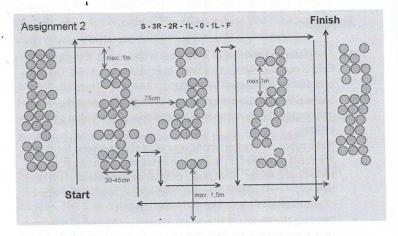
The code of the pattern is made available to the competitors 10 minutes before the start of the competition. Competitors do not have the opportunity to test it in the container field.

Assessment:

- The distance travelled in 3 minutes is measured. If the end of field is reached within this time, the total time counts. Distance and time are observed by officials;
- Manual intervention results in a penalty of 3 meters (per intervention). The number of interventions is counted by the officials;
- If the robot enters the wrong row after the headland turning or if there is intervention during the headland, it results in a penalty of 5 meter. The robot must be set into the correct row by hand if the headland turning was not successful. The number of interventions is counted by the officials;
- Crossing the headland boundary located at the end of the rows by a distance of more than 1.5 meters or twice the length of the robot (if the length is larger than 75 cm) results in a penalty of 5 meters per crossing; number of crossings is counted by officials;
- The robot is allowed to touch a potted plant, however, when a potted plant is tipped over, this will result in a penalty of 2 meter (per plant tipped over). The officials will count the number of pots that have been tipped over.

The calculated distance and time result in a team ranking. Numbers 1 to 3 will be rewarded with a price for their achievements in this task. This task, together with tasks 1 and 3, contributes to the overall Fieldrobotevent 2012 championship. The following sequence for the overall points is used: 10-8-6-5-4-3-2-1-1-1-1... Not participating in this task results in 0 points.

The following picture shows an example of how the track could look like for task 2. The gaps in the rows and the drive pattern will be different at the real event!

Task 3 "Professional" – Customer Order

The "Professional Task": Customer order consists of a number of subtasks, Identify, Pick and Place. First the robot has to find the ordered plant in a container field and show that the ordered plant has been found (Identify). Second, the ordered plant should be marked AND/OR the ordered plant should be taken and third, the ordered plant should be delivered at the starting point.

As in the rose business, the plants will be indicated with tags.

Subtask 1:   Navigate in a 'chaos'-field and identify the ordered plant;

Subtask 2:   Pick the identified plant;

Subtask 3:   Deliver the plant.

The tags can be chosen by the teams themselves, one can think of barcode identification (stickers on the pots), RFID tags, plant pins, etc... The officials will place the tag on a random plant, taking into account the wishes of the team (height, visibility). We do not want to force teams to work e.g. with RFID, because of the limitations of some (embedded) systems.

Assessment:

➔   The robot has 3 minutes to show the identification of a plant. Finding (and signalling) the ordered plant within a radius of 0.5 m results in 10 points, within a radius of 1.0 m results in 9 points, within 1.5 m in 8 points etc. (points = 11-2*radius). Navigating to the right row will give a bonus multiplication of 1.5 to the gathered points in this subtask.

→ Picking the ordered plant within 2 minutes.
Picking the ordered plant WITHOUT any manual intervention gives a bonus of 20 points.

Picking the ordered plant with manual intervention (put robot in right row and in front of ordered plant) gives 10 points.

→ Last, the robot delivers the plant, for this task a maximum of 2 minutes is allowed.

Delivering the ordered plant gives a bonus of 10 points. Penalty of 1 point per 0.5 meter distance from starting point is subtracted.

- Touching other plants is allowed in this assignment. When a pot tips over, a penalty of 1 point per pot is given.
- The total score of sub-tasks 1 – 3 is added.
- Numbers 1 to 3 will be rewarded with a price for their achievements in this task.
- As this task, together with tasks 1 and 2, contributes to the overall FielRobotEvent2012 championship,. the teams are ranked based on the total score. The winning team gets 10 points, second team 8 points, etc. The following sequence is used: 10-8-6-5-4-3-2-1-1-1-1...
- The following picture shows an example of how the track could look like for task 3. The gaps in the rows and the drive pattern will be different at the real event! In comparison to task 2 the field will be less chaotic. There will be less gaps in the rows and there won't be a barrier in a row.

Task 4 "Freestyle"

Robots are invited to perform a free-style operation on the field. Fun is important in this task as well as an application-oriented performance. One team member has to inform the jury and the audience about the idea.

For the "Freestyle" challenge, the potted roses can be positioned as required. It is not necessary to keep the pots in curved or straight rows.

Assessment:

The jury ranks the idea and the robot performances at the end of the task, both with a mark from 1 – 10. These points are added and the team with the highest score gets 10 points, second position 8 points etc. according to the previous mentioned sequence: 10-8-6-5-4-3-2-1-1-1-1......

This task is optional and will be awarded separately. This task does not contribute to the overall FieldRobotEvent 2012 championship.

Task 5 "Cooperation"

On the third day groups of two teams will participate in a cooperative freestyle task. The teams will be chosen by the organizer and will be pronounced as early as possible. So there is much time to prepare. The groups choose their own task but it has to be a task with two robots working together. The field can be changed as desired. For this purpose there has to be a communication between the robots. This is a nice step forward in technology because communication between field robots will be very important in the future.

This communication should be done with Wi-Fi and ISOBUS as protocol. Nevertheless every other way of communication is possible and we are open for good ideas. Also the robots could "communicate" via pressure sensors or vision. Everything is possible in this task as long as it is cooperative.

Assessment:

The jury ranks the idea and the robot performances at the end of the task, both with a mark from 1 – 10. The idea and the quality (communication) of the co-op task are most important. These points are added and the team with the highest score gets 10 points, second position 8 points etc. according to the previous mentioned sequence: 10-8-6-5-4-3-2-1-1-1-1......

This task is optional and will be awarded separately. This task does not contribute to the overall FieldRobotEvent 2012 championship.

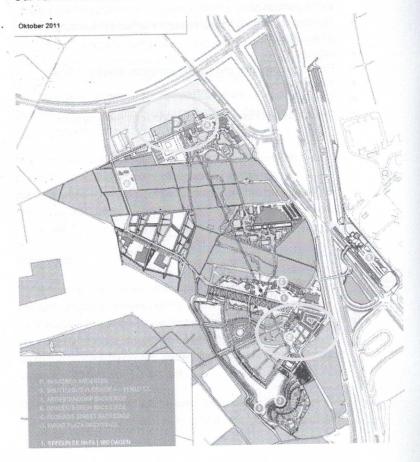*Examples of possible cooperative tasks:*

- Find a rose
- The first robot finds the marked rose pot and the second gets it to the start point
- The first robot finds the marked rose pot and the second prints a barcode on it
- Labyrinth
- First robot explores and second navigates directly to finish
- Follow the leader
- Sort roses
- One robot gets roses and the second sorts them by color

Map of the Floriade terrain

Your car is parked on the parking place marked with a P.

Our Terrain on the floriade is marked with a X.

Oktober 2011

Map of the fieldrobot terrain