Embedded Systems 2017-18. Derbot Challenge
tjw 5.10.17

Task Statement as issued

Any clarifications or modifications to this statement will be published on the module web site.

Summary

In your team, design and build a Derbot-based AGV which undertakes all or some of the following actions:
The AGV runs on a black "competition surface" approximately 2.4m square. It follows a white track in the approximate form of a figure-of-8 as fast as possible. It starts at the central intersection of this, and having completed 5 laps, finishes in the same place. Along the track it will find obstacles, which it must count and remove from the track, leaving them on the inside of the figure-of-8 track, such that they don't impede the AGV when it next comes round. On completing the track, the Derbot should stop in the position it started. Having stopped, it should display continuously the total number of obstacles it encountered, on a 7-segment LED display.

Any revisions or clarifications to this task statement, or to competition rules, will be communicated on the module Blackboard site.

Track Following

The track width is 17mm approx, white insulating tape laid on flat plywood painted matt black. The AGV must be tolerant of some scuffing/imperfection of surfaces, small variability in track width, and minor discontinuities in board height.

Obstacles

Obstacles will be made from the lower part of a 500ml plastic drinks bottle. The height is 100mm approx, and diameter 65mm approx. The obstacle will be weighted with a filler material, e.g. wax or "polyfilla", to bring its overall mass to 0.09kg (90 grams). The extra weight will be at the bottom, so the obstacle overall will have a low centre of gravity. Sample obstacles will be available for inspection and trial. There will not be more than nine obstacles in total. Obstacles may be added to the track at any time during the run of an AGV.

Start and Finish

The AGV should start at the figure-of-8 intersection, facing one line and with wheels on the other, as directed by the marshals. It should stop in the same place, after 5 laps have been completed. The stop position will be deemed accurate if the Derbot body is completely over the point of intersection itself.

Obstacle Count Display

The display must be a 7-segment LED display, easily visible to an observer. It must be updated every time a new obstacle is found, and must be continuous on stopping, until the Derbot is switched off.

Competition Conduct

At the start of competition, all AGVs must be placed in the "holding bay". Before the first team competes, a "house robot" will be run round the track, to prove it is clear. Teams take their AGV from the holding bay when it is their turn to compete. One team member should give a brief presentation (less than 3 minutes), introducing the team, and indicating the team strategy. The AGV with power switched off should then be placed in the start position. On the command GO, power should be switched on; there should be no further manual contact with the vehicle. Once the AGV has started moving, it may exceptionally be redirected by hand, with contact of less than 3 seconds, and a penalty for each such intervention. A team may also request a 10-minute delay and restart (e.g. for emergency repair), again with fixed penalty. Gross manual intervention leads to forced restart, or disqualification; this includes lifting and relocating the AGV, or pushing and guiding.

Build Quality

After the competition, all Derbots are retained by the module tutors. A mark is awarded for build quality.

The competition judges' interpretation and ruling will be final in all cases.

Example Track Layout
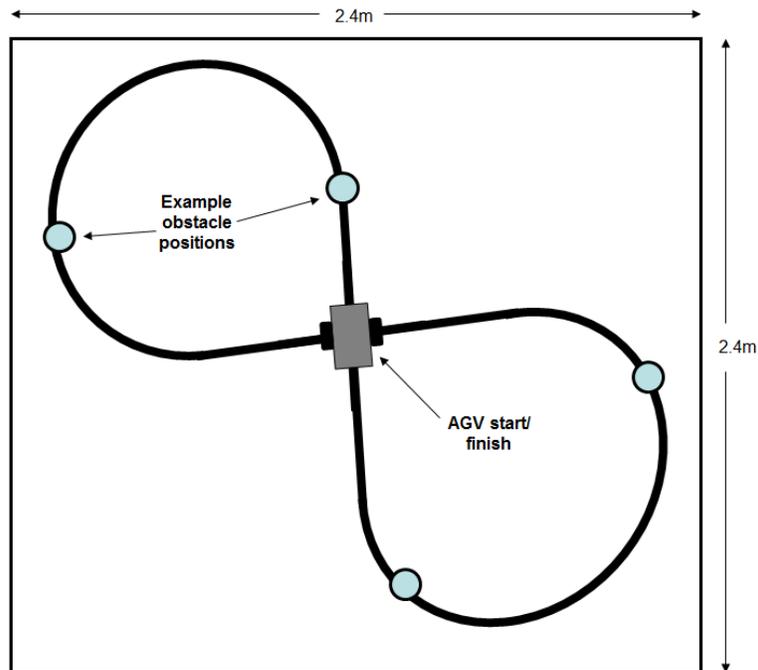
Scoring

Action	Points
Derbot presented for competition	10
Derbot starts moving down track	10
X laps completed, where X ≤ 5	10X
Accurate stop at finish point	40
OR	
Nearly accurate stop at finish point (within 20 cms of intersection)	20
Correct display of number of obstacles found	60
OR	
± 1 error in display of number of obstacles found	20
Speed of completion	5(N-P)*
Removal from track of Y obstacles, to "inside" of track	10Y
Hitting or touching Z "removed" obstacles on subsequent laps (any further hit of the same obstacle is not counted)	-5Z
Manual intervention (AGV redirected - not lifted or moved)	-20
Stop and Restart (clock restarted, only allowed once)	-50
Example max. possible score, 10 teams, 7 obstacles = 10+10+50+40+60+5(10-1)+70	**285**

* N = number of competitors,   P = position in order of speed. For non-competers, P=N.