

Embedded Systems 2011-12. Coursework Assignment (Derbot Challenge)

tjw rev. 17.10.11

Task Statement

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 as fast as possible. At an early stage on the track will be a fixed, 240mm wide gateway, placed symmetrically astride the track. Along the track will be placed a series of small moveable obstacles, each obstacle being a battery-powered led light. Whenever the Derbot detects an obstacle, it should remove it from the track, as described below. On completing the track, the Derbot should stop within the Finish Zone. Having stopped, it should display continuously the total number of obstacles it has found.

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

Track Following and Gateway

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, and variability in track width. In the competition, the AGV will only be allowed to proceed if it can fit through the gateway.

Obstacles

Obstacles are hexagonal led battery-powered lights, of overall height 25 mm, and side 35 mm. Their mass is 60 g approx. There will be not more than nine obstacles in total. Obstacles will not be placed close to corners of the competition surface. Wherever they are placed, the track will be at least 300 mm from the surface edge. They will be placed at least 300mm from each other. “Correct removal” of obstacle indicates that it is completely off the track, placed to the right of the track if switched on, to the left if switched off.

Finish Zone

All AGV points of contact with the competition surface must be completely within the line defining the finish zone. Approx. internal dimensions of finish zone = 250 mm square.

Obstacle Count Display

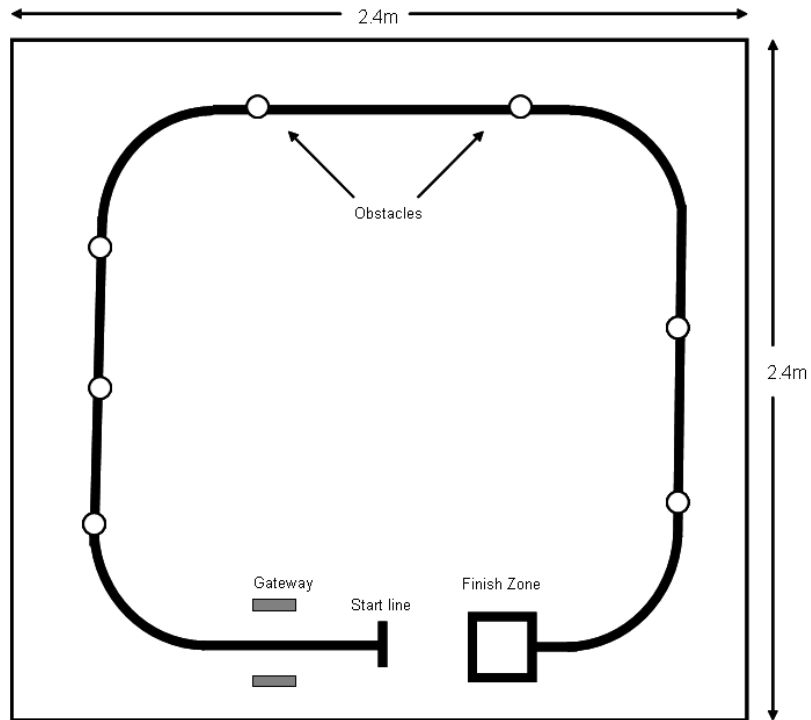
Any form of display which gives a clear indication of number is acceptable. This may include, for example, a single-digit display, or led flashing the specified number of times. Whatever form of display, it must be continuous, until the Derbot is switched off.

Competition Conduct

At the start of competition, all AGVs must be placed in the “holding bay”. 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 with wheels on the start line. 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.

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
Correct removal of obstacle from track	10S**
Accurate stop within finish zone	60
OR	
Nearly accurate stop within finish zone (two points of contact entirely within finish zone)	40
OR	
Inaccurate stop within finish zone (at least one point of AGV contact within zone or on surrounding tape)	20
Speed of completion	5(N-P)*
Correct display of number of obstacles found	60
OR	
± 1 error in display of number of obstacles found	20
Touches or hits gate	-20
Manual intervention (AGV redirected - not lifted or moved)	-20
Stop and Restart (clock restarted, only allowed once)	-50
Example max. possible score, 9 teams, 6 obstacles = 10+10+(6x10)+60+(5x8)+60	240

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

** S = number of obstacles correctly removed.