

OBSTACLE AVOIDANCE ROBOT COMPETITION

1. INTRODUCTION

The object of the contest is to build a small microprocessor-controlled robot vehicle that is able to navigate its way, through an unknown terrain, to the target in the shortest possible time. The target is a yellow coloured square at the center of the quadrant furthest away from the starting point.

The challenge is to design and build a small vehicle capable of fast controlled motion, and provide it with sufficient intelligence to explore and negotiate around obstacles in the shortest possible time to reach the target yellow square. On the first run through the maze, the vehicle can employ a search strategy to navigate through the maze. On subsequent runs, the vehicle would have the capability to record the correct navigation route through the maze and thus be able to perform a 'dash' run through the maze to the yellow square to achieve a faster maze run time.

The purpose of this competition is to provide a technically demanding yet enjoyable problem for the participants.

2. TERRAIN SPECIFICATION

- 2.1 The domain for the obstacle avoidance vehicle competition is a flat area criss-crossed by reflective tape forming a 16 x 16 array of 180mm x 180mm (between centres) squares. An unobstructed border of at least one square width will bound the domain.
- 2.2 The domain floor and its border will be made of wood painted with non-gloss black paint. The squares marking the domain will be constructed with reflective tape (3M Scotchlite reflective tape) of 10mm width.

3. OBSTACLES

- 3.1 The obstacles will consist of rectangular wooden blocks painted with white paint. It will be ensured that all obstacle surfaces will have the same consistent shade of white. The block can be of any height from a minimum of 50 mm. The length and width of the block shall be of a uniform cross-section, either 150 mm x 150 mm or 75 mm x 75 mm. If a block is higher than 50 mm, then the horizontal cross-section of the block that is above 50mm can be of any shape provided no part of it extend beyond the base cross-section of 150 mm x 150 mm.
- 3.2 The obstacles will be placed, approximately centrally, within the squares. A minimum passage width of at least one square is guaranteed.
- 3.3 The first move from the start position must be towards the North. This is to facilitate electronic clocking. Obstacles may be placed to ensure this.

4. GENERAL TOLERANCES

- 4.1 The tolerance of the obstacles and domain platform will be within specifications specified in the attached drawings.

5. ROBOT SPECIFICATIONS

- 5.1 There will be no restriction to the length, width or height of the robot vehicle as long as the vehicle fits within the area bounded by 1 square (180mm X 180mm) The vehicle must be fully self contained and not receive assistance from external sources and all parts of the vehicle must travel to the target. The judge may, however, allow participants to retrieve and restart their vehicles in the event of a collision or other situations when a restart is required.
- 5.2 The vehicle must not attempt to change or damage its environment.
- 5.3 During competition, only the following components are allowed for operation by the competitor
- One single coloured LED – for indication of power on purposes only. The LED should be either continuously ‘on’ or continuously ‘off’. No blinking of LED or any transmission of coded message is allowed back to the competitor.
 - One power on toggle switch - for connection to the battery power supply.
 - One start/stop button – to start/stop the vehicle before and after each maze run.
 - One reset button – to reset the vehicle CPU.
- 5.4 Any other visual or audible electronics components (e.g. 7-segment LEDs, LCD screens, beeper, LED clusters, etc...) on the vehicle which convey information on navigation strategy or speed mode to the operator is NOT allowed. If there are any of these components used on the vehicle, they must be removed or covered prior to the caging of all entry events. Contravening this rule leads to disqualification.
- 5.5 Starting of vehicle for each maze run is to be activated by one reset button and/or one start button activated by one “press” at a time. Competitors are not allowed to perform double clicks or multiple “presses” on a button in quick succession. Judges will strictly enforce this rule.

6. RULES FOR THE CONTEST

- 6.1 The objective of the competition would be for the robot to reach the target in the shortest time.
- 6.2 Each robot will perform at least two runs within an allotted time of 6 minutes. (The final time allotment will be decided by the event chairman depending on the number of entries.) The timing for a run will start at the instant the judges instruct the participants to start their robots, and end at the instant any part of the robot makes contact with the target yellow square. An entry must make a successful run within the first 3 minutes in order to qualify for the remaining time allotment to that entry.

- 6.3 All robots must travel on the surface of the domain. Robot vehicles are required to travel within the specified domain and no part of the vehicle must come in direct contact with regions outside the domain. Overhanging within the boundary is allowed.
- 6.4 The use of long probes reaching across obstacles does not constitute "navigate its way through an unknown terrain", and is contrary to the spirit and implied rules of this competition.
- 6.5 No servicing or repairs of any kind are allowed during the time allocation to each entry. Should the need arise to replace exhausted battery supplies, permission must be sought from the judges to perform this function. The decision to allow this is left at the discretion of the judges.
- 6.6 The participants will be graded on the fastest 1st run, and on the fastest run. If a vehicle requires a restart, during the first run, it will be disqualified from consideration for the fastest first run prize.
- 6.7 There should be at least 1 clear path (contiguous sequence of full squares) from the starting to the ending position.
- 6.8 Before the start of the competition, entrants are allowed to inspect the layout of the maze to satisfy themselves that all blocks are approximately centrally located on the squares.
- 6.9 Under all circumstances, entrants are not allowed to touch the block obstacles. Should any positional adjustment be made to the block obstacles, these will be performed by the event timers/helpers/judges.
- 6.10 Each handler will only be allowed to handle one robot. The same handler cannot be used to handle another robot in other runs.
- 6.11 Entries should have their nominated handlers before the run commences. Robots without handlers will be disqualified.

7. CLONING

- 7.1 In accordance with the spirit of the competition, clones among the winning entries will only be awarded one prize. Clones will be identified during the "caging" as well as after the completion of the maze run. The vehicles will not be considered a clone if the search strategies for entries are visibly different through the maze even if the physical appearances are nearly the same.
- 7.2 Clones are robots with substantially identical physical appearance and navigation principles. If the vehicles are only similar in one of these categories, the vehicles are not considered clones.

8. Caging

- 8.1 All entries must be caged ½ hour prior to the start of the competition. This is to allow the organisers time to set up the maze.
- 8.2 During caging, judges will identify potential clones as well as inspect entries which contravene rules on robot specifications in paragraph 6.

8.3 Battery charging of robots is not allowed during caging. Entrants are however allowed to cage backup batteries along with their robot entries.

9. Judging and Disputes

9.1 Decision of the Judges will be final.

9.2 Any disputes arising during the competition must be brought up immediately to the judges.

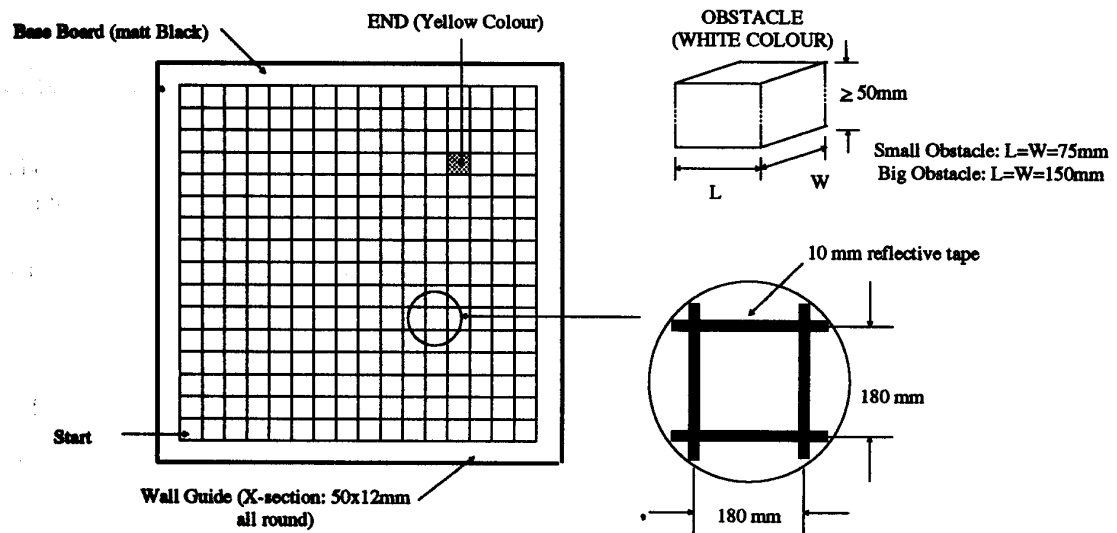


Figure 1: Obstacle Avoidance Robot Terrain