Sri Lankan Robotics Challenge

SLRC 2017

University Category

Electronic and Telecommunication Engineering

THE ELECTRONIC CLUB

Who we are?

University of Moratuwa, being the country's leading technological higher education institute, has been monumental in introducing cutting-edge technology to the local communities.

The Department of Electronic and Telecommunication Engineering of University of Moratuwa, generally known as ENTC, is a place renowned for its contribution in reshaping the technological landscape of Sri Lanka by molding the brightest Sri Lankan minds to be remarkable innovators and technology leaders.

The official student association of Department of Electronic and Telecommunication Engineering, University of Moratuwa, Electronic club (affectionately known as E club) was established two decades ago with the vision of "Serving humanity through electronics". Year by year, growing its strength, E-Club has been able to carry out various activities focusing on the avenues of professional development as well as community service. These activities have contributed to the society in multiple aspects whilst earning undergraduates many opportunities to polish their soft skills and leadership abilities.

What we do?

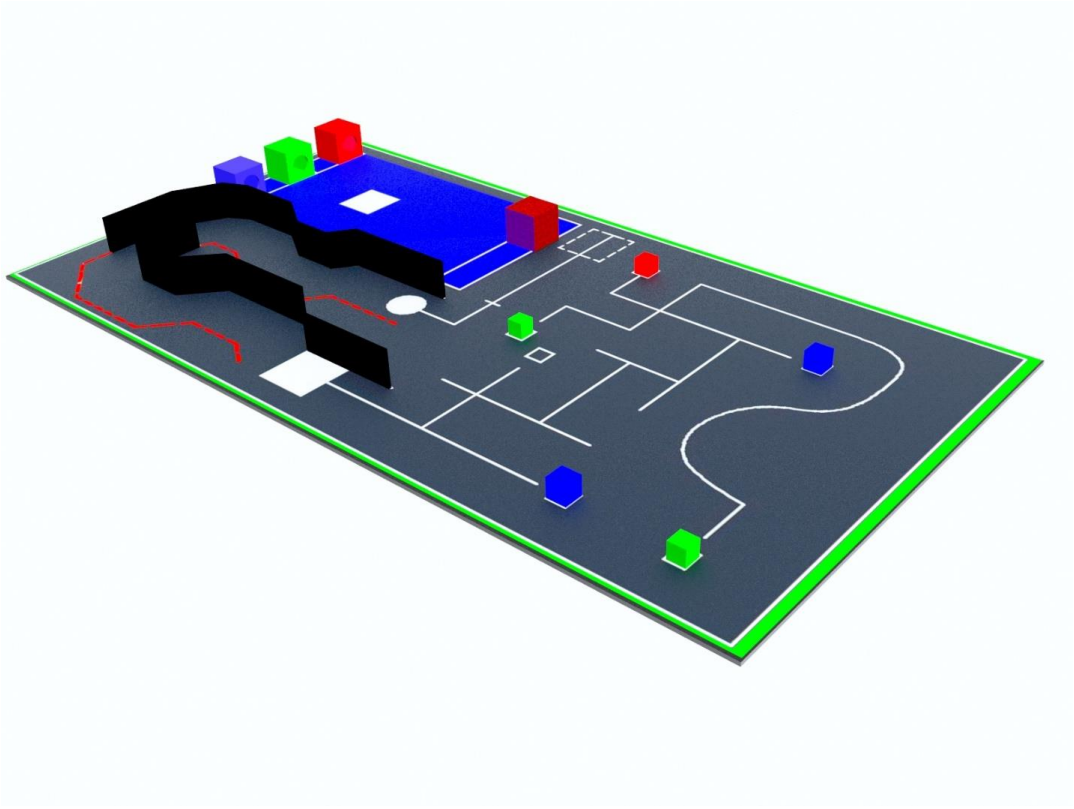
E-Club has been successfully completing a wide range of projects each year, accomplishing the club's vision to facilitate both the undergraduates and the society. Each of these projects is organized with tremendous effort by the undergraduates under the guidance of the academic staff.

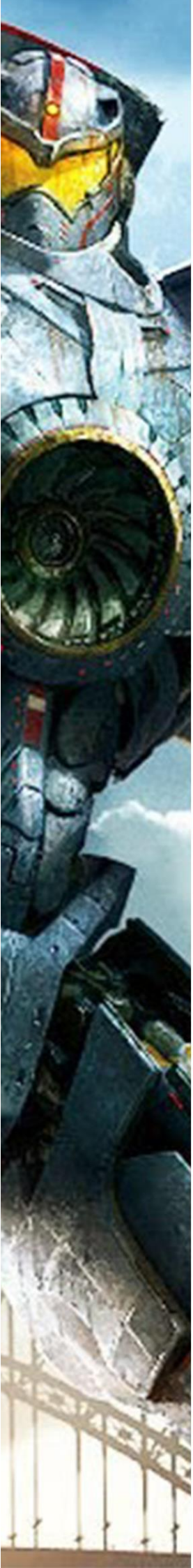
"E-Forum" is a platform where the students, faculty, government and industry come together. The forum is very much appreciated by all and the common challenges the industry faces are discussed at this forum. The results are always beneficial for all.

Sri Lankan Robotics Challenge (SLRC), formally known as iNexus is organized annually by the E-club. The event, which brings an international experience for all, is open to students across the country; university and school students. Numerous robotics workshops are also conducted to the school students to develop their knowledge in robotics.

Task

The competition task should be achieved using an autonomous *mobile* robot and an autonomous *stationary* robot. The mobile robot has to solve a line maze while detecting colored cubes. When a cube is detected, the mobile robot has to detect its color and send that information to the stationary robot and the stationary robot has to shoot balls to target boxes based on the information given by the mobile robot. After finding cubes in the line maze, the mobile robot has to follow a wall to enter the shooting area. In the shooting area, the mobile robot has to find the position of the target and send that information to the stationary robot to shoot, in order to complete the task.





Game Field

1) The game field consists of an arena having dimensions 4700mm x 2350 mm.
2) The arena will consist of three major areas, the line maze, the wall following section and the shooting area.
3) The arena will further contain a mobile robot starting zone and a stationary robot location.
4) Line maze
   a) The maze will consist of white lines of 30mm width on a non-reflective matt black surface.
   b) The junctions in the maze will be composed of lines intersecting at angles; 90^0 and 180^0 only. (There will not be any junctions in **curved line sections**)
   c) Some dead ends in the line maze will have cubes (These will be placed randomly). The distance from the end of the line to a cube will be **10cm** and the size of a cube will be **10 cm X 10 cm X 10 cm**.
   d) Cubes will be of color Red, Green and Blue, and they will have a matt non-reflective surface.
   e) The number of cubes placed in the maze will be the same for each match. The number will be picked from a draw, after all the teams have handed over their robots.
   f) Minimum distance from a dead end to a wall segment or another object other than a cube will be greater than 20 cm.
5) Wall following section
   a) This section will have two wall segments, first on the right side and then on the left.
   b) The Height of a wall will be 20 cm and its color will be black.
   c) There will be a red dashed line 35cm away from the wall which the robot should not cross. Penalties will be given, each time the robot crosses this line.
6) Shooting area
   a) This area will consist of Target Area 1 and Target Area 2.
   b) Target Area 1 will have three colored target boxes Red, Green and Blue with equal space (20cm) in between.
   c) Target Area 2 will have one target which will be placed at a random position, before each match starts.
   d) Distance from the center of the stationary robot position to the center of the Target Area 1 will be 75 cm
   e) Distance from the center of the stationary robot position to the center of the Target Area 2 will be 1.2 m

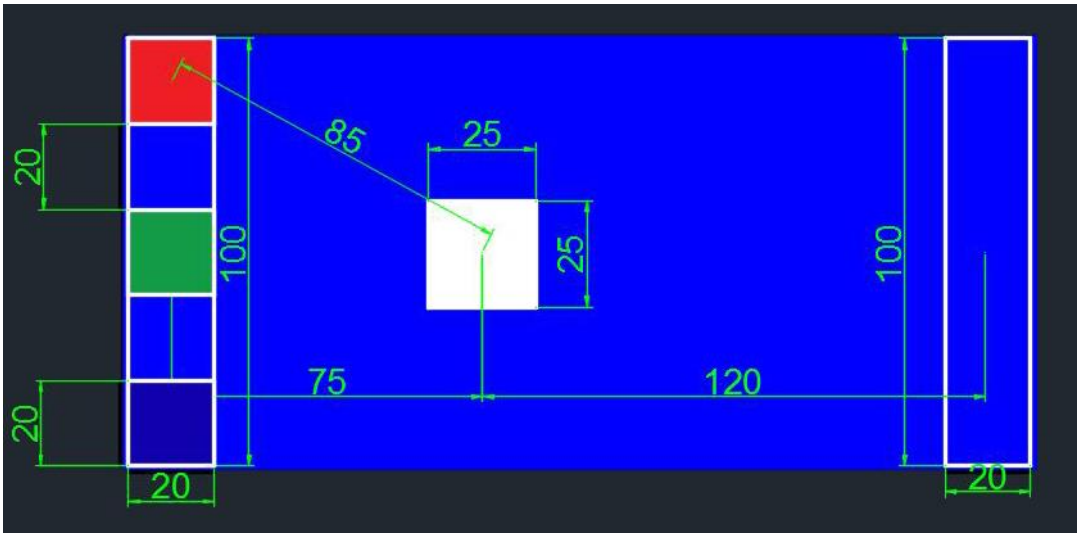


Figure 1 Shooting Area (Dimensions in cm)

f) Target Area 1,2: A rectangular area of 100 cm X 20 cm at both ends of Shooting Area; all the targets will be placed within these boundaries (see figure 1)

g) Target boxes

   i) These will have dimensions 20cm X 20cm X 20cm and a circular hole of radius 6 cm (figure 2).

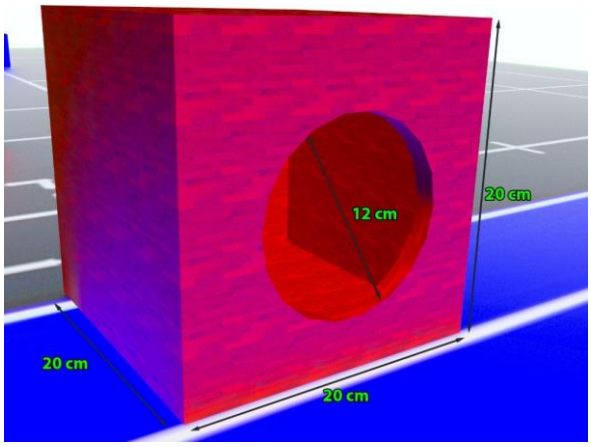


Figure 2

h) Shooting balls: Balls of diameter 40mm and weight approximately 2.7g.

i) Mobile robot start zone: this will be a square of 30cm X 30 cm; the mobile robot must start the game from this zone

j) Stationary robot Location: This will be a square of 25cm X 25 cm.

Note:

- Positions of Red, Green and Blue targets will be as shown as in figures (figure 1 and 3).
- Do not make any assumptions about the amount of sunlight, incandescent light, or fluorescent light that may be present at the contest site
- The dimensions of the arena will be accurate to within 5% or 20 mm, whichever is less.

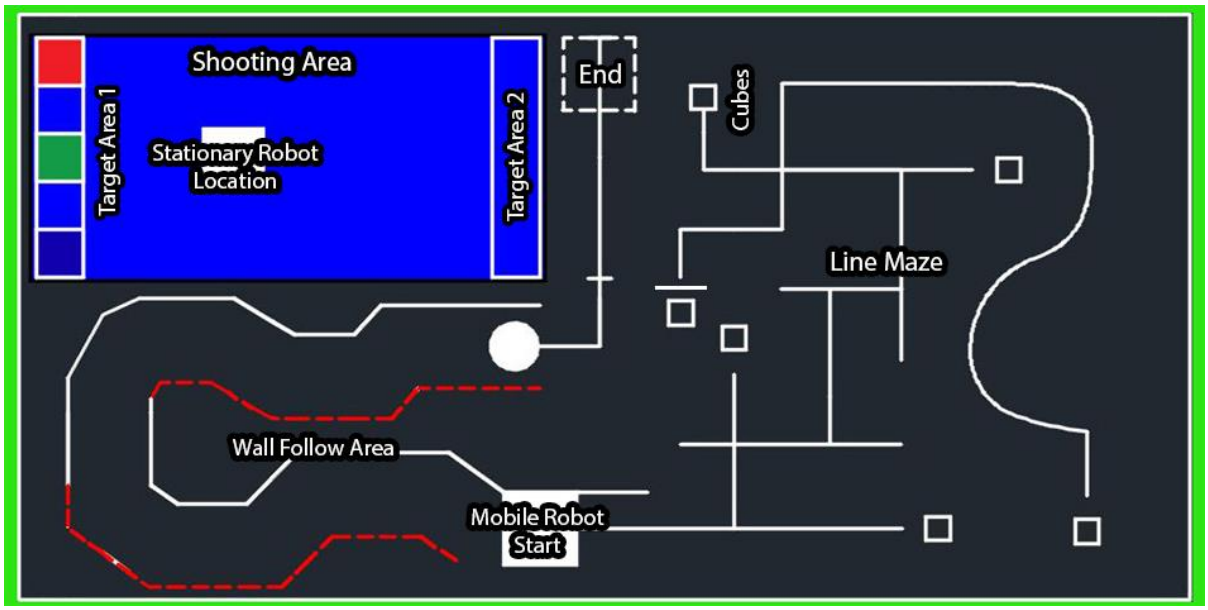
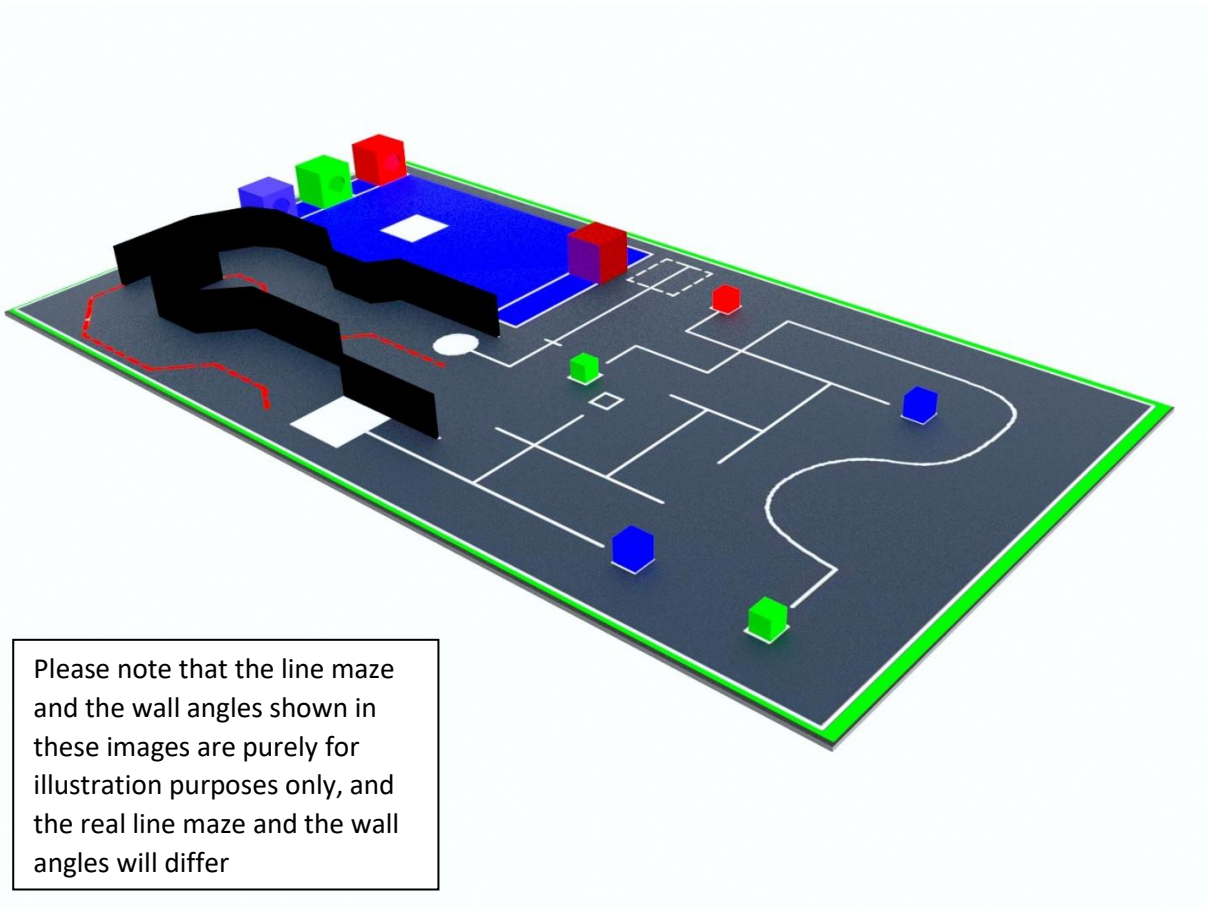


Figure 3 Arena Description



Please note that the line maze and the wall angles shown in these images are purely for illustration purposes only, and the real line maze and the wall angles will differ

Figure 4 3D view of Arena

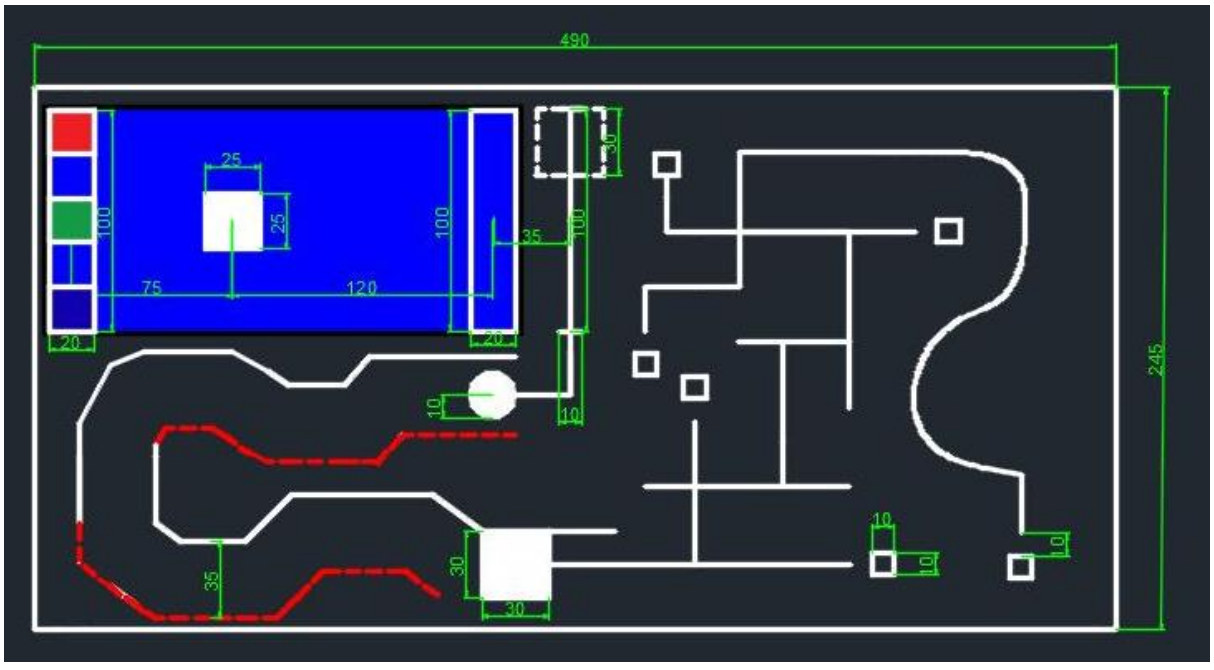


Figure 5 Dimensions of Arena (In cm)

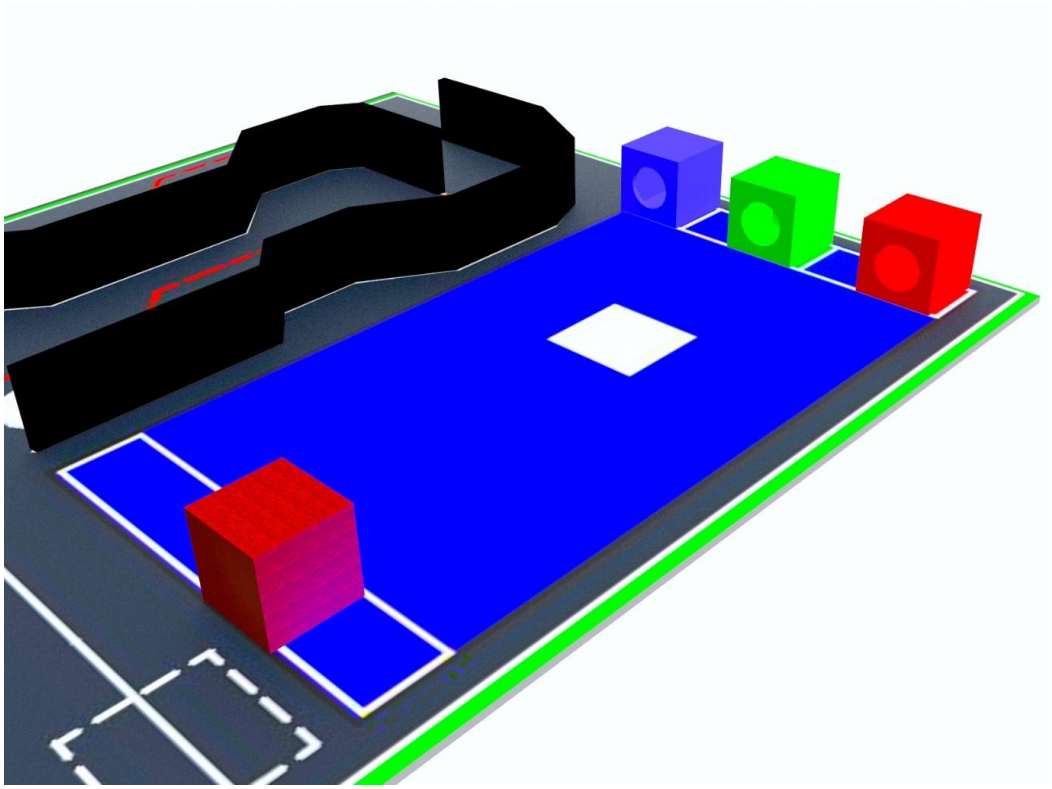


Figure 6 Shooting Area

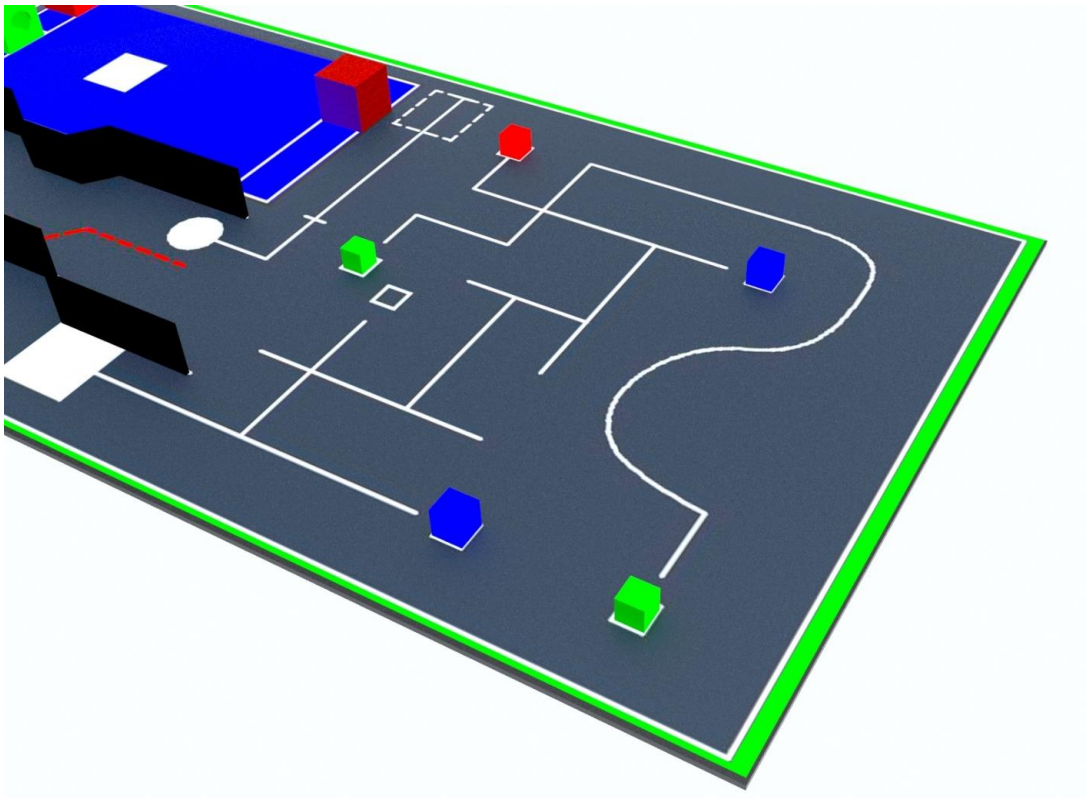
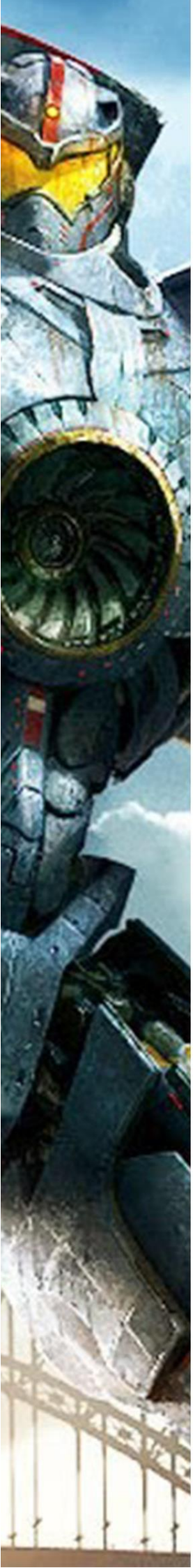


Figure 7 Line Maze



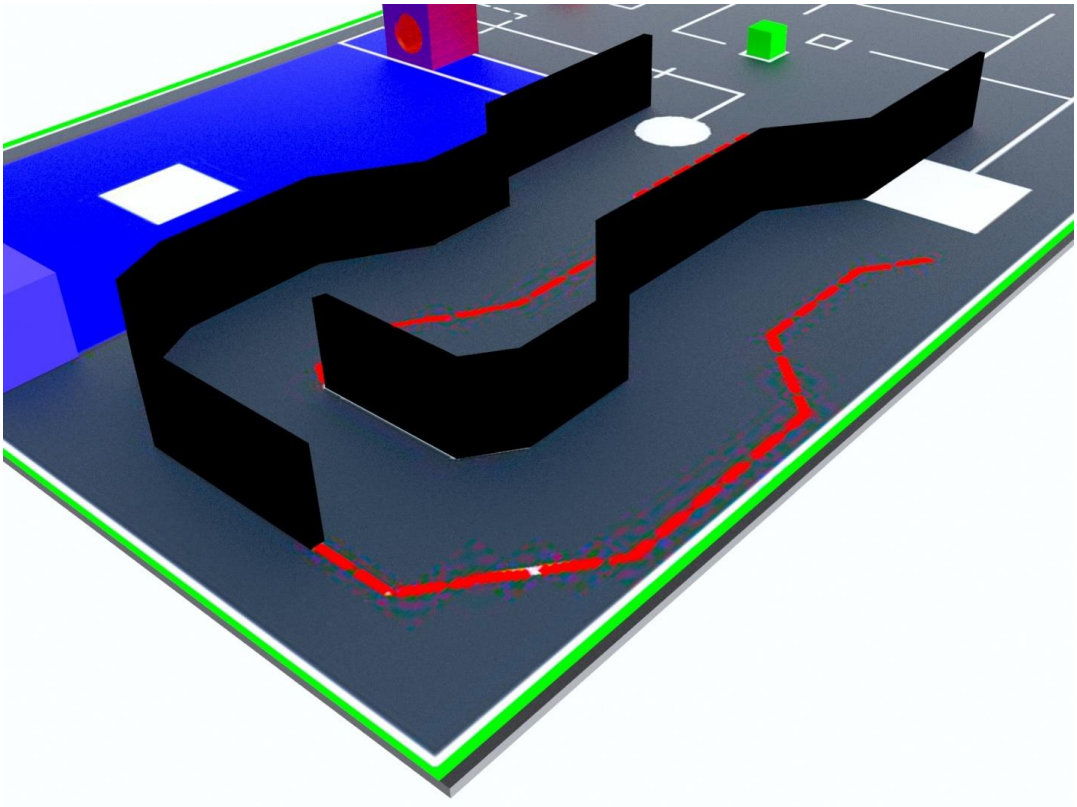


Figure 8 Wall Following Section

Robot Specifications

1) During the whole event the mobile robot must fit within a box of 250mm X 250mm X 250mm (length (l) X breadth (b) X height (h)).
2) The base of the stationary robot must fit within a square of 250mm X 250mm (l X b).
3) The stationary robot must be stable, without any external forces. Robots not fulfilling these criteria will be disqualified.
4) Stationary robot should have a ball shooter. Off-the-shelf ball shooters are not allowed.
5) The ball shooter can store multiple balls or balls can be fed to the shooter manually during the game time. Feeding balls refers to placing the ball in some part of the robot or dropping the ball into some part of the robot. Players cannot push, or press the ball into the robot, with force, during the game-play. Pushing or pressing the ball into the robot with force will result in penalties. Manual loading of mechanisms in stationary robot during game-play is not permitted. However, teams can continue to do so, with a penalty for each time manual loading is done. (An example scenario for manual loading is pressing the ball into the shooter, in a way which compresses the spring which shoots the ball)

6) Players cannot manually alter the orientation of the stationary robot during the game-play. Players are not allowed to communicate with the stationary robot by any means (i.e. button presses, radio communication, optical communication). These actions will result in immediate disqualification.
7) Both robots must be completely autonomous.
8) The mobile robot must be stable and able to move on its own. A robot not fulfilling these criteria will be disqualified.
9) Any robot should not split into two or more units.
10) Teams are allowed to use readymade microcontroller boards/readymade sensor kits. However, teams are not allowed to use readymade Lego kits or any such assemblies.
11) The starting procedure of the robot should be simple and should not involve giving the robot any manual force or impulse in any direction.
12) Teams are allowed to use any communication method between two robots (Teams have to make sure that communication will not be affected and will not affect devices in environment).

Power Supply

1) Both the robots must use an onboard power supply. No external power supply will be allowed.
2) Each team has to bring its own power supply for its robots. The voltage difference between any two points on the robot must not exceed 24 volts.

Control

1) You can start the robot at the beginning of the trial and no human intervention is allowed thereafter except for loading balls. If human intervention is necessary, the ongoing trial will come to an end. Teams may go for another trial if they have sufficient time left.
2) Any robot must not receive any input from anywhere outside the arena.

Gameplay

1) The mobile robot must start from the mobile robot start zone. It has to solve the line maze by following the lines, while detecting cubes.
2) Mobile robot is not allowed to touch cubes in line maze section.
3) When a cube is detected, the mobile robot has to signal the stationary robot the color of the cube and the stationary robot is then and only then, is allowed to shoot a ball in to the corresponding box having the same color as the cube.
4) The mobile robot is not allowed to move after detecting a cube, until the stationary robot shoots a corresponding ball.
5) Only one member from each team is allowed to manually feed balls to the stationary robot if necessary.
6) There will be a red dashed line 35cm away from the wall which the robot should not cross. Penalties will be given, each time the robot crosses this line.
7) The robot is not allowed to make any contact to the wall segments.
8) After following the wall, there will be a line, guiding the robot to the target area. The nature of the lines will be same as in the line maze section. There will be a short perpendicular line segment of 10 cm provided for aligning the robots.
9) The mobile robot has to detect the position of the target and transmit this information to the stationary robot. And the stationary robot has to shoot at the received target to complete the task.

Rules

1) No damage should be made by a robot to the arena during the match in any manner.
2) Robots should not be disassembled until the results are declared.
3) The organizers reserve the right to change the rules as they deem fit.
4) When a team is called for match, they must report within five minutes.
5) Judges' decision will be the final.
6) Only one member can feed balls to the stationary robot. Time will not be paused for loading balls.
7) During line maze solving, if a robot deviates from a line and fails to return within 20 seconds then human intervention would be allowed and a restart has to be taken.
8) A maximum of 10 minutes will be allocated to each participating team to complete the task.
9) The clock will not be paused during restarts.

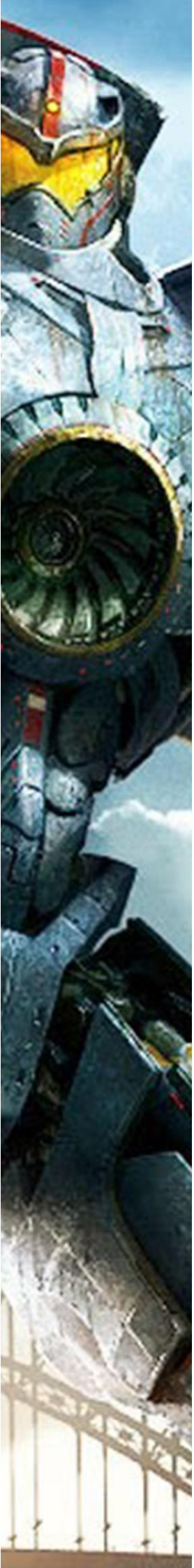
Checkpoints

If a robot fails to complete the task, the robot can be re-started from the last completed checkpoint. Available checkpoints are:

1) First Checkpoint: - At the beginning of wall following
2) Second Checkpoint: - At the end of wall following

Judging

1. The judges can ask for an explanation of any mechanism on the bot and there would be an immediate disqualification of defaulters of any kind.
2. Bot's code will be checked for hard coding upon request of judges.
3. Points are provided on the following merit:
   - i) Detecting Cubes and Shooting (for each cube)
     - (1) Detecting the cube — +5 points
     - (2) Stationary robot targeting at the correct color target — +10 points
     - (3) Shooting and hitting the target box but fails to successfully shoot in to the target — +15 points
     - (4) Successfully shoot in to the target — +25 points
   - ii) Returning to start position from line maze after detecting cubes — +20 points
   - iii) Completing wall following — +80 points
   - iv) Detecting and shooting the randomly placed target
     - (1) Targeting correctly at the box — +25 points
     - (2) Shooting and hitting the target box but fails to successfully shoot in to the target — +35 points
     - (3) successfully shoot in to the target — +50 points
4. Penalties
   - i) Touching cubes in line maze — -5 points
   - ii) Each touching of the wall during wall following (penalty) — -10 points
   - iii) Each crossing of red line — -10 points
   - iv) Manual loading of balls (each time) — -10 points
5. Time bonus
   - i) 600 - total time taken to complete the run (seconds)
   - ii) Time bonus will be considered only if a team completes all the tasks within the stipulated period of 600 seconds
6. Total score will be the addition of above three scores.



7. Team with maximum points will win the round.
8. Judging criteria might be subject to changes, final judging criteria will be given on the competition day.

Eligibility

All students with a valid identity card of their respective educational institutes are eligible to participate in the event.

Team Specifications

Each team can have a maximum of 5 participants. Students from different educational institutes can form a team.

Contact

- Randima Senanayaka
  - 071-0402244
  - randimasenanayaka@icloud.com
- Chinthani Kumaradasa
  - 071-4817161
  - ckumaradasa@gmail.com

Any changes will be notified to team leaders via e-mail