Line Following Challenge Rules

Goal

Design, build, and program a line following robot that can (In three minutes time) follow a black line on a white background to a tower and deliver at least one (1) ball and then return to its starting point. Then, in the remaining time, return to the tower (as many times as needed) to deliver a set number(not over, not under) of balls as per your teams division requirements.

Who Can Play

Teams in this challenge compete in separate divisions:

1) Elementary School (ES)

2) Middle School (MS)

3) High School (HS)

4) University/Professional (UP)

Requirements

1) Autonomous robot, any platform, costing USD 1,500 or less, and meets the following design constraints, which will be verified during Check-In.

a) The robot can demonstrate that it is running a line-following program on a test track.

b) The robot can demonstrate it will stop upon reaching the tower; you do not have to prove the ability to deliver a ball or turn around.

c) Multiple sensors and processors are allowed.

d) The volume of the robot must not exceed 65030 cm3.

General Rules

1) The Event Director can establish:

a) the payload quantity for each division (see range in Scoring)

b) the number of official runs allowed (suggested: minimum of 3, maximum of 5)

c) the number of those official runs that will be counted for the aggregate score used to determine the Top 8 teams that will compete in the tournament (may be up to the maximum number of official runs OR less

d) to have the option of using the HS track, or creating a more difficult challenge track for the UP division.

e) the tower opening can be reduced in size for the UP Division

Challenge Specific Rules:

The Payload.

1) Ping pong balls, full spheres, and unaltered (can not be smashed, shredded, cut pieces, connected, or containing any additional material inside the sphere other than air)

2) Different colors, materials, markings, logos, and text ARE allowed

3) Diameters range, generally, between 38 mm to 40 mm

The Robot, Code, Sensors

1) The robot has 3 minutes to complete the challenge's tasks

2) Completion of the task requires the robot to deliver the specific number of payload items within the challenge time

3) A line following program using an Infrared sensor must control your robot's motion at all times

4) Only players can operate and manipulate the robot during the heat. Remember, "Players Play, Coaches Coach, Parents Cheer".

5) The tower cannot be touched by any person during payload delivery.

6) NO scooping of balls out of the tower (NO reaching INTO the tower) by any person during payload delivery

7) Scooping away from the tower is allowed ONCE the payload has left the tower

8) Touching the robot by anyone other than the track monitor (judge) at any time requires it to be picked up and returned to home if time remains

The Tower. (dimensions are approximate and might vary slightly)

1) All divisions use the same 20 cm tall x 10 cm wide x 35 cm long tower with a 10 cm x 10 cm opening at the top

2) An open back (facing away from the track) to allow the payload (38 - 42 mm diameter ping pong balls) to roll out during delivery. The tower is held firm to the track by a strip of Velcro tape

3) If a track monitor sees that a team touches or reaches INTO the tower, the run will be stopped, and the team will receive only 400 points for completing the challenge track, regardless of how many balls were delivered.

The Track

1) Tracks are typically printed on durable paper or a PVC vinyl background (i.e., outdoor banner material)

2) Line thickness and “T” intersections:

a) Elementary Division - No intersections, 1.25 cm black line

b) Middle School Division - One intersection, 1.25 cm black line

c) High School Kid Division - Two intersections, 0.75 cm black line

d) University/Professional - Two or more intersections, “T” and/or “L”, 0.75 cm; line may be variations of color and broken

3) There will be a minimum of 20 cm of straight line leading into the tower

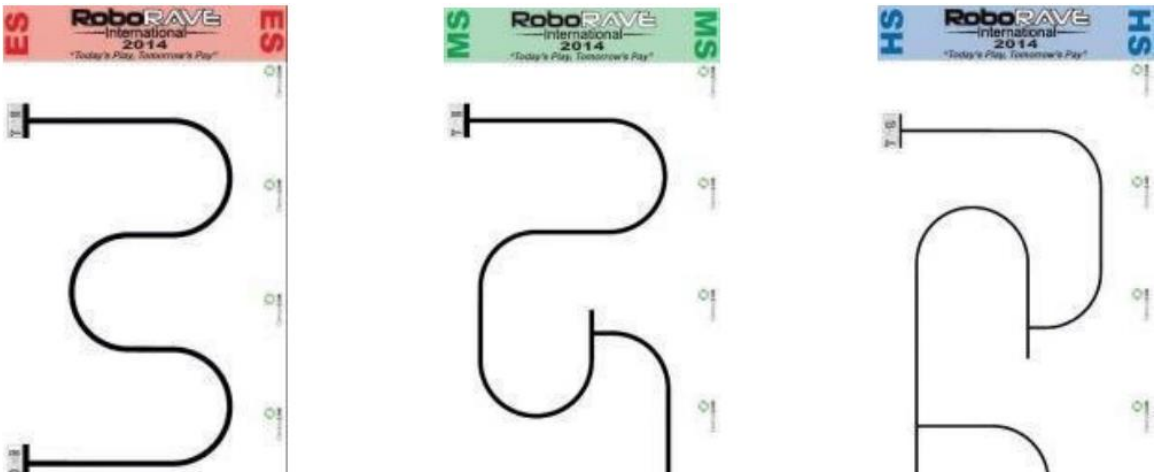
4) The line will be no closer than 10 cm from the edge of the track or any other line

5) Advertisement, or printed instructions, can be placed anywhere on the track surface but must be a minimum of 10 cm from any line

6) Curves can have different/changing radii, but no part of the curve can have a radius less than 15 cm

7) The challenge may be held in areas with natural light present, which may change the lighting conditions of the track. Teams should be prepared to engineer around this natural condition

Track Examples:



The tracks shown are an example. The design changes every year and is revealed on the first day of the event.

Scoring

1) The overall score is a combination of points earned from

a) running the track to the tower.

b) Delivering at least one ball.

c) Returning home.

d) Delivering the required number of balls.

2) Each division will have a set number of balls to deliver as follows. The numbers will be published at the event. Below is the range from which the division numbers will be chosen:

a) Elementary School: $75 \leq x \leq 12$

b) Middle School: $125 \leq x \leq 20$

c) High School: $200 \leq x \leq 30$

d) University/Professional: $300 \leq x \leq 500$ (use the lower range if the tower opening is reduced)

See the scoring matrix for your division below for details on the scores assigned during your first trip to the tower and back.

A successful run is defined as:

e) The robot traverses the track from Home to the Tower, delivering at least 1 ball and traversing the track back home. These balls are removed and do not count toward achieving the bonus runs.

After all the elements have been accomplished above, you may make Bonus Ball Runs.

f) A Bonus Ball Run is when the robot traverses the track from Home to the Tower and delivers the required number of balls set for your division. During “Bonus Ball runs”, the robot does not have to traverse the track from the tower back to home.

Scoring the Bonus Ball delivery:

g) If the number of balls is less than the required number of balls, then that number is your Bonus Ball Score.

h) If the number of balls is more than the required number of balls, then the extra will be subtracted from the required number, resulting in your ball score.

Scoring Matrix:

	eaves Home	urns at 1st "T"	urns at 2nd "T"	t Tower, heel motors off	Delivers One (1) Ball
ES	50	*N/A*	*N/A*	100	100
MS	25	25	*N/A*	100	100
HS/UP	25	25	25	50	100

Tournament Scoring

1) The top eight teams from each division will compete in the final tournament.

2) Advancing teams will be seeded into the tournament bracket according to their aggregate score (see bracket below).

3) The runner-up is used to determine 3rd place based on the outcome of the semi-finals.