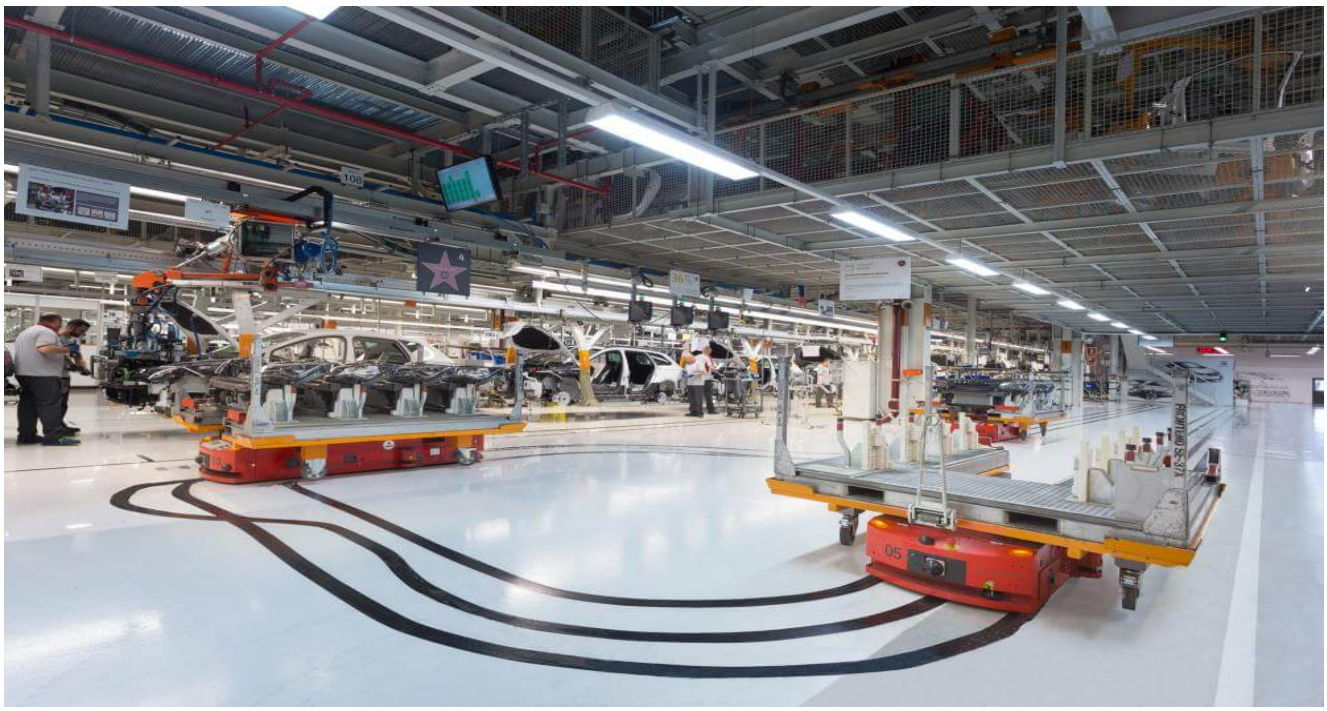
Society of Robotics and Automation, VJTI presents

SAC - SRA AutoSim Challenge



Theme:

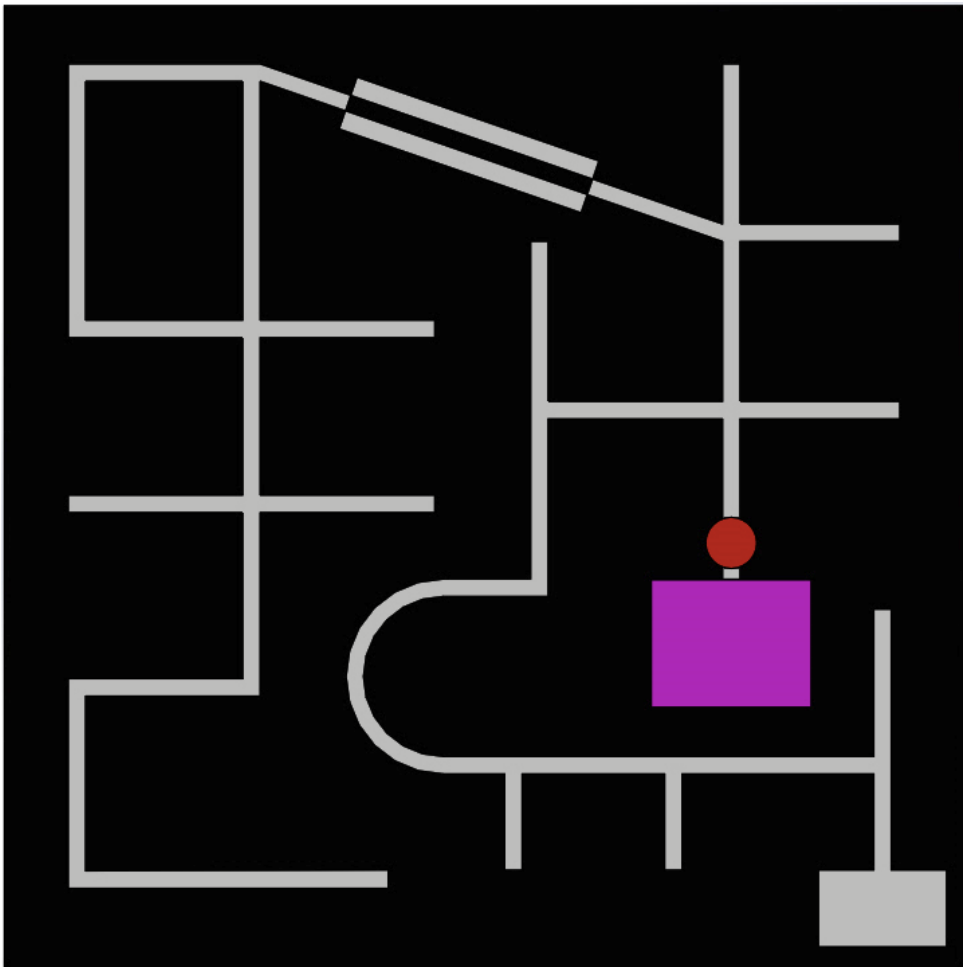
Industrial automation isn't cutting-edge tech. It's been around for quite a while now, with most large-scale companies involving robots in some form or the other. Line-follower robots are easy to scale up, and have amazing benefits in terms of material delivery and cost-cutting.

The global industrial automation market is expected to grow to $250.77 billion in 2026 at a CAGR of 8.8%. This calls for better, more efficient and robust robots, and consequently, more engineers skilled at innovating. Test your skills at innovating your way out of difficult situations.

Problem Statement:

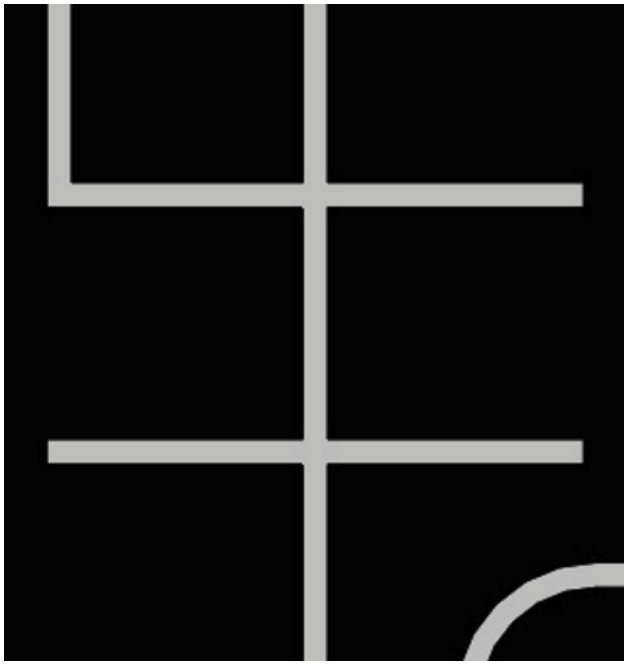
This is SRA's very own maze solving competition for our SYs where they'll be assigned a very unique maze to track and crack it. There will be a number of challenges in the maze, for instance colourblind paths, object detection and some tricky challenges to overcome.
Each of these challenges has a sense of logic to crack it and get through it.
The bot will have to start from a starting point and track the desired maze with different junctions in between.The maze will have twists and turns for which you will have to tune the bot accordingly.
Use the sensors available at your disposal to perform the given tasks, on hardware.

The Arena



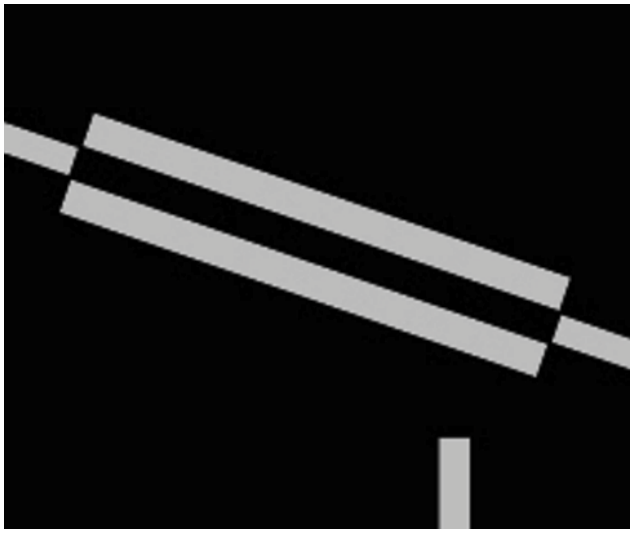
Nodes:

The lifeline of any maze traversal are the nodes. Detect junctions, apply algorithms and keep moving forward.



Colour Blind Path:

Does your robot work in drastically changing scenarios? This section tests your bot's adaptability to the line. Can it still stay on track if the colours are inverted?



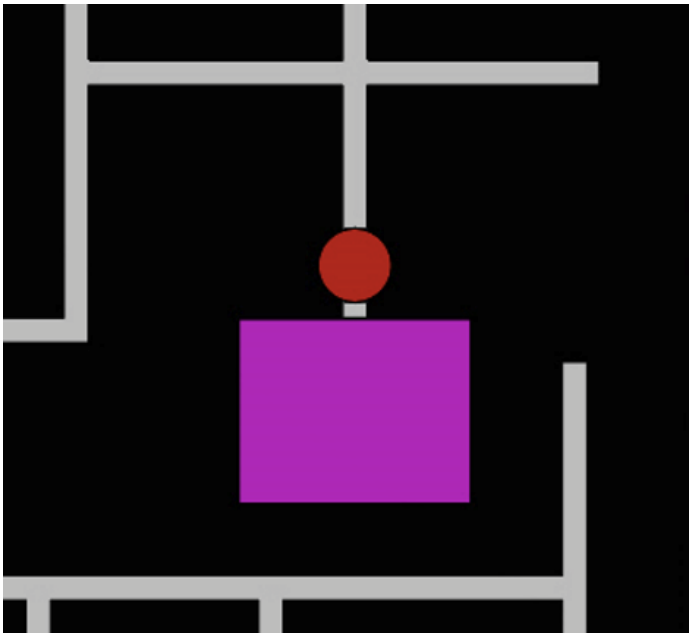
Checkpoints:

Did you go off-track? Don't worry about having to start from scratch. If you've reached a checkpoint already, you can reposition your robot to the latest checkpoint. Careful though! Too many repositions and you risk being disqualified.

(Checkpoint represented by the blue dot in this image)

Object Detection Task:

Sure, your bot can follow lines, but is it useful? Can it perform real-world tasks? Detect an obstacle and push it into a Drop Zone in this crucial part of the maze.



(The object is marked with red and the Drop Zone is represented by the pink rectangle here.)

Snake Road:

The real world isn't as forgiving as 90° turns and straightforward nodes. As the name suggests, make your bot follow a sharply curved, snake-like path using the algorithm of your choice.

Game Play:

Enough talk, let's set the rules.

1. The bot shall start from the **Start Zone**.
2. Stay on the line, detect the nodes encountered by the intersection of lines and keep moving forward.
3. Encounter and pass **checkpoints**. These will serve to help your bot in case it requires any repositioning.
4. Move ahead to find the **colour-inverted** line. Follow the line and exit this zone.
5. Find the obstacle and push it into the **Drop Zone**. Take a U-turn once this is done and resume your path.
6. Follow the extreme turn present at the **Snake Road**.
7. Reach the **End Zone** and stop the robot.

Repositions: If your bot drifts away from the line and continues to move in a loop/moves out of the maze, you can place the bot to the previously crossed checkpoint.

Maximum Number of re-positions allowed: 4

Assistance: If your bot fails to follow the line (offshoots)/stops moving, you can give encouragement to the bot to bring it back to its desired position/moving state.
Maximum Number of assistance allowed: 4

Scoring:

Get the maximum points by completing the maximum number of challenges in the minimum time possible.

Sr. no	Task	Task code	Points
1	Checkpoint 1	C1	40
2	Checkpoint 2	C2	60
3	Checkpoint 3	C3	30
4	Checkpoint 4	C4	20
5	Pushing the obstacle * no.	po	75*no.
6	Stopping at end zone	stop	20

Initial score : 700

Penalties:
The first two repositions and assists are free.

1) For each extra reposition after 2 repositions : -50
2) For each extra assistance after 2 assists: -25
3) For each obstacle undetected and unpushed: -20

Example score:
Final Score = 700 + C1 + C2 + C3 + C4 + po + stop - time taken - Penalties
Hence assuming time taken to be 300 seconds in sample arena, penalty= -100:
Final Score = 700 + 40 + 60 + 30 + 20 + 75*2 + 20 -300 -100 = 620
Invalid run:

1) If Max time limit is exceeded
2) If number of repositions are exceeded (Limit: 4)
3) If no obstacle is detected and pushed

Tie Breaker:
In case of equal points scored by any two teams, the following points will be considered:

1. Tuning of the bot during line following
2. Time taken to complete the run
3. Code quality

General Rules:

1. The time measured by the organisers will be final and will be used for scoring the teams
2. In case any teams are found participating in unfair practices, such as code sharing/debugging of other teams, **all the involved teams will be disqualified**.
3. In case of any disputes/discrepancies, the organisers' decision will be final and binding.
4. The organisers reserve the rights to change any or all of the above rules as they deem fit.

Team Specifications:

Each team shall consist of a maximum of 4 members.

Contact:

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