Event 3 - Line Follower Challenge Rulebook

Location	Arena
Line Follower	
2 Rounds	Qualifier and Finale
Per team	5 minutes
Max teams (team of 4): 15	1 hour, 45 minutes
Prize	Point based (in the case of ties, time based)
Jury	Internal

Event Overview: In the Line Follower Challenge, participants will design and program a robot that can autonomously follow a pre-defined path marked on the ground. The challenge tests a robot's ability to navigate with precision, handle sharp turns, and maintain speed while following a line without human intervention. The path can be simple or complex, including intersections, curves, and obstacles, all of which test the robot's adaptability and sensor accuracy.

The task is simple yet challenging: design a robot that follows a line (usually black on a white background or vice versa) with a high degree of accuracy. The robot should be able to navigate through curves, intersections, and obstacles along the path, demonstrating good control, sensors, and programming skills.

Stages: Qualifiers and Finale (top 4 teams compete in the finale)

Objective:

Participants must:

- **Build and program** a robot that can autonomously follow a black line (or vice versa) marked on a white surface.
- Navigate through sharp turns, intersections, and obstacles without losing track of the line.
- Complete the track in the shortest time possible, with the robot maintaining continuous line following.

Arena Layout:

1. **Track Design:**
    - **Track Length:** Varies depending on the event round, typically ranging from 5 meters to 20 meters.
    - **Track Width:** The line will typically be between **5–10 cm** wide, depending on the difficulty level.
    - The track will consist of various features:
        - **Straight sections**
        - **Curves:** 45°, 90°, and more aggressive curves.
        - **Intersections:** Where the robot must decide which path to follow (can include T-junctions or cross-junctions).
        - **Obstacles or Detours:** Small obstacles or sections where the robot may need to slow down or navigate carefully.
        - **Sharp Turns:** These will test the robot's speed control and ability to handle tight corners.
2. **Surface:**
    - A **white background** with a **black line** or vice versa.
    - The track will have markers for boundaries and sometimes walls to ensure the robot does not drift off the track.

Robot Specifications:

- The robot should fit inside a box of 20cm x 20cm x 30cm.
- The robot should not exceed 3 kg.
- The robot should be self-powered with supply not exceeding 12V (on board power supply). Participants cannot draw power from outside.
- **Sensors:** Robots must be equipped with **line sensors** (e.g., infrared sensors or color sensors) to detect the line. Participants are free to choose the sensor type but must only rely on sensors for navigation.
- **Movement:** Robots must be autonomous, meaning no manual control is allowed during the race. The robot must follow the line from start to finish without human intervention.

- **Power Source:** The robot must be electrically powered, either through batteries or a power supply.

Rules:

1. **Autonomy:**
    - The robot must be **fully autonomous.** No external input or manual control is allowed during the race.
2. **Sensors:**
    - Only sensors (e.g., infrared, color) can be used to follow the line. The robot cannot rely on external systems for guidance.
3. **Line Detection:**
    - The robot must detect the line and stay within the boundaries. If the robot veers off track or exits the boundaries, the team will be penalized or disqualified.
4. **Time Limit:**
    - Teams will have a set time to complete the track. If the robot completes the track in the fastest time, it will be judged as the winner.

Arena:

Dimensions:

- **Track Length:** 10 meters (can vary depending on the event).
- **Track Width:** 5-10 cm for the line (black on white or vice versa).
- **Arena Size:** The total arena size will be approximately **5 meters x 5 meters**, with plenty of space for the track and obstacles.

Track Design:

- The track is made of smooth **white surface** with a **black line** (or vice versa). The line will be clearly visible, and it will follow a winding path throughout the arena.
- The path is designed to include a variety of sections:
    - **Straight Path:** Sections with no turns for the robot to maintain high speed.
    - **Curves:** 45°, 90°, and sharp U-turns to test the robot's cornering ability and sensor responsiveness.
    - **Intersections (T-Junctions and Crossroads):** Sections where the robot will encounter multiple path options and must choose the correct direction. This tests the robot's ability to handle junctions and switch between paths accurately.

- **Sharp Turns:** Tight turns that challenge the robot's ability to slow down, adjust its angle, and regain control after sharp direction changes.
- **Obstacles:** Small, movable objects that could randomly block parts of the path, requiring the robot to adjust its navigation or take alternative paths to avoid collision. Obstacles could be cones or walls placed temporarily during the challenge.
- **Narrow Pathways:** Some parts of the track will become narrower, forcing the robot to slow down and remain within the line without drifting off the track.

Line Variation:

- The **black line** may sometimes become dotted or broken in some areas, creating sections where the robot must rely on its sensors to stay on track without visual cues.
- At intersections, the track may split into two or more directions, and the robot will need to follow the correct path by determining the continuation of the line.

Surface Details:

- The track will be **non-slip**, with a consistent white background to ensure the line is easy to detect by the robot's sensors.
- The **lines will be taped** or painted on the surface, with clear demarcation, especially around intersections and sharp turns.

Boundary Markings:

- The track will be bordered by soft barriers or tapes to ensure that robots do not go off-track and to prevent accidents.
- Any robot that exits the boundaries of the track will be penalized or disqualified, depending on the rules.

Judging Criteria:

1. **Time based -** The bot that completes the arena with the least amount of time is declared the winner
2. **Every adjustment** amounts to a penalty of +5 to +10 seconds on the timer

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Prizes and Recognition:

- **Winner:** 5,000 INR + Certificate + Line Follower Champion Trophy
- **Runner-Up:** 3,000 INR + Certificate
- **Best Innovation Award:** Special recognition for the most creative robot design.

Ethics and Conduct:

- Robots must be original creations. Pre-built kits without significant modification will lead to disqualification.
- Participants must ensure that their robots adhere to the competition rules. Any attempt to interfere with another team's robot or sabotage the event will lead to disqualification.