



Line Follower Robot Instructions (Class 6-8)

Mission: The robot must autonomously follow a designated path marked by a visible black line on the competition track, navigating any obstacles or challenges along the way, to reach the finish line in the shortest time possible.

1. Objectives:

- Design and build a robot capable of following a line on a track.
- Program the robot to navigate the course as quickly and accurately as possible.
- Demonstrate your robot's ability to handle various track challenges, such as curves, intersections.
- **Time Limit:** The robot must complete the mission within a set time limit (max 90 seconds). Failure to do so will result in point deduction.
- Once a run has begun, the handler may not touch the robot until the run is complete. Touching the robot at any time during a run will cause that run to be disqualified and no time will be recorded.
- If a Line Follower leaves the white line, and has not crossed the finishing line, it will be considered to have gone off the track, and that run shall be invalid unless the robot recovers itself to hit the line again, one time manual intervention is allowed with deduction of 5 points. Otherwise, a line follower will be judged to have left the line.

2. Track Specifications:

- The track will be outlined with a black line on a white or light-colored surface.
- The track will include straight segments, sharp turns, and intersections.
- The line width and track dimensions will be specified prior to the contest.

3. Robot Specifications:

- **Dimensions:** The robot must fit within a specified maximum size limit (max W:11.5 x L 11.5 x H: 7.5 inches) to ensure it can navigate the track effectively.
- **Weight:** The robot must not exceed a maximum weight limit (3 lb) to ensure fair competition and consistent track performance.
- **Power Source:** Robots must be powered by onboard batteries, max 12V. No external power sources or tethered connections are allowed.
- **Sensors:** Robots may use various sensors (e.g., infrared, optical) to detect and follow the line. The use of advanced sensors and algorithms is encouraged.
- **Actuators:** Robots can use motors or servos to drive and steer. Any type of motor or actuator is permissible as long as it adheres to the weight and size constraints.

4. Programming and Control:

- **Autonomous Operation:** Robots must operate autonomously without human intervention during the contest. Remote control or manual adjustments are not permitted.
- **Programming Languages:** Participants can use any programming language or development environment suitable for their robot's control system.
- **Algorithm Requirements:** The robot's line-following algorithm should be able to handle different track segments and challenges, including sudden changes in direction.

5. Failure to Pass Inspection

- If a robot fails to meet any inspection criteria, the team will be given time to correct the issues.
- Hazardous materials, sharp edges, or flammable components are strictly prohibited.
- Any team that fails to pass inspection before the start of the competition will not be allowed to compete.
- Continuous violations of inspection rules during the competition may result in disqualification.
- Teams are not allowed to use external power.
- *US outlets are 110V, not 220V.

This type of robot can be built in various ways. You are welcome to use a wheeled system, you are also open to use integrated circuits such as Arduino, RaspberryPi, Microcontroller Units, VEX-Iq, Lego etc.

Scoring Rubrics:

Category	Description	Max Points	Deductions	Notes
Completion Time	Time taken to complete the track.	50	-2 point per 3 seconds over the target time	Fastest robot gets full points, slower robots lose points.
Line Following Accuracy	How well the robot stays on the line.	30	-5 points per deviation from the line	Deduct points for every significant deviation.
Intersection Handling	Correctly navigates intersections or forks in the track.	15	-5 points for incorrect decisions at intersections	Deduct points for every significant deviation.
Autonomous Recovery	Ability to recover after going off the line.	10	-5 points if manual intervention is required	Autonomous recovery gets full points. Manual resets lose points.
Total Completion	Successfully reaches the finish line.	20	-10 points for not finishing the course	Deductions applied if the robot fails to finish the track.

Possible Line follower can be implemented:

Here's a step-by-step guide to help you create a basic line follower robot:

Materials and Tools

Components:

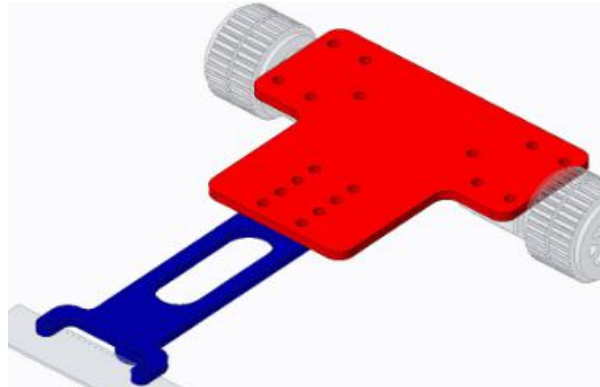
1. **Microcontroller/Development Board:** Arduino, Raspberry Pi, or similar.
2. **Motors:** DC motors with wheels or a motor driver board for mobility.
3. **Sensors:** Infrared (IR) or optical sensors for line detection.
4. **Chassis:** A frame or base to mount your components.
5. **Battery Pack:** To power the robot.
6. **Motor Driver:** To control the motors (e.g., L298N motor driver module).
7. **Wires and Connectors:** For connecting components.
8. **Breadboard:** For prototyping and connecting components.
9. **Resistors, capacitors, etc.:** Depending on your circuit design.
10. **Screws, nuts, bolts, and standoffs:** For assembling the chassis.

Tools:

- Soldering iron (if needed)
- Wire cutters/strippers
- Screwdriver
- Multimeter (for testing connections)

Design and Assemble the Chassis

1. **Choose a Chassis:** Select or design a chassis that can hold all your components. You can use plastic, acrylic, or even pre-made robot chassis kits.
2. **Mount Motors:** Attach the motors to the chassis. Ensure they are securely fixed and aligned properly to avoid any movement issues.
3. **Attach Wheels:** Fix the wheels to the motors. Ensure they rotate freely and the robot can move forward and backward.



Set Up the Electronics

1. Connect the Motor Driver:

- Connect the motors to the motor driver according to the driver's datasheet or user manual.
- Connect the motor driver's power pins to the battery pack.
- Connect the motor driver's control pins to the microcontroller (e.g., Arduino) for controlling motor direction and speed.



2. Attach the IR Sensors:

- Place the IR sensors near the front of the robot, aligned to detect the line on the track.
- Connect the output of each sensor to the analog or digital input pins on the microcontroller.

3. Connect the Battery Pack:

- Ensure that the battery pack is connected to both the motor driver and the microcontroller, providing the necessary power.