**Technical Description and Working of Line Following Robot**

**Technical Description**

A robot that follows a pre-defined path (black line on a white surface or vice versa) using **Infrared (IR) sensors**. It employs an **Arduino Uno microcontroller**, an **L293D motor driver**, **DC motors**, and **IR sensors** to detect and follow the line.

**Key Components and Their Roles**

1. **Arduino Uno**:
   * Acts as the brain of the robot.
   * Processes input from **IR sensors** and controls **motors** accordingly.
2. **IR Sensors (4 in Front)**:
   * Detect the line by differentiating between **black and white surfaces**.
   * **Black surface** absorbs IR light → **sensor output LOW (0)**.
   * **White surface** reflects IR light → **sensor output HIGH (1)**.
3. **L293D Motor Driver**:
   * Controls the movement and direction of the **DC motors**.
   * Takes signals from **Arduino** and regulates motor power.
4. **DC Motors (2 Front Wheels)**:
   * Propel the robot forward or steer left/right based on sensor input.
5. **Caster Wheel (Back)**:
   * Provides stability and smooth movement.
6. **Power Supply (2 DC Batteries)**:
   * Powers the **motors (9V or 12V)** and **Arduino (5V via regulator)**.

**Working Principle**

**Step-by-Step Operation**

1. **IR Sensors Detect the Line**:
   * The robot moves along a track with a **black line on a white surface**.
   * **IR sensors continuously read the surface** and send signals to **Arduino**.
2. **Arduino Processes Sensor Data**:
   * Based on **which sensors detect black or white**, the Arduino **decides the motor action**.
3. **Motor Control Based on Sensor Input**:
   * **Forward Movement**: If both middle sensors detect the line, the robot moves straight.
   * **Left Turn**: If the left-side sensors detect black, the right motor speeds up while the left motor slows down or stops.
   * **Right Turn**: If the right-side sensors detect black, the left motor speeds up while the right motor slows down or stops.
   * **Sharp Turns**: If only the extreme left or right sensor detects the line, the robot turns sharply.
   * **Stop Condition**: If no sensor detects black, the robot halts.
4. **Continuous Adjustment**:
   * The robot **constantly adjusts its path** by comparing sensor readings and modifying motor speed.
   * This is achieved using a **basic control algorithm** (if-else conditions) to maintain alignment with the line.

**Control Algorithm**

* The control strategy used is a **simple rule-based (if-else) logic**.

**Summary**

* **Sensors read the line → Arduino processes data → Motor driver moves motors accordingly**.
* The robot **corrects deviations by adjusting motor speeds**.
* **Simple logic-based algorithm ensures movement along the line**.