

Working Principle – Autonomous Rover Project

The **Autonomous Rover** is a self-navigating, terrain-aware robotic vehicle designed to reach a given destination with minimal user intervention. It uses embedded electronics and basic sensors to handle navigation, obstacle avoidance, and pothole detection.

System Workflow:

1. Bluetooth-Based Destination Input:

- a. The user sends destination coordinates/directions via a mobile app using a Bluetooth module (HC-05).
- b. The Arduino receives this data and determines the required heading.

2. Compass-Based Direction Control:

- a. The **HMC5883L Compass** continuously provides the current heading.
- b. The Arduino calculates the difference between current and target headings and adjusts motor direction to align accordingly.

3. Motor Control:

- a. 4 BO motors are controlled using the **L298N motor driver**.
- b. The rover can move forward, turn left/right, or stop based on compass orientation and sensor feedback.

4. Obstacle Detection:

- a. **Ultrasonic Sensor 1 (Front-facing)** detects obstacles in the rover's path.
- b. If an object is detected within a threshold distance, the rover stops and attempts to steer around it.

5. Pothole Detection:

- a. **Ultrasonic Sensor 2 (Down-facing)** monitors the surface below.
- b. A sudden drop in distance reading indicates a pothole; the rover stops or reroutes.

6. Decision Making:

- a. The Arduino makes real-time decisions using sensor data and heading differences.
- b. Motor speeds and directions are dynamically controlled for smooth navigation.

Summary:

This rover demonstrates fundamental autonomous navigation using low-cost electronics. It integrates multiple sensor modules (ultrasonic, compass) and a

communication module (Bluetooth) to achieve a basic but functional autonomous system without requiring GPS or complex machine learning algorithms.