User Guide: Vehicle-to-Vehicle (V2V) Communication System

1. Introduction

This system enables real-time communication between vehicles using an NRF24L01 transceiver and GSM module. It collects and shares speed data, detects obstacles, and provides audible and visual alerts. The goal is to reduce vehicle collisions through proactive communication and monitoring.

2. System Overview

- Microcontroller: Arduino Uno/Nano
- Communication:
  - Vehicle-to-Vehicle: NRF24L01
  - Vehicle-to-Server: GSM (SIM800L)
- Monitoring: LCD 16x2 (I2C), RPM sensor, Ultrasonic sensor
- Actuation: Motor driver (L298N), Servo motor (steering), Buzzer

3. Hardware Components

Component | Description

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Arduino Uno/Nano | Central processing unit

RPM Sensor | Measures wheel rotation

Ultrasonic Sensor | Detects obstacles ahead

GSM Module | Sends SMS & updates web

NRF24L01 Module | Wireless communication

LCD 16x2 (I2C) | Displays info

L298N Motor Driver | Vehicle movement

Servo Motor | Steering control

Push Buttons | Forward/Reverse inputs

Buzzer | Fault alert

4. System Features

- Speed Measurement: RPM sensor
- Obstacle Detection: Ultrasonic sensor

- Fault Alerts:
  - GSM SMS
  - HTTP request to dashboard
- Remote Data: NRF24L01
- LCD Display
- Emergency Stop: If obstacle < 20cm

5. How to Use the System

Setup:

1. Connect all components as per wiring diagram
2. Power Arduino with 7-12V DC

Operation:

1. System runs diagnostics
2. Buttons control motion
3. Auto speed check, obstacle detection, data send

6. Online Integration

URL: https://v2v-dashboard-tractech-inovs-projects.vercel.app

Data Sent via GET:

Example: /update?id=A&speed=28&fault=Obstacle%20Detected

7. SMS Alerts

- Phone: +256761232313
- Message: Obstacle detected! Speed: XX

8. Testing & Diagnostics

LCD shows:

- LCD OK
- GSM OK / FAIL

- RPM OK / FAIL
- ULTRASONIC OK / FAIL
- MOTOR OK
- SERVO OK

9. Troubleshooting

Issue	Possible Cause	Solution
LCD not displaying	I2C address or wiring	Check SDA/SCL, I2C Scan
GSM no response	Voltage or signal	Use diode & capacitor
No speed shown	RPM wiring	Check pin D3
Obstacle ignored	Ultrasonic issue	Test with known object

10. Future Improvements

- Add GPS
- Add camera
- Encrypt NRF data
- Replace ultrasonic with LIDAR
- Battery monitoring