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Dust Suppression System for Vehicles: A Smart and Eco-Friendly Approach to Road Pollution Control

Mr. Shravan M

Student, Education, Learning Links Foundation

Abstract

Dust pollution generated by moving vehicles is a serious environmental and health concern, particularly on unpaved roads, construction sites, and high-traffic areas. Airborne dust reduces visibility, degrades air quality, and causes respiratory problems, increasing the risk of road accidents. This research presents a smart and eco-friendly dust suppression system for vehicles that automatically monitors dust concentration and controls water spraying accordingly. The proposed system uses a dust sensor to detect high dust levels and activates a water mist spray to suppress dust efficiently while minimizing water wastage. Visual and audio alerts using LEDs and a buzzer inform the driver about dust conditions in real time. The system can be powered using solar energy, making it sustainable and suitable for both urban and rural vehicles. The proposed solution enhances road safety, conserves water, and contributes to cleaner and healthier transportation systems.

Keywords: Dust Suppression System, Vehicle Pollution Control, Smart Roads, Air Quality Improvement, Eco-Friendly Technology, Sensor-Based Automation

Introduction

Dust pollution from vehicles is a major environmental and health issue, especially on unpaved roads, construction zones, and heavy traffic areas. Dust particles reduce air quality, cause respiratory problems, and create visibility hazards, increasing the risk of accidents. Existing solutions like water sprinklers or manual cleaning are inefficient, waste water, and cannot target dust produced directly by moving vehicles. There is a need for an automated, eco-friendly system that reduces dust efficiently while alerting drivers.

Proposed Solution

The system uses a dust sensor to monitor airborne dust levels and vehicle speed. When dust exceeds a safe threshold, a Red LED and buzzer alert the driver, while Green LED indicates normal conditions. Water mist is sprayed through nozzles to suppress dust, and spray intensity is adjusted based on dust concentration and vehicle speed to avoid water wastage. Solar panels can optionally power the system, making it eco-friendly. A 16x2 LCD can display real-time dust levels and spray status.

Objectives

- Reduce dust pollution caused by vehicles

- Improve road safety and visibility for drivers
- Conserve water through controlled spraying
- Provide driver alerts using LEDs and buzzer
- Make the system affordable and suitable for urban and rural vehicles
- Promote sustainable and eco-friendly transport solutions

Working Principle

A dust sensor continuously measures dust levels around the vehicle. If dust exceeds the threshold, the Red LED turns ON and the buzzer sounds to alert the driver, and the water pump sprays mist through nozzles to suppress dust. When dust levels return to normal, Green LED turns ON, Red LED and buzzer turn OFF, and spraying stops to conserve water. Spray intensity is automatically adjusted based on dust concentration and vehicle speed. Solar panels can power the system sustainably.

Materials Required

- Arduino Uno
- Dust Sensor (e.g., GP2Y1010AU0F)
- 12V Water Pump
- Water Tank (5–10 liters)
- Spray Nozzles
- 12V Battery / Solar Panel
- Relay Module (5V)
- 16x2 LCD Display (optional)
- Green LED, Red LED, Buzzer
- Wires, Connectors, Switches
- Mounting Frame for vehicle

Conclusion

The Dust Suppression System for Vehicles is a smart, eco-friendly solution that minimizes dust pollution, improves air quality, and enhances road safety. By integrating sensor-based automation with LED and buzzer alerts, drivers are notified of high dust conditions, and controlled water spraying ensures efficient dust suppression. The system is cost-effective, easy to install, and suitable for both urban and rural vehicles, promoting cleaner, safer, and more sustainable roads.