International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 09 Issue: 04 | April - 2025 SJIF Rating: 8.586 ISSN: 2582-3930

Smart Movable Road Divider for Real-Time Traffic Control and Emergency Vehicle Management

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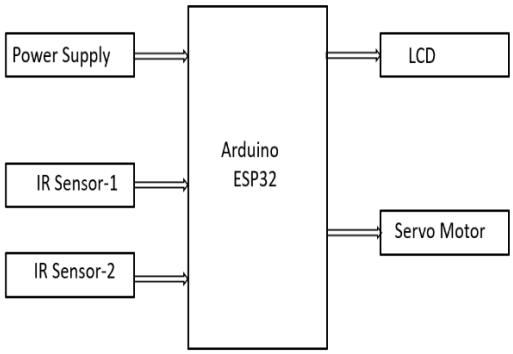
1. ABSTRACT-

In today's cities, managing traffic efficiently is a growing challenge due to the rising number of vehicles on roads. One major issue is that traditional road dividers are fixed and don't adapt to traffic conditions, often causing unnecessary congestion. This project presents a smart solution—a movable road divider system that automatically adjusts lane allocation based on real-time traffic flow. Using IR sensors to detect vehicle density and an ESP32 microcontroller to control servo motors, the divider can shift from one lane to another. Additionally, the system offers remote monitoring through an online dash board. The goal is to reduce congestion, improve emergency vehicle movement, and make traffic systems more adaptive.

INTRODUCTION-

Urban areas face daily struggles with traffic jams and poor lane discipline. Most roads have permanent dividers that split lanes equally, but in reality, traffic is never equal in both directions. During peak hours, one side may experience heavy congestion while the other side remains underutilized. To solve this, we propose a smart movable road divider system. It uses simple electronics—IR sensors to monitor traffic, an ESP32 to process the data, and servo motors to move the dividers. A web-based interface also allows authorities to view traffic conditions and control the system if needed. The goal is to provide dynamic lane management to match real-time traffic needs.

2. BLOCK DIAGRAM



Block diagram of Movable Road Divider

ESP32 Module – Processes data from sensors and controls the movement of the road divider. It ensures real-time adjustments based on traffic conditions. Acts as the central controller for automated lane management.

IR Sensors – Detects traffic density and emergency vehicles to optimize lane allocation. Sends data to ESP32 for responsive road divider movement. Improves traffic efficiency by enabling dynamic lane control.

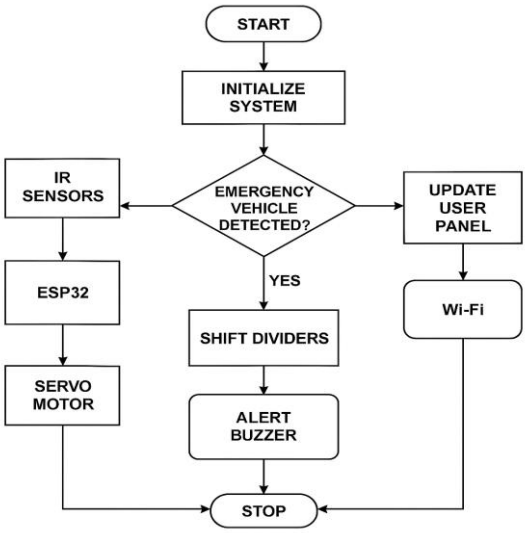
Servo Motor – Moves the road divider according to sensor inputs and traffic flow. Ensures precise, automated transitions without manual intervention. Facilitates smooth lane shifting for congestion management.

LCD Display – Shows real-time traffic updates and system status. Provides visual feedback for monitoring road divider movement. Helps users track lane shifts and vehicle flow dynamically.

Power Supply – Converts AC power to stable DC voltage for system operation. Ensures uninterrupted functionality of all electronic components. Prevents

voltage fluctuations affecting system performance.

3. FLOW CHART:



WORKING- The system starts by activating the IR sensors placed along each lane. These sensors detect how many vehicles pass in a given timeframe. The ESP32 then analyzes this data and determines the traffic load on both sides. If one side is busier, the controller activates the servo motors to shift the divider in that direction, giving more lanes to the congested side. If an emergency vehicle is detected, the system immediately adjusts to make way. All data is stored and displayed on a web dash board, which can be accessed by authorized personnel.[7]

6.RESULT-

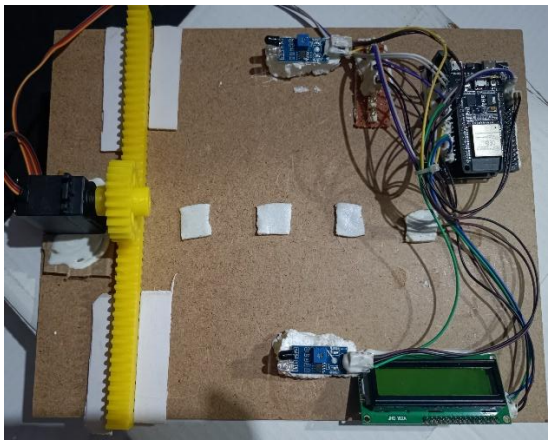


Fig.1: Circuit Connection

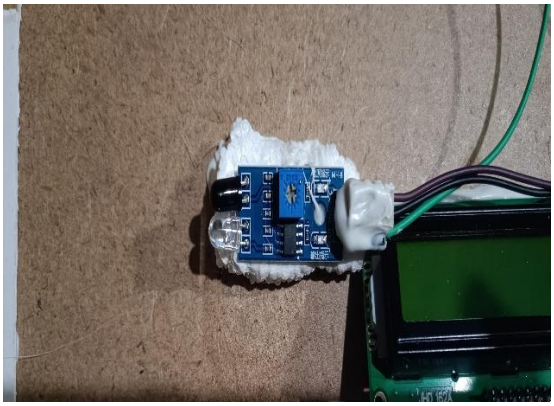


Fig.2: Sensor Connection

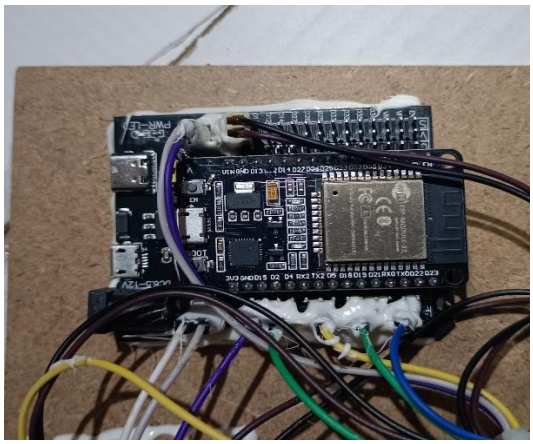


Fig.3: Arduino Connection

• The divider system successfully shifted based on traffic density detected by IR sensors.
• Emergency vehicles were prioritized without manual intervention.
• The live dashboard updated in real time, showing traffic conditions and system status.
• The entire system worked autonomously with minimal delay in response time

7. APPLICATIONS-

Urban Traffic Management – Helps regulate peak-hour congestion by dynamically adjusting lanes based on traffic density, improving overall road efficiency.
Shopping Centers & Business Districts – Ideal for areas where traffic flows predominantly in one direction during specific hours, ensuring smoother vehicle movement.
Emergency Vehicle Clearance – Automatically shifts lanes to prioritize ambulances, fire trucks, and police vehicles, reducing response times during emergencies.
Highways & Expressways – Enhances lane

distribution to manage varying traffic volumes, preventing bottlenecks and optimizing space utilization.

Smart City Integration – Can be integrated with IoT and AI-based smart city systems for real-time traffic monitoring, improving urban mobility.

Temporary Road Diversions – Useful for construction zones, allowing roads to adjust dynamically without causing unnecessary delays.

8. CONCLUSION-

This project shows how simple technology can solve real world traffic issues. With affordable components and effective programming, we created a system that adjusts lane allocation dynamically, making roads smarter and safer. The project promotes automation, reduces human error, and helps manage peak-hour traffic better. It is also scalable and can be expanded for larger road networks

9. FUTURE SCOPE-

AI-Powered Traffic Prediction – Imagine a system that learns from past traffic data to predict congestion and adjust lanes before a jam even happens! Using machine learning, the divider can shift proactively, keeping roads smoother.

Smart City Integration – By connecting with IoT-enabled traffic lights, navigation apps, and vehicle tracking systems, the road divider could sync seamlessly with smart city infrastructure for a fully automated experience.

Solar-Powered Operation – Sustainability is key! By integrating solar panels, the system could run independently, cutting down energy costs while making traffic management more eco-friendly.

Vehicle-to-Infrastructure (V2I) Communication – Future vehicles might be able to communicate with the road divider! Emergency vehicles could request lane shifts instantly, ensuring faster response times during critical situations.

Improved Emergency Routes – The system could automatically detect ambulances, fire trucks, or police vehicles, adjusting lane distribution instantly to clear paths for them—saving **precious seconds** during emergencies.

Autonomous Functionality – With advanced self-learning algorithms, the divider could make real-time decisions without needing manual inputs, adapting automatically to rush hours and unpredictable traffic conditions.

Cloud-Based Analytics & Monitoring – Traffic authorities could access real-time data from a cloud dashboard, tracking lane shifts, congestion levels, and emergency interventions to improve long-term urban planning.

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