

Autonomous Vehicle Weight Overload, Insurance Verification and Vehicle Recognition with Penalty System.

**Bhadange Samruddhi D., Kute Tanishka A., Mutrak Siddhi P.,
Bhamare Kashish A., Prof. Kanawade M. V**

Department of E and TC
Amruthvahini Polytechnic, Sangamner

Abstract: *The rapid increase in the number of vehicles has created significant challenges in traffic management and road safety. Overloaded vehicles damage roads, expired insurance increases financial risks, and unidentified vehicles contribute to traffic violations. This paper presents a smart system for autonomous vehicle monitoring that detects vehicle weight overload, verifies insurance status, and recognizes vehicles using automated identification techniques. The proposed system integrates sensors, image processing, and database verification to automatically identify violations and impose penalties. Load sensors measure vehicle weight, cameras capture license plate images, and an automated verification system checks insurance validity through a digital database. When violations are detected, the system automatically generates a penalty notification. This system improves road safety, reduces manual inspection, and supports efficient traffic law enforcement.*

Keywords: Autonomous Vehicle Monitoring, Weight Overload Detection, Vehicle Recognition, Insurance Verification, Smart Traffic System

I. INTRODUCTION

Action traffic, road accidents and infrastructure damage. Manual inspection methods are inefficient because of the large number of vehicles on the road. Intelligent Transportation Systems (ITS) aim to automate traffic monitoring and enforcement through advanced technologies.

Automated systems using sensors, computer vision, and RFID can identify vehicles, monitor their weight, and verify compliance with regulations in real time. These systems can also send alerts to authorities and automatically apply penalties when violations occur.

The proposed system combines vehicle recognition, overload detection, insurance verification, and penalty enforcement into a single intelligent platform

II. LITERATURE REVIEW

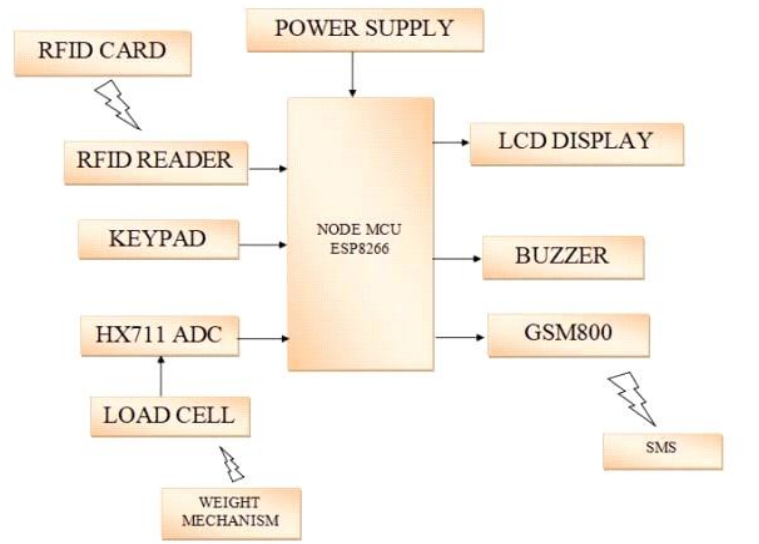
Several intelligent traffic monitoring systems have been developed in recent years. Researchers have explored various technologies such as RFID, Automatic Number Plate Recognition (ANPR), and Internet of Things (IoT) sensors for vehicle monitoring.

Studies show that weight detection systems using load sensors can effectively identify overloaded vehicles. Additionally, number plate recognition using image processing algorithms can automatically identify vehicles. Integration of these technologies with cloud databases allows authorities to verify vehicle registration and insurance status in real time.



However, many existing systems focus on only one function such as weight detection or vehicle identification. The proposed system integrates multiple functions including weight detection, insurance verification, and automatic penalty generation.

III. BLOCK DIAGRAM



IV. SYSTEM ARCHITECTURE

The proposed system consists of multiple components working together to monitor vehicles automatically.

Main Components

Weight Sensor (Load Cell) – Measures the weight of the vehicle passing over the platform.

Camera Module – Captures the image of the vehicle number plate.

Microcontroller/Processor – Processes sensor data and image information.

Vehicle Database – Stores vehicle registration and insurance details.

Penalty Generation Module – Automatically generates violation reports.

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The proposed system uses the following hardware components:

V. HARDWARE COMPONENTS

The proposed system uses the following hardware components:

Camera Module – Captures vehicle images for number plate recognition.

load Cell Sensor – Measures the weight of vehicles passing over the road.

Raspberry Pi / Arduino – Processes sensor data and controls system operations.

GSM Module – Sends SMS alerts to vehicle owners and traffic authorities.

LCD Display – Displays vehicle information and system status.



Power Supply Unit – Provides electrical power to system components.

VI. SOFTWARE DESIGN

The software integrates computer vision, database management, and communication modules.

Main software tools:

Python – Main programming language

OpenCV – Vehicle detection and number plate recognition

Tesseract OCR – Extracts vehicle number from license plate

MySQL / Firebase – Stores vehicle and insurance data

Web Interface – Used by traffic authorities to monitor violations

The software processes vehicle data, checks insurance validity, and generates penalties

VII. ALGORITHM

Start system.

Capture vehicle image using camera.

Detect number plate using image processing.

Extract vehicle number using OCR.

Measure vehicle weight using load sensor.

Compare measured weight with allowed weight limit.

Check insurance status from database.

If overload or insurance expired → generate violation.

Send SMS notification to vehicle owner.

Store violation record in database.

VIII. WORKING PRINCIPLE

The system works by automatically monitoring vehicles passing through a checkpoint.

When a vehicle passes the monitoring area, a camera captures the vehicle image.

The number plate recognition system extracts the vehicle number.

At the same time, the load cell sensor measures the vehicle weight.

The software checks insurance validity from a database.

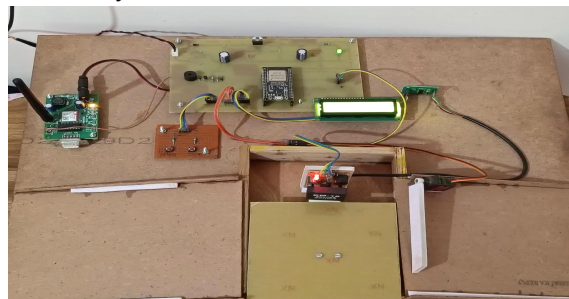
If the vehicle is overloaded or insurance is expired, the system automatically generates a penalty and sends a notification.

This process happens in real time without manual inspection.

Example SMS Alert

If a violation occurs, the vehicle owner receives a message such as:

"Traffic Alert: Your vehicle MH12AB1234 is detected with overload violation at Highway Checkpoint. Fine Amount: ₹5000. Please clear the penalty within 7 days.



IX. ADVANTAGES

- Automatic traffic monitoring
- Reduces manual inspection
- Improves road safety
- Prevents infrastructure damage due to overload
- Real-time violation detection
- Automated penalty system
- Supports smart city traffic management

X. APPLICATIONS

- Highway toll plazas
- Smart city traffic monitoring
- Border security checkpoints
- Logistics and transport monitoring
- Traffic police enforcement systems

XI. FUTURE SCOPE

- Integration with smart traffic lights
- Blockchain-based insurance verification
- Integration with national vehicle databases
- Cloud-based traffic monitoring systems

XII. CONCLUSION

The proposed system provides an intelligent solution for monitoring vehicle overload and insurance compliance. By integrating computer vision, IoT sensors, and automated databases, the system can detect violations in real time and generate penalties automatically. This approach reduces manual workload, improves traffic regulation efficiency, and enhances road safety.

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