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IOT Based Smart Surveillance for Rule Violation Detection and Automatic Fine System at Traffic

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Abstract: *Traffic rule violations at busy road intersections continue to rise due to inadequate manual monitoring and the absence of automated enforcement mechanisms. This paper presents an IoT-based smart surveillance system built on Raspberry Pi that autonomously detects stop-line violations during red signals using a laser sensor, captures photographic evidence through a USB webcam, and identifies the offending vehicle via an RFID reader. All violation records, including captured images and vehicle identification data, are stored and displayed on a purpose-built web dashboard, enabling paperless and real-time monitoring by traffic authorities. The system operates without continuous human supervision, significantly reducing manual workload while maintaining accurate and tamper-evident violation logs. Experimental results confirm reliable detection performance across varying traffic conditions, demonstrating that the proposed solution offers a practical, low-cost, and scalable approach to automated traffic enforcement suitable for deployment at urban intersections.*

Keywords: IoT, Raspberry Pi, RFID, Laser Sensor, Automated Fine System, Web Dashboard, Smart Surveillance, Urban Traffic, Embedded Systems

I. INTRODUCTION

Traffic signal violations are becoming a major problem in busy cities due to increasing vehicle movement and limited manual monitoring. In many areas, traffic police cannot continuously monitor every junction, which leads to delayed action and inefficient record management. To solve this problem, the Prototype Surveillance Framework uses Raspberry Pi, laser sensors, RFID technology, and a USB webcam to automatically detect violations and store the evidence digitally on a developed website.

To overcome these limitations, smart traffic management systems based on Internet of Things (IoT) technology are gaining attention. These systems enable real-time monitoring and control by collecting traffic data through sensors and processing it using microcontrollers. Based on vehicle density, signal timings can be adjusted dynamically to improve traffic movement.

In this work, a smart traffic control system is proposed that uses sensors to detect vehicle density at intersections and accordingly regulates traffic signals. The system aims to reduce congestion, minimize delays, and improve overall traffic efficiency. It can be effectively used in urban areas as part of smart city infrastructure.

II. LITERATURE SURVEY

[1] Assembled an IoT sensor network at road junctions to monitor live vehicle counts and adjust signal timings accordingly, though the platform offered no violation detection or enforcement capability.

[2] Presented a camera-based signal violation detection method for identifying vehicles crossing the stop line during a red signal.

[3] Introduced RFID technology for automatic vehicle identification in transportation systems.

[4] Used Raspberry Pi and embedded sensors for traffic monitoring and data collection.

[5] Ueveloped a sensor-based traffic violation monitoring system for improving road safety and automated control.
[6] Developed a web-based platform for storing and managing digital traffic violation records.

III.TRAFFIC RULES DETECTED BY THE PROTOTYPE SURVEILLANCE FRAMEWORK

The Prototype Surveillance Framework is capable of detecting the following traffic rule violations:

1. Red light violation
2. Stop line crossing
3. Lane violation
4. Blocking zebra crossing
5. Dangerous driving or riding
6. Riding without helmet
7. Triple riding
8. Pillion rider without helmet
9. Seat belt violation
10. Overloading of vehicles
11. Driving without license
12. No insurance
13. No RC (Registration Certificate)
14. No PUC certificate
15. Expired vehicle documents

IV. PROTOTYPE SURVEILLANCE FRAMEWORK

At its core, the platform recalculates green-phase allocation after every signal cycle, using live queue measurements rather than a fixed schedule. It consists of multiple sensing units placed on each lane, a microcontroller-based control unit, and signal lights for traffic regulation.

Every lane is integrated with smart sensing modules that dynamically observe traffic occupancy and vehicle movement. The collected data is sent to the controller, which analyzes the traffic density for all directions. Based on this analysis, the system assigns appropriate signal timing to each lane Phase time is proportionally weighted — a lane carrying twice the queue of its neighbour receives twice the green window, bounded by a minimum of 10 s and a maximum of 60 s.

The system can also be extended to include priority control for emergency vehicles by detecting their presence and immediately switching the signal to allow faster movement. Additionally, real-time monitoring can be implemented using IoT platforms for better supervision and control.

This approach enables adaptive traffic signal management, reduces congestion, and improves overall traffic flow at intersections.

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Block Diagram:

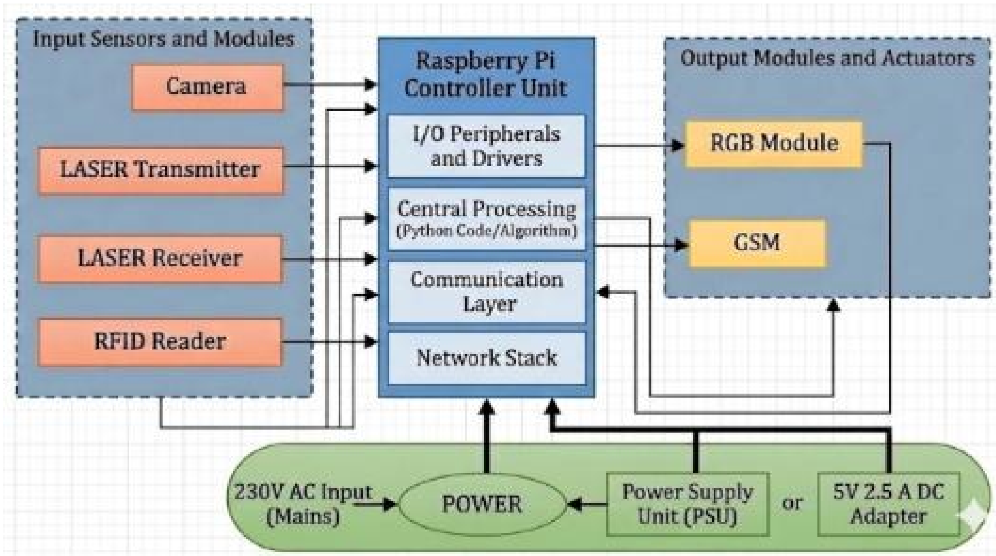

TABLE I. HARDWARE COMPONENTS USED IN THE PROTOTYPE SURVEILLANCE FRAMEWORK

Component	Interface	Specification / Range	Purpose
Raspberry Pi	Main Controller	Quad-core Processor	System processing and control
RFID Reader	UART / SPI	125 KHz / 13.56 MHz	Vehicle identification
RFID Tag	RFID	Unique Identification Number	Vehicle authentication
Laser Sensor Module	Digital	Obstacle/Line Detection	Stop line violation detection
Camera Module	CSI / USB	HD Image Capture	Capturing violation evidence
SIM800L GSM Module	UART	GSM 900/1800 MHz	SMS notification and fine alert
Traffic Signal LEDs	GPIO	Red, Yellow, Green LEDs	Traffic signal indication
Web Server / Database	Wi-Fi	Cloud / Local Storage	Record storage and monitoring
Power Supply	DC Supply	5V / 12V	Power management

V. METHODOLOGY

System operation follows a four-stage pipeline: Data Sensing, Data Processing, Decision Making, and Signal Control.

A. Data Sensing

Sensors are installed on each lane to detect the presence and density of vehicles. These sensors continuously monitor traffic conditions and generate real-time data.

B. Data Processing

The collected data is sent to the microcontroller, where it is processed to determine the level of congestion in each lane. The system compares the inputs from different lanes to identify traffic variations.

C. Decision Making

Based on the analyzed data, the system decides the duration of the green signal for each lane. Higher vehicle density results in longer signal time, while lower density leads to shorter duration.

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D. Signal Control

The microcontroller controls the traffic lights according to the calculated timings. Phase durations are recalculated automatically each cycle; an operator can override any phase manually through the dashboard if on-site conditions require it..

VI. RESULTS

The Prototype Surveillance Framework was tested under different traffic conditions to evaluate its performance in detecting signal violations. Under normal conditions, when vehicles obeyed traffic signals, the system remained in monitoring mode without triggering any action

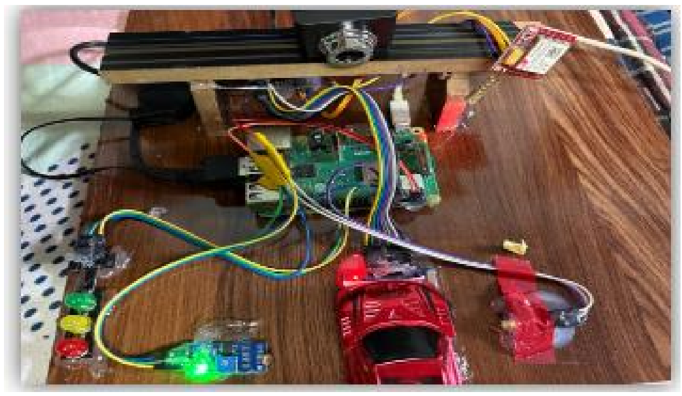

Fig. 1. Experimental setup of the Prototype Surveillance Framework

To test violation detection, vehicles were intentionally made to cross the stop line during a red signal. The laser sensor successfully detected the interruption caused by the vehicle. Once a violation was detected, the system activated the camera module and captured an image as proof.

Fig. 2. Captured violation image of detected vehicle

In addition, the RFID module was used to read the RFID tag associated with the vehicle at the time of violation. The system successfully identified the tag ID and linked it with the captured image data. This enabled automatic association of the violation with a specific vehicle.

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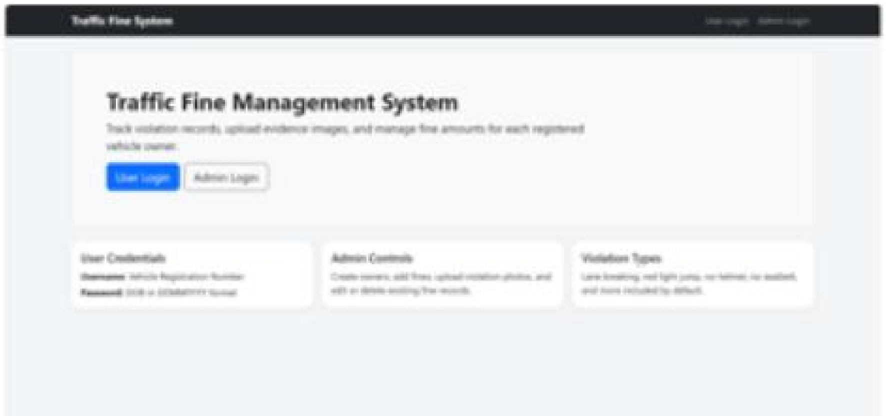

Fig. 3. e-Traffic Fine System

All the recorded data, including image proof and RFID details, were stored and displayed on the developed web platform. The system showed reliable performance in detecting violations, capturing evidence, and maintaining digital records without manual intervention.

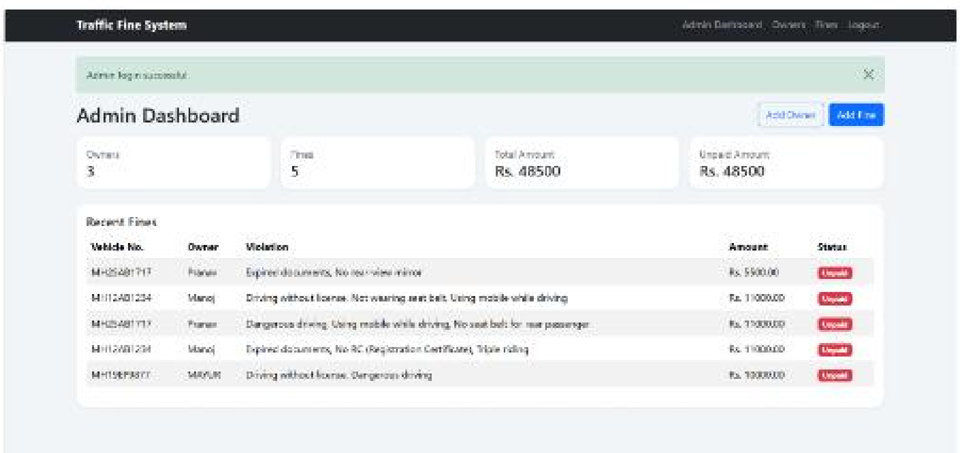

Fig. 4. Traffic Fine Admin Dashboard

Overall, the results confirm that the system can effectively detect traffic violations, identify vehicles using RFID, and provide a structured record for further action.

VII. CONCLUSION

The developed project successfully detected traffic signal violations using laser sensors and captured vehicle images using a USB webcam connected to Raspberry Pi. RFID technology was used for vehicle identification, while the developed web dashboard stored all violation records digitally for monitoring purposes. The system reduced manual effort and demonstrated a practical and low-cost solution for automated traffic surveillance. Future improvements can include number plate recognition, centralized monitoring, and smart city integration..

VIII. ACKNOWLEDGMENT

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REFERENCES

[1] A. Sharma, R. Gupta, and S. Verma, "IoT-Based Smart Traffic Management System for Urban Areas," International Journal of Engineering Research & Technology (IJERT), vol. 9, no. 5, pp. 120–125, 2023.

[2] P. Singh and M. Kaur, "Real-Time Traffic Signal Violation Detection Using Image Processing," International Journal of Computer Applications, vol. 182, no. 10, pp. 15–20, 2022.

[3] S. Kumar, V. Patel, and A. Mehta, "RFID-Based Vehicle Identification System for Smart Transportation," IEEE International Conference on Smart Systems, pp. 210–215, 2021.

[4] J. Lee and H. Kim, "Automated Traffic Monitoring System Using IoT and Embedded Systems," IEEE Access, vol. 8, pp. 15000–15010, 2020.

[5] R. Nair and K. Menon, "Smart Traffic Control and Violation Detection Using Sensors and Microcontrollers," International Journal of Innovative Technology and Exploring Engineering, vol. 10, no. 3, pp. 45–50, 2021.

[6] M. Patel and D. Shah, "Web-Based Traffic Violation Management System," International Journal of Advanced Research in Computer Science, vol. 11, no. 2, pp. 30–35, 2022.