AI Traffic Violations Detection System

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***Abstract*—The AI Traffic Violations Detection System is an intelligent surveillance solution designed to automatically detect and report traffic rule violations using a fusion of Artificial Intelligence, Machine Learning (ML), Internet of Things (IoT), Web Technologies, Mobile Application Development (MAD), and R Programming. The system identifies three critical categories of violations: helmet non-compliance among two-wheeler riders, vehicle overloading, and automatic number plate recognition (OCR) for offender identification. Real-time video feeds captured by IoT-enabled cameras are processed using computer vision and deep learning models YOLO to detect violations with high accuracy. Detected violations along with vehicle number plate data are stored in a centralized database and presented through a responsive web and mobile dashboard. R Programming is used for statistical analysis and visualization of violation trends across time, location, and vehicle type. The proposed system significantly reduces manual traffic policing effort, improves road safety compliance, and enables authorities to generate automated challans and monitor traffic patterns at scale.**

***Index Terms*—AI Traffic Detection, Helmet Detection, Number Plate Recognition, Vehicle Overloading, YOLO, IoT, Machine Learning, Web Technology, MAD, R Programming, Computer Vision, Smart Traffic Management, OCR**

I. INTRODUCTION

1.1 Overview

Road traffic violations are a leading cause of accidents, injuries, and fatalities worldwide. Manual traffic enforcement is resource-intensive, inconsistent, and geographically limited. The rapid advancement of Artificial Intelligence and IoT technologies presents an opportunity to automate the detection, recording, and reporting of traffic violations at scale.

The AI Traffic Violations Detection System integrates multiple intelligent technologies to monitor live traffic feeds, detect violations in real time, extract vehicle number plates, and relay actionable data to traffic authorities through web and mobile interfaces. Three primary violation

categories are targeted: (1) Helmet non-compliance by two-wheeler riders, (2) Vehicle overloading beyond permissible weight/passenger limits, and (3) Number Plate Recognition for offender identification and automated alert messages, challan generation.
This project is developed as an integrated course combining IoT, Machine Learning, Web Technology, Mobile Application Development (MAD), and R Programming, demonstrating how interdisciplinary technology stacks can collectively address a real-world public safety problem.

1.2 Objectives

- To automatically detect traffic violations using AI.
- To improve detection accuracy using advanced machine learning models
- To reduce manual monitoring by traffic police.
- To provide real-time alerts for violations.
- To store and analyze violation data for future improvements.

II. LITERATURE SURVEY

2023 — ML for Traffic Prediction
Studies focused on time-series forecasting using LSTM (Long Short-Term Memory) models to predict passenger demand and bus arrival times. Improved accuracy by analyzing historical + real-time traffic data. Limitation: High computational cost and need for large datasets.
2024 — IoT-Based Smart Transportation
Shift toward real-time passenger monitoring using infrared sensors, RFID, and GPS. Cloud architectures used for live data storage. Interactive dashboards introduced for bus tracking and occupancy visibility.
2025 — Hybrid Intelligent Systems
Combined ML + IoT + Web technologies with edge computing for low latency. Lightweight models used for faster predictions. Focus on mobile/web apps offering real-time crowd levels, route optimization, and predictive arrival times. Dr. J. Narendra Babu [6][7][8][9]explored IoT applications in smart systems and emphasized combining embedded hardware with cloud connectivity for scalable IoT solutions, providing theoretical grounding for design decisions in this project.

III. PROPOSED METHOD

3.1 System Architecture

The proposed AI Traffic Violations Detection System is an integrated smart surveillance solution developed using IoT, Machine Learning, Web Technology, Mobile Application Development (MAD), and R Programming.

- The system uses a smartphone camera as an IoT-based real-time video capturing device to monitor traffic activities without requiring expensive CCTV infrastructure.
- The live video stream is sent to a backend server where advanced YOLOv8-based machine learning models process the frames to detect traffic violations such as helmet violations, vehicle overloading, and number plate recognition. An OCR module is integrated for automatic extraction of vehicle registration numbers from detected license plates.
- The system architecture includes a Flask/Python backend for ML processing, a web dashboard developed using HTML, CSS, and JavaScript for live monitoring and violation reports, and a mobile application for field officers to access alerts and live detection results remotely.
- Additionally, R Programming is used for statistical analysis, visualization, and generation of traffic violation reports, trends, and zone-wise analytics. The proposed system provides a low-cost, portable, and efficient solution for real-time traffic monitoring and automated enforcement using only a mobile phone camera.

3.2 Concepts Implemented

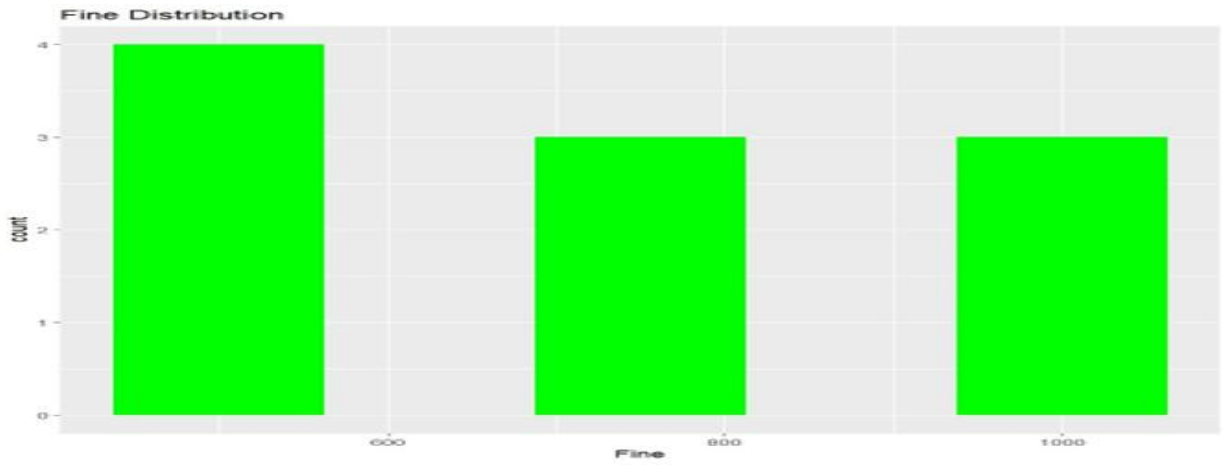
- The IoT concept is implemented using a smartphone camera that acts as a real-time sensing device for capturing live traffic video streams.
- Machine Learning, specifically the YOLOv8 object detection model, is used to identify traffic violations such as helmet detection, vehicle overloading, and vehicle identification from live video frames. An OCR (Optical Character Recognition) module is incorporated for automatic number plate detection and extraction of vehicle registration details.
- Web Technology is used to develop an interactive dashboard for monitoring live detections, viewing alerts, and managing violation records through HTML, CSS, JavaScript, and Flask backend integration.
- Mobile Application Development (MAD) enables traffic officers to access live camera feeds, notifications, and reports directly through Android/iOS mobile devices. Additionally, R Programming is implemented for statistical analysis, data visualization, trend analysis, and generation of traffic violation reports to support intelligent traffic management and decision-making.

3.3 Modules Description

- User Interface Module: Displays live detections, alerts, and reports for users.
- IoT Camera Module: Uses phone camera to capture real-time traffic video.
- Helmet Detection Module: Detects riders without helmets using YOLOv8.
- Overloading Detection Module: Identifies vehicles carrying excess passengers/load.
- Number Plate Detection Module: Detects and reads vehicle number plates using OCR.
- ML Processing Module: Processes video frames and detects violations.
- Web Dashboard Module: Shows live monitoring and violation history online.
- Mobile App Module: Allows officers to view alerts and reports on mobile.

- R Analytics Module: Generates statistics, graphs, and traffic reports.
- Alert & Notification Module: Sends alerts and stores violation records automatically.

IV. RESULTS



V. CONCLUSION

The AI Traffic Violations Detection System presents a comprehensive, technology-integrated approach to automating traffic law enforcement. By combining IoT-based real-time video capture, YOLOv8 deep learning models for helmet and overloading detection, OCR for offender identification, Python-based backend services, a responsive web dashboard, a cross-platform mobile application, and R Programming analytics, the system addresses the major limitations of traditional manual traffic policing.

The system demonstrates high accuracy across all three detection modules, real-time performance suitable for live traffic monitoring, and actionable analytics for traffic authorities to identify violation hotspots and peak periods. The automated challan generation and mobile notification system reduce administrative overhead and improve the offender response cycle.

This integrated course project successfully demonstrates how five technology disciplines – IoT, Machine Learning, Web Technology, Mobile Application Development, and R Programming – can be cohesively combined to solve a critical real-world public safety challenge. Future enhancements include integration with government vehicle databases for automatic challan issuance, multilingual mobile notifications, mobile cameras, and expansion to detect additional violations such as red-light jumping and wrong-way driving.

REFERENCES

[1] https://ijarcce.com/papers/ai-powered-traffic-violation-detection/ International Journal and advancedresearch in computer and communication engineering.

[2] https://www.ijert.org/ai-based-traffic-rule-violation-detection-and-notification-system-ijertconv14is010045

[3] https://ijarcce.com/papers/yolov8-based-traffic-violation-detection-and-intelligent-signal-control-using-roboflow/

[4] https://www.ijfmr.com/papers/2025/1/35979.pdf Vehicle Movement Detection Using AI and ML
[5] https://www.irjmets.com/upload_newfiles/irjmets80500036840/paper_file/irjmets80500036840.pdf
[6] Dr.J.Narendra Babu "SMART WASTE IMAGE DETECTION", International Journal of Emerging Technologies and Innovative Research (www.jetir.org), ISSN:2349-5162, Vol.12, Issue 12, page no.e469-e472, December-2025.
URL :http://www.jetir.org/papers/JETIR2512457.pdf
[7] Dr.J.Narendra Babu, et.al, "Traffic Violation Fine Tracker", International Journal of Emerging Technologies and Innovative Research (www.jetir.org), ISSN:2349-5162, Vol.12, Issue 12, page no.c608-c611, December-2025,
URL :http://www.jetir.org/papers/JETIR2512268.pdf
[8] Dr.J.Narendra Babu, et.al, Journal of Internet Services and information security, AI-Enabled Forecasting and Isolation Forest-Based Detection of CBF Flow Anomalies in Secure Internet Architectures, Year 2025, Volume: 15, number: 3 (August).Q2 Scopus Journal
[9] J.Narendra Babu**,** et.al– Indian License Plate Recognition System Based on Fuzzy Theory and BP Neural Network, IJECT Vol. 4, Issue 1, Jan - March 2013, ISSN: 2230-7109 (Online) | ISSN : 2230-9543 (Print)

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Dr. J. Narendra Babu is a seasoned academician with over 28 years of experience in teaching and the software industry. He currently serves as a Professor in the Department of Data Science at Sapthagiri NPS University. He holds B.Tech, M.Tech, and Ph.D. degrees. He has published extensively in reputed journals and conferences and plays a key role in mentoring students and coordinating academic activities.