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A Comprehensive Survey on Traffic Rules Notification System

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Abstract- **With the increase in vehicular traffic, following traffic rules becomes very essential. In this respect, this paper proposes a Clouded and Mobile based Traffic Rules Notification System in real-time to notify the drivers according to their location. Place in the cloud a MySQL database for keeping track of the updated rules, traffic officers managing the tickets keep this via a small web interface. Rules are pulled over RESTful APIs to a mobile app, which monitors the GPS location of the user and sends alerts in form of on-screen icons and voice instructions. Key features include rule management, location-based queries, API integration, and dynamic alerts. This hybrid web-mobile system enhances driver awareness, improves road safety, and supports scalable, real-time traffic enforcement.**

Index terms- **Traffic rule notification, Real-time alerts, GPS tracking, Cloud computing, RESTful API, Mobile application, MySQL database, Rule-based alerts, Haversine formula.**

I. INTRODUCTION

Traffic violations are one of the leading contributors to road accidents, congestion, and overall traffic mismanagement in rapidly urbanizing environments. In many cases, these violations are not intentional but occur due to a lack of awareness about the specific traffic regulations applicable in particular areas—such as designated speed limits, silent zones, or no parking regions. Traditional methods of traffic rule communication, such as signboards, often go unnoticed, particularly by drivers navigating through unfamiliar territories. To address this issue, this project proposes an innovative, technology-driven solution that notifies users about traffic rules dynamically based on their current geographical location. By integrating mobile and web technologies with cloud computing and GPS, the *Traffic Rules Notification System* offers a real-time, scalable, and intelligent framework to improve road discipline and safety compliance. Central to this system is a cloud-based MySQL database where the traffic rules, identified and updated by the traffic department (Admin), are stored securely. The system is designed as a dual-platform application: a web interface for administrative rule management and a mobile app that delivers location-specific alerts to users via visual cues and voice outputs.Over recent years, vehicle monitoring technologies have significantly evolved, providing enhanced tools for analysing and guiding driver behaviour. These technologies are not only capable of tracking and logging driver activity but also issuing in-vehicle warnings when safety parameters such as speeding or reckless acceleration are breached. Building on these capabilities, this project incorporates surveillance and safety mechanisms to proactively inform drivers of local rules, thereby reducing the chances of traffic violations and subsequent road hazards. The system empowers the traffic department to assess real-time road scenarios using GPS coordinates, analyse traffic flow implications, and accordingly update traffic regulations. These rules are then made available via APIs that mobile applications can query to retrieve appropriate data based on the user's location. Once a user installs and logs into the mobile application, their location is continuously tracked using GPS, and nearby traffic rules are fetched and presented through on-screen icons and voice-based notifications using JSON data.The system's main components include administrative rule input, cloud-based data storage, GPS-driven mobile detection, real-time rule retrieval via API, and user notifications via visual and voice prompts. A vital part of the logic includes the use of the Haversine formula to calculate the user's proximity to rule-defined GPS points—typically within 20 to 30 meters. If a match is found, the system triggers an API response to deliver the relevant rule information. The overall design emphasizes two main actors: the admin, responsible for uploading and managing traffic rules, and the User, who interacts with the mobile application to receive contextual alerts based on movement and location. This system, therefore, presents a comprehensive road safety surveillance approach that bridges the information gap between traffic authorities and road users. By automating rule awareness through real-time, location-based alerts, it aims to minimize traffic violations, enhance public safety, and offer a practical, smart solution for modern traffic management challenges.

II. LITERATURE SURVEY

The growing dependence on autonomous driving technology and advanced driver-assistance features has accelerated the demand for accurate and real-time traffic sign detection (TSD). As a result of the diversity in urban and highway scenarios—from occlusion and changing light to small signs—deep learning models, especially YOLO (You Only Look Once) variants and Convolutional Neural Networks (CNNs), have proven to be robust aids in improving the reliability of TSD systems.In order to tackle challenges such as inaccurate detections and low-quality images, Jiang et al. [1] introduced YOLO-CCA, a context-aware detection framework based on YOLOv7. The incorporation of a Local Context Feature Enhancement (LCFE) module allowed the model to enhance feature extraction via multi-scale dilated convolutions, resulting in improved accuracy in recognizing small and obscured traffic signs. Likewise, Zhang et al. [2] aimed to refine YOLOv5 to achieve superior detection accuracy in varying lighting and weather conditions. This method advanced beyond traditional color and shape-based techniques, which, while lightweight, often faltered in real-world environmental variations.Liu [3] developed a real-time multifunctional traffic monitoring system that utilizes Faster R-CNN and integrates IoT technology with Raspberry Pi 4B. This system features various traffic-related detection capabilities, such as pedestrian tracking, accident notifications, and traffic sign identification. The integration of computer vision and embedded systems resulted in dependable performance, achieving a reported mAP50 of 56.3%.In an effort to optimize both speed and accuracy, Chen et al. [4] introduced YOLO-TS, a real-time detection model that employs optimized receptive fields and anchor-free fusion techniques. This model effectively reduced grid pattern artifacts associated with dilated convolutions and expanded the receptive field to improve the detection of smaller traffic signs in intricate environments.Raja et al. [5] presented a new integration of CNN-based detection with voice feedback whereby a real-time voice assistant module announced identified traffic signs to drivers. This model shown strong performance even in demanding lighting conditions by using OpenCV for preprocessing and TensorFlow/Keras for training, so improving road safety by reducing visual distractions.Siniosoglou et al. [6] presented a synthetic benchmark dataset combining CTSD and CATERED, especially intended for traffic sign detection and recognition, to address dataset constraints. Their approach showed flexibility in federated learning environments for distributed intelligent transportation systems and used a deep autoencoder for sign recognition of distortions.Suwattanapunkul and Wang [7] addressed the issue of Taiwan's non-standardized traffic signs. They constructed the TWTS dataset and combined it with TT100K to create a hybrid dataset, which they used to train YOLOv5s6 and YOLOv8s. The results demonstrated that YOLOv8s achieved a superior mAP@0.5 of 76.2%, confirming the benefits of training on a variety of datasets.

Jayasinghe et al. [8] emphasized real-time detection on embedded devices. On an Nvidia Jetson AGX Xavier, their deep learning pipeline operated at 63 frames per second using TensorRT optimization. Additionally, they produced the CeyRo dataset, the first comprehensive traffic sign and light dataset for Sri Lanka, which consists of 70 sign classes and five light classes.Sai Krishna et al. [9] utilized YOLOv8 for the detection of traffic lights, addressing the latency and accuracy challenges that plagued earlier systems. The research indicates that the enhancements in YOLOv8 facilitate quicker and more precise identification, which is essential for autonomous vehicles and systems designed for individuals with visual impairments. Using TensorFlow's Object Detection API, Kilic and Aydin [10] sought traffic sign detection for Turkey. Their custom dataset gathered under different weather conditions produced satisfactory results despite limited training data, underlining the flexibility of TensorFlow for regional TSD uses.

Employing the GTSRB dataset, Kumar and Karthika [11] presented a CNN-based real-time detection system on Raspberry Pi 4. Built using a sequential CNN architecture, their model classified traffic signs into 43 classes with real-time detection capability via a web camera, so providing low-cost driver-assistance solutions.

III. METHODOLGY

The Cloud-Based Web and Mobile Application Traffic Rules Notification System adopts a systematic, actor-oriented, and modular approach in responding to the increasing demand for real-time traffic rule awareness for drivers. The system is developed on two platforms (Fig 1)—a web application for administrators (traffic authorities) and a mobile application for end-users (drivers). The approach focuses on the smooth interaction among cloud storage, GPS tracking, and RESTful API communication to provide timely traffic alerts based on location.

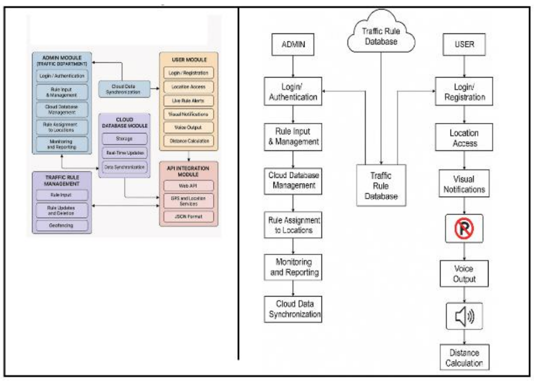

Figure 1: Methodology Overview

The suggested system combines a web-based administrative portal with a GPS-enabled mobile application to enable dynamic, location-based traffic rule distribution. The Administrator, who is usually a representative of the Traffic Department, and the User, who is a driver using the mobile application, are the two main actors that impact the system. The objective is to make sure that, depending on their current geographic location, drivers are always aware of pertinent traffic laws.The admin workflow starts with a safe login and authentication procedure that gives users access to the web portal's administrative dashboard. The administrator can use this interface to enter different traffic regulations, like "No Parking" or particular "Speed Limits," and link them to exact GPS coordinates. After being entered, these rules are kept in a MySQL database hosted in the cloud, which acts as the centralized backend for the mobile and web platforms. Any changes or newly added rules are instantly updated and made available to all mobile users thanks to this configuration, which guarantees smooth cloud synchronization. The administrator has the ability to enter and manage rules, track location-based user interactions, keep an eye on system usage, and produce reports to help with traffic management decision-making.A specialized mobile application powers the user workflow. Continuous real-time location tracking is made possible by the user granting the app access to the device's GPS services upon registration and login. To determine the distance between each GPS coordinate linked to traffic rules stored in the system and the user's current location, the application uses the Haversine algorithm. The mobile application automatically sends a Web API request to the cloud database if it detects that the user is within a predetermined proximity threshold (usually 20 to 30 meters) of any such rule location. In response, the server provides rule information tailored to the user's current location in a JSON format.In order to notify the driver, the mobile app takes two crucial steps after receiving this response. First, it gives a clear and instantaneous visual cue by displaying an appropriate visual icon on the screen (such as a "No Parking" or "Speed Limit" sign). Second, the app uses a text-to-speech engine to provide a voice-based notification, enabling hands-free awareness of the applicable rule, in order to promote safety and reduce driver distraction. This dual-mode alert system encourages adherence to traffic laws and improves situational awareness.

The system guarantees that drivers receive timely and context-aware traffic rule notifications by integrating cloud-based rule management, real-time GPS tracking, and effective distance calculation. Through digital transformation, the architecture provides a dependable solution for dynamic traffic management by supporting scalability and real-time synchronization.

IV. RESULTS AND DISCUSSIONS

The system is intended to allow drivers to be aware of traffic rules depending on where they currently are at any time. It works by combining a web-based portal that administrators use and a GPS-enabled mobile app for drivers. There are two main users of the system, the Admin which is mainly the Traffic Department worker while the other user is the driver under the user category who will see or use the client side mobile application. The aim is to ensure that drivers have information on current traffic regulations pertaining to their current location at their finger tips.It would begin for the Admin, by login into a secured web appearance. Once inside, they are able to enter different rules of the road — such as “No Parking” zones or speed limits — and tie them to specific GPS locations. These entries are persisted in a MySQL database as a central hub for both web and mobile part of the system. And because it’s in the cloud, any adjustments made by Admin are instantly mobile ready, which helps maintain consistency between platforms. Its administrators can also use the system to track how well drivers follow rules around the city’s different monitored sites and compile reports to assist with traffic planning and enforcement.The app does the rest on the driver’s end. When a user registers, logs in and grants access to GPS, the app starts tracking location in real time. It employs the Haversine formula to determine how far the driver is from any nearby traffic rule locations. if(driver is nearby = 20-30 meters away) make a request to the server to check if there are any applicable rules.When the app receives a response from the server, it informs the driver in two ways. First, it displays a visual icon on the screen (for example, a “No Parking” or “Speed Limit” sign) so the driver knows what to look for. Second, it provides voice output for announcing the rule aloud, so the driver gets the message without having to look away from the road. This visual and audible combination keeps drivers "in the know" and safe!When real-time location tracing is combined with a smart rule checking system and cloud management, location-based alerts can be sent out to drivers quickly. It’s made for easy scaling and adjusting, which makes it a feasible and contemporary system of enhancing road safety and enforcing traffic regulations.

V. CONCLUSION

This project's Traffic Rules Notification System meets an essential requirement in contemporary traffic control by delivering a location-sensitive real-time platform which boosts both road safety and driver adherence through technological means. The integration of cloud computing with mobile GPS tracking and Web API communication allows the system to let administrators set traffic rules dynamically while drivers get immediate area alerts. The integration of the Haversine algorithm with distance measurement techniques alongside voice-assisted and visual notifications delivers essential rule communication while maintaining minimal driver distraction. Through its dual-platform structure the system enables centralized rule management via a web portal while delivering information seamlessly through a mobile application. This project presents an unnatural yet complex scalable methodology that effectively minimizes traffic violations while reducing accidents and promoting a safe and informed driving culture. The system plays a major role in advancing digital traffic enforcement while setting the foundation for future smart city technologies.

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