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ADVANCED TRAFFIC VIOLATION CONTROL AND PENALTY SYSTEM USING IOT AND IMAGE PROCESSING TECHNIQUES

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ABSTRACT

Currently, road traffic has emerged as a significant predicament. The majority of traffic accidents are attributable to human factors, with traffic violations being one of the most prevalent and typical causes. India is presently progressing towards automated solutions to mitigate traffic violations. The objective of this project is to establish a penalty system for traffic violations by employing Internet of Things (IoT) and image processing techniques, thereby facilitating the traffic police in managing penalties for traffic violations. This system aims to streamline the process by reducing paperwork and manual intervention. In previous endeavors, both technologies have been utilized independently, each possessing its own merits and demerits. Consequently, this undertaking seeks to harness the advantages of both technologies. For the image processing component, the efficient and reliable PYTHON programming language will be employed, specifically utilizing the K-Nearest Neighbor Algorithm for license plate recognition. In this system, immediate notifications will be dispatched to the vehicle owners, ensuring a prompt and efficient response, thereby fostering compliance with traffic regulations.

Keywords: Image Processing, Ultrasonic Sensor, Database.

I. INTRODUCTION

The social situation in India is characterized by a number of challenges, including poverty, unemployment, and a lack of adherence to established norms. As a result, the implementation of an automated tollbooth system is not feasible. Rather, the industry requires an automated vehicle classification system that minimizes human intervention and ensures that financial errors are avoided. This system should operate in the background and provide a cross-check of manual processes. Traditional OCR-based methods for number plate recognition are inadequate due to variations in number plate design. Instead, a proposed method utilizes advanced cameras to capture images and extract features of the vehicle number plate. These features are then compared to a predefined set of images in a database, and character images are matched in real-time.

In terms of vehicle safety, India currently meets only two of the seven vehicle safety standards established by the World Health Organization (WHO). Motorcycles account for 25% of all road fatalities, and records indicate that 75% of motorcycle riders involved in accidents were wearing helmets. It is difficult for authorities to monitor traffic violations, leading to dangerous situations for both drivers and pedestrians. Recent research indicates that India experiences 35 road accidents per 1000 vehicles.

II. RELATED WORK

Numerous research studies have been conducted in the past and present regarding the regulation of traffic violations through various sensor and image processing techniques. It has been observed that approximately 90% of traffic accidents are attributed to human factors, with traffic violations being one of the most prevalent and typical causes. As such, investigating the correlation between traffic violations and accidents holds both theoretical significance and engineering value, given that traffic violations are the most common and detrimental unsafe driving behaviors. Intelligent transportation systems (ITS) for traffic monitoring play a crucial role in mitigating traffic congestion, enhancing safety, and improving productivity.

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III. METHOD

This project concerns the provision of immediate penalty notifications to violators regarding their violations. The camera is utilized for the identification of violators and license plate recognition. The notifications are transmitted to the corresponding vehicle owners through the online platform, Twilio.

The process involves several stages. Firstly, the camera captures an image upon detection of a violation. Secondly, the image acquisition stage is initiated, during which various processing methods can be applied to extract the number plate details from the image. Thirdly, the extracted string is compared with the information already stored in the SQLite database to obtain the mobile number of the vehicle owner. Finally, to transmit the penalty message to the respective vehicle owner, the online platform, Twilio messaging, is utilized.

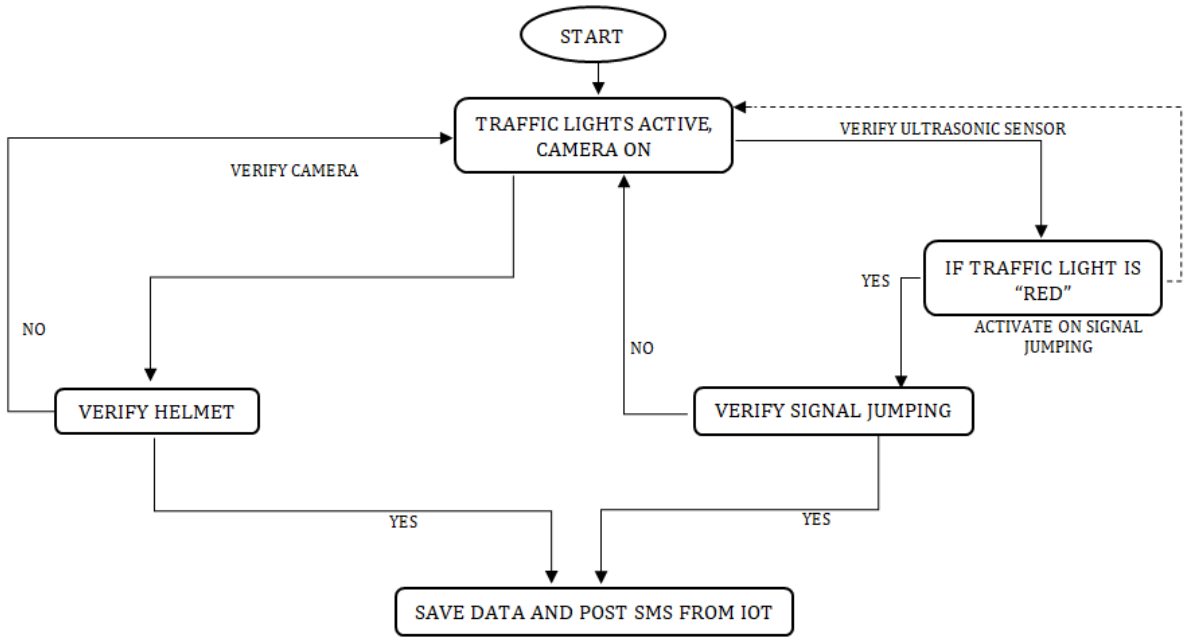

Fig 1: Flow chart for Methodology

IV. EXPERIMENT AND SIMULATION

To validate our proposed system experimental analysis is performed. The hardware setup is as shown below.

The hardware setup is connected as follows:

1. D1 of Node MCU is connected to the Echo pin of the ultrasonic sensor.
2. D2 of Node MCU is connected to the Trigger pin of the Ultrasonic sensor.
3. GND pin of Node MCU is connected to the GND pin of the Ultrasonic sensor.
4. VU pin of Node MCU is connected to Vcc pin of the Ultrasonic sensor.
5. D3 pin of Node MCU is connected to Din pin of the NeoPixel led.
6. VU pin of Node MCU is connected to +5V of NeoPixel led.
7. GND pin of Node MCU is connected to the GND pin of the NeoPixel led.

The programming of Node MCU is performed on Arduino IDE which is used for signal violation detection. And for helmet violation detection we will be using PYTHON programming using the YOLOv3 algorithm. Similarly, in these uncertain times, human civilization needs to quickly adapt to the threat at hand. While wearing a mask is not the ultimate solution, it still reduces the rate of transmission of the virus, so for face mask detection SSD algorithm is used. For the license plate recognition, we used the KNN algorithm and Python-tesseract, an OCR tool for python to obtain the alpha-numeric characters. Initially, the details of the vehicle are stored in the SQLite database. The camera detects the violation of either helmet or signal violation and facemask violation then captures the image. The license plate number will be extracted and compared with the stored vehicle number plates in the database and obtained the vehicle owner details and with the help of the Twilio online messaging platform, the penalty message will be sent to the violator.

V. RESULTS

The license plate is extracted through the utilization of knn and pytesseract tools, resulting in the acquisition of an alphanumeric string subsequent to image processing. This string is then compared to the pre-existing information stored within the database, and subsequently, a penalty message is dispatched to the corresponding vehicle owner with the assistance of the Twilio messaging online platform.

VI. CONCLUSION

After conducting experimentation and simulation, it has been determined that the proposed method can be effectively integrated into the current system, yielding dependable outcomes. The proposed method exhibits evident potential in diminishing the likelihood of errors in traffic violation control. Nevertheless, this endeavor can be further enhanced through the utilization of more sophisticated image processing techniques and the incorporation of novel features.

VII. REFERENCES

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