DESIGN OF TRAFFIC AMERCEMENT AUTOMATION
USING COMPUTER VISION

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Abstract

Traffic rule violations, such as speeding, not wearing a proper protective helmet, and running red lights, are a major contributor to the high number of road accidents in India. According to National Crime Records Bureau data, over 1.5 lakh people lose their lives in road accidents across the country every year, an average of 426 daily or 18 every hour. To address this issue, we propose an automated system for collecting traffic fines using machine learning techniques. The system utilizes object detection to identify vehicles that have violated traffic rules, using video surveillance cameras. It then extracts the number plate and an encrypted QR code of the vehicle, which can be used to retrieve the vehicle owner's phone number and other details. These details are stored on a server, and the system sends three reminders for payment within a fixed time window. If the fine is not paid, the vehicle's registration with the RTO (Regional Transport Office) is automatically cancelled and it is no longer allowed on the road. This system aims to improve the efficiency and accuracy of the traffic fine collection process, while also reducing errors and the possibility of bribery. The use of machine learning techniques and video surveillance cameras allows for continuous monitoring of traffic, reducing the need for large numbers of traffic police to manually monitor the roads. The extraction of the QR code and vehicle owner's details also makes it easier to track and verify transactions, ensuring that the correct fine is being paid by the right individual. The automatic cancellation of the vehicle's registration if the fine is not paid serves as a deterrent for individuals attempting to evade paying their fines. In summary, our proposed system utilizes advanced technology to automate the traffic fine collection process, improving efficiency and accuracy while also reducing the possibility of bribery and errors.y.

I. INTRODUCTION

There has been a significant increase in the number of vehicles on the roads in recent years, with many places experiencing more vehicles than people. This increase in traffic has led to people breaking traffic rules in an effort to reach their destinations on time. In some countries, the lack of proper road lane systems can also contribute to accidents, particularly when heavy vehicles are near smaller two- wheelers. Two-wheelers are particularly prone to accidents due to their vulnerability on the roads, and the lack of helmet usage is a major contributor to fatalities in this category. Traffic-related fatalities, particularly those involving two- wheelers, have risen significantly in the past decade. Most countries have dedicated traffic police forces, but these systems are often overwhelmed by the sheer volume of traffic and can be inefficient in preventing

accidents.Developing countries like India is majorly equipped with humanized traffic system. Such system can sometimes be a blessing and sometime it can be a curse. Here blessing comes with the fact that such system is less prone to human error but not totally. Curse of such system is one of the main reason it should be avoided. Curse involve any miscommunication, misdirection and our major topic of discussion Bribery.

People in such system can easily get away with their crime which involve over-speeding, notwearing helmet etc by simply bribing the traffic police. Such system doesn't bring any justice to the society as such action only increases the traffic violation rate.

Computer equipped traffic system can easily outperform a humanized system. Here everything can be automated by simply eliminating the need of any middle- men. Such system can efficiently implement the traffic rules.It can check whether someone is violating the traffic rules ofnot , if someone is violating then a proper fine is imposed onhim/her .

II. PROBLEM DESCRIPTION

Traffic rule violations are a significant problem in India and are responsible for a considerable number of road accidents, leading to the loss of many lives annually. The existing method of manually monitoring and collecting traffic fines is vulnerable to inefficiencies, inaccuracies, and corrupt practices. Thus, there is an urgent need for an automated system that can efficiently and precisely collect traffic fines while minimizing errors and reducing the possibility of bribery.

To elaborate, the current system of manually monitoring traffic violations and collecting fines is not only time-consuming but also prone to errors due to human involvement. Moreover, it is challenging to track down and penalize offenders who try to evade fines or manipulate the system by bribing officials. This, in turn, leads to an increase in the number of road accidents, which is a matter of grave concern. Therefore, it is imperative to develop an automated system that can identify and penalize offenders accurately and without delay.

The proposed system can incorporate the latest technology, such as artificial intelligence and machine learning, to detect and capture traffic violations accurately and issue fines automatically. The system can use cameras, sensors, and other devices to capture images and data of vehicles and drivers violating traffic rules. The collected data can then be analyzed using AI algorithms to identify the type of violation and issue an appropriate fine. By automating the process, the system can eliminate the possibility of human errors and ensure transparency and accuracy in issuing fines.

III. LITERATURE SURVEY

In [1] Xuemei Xie research Says that The increasing illegal parking has become more and more serious. Nowadays the methods of detecting illegally parked vehicles are based on background segmentation. However, this method is weakly robust and sensitive to environment. Benefitting from deep learning, this paper proposes a novel illegal vehicle parking detection system. Illegal vehicles captured by camera are firstly located and classified by the famous Single Shot MultiBox Detector (SSD) algorithm. To improve the performance, we propose to optimize SSD by adjusting the aspect ratio of default box to accommodate with our dataset better.

In a research study conducted by Y Mohona Roopa [2], the primary goal was to fully automate the process of detecting helmet usage and issuing fines. Previously, traffic surveillance was largely semi-automated or completely reliant on human input. However, the new system being proposed aims to detect vehicles without helmets using CCTV footage and extract the license plate. The number is then searched in a database to obtain the registered phone number. The image of the footage, along with details of the fine and payment options, is mailed and sent via message to the registered phone number. The information is also updated online for future reference. This automated process allows for efficient and accurate enforcement of helmet usage regulations and promotes compliance with traffic rules..

In [3] the proposed system is an android-based solution for automating the process of detecting and enforcing traffic rule violations. It aims to address the challenges associated with manual traffic rule enforcement by utilizing QR code technology and online payment methods.

In this system, a QR reader is used to scan the QR code attached to each vehicle. This code, which is mandatory for all vehicles, is obtained when the vehicle is purchased or when the driver receives their license from the Road Transport Office (RTO). When a violation is detected, the system extracts the QR code from the footage and uses it to search for the registered phone number in a database. An image of the footage, along with details of the violation and a payment request, is then sent to the registered phone number via SMS or UPI app. The fine is automatically collected from the owner's bank account, and the information is updated online for future reference.

In [4] The program for generating QR codes is implemented using the JavaScript language and run on a node.js server. The generated QR code is displayed on a web browser for the user to view and scan. In order to add an additional layer of security, the QR code is encrypted using Elliptical Curve Cryptography

(ECC).

To scan or read the encrypted QR code, the user needs to install a QR code scanner app on their smartphone. There are many such apps available for free on app stores. Once the app is installed, the user can start the application and use the smartphone camera to scan the QR code. The app will automatically display the content of the QR code once it has been scanned.

In[5],First, a selection of QR code images were chosen and the mobile phone QR code reading software was used to try and read the information contained within them. The statistical recognition rate of the QR code images that could not be read by the software was then analyzed.

Next, the processed QR code images were read using the mobile phone QR code reading software, and the statistical recognition rate was analyzed. The results showed that the QR code reading rate after processing by the system algorithm in this article increased by 14%. This demonstrates the effectiveness of the algorithm in improving the recognition rate of QR code images.
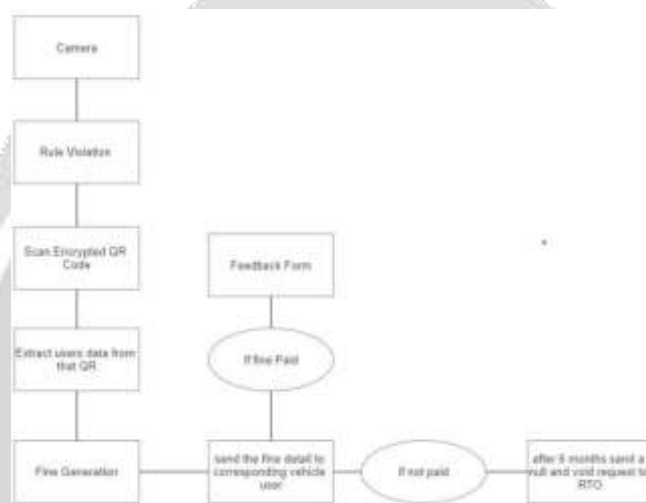
IV. PROPOSED METHODOLOGY

Fig1: flow diagram of proposed methodology

The proposed system aims to fully automate the process of detecting traffic rule violations and issuing fines using CCTV cameras as shown in fig 1. When a violation is detected, the system extracts the vehicle's license plate or QR code from the footage and searches for the associated phone number in a database. The system then sends an image of the footage, along with details of the violation and a UPI payment request, to the registered phone number. The information is also updated online for future reference. The automated process involves several stages, including the detection of the violation, identification of the vehicle, and issuance of the fine..

A. Violation Recognition

In this module we are using Computer vision and Object detection technique to basically detect a vehicle standing in non parking area, thereby capturing the QR code attached to the vehicle.Their will be a parking violation.

B. Training over model

Training a model over Haar cascades involves using positive and negative samples of images to train a classifier. Positive samples represent the object to be detected, while negative samples are images without the object. These samples are used to train the classifier, which learns to distinguish between the object and non-object images. The trained classifier can then be used to detect the object in new images or videos. Tuning the parameters and the quality of the samples can improve the performance of the classifier.

C. QR Code Generation

In this module, we have used python's qrcode module to generate the Qr Code and in this module encrypted data is embedded inside the Qr code. We have used make_image module method of Qr code object to generate the Qr code image.

D. QR Code Encryption and Decrption.

In this module we have intially enrypted the user's information using Fernet symmetric key which is an extension of AES algorithm. From this Fernet Algorithm a secret key is generated which is used for decrypt users enrypted data during user info extraction.

E. Users Number Extraction

In this Module first the Qrcode is scanned when there is traffic violation. From the Qr code we extract the users data after running fernet deryption algorithm on it. And from that Users data is send to backend server through an exposed api endpoint.

F. Fine Generation

Once the user data is sent over server through an exposed API endpoint, the api module will fetch the data with helpof routing system in ExpressJs. These fetched data will be pushed to the database (i.e. MongoDB) and simultaneouslya payment request link will be send automatically through Email and SMS with the help of instance.paymentLink.create method in Razorpay API.

All the details of rule violators will be displayed in tabularformat on the E-challan website with help of MUI library and ReactJs. The system also keeps track of the payment link status and user data in the database, ensuring efficient and accurate record keeping. Whenever someone from officer side access the E-challan website, the payment link staus of each violator is checked with help of instance.paymentLink.fetch(req) in Razorpay APi and data in database will get updated. The data of users who have paid the fine will be stored in different database from the data of users with pending status.

Users who have violated the rule can pay the fine with any method i.e.Debit/Credit card, Netbanking, or even UPI. They will also get a message containing payment link, rule violated, amount to be paid which will be set by default, and place where they were caught violating the rule.
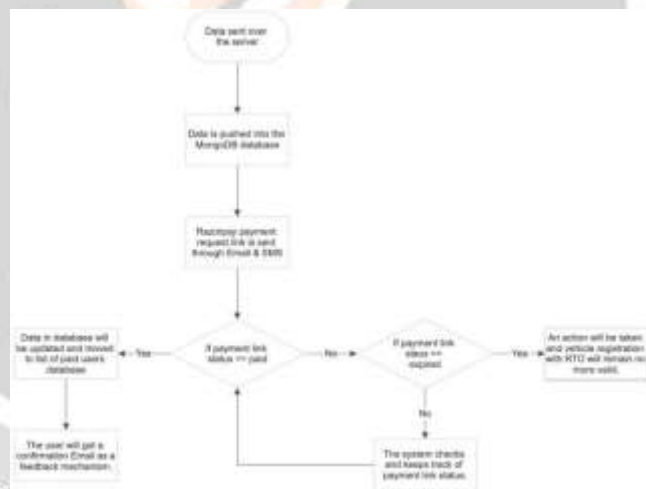

Fig2. Activity in fine generatoin

G. Feedback Mechanism

Once the user pay the fine with payment link, they will also get a payment confirmation email from the organisation involved. These acknowledgment will be sent with the help of Nodemailer module in NodeJs. As the payment link status of the rule violator get updated (i.e. staus: paid), Nodemailer will send an confirmation email tothe violator as a feedback mechanism.

IV Result Analysis

Traffic amercement automation is a system that automates the process of issuing and managing traffic fines. The system uses various technologies like cameras, sensors, and artificial intelligence to capture traffic violations and issue fines to the violators automatically.

The result analysis of traffic amercement automation includes various aspects like efficiency, accuracy, cost-

effectiveness, and safety.

Traffic amercement automation can significantly increase the efficiency of the traffic enforcement process. The automated system can detect and issue fines to a large number of violators in a short period. This reduces the workload on the traffic police and increases the efficiency of the traffic enforcement process.The automated system is highly accurate and can detect traffic violations with a high degree of accuracy. This reduces the chances of false fines and ensures that only genuine violators are fined.The system can significantly improve safety on the roads by enforcing traffic rules strictly. It can also reduce the chances of bribery and corruption, ensuring a fair and transparent system

However, there are also some concerns regarding the implementation of traffic amercement automation. Some people argue that the system can be prone to errors, and there may be privacy concerns regarding the use of cameras and sensors. The system may also face opposition from those who are fined and may lead to public

resentment if not implemented properly

Fig: Website of E-challan

Fig: fine created

Fig: Pyament requests

V Conclusion

Automating the process of collecting traffic fines using violation detection and qr code encryption can have several benefits. One of the main advantages is that it can make the process more efficient and convenient for both the authorities and the individuals who have received the fines. With QR code recognition, authorities can easily identify vehicles that have been involved in traffic violations and automatically send a fine to the owner of the vehicle by extracting data from Encrypted QR code. This can save time and effort for both parties, as the individual does not have to physically visit a payment center to pay their fine.

Another benefit is that automating the fine collection process can help to reduce errors and fraud. By using violation detection technology, it is easier to track and verify transactions, ensuring that the correct amount is being paid by the right person. This can help to prevent individuals from trying to evade paying their fines or from being wrongly charged.

Overall, automating the process of collecting traffic fines for traffic violation and QR code technology can improve the efficiency and accuracy of the process, making it more convenient for both the authorities and individuals. It can also help to reduce errors and fraud, ensuring that the correct amount is being paid by the right person.

Referance

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