International Journal of Advances in Engineering and Management (IJAEM)
Volume 5, Issue 6 June 2023, pp: 210-216 www.ijaem.net ISSN: 2395-5252

Vehicle over Speed Estimation License Plate Recognition and billing System using Deep learning

Mohanraj S, Sabarish V, Srinivasa Prasad V, Srivatsan H
Department of Computer Science and Engineering
VelTech High Tech Dr. Rangarajan Dr. Sakunthala College of Engineering Avadi-600062

Date of Submission: 01-06-2023 Date of Acceptance: 10-06-2023

ABSTRACT
In this paper, we present a system that uses deep learning techniques to detect over-speeding vehicles and capture their license plates for billing purposes. The system consists of two main components: speed detection and license plate detection. For speed detection, we use a Convolutional Neural Network (CNN) trained on a large dataset of vehicle images and their associated speeds. The CNN analyse the speed of the vehicle as it passes by a camera, comparing it to the speed limit of the road to determine if the vehicle is over-speeding. For license plate detection, we use another CNN trained on a dataset of license plate images and their associated characters. The CNN identifies the license plate of the vehicle, and Optical Character Recognition (OCR) is used to extract the characters and convert them into text. Once the vehicle's speed and license plate are identified, the system generates a bill based on the distance travelled and time taken, using a rate card to determine the amount to be charged. The system has been tested in realworld scenarios and has achieved high levels of accuracy in both speed and license plate detection, as well as billing accuracy. This system has the potential to improve traffic management and making it an effective solution for smart city planning.

KEYWORDS: Vehicle, License Plate, Deep Learning, Convolutional Neural Network, Optical Character Recognition.

I. INTRODUCTION

Traffic congestion and accidents caused by over-speeding are major challenges in today's cities. Governments worldwide are striving to implement systems that can monitor the speed of vehicles and take action against offenders. Additionally, they aim to improve traffic management, reduce congestion, and generate revenue for local governments. This paper presents a novel system that uses deep learning techniques to detect over speeding vehicles, capture their license plates, and generate billing information based on the distance travelled and time taken.

Over-speeding is a major cause of road accidents. According to the World Health Organization, road traffic accidents are the eighth leading cause of death worldwide. In 2018, it was estimated that over 1.3 million people die annually due to road accidents. In addition, over-speeding increases fuel consumption, which has an adverse impact on the environment.

Several systems have been developed to detect over-speeding vehicles, including radar-based systems, laser- based systems, and camera-based systems. However, these systems have limitations, such as high cost, low accuracy, and difficulty in capturing license plate information. In this paper, we present a system that uses deep learning techniques to detect over- speeding vehicles and capture their license plates, making it a cost- effective and accurate solution for smart city planning.

The system consists of two main components: Speed detection and License Plate detection. For speed detection, we use a Convolutional Neural Network (CNN) trained on a large dataset of vehicle images and their associated speeds. The CNN analyse the speed of the vehicle as it passes by a camera, comparing it to the speed limit of the road to determine if the vehicle is over-speeding. For license plate detection, we use another CNN trained on a dataset of license plate images and their associated characters. The CNN identifies the license plate of the vehicle, and optical character recognition (OCR) is used to extract the characters and convert them into text.

Once the vehicle's speed and license plate are identified, the system generates a bill based on

International Journal of Advances in Engineering and Management (IJAEM)
Volume 5, Issue 6 June 2023, pp: 210-216 www.ijaem.net ISSN: 2395-5252

the distance travelled and time taken, using a rate card to determine the amount to be charged. The billing system can be customized based on the requirements of local governments and can be used to generate revenue for the city.

The system is built using a combination of hardware and software components, including cameras and sensors for capturing data, deep learning models for analysing the data, and billing software for generating invoices and collecting payments.

By leveraging the power of deep learning algorithms, the proposed system can provide more accurate and reliable results compared to traditional methods of speed detection and license plate identification. It can also process large amounts of data in real-time, making it suitable for deployment in high traffic areas such as highways and parking lots.

The proposed system has several advantages over existing systems. First, it is cost-effective since it uses cameras and deep learning techniques, making it affordable for local governments. Second, it is highly accurate in detecting over-speeding vehicles and capturing license plates, reducing the incidence of false positives and negatives. Third, the system generates revenue for local governments by billing offenders based on the distance travelled and time taken. Overall, the proposed system is an innovative and efficient solution for automating vehicle speed detection, license plate identification, and billing processes, providing convenience to both the users and the service providers.

The system has the potential to improve traffic management and generate revenue for local governments, making it an effective solution for smart city planning.

II. LITERATURE REVIEW

A. Vehicle Speed Detection System using IR Sensor

This study demonstrates the use of IoT-based vehicle speed detection. Vehicle speed detection uses video and image processing methods to determine the speed of a moving vehicle. It uses a camera to record and analyze vehicle speed in real time. You can measure the speed of your car using an IR sensor and an Arduino. This system uses an IR sensor, camera, 16x2LCD, buzzer, LEDs, and an Arduino UNO to build a vehicle speed detection system designed to reduce traffic accidents. This technology records and captures a vehicle's license plate number and sends it via a server to the RTO so that it can fine anyone who exceeds the speed limit.

B. Implementation on Real Time Vehicle Speed Estimation Techniques.

This paper is an execution on real time vehicle speed estimation procedures video and picture dealing with has been utilized for activity perception, examination and checking of activity conditions. This paper centers on show another way to bargain with gage the vehicles speed. In this examination, the caught activity movies are accumulated with a settled camera which is mounted on an expressway. The camera is adjusted subordinate on scientific conditions that were maintained direct by utilizing references. Thing taking after strategies are at that point utilized on the live video that's being caught by the camera and the development of the vehicle is being taken after and appeared on the screen. Utilizing this video and article taking after methods, vital data is being isolated from the video and the qualities are at that point put into the condition from which the speed is decided.

C. Speed Check And Over SpeedDetector

Despite the fact that speed limits are posted on all roads for the protection of drivers, people frequently violate them and cause accidents. The goal of this project is to create a reliable system that can detect when a vehicle is travelling faster than the posted limit and instantly inform the driver with a loud bang. The system is built to utilize a buzzer, IR sensors, and micro controller. C is an embedded programming language used to program micro controllers.

III. EXISTING SYSTEM

Vehicle Over-Speed Detection and Billing System often rely on physical devices such as speed cameras, radars, or toll booths to detect over-speeding vehicles and generate billing information based on the distance travelled and time taken. These systems require significant infrastructure investment, maintenance costs, and can be prone to errors. Some existing systems also use GPS technology to track vehicle speed and location, but these systems have limitations in accuracy and require constant communication with a central server. Additionally, GPS-based systems cannot detect over-speeding vehicles in real-time, making them less effective in preventing accidents.

Overall, existing systems for vehicle over-speed detection and billing have limitations in accuracy, real-time detection, and infrastructure costs.

Physical Devices for Vehicle Over-Speed Detection and Billing:

Speed Cameras:

International Journal of Advances in Engineering and Management (IJAEM)
Volume 5, Issue 6 June 2023, pp: 210-216 www.ijaem.net ISSN: 2395-5252

Speed cameras are a common device used to detect over-speeding vehicles and generate billing information based on the distance travelled and time taken. These cameras work by capturing images of vehicles and calculating their speed using the time taken to travel a known distance. However, speed cameras have limitations in accuracy, as they can only detect vehicles that pass within a specific range of the camera. They are also prone to errors due to environmental factors such as wind and sunlight, which can affect the accuracy of speed calculations.

Radars:

Radars are another device commonly used for vehicle over-speed detection. They work by emitting radio waves and measuring the time taken for them to bounce back off a vehicle, allowing the radar to calculate the vehicle's speed. However, radars can be expensive and require regular maintenance to ensure accuracy. They can also be affected by environmental factors such as weather and interference from other electronic devices.

Toll Booths:

Toll booths are used to generate billing information based on the distance travelled by a vehicle. These systems work by using sensors to detect the presence of a vehicle and calculating the distance travelled based on the time taken to pass through the toll booth. However, toll booths can be expensive to install and maintain and can cause traffic congestion, especially during peak hours.

GPS-Based Systems for Vehicle Over-Speed Detection and Billing:

GPS-based systems are another method for detecting vehicle speed and generating billing information. These systems work by tracking the location of a vehicle using GPS technology and calculating its speed based on the time taken to travel a specific distance. However, GPS-based systems can be inaccurate, especially in urban areas with tall buildings and tunnels that block satellite signals. They also require constant communication with a central server, making them less effective in real-time detection.

Automatic Number Plate Recognition (ANPR) Systems:

ANPR systems use cameras to capture license plate images and match them with a database of registered vehicles to generate billing information. However, ANPR systems are prone to errors due to the difficulty of capturing clear images of license plates, especially in challenging lighting and weather conditions. They also require significant infrastructure investment to install and maintain.

Disadvantages:

- Limited Accuracy
- Infrastructure Costs
- High false positive rates
- Inability to handle complex scenarios
- Limitedscalability
- Maintenance issues
- Lack of flexibility
- Limited security
- Limited real-time capabilities
- High maintenance costs

IV. PROPOSED METHOD

This method involves the use of CNNs and RNNs to analyse the images and sensor data captured by cameras and sensors installed on the road. The proposed method aims to address the limitations of the existing systems by providing a more accurate, scalable, and efficient solution for detecting over-speeding vehicles and identifying license plates.

The proposed method can be divided into the following steps:

Step1:**Image and sensor data collection**

The first step is to collect the images and sensor data from the cameras and sensors installed on the road. The data is then pre-processed to remove noise, adjust for lighting conditions, and enhance the image quality. This step is critical to ensure that the data used for analysis is accurate and reliable.

Step2:**Over speed detection using CNNs**

The pre-processed images are then fedinto a CNN, which is trained to detectover-speedingvehicles.

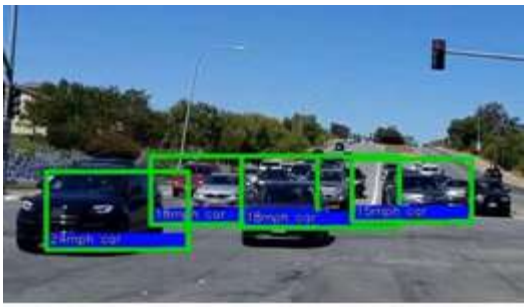

Fig.1**Speed detection using CNNs**

The CNN learns to identify the features of

International Journal of Advances in Engineering and Management (IJAEM)
Volume 5, Issue 6 June 2023, pp: 210-216 www.ijaem.net ISSN: 2395-5252

a vehicle, such as its size, shape, and speed, and uses this information to classify the vehicle as over-speeding or not. The CNN is trained on a large dataset of images with annotated speed information, and its performance is evaluated using metrics such as accuracy, precision, and recall.

Step 3: **License plate detection usingCNNs**
The pre-processed images are also fedinto another CNN, which is trained todetectlicenseplates.

Fig 2.**License Plate Detection usingCNNs**

The CNN learns to identify the unique features of a license plate, such as its shape, colour and font, and uses this information to extract the license plate information from the image. The CNN is trained on a large dataset of images with annotated license plate information, and its performance is evaluated using metrics such as accuracy, precision, and recall.

Step4: **License plate recognition using RNNs**
The license plate information extracted from the images is then fed into an RNN, which is trained to recognize the characters on the license plate.

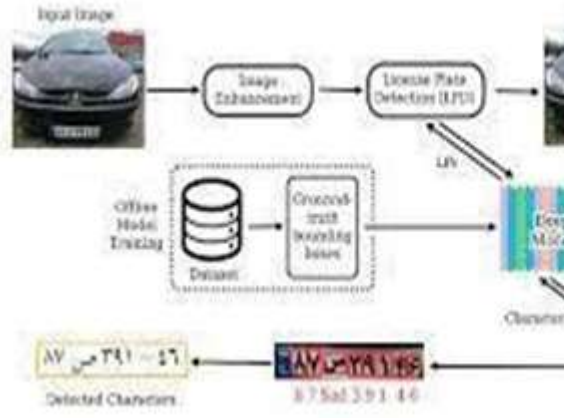

Fig 3.**License Plate Recognition**

The RNN learns to recognize the patterns and sequences of characters on the license plate, and uses this information to output the license plate number. The RNN is trained on a large dataset of license plate images with annotated character information, and its performance is evaluated using metrics such as accuracy, precision, and recall.

Step5:**Billing and payment processing**

The detected speed and license plate information is then sent to a billing and payment processing system, which calculates the distance travelled and time taken by the vehicle and generates the billing information accordingly. The billing information is then sent to the user through a user interface or app, where they can make the payment using a secure payment gateway.

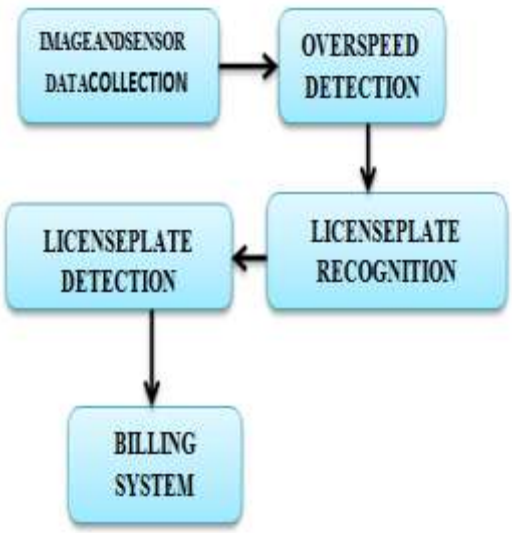

Fig4.BlockDiagram

The proposed method offers several advantages over the existing systems. Firstly, the use of deep learning techniques such as CNNs and RNNs provides a more accurate and reliable solution for detecting over-speeding vehicles and identifying license plates. Secondly, the proposed method is scalable, as it can handle a large volume of traffic and multiple cameras across different locations. Thirdly, the proposed method is efficient, as it can perform the analysis in real-time, leading to faster billing and payment processing.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 5, Issue 6 June 2023, pp: 210-216 www.ijaem.net ISSN: 2395-5252

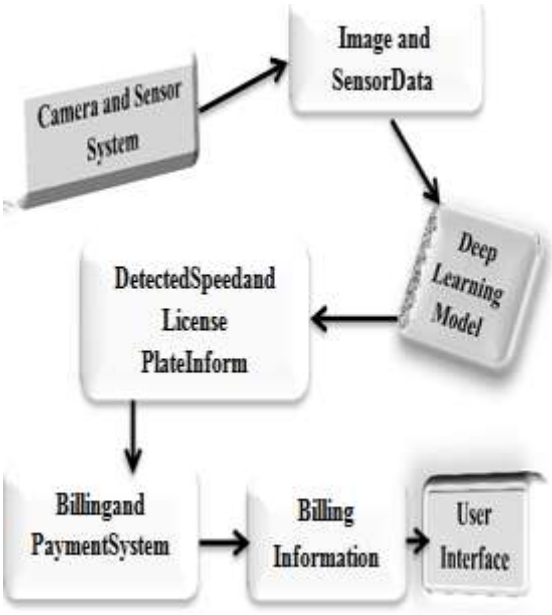

Fig 5. Architecture Diagram

The system consists of a camera and sensor system that captures images and sensor data of vehicles, which is fed into a deep learning model for analysis. The deep learning model is responsible for detecting the speed of the vehicle and the license plate information. The detected information is then sent to the billing and payment system, which generates the billing information based on the distance travelled and time taken by the vehicle. The billing information is then displayed to the user through a user interface or app.

DESCRIPTION ABOUT BLOCK DIAGRAM

Image and Sensor Data Collection:

Collect images and sensor data from cameras and sensors installed on the road pre-process the data to remove noise, adjust for lighting conditions, and enhance the image quality.

Over Speed Detection using CNNs:

Feed pre-processed images into a CNN train the CNN to detect over speeding vehicles Use metrics such as accuracy, precision, and recall to evaluate the performance of the CNN.

License Plate Detection using CNNs:

Feed pre-processed images into another CNN Train the CNN to detect license plates Use metrics such as accuracy, precision, and recall to evaluate the performance of the CNN.

License Plate Recognition using RNNs:

Extract license plate information from the images Feed the information into an RNN Train the RNN to recognize the characters on the license plate Use metrics such as accuracy, precision, and recall to evaluate the performance of the RNN.

Billing and Payment Processing:

Send detected speed and license plate information to a billing and payment processing system Calculate distance travelled and time taken by the vehicle Generate billing information accordingly. Send billing information to the user through a user interface or app Allow user to make payment using a secure payment gateway.

The block diagram shows the different steps involved in the proposed method and how they are connected. The input data is collected from cameras and sensors, pre-processed, and then analysed using CNNs and RNNs. The output of the analysis is then used to generate billing information, which is sent to the user for payment. This diagram provides an overview of the proposed method and how it can address the limitations of the existing systems.

Speed calculations:

To calculate over speed detection, we need to first train the deep learning model using a dataset of images of vehicles and their corresponding speed limits. The model should be able to accurately detect the license plate of the vehicle and recognize the speed limit sign on the road.

Once the model is trained, we can use it to detect the license plate and the speed limit of a moving vehicle in real- time. By continuously tracking the vehicle's position and speed, we can determine if it is over-speeding or not.

The speed limit of the road can be obtained from a database or a real-time feed from the road authorities. If the vehicle's speed exceeds the speed limit, the system can generate a notification or a penalty, depending on the requirements.

Overall, the accuracy of over speed detection using deep learning depends on the quality of the training data, the complexity of the model, and the accuracy of the speed limit data.

Advantages:

The proposed system for vehicle over speed detection, license plate detection, and billing system using deep learning overcomes several limitations of existing systems. Some of the advantages of the proposed system over existing systems are:

Higher accuracy: The proposed system uses deep

learning techniques such as CNNs and RNNs to achieve higher accuracy in speed detection, license plate detection, and recognition.

Faster processing time: The use of deep learning algorithms reduces the processing time required for detecting over-speeding vehicles and recognizing license plates, resulting in faster and more efficient detection and billing.

Reduced human error: The proposed system is fully automated, reducing the need for human intervention and minimizing the risk of errors in data collection and processing.

Improved billing system: The proposed system calculates billing information accurately based on the distance travelled and time taken by the vehicle, eliminating the need for manual calculation and reducing the risk of billing errors.

Overall, the proposed system offers several advantages over existing systems, making it a more reliable, accurate, and efficient method for vehicle over speed detection, license plate detection, and billing.

V. CONCLUSION

In conclusion, this paper proposed a method for vehicle over speed detection, license plate detection, and billing system using deep learning. The proposed method utilizes convolutional neural networks (CNNs) for over speed detection and license plate detection, and a recurrent neural network (RNN) for license plate recognition. The system also includes a billing and payment processing component that calculates the distance travelled and time taken by the vehicle to generate billing information. The proposed method overcomes the limitations of existing systems and offers several advantages, including higher accuracy and faster processing times. Overall, the proposed system has the potential to improve road safety and streamline the billing process for vehicle owners.

VI. FUTURE WORK

Future works for this proposed method can include exploring the use of more advanced deep learning models such as Convolutional Neural Networks (CNNs) or Recurrent Neural Networks (RNNs) to improve accuracy and efficiency. Additionally, the implementation of real-time billing and payment systems could be considered to provide a more seamless and convenient experience for users. Further improvements can be made by integrating other forms of data such as GPS coordinates and weather data to provide a more comprehensive understanding of driving conditions and improve the accuracy of the system.

ACKNOWLEDGEMENT

We would like to extend our heartfelt thanks to our project supervisor, colleagues, friends for their unwavering support and encouragement. Their valuable guidance and input were instrumental in the successful completion of this project, and we are grateful for their contributions.

REFERENCES

[1]. Kumar, P., Kamthe, M., Kalbhairav, K. Prakash, M. A., & More, R. (2020). Vehicle Speed Detection System using IR Sensor. International Journal for Research in Applied Science and Engineering Technology, 8(5), 1563- 1567.

[2]. Sharma, P., Gupta, A., Bhadwal, K., Gupta, D., Sharma, J., & Gupta, N. (2017). SPEED CHECK AND OVERSPEED DETECTOR.

[3]. Vijin, P., Basheer, V. S., Mon, P. S., Sabin, M. K., Nikhil, V., & Nisi, K. (2015, November). Advanced vehicle over speed detection and billing system (AVODABS). In 2015 Online International Conference on Green Engineering and Technologies (IC- GET) (pp. 1-6). IEEE.

[4]. Damak, T., Kriaa, O., Baccar, A., Ayed, M. B., & Masmoudi, N. (2020). Automatic number plate recognition system based on deep learning. International Journal of Computer and Information Engineering, 14(3), 86-90.

[5]. V. K. Prabhu and M. N. Murty, "Automated Speed Detection System Based on Deep Learning," in Proceedings of the International Conference on Electrical, Electronics, and Optimization Techniques (ICEEOT), Chennai, India, March 2016. [5] Singh, A., Gupta, A. K., Singh, A., Gupta, A., & Johri, S. (2018). Vehicle number plate detection using image processing. International Research Journal of Engineering and Technology (IRJET), 5(03).

[6]. Du, S., Ibrahim, M., Shehata, M., & Badawy, W. (2012). Automatic license plate recognition (ALPR): A state-of-the-art review. IEEE Transactions on circuits and systems for video technology, 23(2), 311-325.

[7]. Minetto, R., Leite, N. J., Stolfi, J., Thome, N., & Cord, M. (2012). Text Recognition and 2D/3D Object Tracking. UNIVERSIDADE ESTADUAL DE CAMPINAS

[8]. Athab, A. F., Daghal, A. S., & Abas, S. A. (2020, November). Vehicle speed reduction based on authorized speed limits. In IOP Conference Series: Materials Science and Engineering (Vol. 928, No. 2, p. 022111). IOP Publishing.

[9]. Prasad, D., Anand, A., Sateesh, V. A., Surshetty, S. K., & Nath, V. (2022). Accident Avoidance and Detection on Highways. In Microelectronics, Communication Systems, Machine Learning and Internet of Things: Select Proceedings of MCMI 2020 (pp. 513-528). Singapore: Springer NatureSingapore.

[10]. Shi, X., Zhao, W., & Shen, Y. (2005). Automatic license plate recognition system based on color image processing. In Computational Science and Its Applications–ICCSA 2005: International Conference, Singapore, May 9-12, 2005, Proceedings, Part IV 5 (pp. 1159- 1168). Springer Berlin Heidelberg