International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 06 | June - 2023 SJIF Rating: 8.176 ISSN: 2582-3930

TWO WHEELERS TRAFFIC VIOLATION FINDER AND WARNING SYSTEM

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Abstract—**In recent years, riding a motorcycle has become one of the most convenient ways for consumers to go to their destination. The safety of riders depends greatly on their wearing helmets. Helmets are very important and necessary for the safety of motorcyclists, however, officers find it difficult to enforce the laws regarding the wearing of authorized helmets. In recent years, the real-time video monitoring of helmet wearing based on deep learning has attracted extensive attention. This project presents an automatic surveillance system for detecting two-wheeler drivers without helmets and recognizes their License plate numbers in the system. The proposed system is to solve this problem by automating the process of detecting the riders who are riding without helmets. The automated system for Helmet and Number Plate Detection and Recognition were to first detect if someone is wearing a helmet or not, if he is wearing it, no problem, but if not, detect his number plate and send an e-challan to him.The license plate is provided as the output in case the rider is not wearing a helmet. Theextracted registration numbers are then stored in a database for further identification of the bikers without helmets. This project can help local authorities to quantify the compliance levels of motorcyclists and prevent irreversible damage to them. To achieve an efficient helmet detection model, machine learning classifier is applied to the moving object to identify if the moving object is a two-wheeler. And then the system used the Faster Region Convolution Neural Network object detection model using transfer learning.For number plate recognition the system usesEasyOCR. As a result, the model with the best training received a mAP(Mean Average Precision) of 97%. The proposed system outperforms other related real-time helmet detection systems and license plate recognition models. This proposed system may be used on any CCTV camera to monitor motorcyclists to see if they are wearing a helmet or not**

INTRODUCTION

Helmet, defensive covering for the head, one of the most universal forms of armour. Helmets designed to handle major crash energy generally contain a layer of crushable foam. When you crash and hit a hard surface, the foam part of a helmet crushes, controlling the crash energy and extending your head's stopping time by about six thousandths of a second (6 ms) to reduce the peak impact to the brain. Rotational forces and internal strains are likely to be reduced by the crushing.

A motorcycle helmet is a type of helmet used by motorcycle riders. Motorcycle helmets contribute to motorcycle safety by protecting the rider's head in the event of an impact. They reduce the risk of head injury by 69% and the risk of death by 42%. Their use is required by law in many countries. Motorcycle helmets consist of a polystyrene foam inner shell that absorbs the shock of an impact, and a protective plastic outer layer. Several variations exist, notably helmets that cover the chin area and helmets that do not. Some helmets provide additional conveniences, such as ventilation, face shields, sun visors, ear protection or intercom.

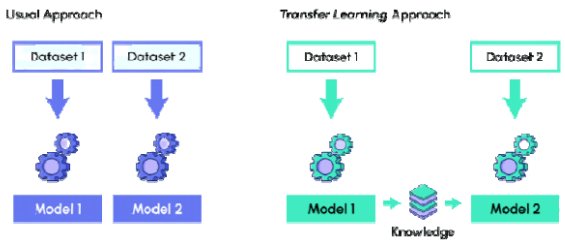
A motorcycle helmet is a crucial safety accessory not only for riders but also for passengers.However, people often tend to skip wearing these protective headgears, thereby leading to dangerous accidents.To avoid such incidents, you must learn and understand the importance of a helmet.Here, we have put forward a list of several understand the importance of wearing a helmet.

Problems Identified

In India, the number of accidents occurring each day is rapidly. The two-wheelers account 25 percent of road crash deaths because of ignoring safety measures like wearing helmets while driving. More than two drivers are travelling in a two-wheeler is also a major reason.Over the most recentfew years alone most of the deaths in accidents are due todamage in the head resulting in trauma to the skull or mind. In light of this, wearing a helmet is obligatory according to traffic rules, violation of which pulls in heavy fines. Inspite, an enormous number of motorcyclists don't comply with the standard. The police officer attempted to control this issue physically, however it is insufficient for the real circumstance. The requirement for security measures is an unquestionable requirement to decrease the number of deaths in road accidents, and use of helmets is a significant factor regarding safety. Even though helmets are for the safety of the riders, most of them avoid it due to reasons like “it spoils my hairstyle”, “it feels uncomfortable”,” good helmets are costly” or “it obstructs my peripheral vision”. These reasons are not comparable to losing a life. The existing system for checking

whether a rider is wearing a helmet or not is a checkpoint by police or other personnel to manually check each rider. In this system, there is an impossibility of riders evading checkpoints.Thus the importance of automatic systems in traffic control has been increased in recent years. Presently, all major urban areas already deployed huge video reconnaissance systems to keep a vigil on a wide assortment of dangers. In this way utilizing such an already existing system will be a cost- efficient arrangement, however, these frameworks include an enormous number of people whose performance is not significant for long periods of time. Recent studies have shown that human surveillance proves ineffective, as the span of checking ofrecordings expands, the blunders made by people likewise increases.There is many research on visual detection of an intelligent transportation system, such as road detection, traffic flow prediction, license plate recognition and vehicle recognition, but there is few research on helmet detection of motorcyclists. At present, although some motorcycle helmet detection methods have been proposed, there are still some problems: (1) Most of the methods use traditional machine learning technology, which is poor in accuracy and speed. (2) For the detection of motorcycles, most of them use the background subtraction method to get the foreground objects, and then classify them to get motorcycles. However, in a crowded scene, when the motorcycles run slowly or stop, the detection will fail. (3) For helmet detection, many methods use a classification algorithm. However, when there is more than one persons on a motorcycle, it is difficult to judge whether someone is not wearing a helmet. (4) Lack of datasets for complex traffic monitoring scenarios.Therefore, it is necessary to develop an automatic helmet detection of motorcyclist's system based on deep learning to reduce the number of deaths in motorcycle traffic accidents.To achieve an efficient helmet detection model, machine learning classifier is applied to the moving object to identify if the moving object is a two-wheeler. And then the system used the Faster Region Convolution Neural Network object detection model using transfer learning.

Transfer Learning: Transfer learning is a machine learning technique that enables data scientists to benefit from the knowledge gained from a previously used machine learning model for a similar task. This learning takes humans' ability to transfer their knowledge as an example. If you learn how to ride a bicycle, you can learn how to drive other two-wheeled vehicles more easily. Similarly, a model trained for autonomous driving of cars can be used for autonomous driving of trucks.



Objective of the Project:The objective of the project is to design and develop an automated helmet detection system can distinguish person wearing a helmet from those who don't. The no helmet detection system makes transfer learning based automated system for helmet detection using trained models and datasets that would be useful for the public authorities to enforce the law for the betterment of society.

The principle goal of Helmet Detection System is to guarantee the safety of the people wearing them.

- To detect motorcycle
- To detect whether a rider is wearing a helmet or not
- To detect license plate and extract number

LITERATURE SURVEY

1.Deep Learning-Based Automatic Safety Helmet DetectionSystem for Construction Safety

Author:AhatshamHayat and Fernando Morgado-Dias Year:2022

Problem identified: Wearing safety helmets can reduce injuries to workers at construction sites, but due to variousreasons, safety helmets are not always worn properly.

Objective:To Aim of this paper presents a You Only Look Once (YOLO)-based real-time computervision-based automatic safety helmet detection system at a construction site. YOLO architecture is high-speed and can process 45 frames per second, making YOLO-based architectures feasible to use in real-time safety helmet detection.

Methodology: This work proposes a deep learning-based framework architecture to detect workers'helmets at construction sites using a publicly available benchmark dataset. Power-law transformation was initially performed for image enhancement, followed by image rescaling. Finally, a computer vision system was developed using the YOLOv5 object detection algorithm to classify workers with or without a helmet.

Findings:As worker safety is a major concern on construction sites, this study considered helmet detection as a computer vision problem, and proposed a deep learning-based solution.Existing studies have struggled in detecting objects from low-light images and smaller objects (due to the larger distance between the camera and workers).

2.Detection of Non-Helmet Riders and Extraction of License Plate Number using Yolo v2 and OCR Method

Author: Prajwal M. J,Tejas K. B., Year:2019

Problem identified: Riding motorcycle/mopeds without wearing helmet is a traffic violation which has resulted in increase in number of accidents and deaths in India.

Objective: To Aim of the project principle is Object Detection using Deep Learning at three levels. The objects detected are person, motorcycle/moped at first level using YOLOv2, helmet at second level using YOLOv3, License plate at the last level using YOLOv2. Then the license plate registration number is extracted using OCR (Optical Character Recognition).

Methodology:In this section we explainthe frame chosen is given as input to YOLOv2 object detection model, where the classes to be detected are 'Motorbike', 'Person'. At the output,

image with required class detection along with confidence of detection through bounding box and probability value

Findings:A Non-Helmet Rider Detection system is developed where a video file is taken as input. If the motorcycle rider in the video footage is not wearing helmet while riding the motorcycle, then the license plate number of that motorcycle is extracted and displayed. Object detection principle with YOLO architecture is used for motorcycle, person, helmet and license plate detection.

3.An Intelligent Traffic Monitoring System for Non-Helmet Wearing Motorcyclists Detection

Author:Sumisha Samuel, SaanuReghunadh Year:2021

Problem identified: Riding without a helmet is the most common road offense in India. Road safety rules and regulations have to be more strictly followed and enforced. Currently, police officers identify offenders with human surveillance.

Objective: To Aim of this propose an intelligent traffic monitoring system, which can detect non-helmet wearing motorcyclists from video streams using a convolutional object detector in real-time. The system will detect a violation, then attempt to extract the registration number of the vehicle and then persist the violation with evidence.

Methodology:The proposed system is an end-to-end intelligent traffic monitoring solution to detect non- helmet wearingmotorcyclists. The solution uses a convolutional object detector to detect violators from the input video streams in real-time.They replaced manual feature extraction with a Convolutional Neural Network (CNN), leading to significantly higher accuracy.

Findings: This paper helps to an intelligent traffic monitoring system to detect non helmet wearing motorcyclists was built. The confusionmatrix is a table that shows the classification results. Thematrix is composed of four values: true positive (TP), false positive (FP), false negative (FN) and true negative (TN).

4.Helmet Detection and Number Plate Recognition using Machine Learning

Author: Gauri Marathe1, Pradnya Gurav2 ,Year:2022

Problem identified:Motorcycles have always been the primary mode of transportation in developing countries. Motorcycle accidents have increased in recent years. One of the main reasons for fatalities in accidents is that a motorcyclist does not wear a protective helmet.

Objective:To Aim of main goal of helmet is to protect the drivers head in case of an accident. In such a case, if the motorcyclist does not use a helmet, it can be fatal. It is not possible for traffic police force to watch every motorcycle and detect the person who is not wearing a helmet.

Methodology: This paperYOLOv3 algorithm first separates a frame into a grid. Each grid cell predicts some number of boundary boxes (sometimes referred to as anchor boxes) around objects that score highly with the aforementioned predefined classes. The object detection problem is treated as a regression problem in the YOLO algorithm.

Findings:This Paper give the input video wearing helmet, it successfully detects the helmet and shows the confidence score and also it prints “Helmet Detected!” on the consoleWhen the person is not wearing helmet the system searches for the number plate in the frame. Once detected it extracts characters and prints on the console.

5.Helmet Detection using Machine Learning and Automatic License Plate Recognition

Author: Lokesh Allamki1, Manjunath Panchakshari2 Year:2019

Problem identified:Motorcycle accidents have been rapidly growing through the years in many countries. In India more than 37 million people use two wheelers. Therefore, it is necessary to develop a system for automatic detection of helmet wearing for road safety.

Objective: To Aim of this Project is safety equipment of motorcyclist is the helmet. The helmet protects the motorcyclist against accidents. Although the helmet use is mandatory in many countries, there are motorcyclists that do not use it or use it incorrectly. Over the past years many works have been carried out in traffic analysis, including vehicle detection and classification, and helmet detection.

Methodology: This paper proposed real-time helmet detection, there is a need for accuracy and speed. Hence a DNN based model You Only Look Once (YOLO) was chosen. YOLO is a state-of-the-art, real-time object detection system.

Findings:The proposed end-to-end model was developed successfully and has all the capabilities to be automated and deployed for monitoring. For extracting the number plates some techniques are employed by considering different cases such as multiple riders without helmets and designed to handle most of the cases.

6.Helmet Detection and Number Plate Recognition using Machine Learning

Author:Ranveer Roy1, Shivam Kumar,Year:2021

Problem identified:Motorcycle crashes have been on the rise in the last few years. A number of people who are involved in traffic collisions include motorcyclists who do not wear reflective helmets, since they do not believe they provide sufficient protection. Once the traffic police spot those driving motorcycle on a whole-or Motorcycles in junctions-without helmets, they also use video from CCTV to take control of the drivers of those vehicles and penalise those who are riding without one.

Objective:To Aim the role of tracking motorcycle drivers is proposed in this paper to be automated in the scheme. By using machine learning, the device identifies motorists not wearing helmets and automatically provides their motorcyclist's licence plate number on demand, without the need for operators to look it up on driver licence photos at camera posts.

Methodology:This proposed system, first we apply adaptive background subtraction to detect the moving objects. These moving objects are then given to a CNN classifier as input which then classifies them into two classes, namely, motorcyclists and non-motorcyclists. After this, objects other than motorcyclists are discarded and passed only objects predicted as motorcyclist for next step where we determine weather the motorcyclist is wearing a helmet or not again using another CNN classifier.

Findings:This paper help our bike scanning and tracking device is capable of finding a bike owners that doesn't need any human interference as yet it has been used to recognise helmetless motorcyclists successfully; it has had already been very effective in identifying motorcycle .

Existing System

Traditional Machine Learning Methods:

Traditional methods mostly adopt similar ideas. The first step is moving object detection. First, the motion segmentation method is used to extract moving objects from surveillance videos. Common motion segmentation methods include optical flow, frame difference and background subtraction. Second, hand-designed feature descriptors, such as local binary pattern (LBP), histogram of oriented gradient (HOG), scale invariant feature transform (SIFT), are used to extract the features of motorcycles and other vehicles. Finally, motorcycles are classified by binary classifiers (such as support vector machine (SVM) and K-nearest neighbour (KNN)).

Deep Learning Model:

In recent years, researchers have proposed some methods based on deep learning. In the background subtraction method and the SMO classifier are used to detect motorcycles from videos. Then, hand-crafted features and CNN are used to classify helmet and no helmet respectively. Finally, it is verified that the accuracy of CNN is higher than that of manual features. Adaptive background subtraction is used to obtain the moving object on the video frame. Then, CNN is used to classify motorcyclists in moving objects. Finally, they continue to use CNN to classify the top quarter area of motorcycles to further identify that motorcyclists do not have helmets. Gaussian mixture model (GMM) is used to segment foreground objects, and then label them.YOLOv3 algorithm to detect whether a motorcyclist is wearing a helmet, but the detection of motorcycles is not reported.

Proposed System

The proposed system used for traffic rule violation monitoring of helmetless motorcyclists and multiple pillion riders on motorbikes. Transfer learning is used to extract the multiscale features, and a single-shot multi-box detector (SSD) has been employed to handle crowded traffic scenarios. The proposed traffic violation detection finder (TVF) model combines aspect ratio aware training in the subsequent fine-tuning stage to improve the detection performance. The proposed TVF model is evaluated on the real-world TVF dataset, collected from surveillance cameras, with busy and sparse roads under different views and weather conditions.

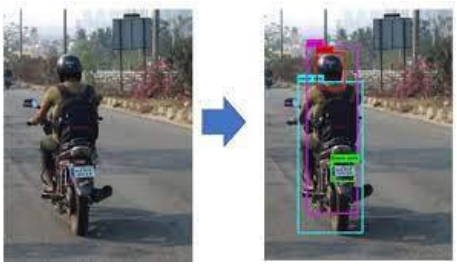
To achieve an efficient helmet detection model, transfer learning classifier is applied to the moving object to identify if the moving object is a two-wheeler. And then the system used the Faster Region Convolution Neural Network object detection model using transfer learning. For number plate recognition the system uses TesseractOCR.

Object Detection using Faster Region Convolutional Neural Network:

Faster R-CNN is a single-stage model that is trained end-to-end. It uses a novel region proposal network (RPN) for generating region proposals, which save time compared to traditional algorithms like Selective Search. It uses the ROI Pooling layer to extract a fixed-length feature vector from each region proposal.

Single Shot Detector (SSD):

Single Shot detector takes only one shot to detect multiple objects present in an image using multibox.It is significantly faster in speed and high-accuracy object detection algorithm.High detection accuracy in SSD is achieved by using multiple boxes or filters with different sizes, and aspect ratio for object detection. It also applies these filters to multiple feature maps from the later stages of a network. This helps perform detection at multiple scales.



SYSTEM DESIGN

System design for the Automatic Surveillance System for Detecting Two-Wheeler Drivers without Helmets and recognizes their License plate numbers and Send Warning and Fine SMS using Temporal Convolutional Network and Tesseract OCR with Python Flask Tensor Flow and MySQL.

1.Data Collection: Surveillance cameras or drones are installed at the desired locations to capture images of two-wheeler riders with and without helmets, as well as images of their license plates. These images are then sent to a server for processing.

2.Pre-processing: The images received from the cameras or drones are pre-processed by resizing, cropping, and converting them to grayscale. This step helps reduce the amount of data that needs to be processed and improves the accuracy of the detection algorithm.

3.Helmet Detection: A computer vision technique such as RPN or YOLO (You Only Look Once) is used to detect whether a rider is wearing a helmet or not. The detected images are then sent to a Temporal Convolutional Network (TCN) to improve the accuracy of the detection algorithm.

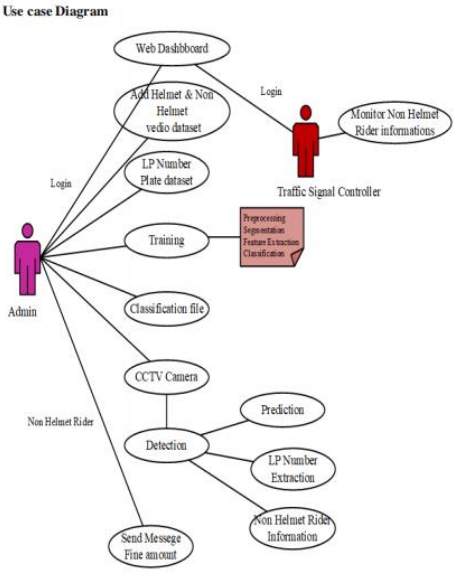
4.License Plate Recognition: Optical Character Recognition (OCR) algorithms such as Tesseract are used to extract the license plate number from the image. The recognized license plate number is then sent to the database for further processing.

5.Alert System: Once a rider without a helmet is detected, a warning message is sent to the rider using a speaker or LED screen. The system captures the license plate number of the rider and checks it against the database to identify the registered phone number of the vehicle owner. Then a fine SMS is sent to the registered phone number.

6.Data Storage: The license plate number and other relevant data such as location, date, and time are stored in a MySQL database for future reference.

7.Deployment: The system is deployed using Python Flask, which creates a RESTful API for the system. Users can interact with the system using a simple web interface.

The system design can be used to develop an Automatic Surveillance System for Detecting Two-Wheeler Drivers without Helmets and recognizes their License plate numbers and Send Warning and Fine SMS using Temporal Convolutional Network and Tesseract OCR with Python Flask Tensor Flow and MySQL. This system can be deployed in public areas such as roads and parking lots to promote safety and reduce accidents.



PROJECT DESCRIPTION

The Automatic Surveillance System for Detecting Two-Wheeler Drivers without Helmets and recognizes their License plate numbers and Send Warning and Fine SMS using Temporal Convolutional Network and Tesseract OCR with Python Flask Tensor Flow and MySQL is a system designed to improve safety on roads and reduce accidents caused by two-wheeler riders who do not wear helmets. The system uses computer vision techniques, deep learning algorithms, and OCR algorithms to detect helmetless riders, recognize their license plate numbers, and send warning messages and fine SMS to the registered phone number of the vehicle owner**.**

2.Helmet Violation Finder Web App: The "Design and Development of Web based Helmet Violation Finder Web App Python Flask and MySQL" module is a key component of the Automatic Surveillance System for Detecting Two-Wheeler Drivers without Helmets and recognizes their License plate numbers and Send Warning and Fine SMS. This module is responsible for the web-based user interface that allows users to interact with the system, view results, and manage system settings.

2.End User Interface: The end-users of the Automatic Surveillance System for Detecting Two-Wheeler Drivers without Helmets and recognizes their License plate numbers and Send Warning and Fine SMS using Temporal Convolutional Network and Tesseract OCR with Python Flask Tensor Flow and MySQL

3.Traffic Dataset Annotations:The Traffic Video Import Dataset module is responsible for importing video datasets into the system for processing. This module is important for the proper functioning of the Automatic Surveillance System for Detecting Two-Wheeler Drivers without Helmets and recognizes their License plate numbers and Send Warning and Fine SMS using Temporal Convolutional Network and Tesseract OCR with Python Flask Tensor Flow and MySQL**.**

4. **Alert or Warning Notification:**The Alert or Notification generation module is responsible for generating warning and fine SMS to the riders who are found violating the helmet rules or number plate requirements. This module will use an SMS API to send SMS to the mobile number registered with the license plate number.The module will receive the rider's information, including the license plate number and mobile number, from the Violation Detection module. The module will then use an SMS API to send SMS to the mobile number registered with the license plate

number.

The SMS will contain information about the

violation, the amount of fine, and the warning to wear a helmet while riding.To use the SMS API, the module will need to authenticate itself with the API service provider. The API credentials, including the API key and API secret, will be stored in a secure configuration file.

The module will read the credentials from this file and use them to connect to the SMS API.Once connected, the module will use the API's functions to send SMS to the mobile number registered with the license plate number. The module will also log the SMS details, including the mobile number, message, and delivery status, in a database for future reference.The module will also handle any errors that occur during the SMS sending process and will log them in the database. If the SMS sending fails, the module will retry sending the SMS a few times before giving up and marking the SMS as failed in the database.

5.Performance Analysis:Performance Analysis module is responsible for evaluating the accuracy and efficiency of the Automatic Surveillance System for Detecting Two-Wheeler Drivers without Helmets and recognizes their License plate numbers and Send Warning and Fine SMS using Temporal Convolutional Network and Tesseract OCR with Python Flask Tensor Flow and MySQL.The module will use various performance metrics to analyse the performance of the system, such as precision, recall, F1-score, and accuracy. It will also analyse the efficiency of the system, such as the time required for processing each frame of the video, the memory utilization, and the CPU usage.The Performance Analysis module will generate reports to visualize the performance metrics and efficiency of the system, which will be useful for further improving the system's accuracy and efficiency. The reports can be in the form of graphs, tables, and charts.The module will also provide options to fine-tune the system by changing the hyper parameters of the model, such as learning rate, batch size, and optimizer. This will help in achieving better accuracy and efficiency.Overall, the Performance Analysis module plays a crucial role in evaluating and improving the performance of the Automatic Surveillance System.

RESULT&IMPLEMENTATION

The proposed system is illustrated in YOLO was used for the real-time detection of motorcycles. There are two stages in the proposed approach. In the first stage, each frame is taken as the input to the YOLO model, which detects all the motorcycles in the frame. Then in the second stage, each detected motorcycle is extracted and passed to the next YOLO model, which detects the helmet, non-helmet, and license plate in the input motorcycle image. If the motorcyclist is non-helmeted, the license plate is extracted from the frame and passed for Optical Character Recognition to extract the characters on the license plate. The output is recorded and can be used to fine motorcycle riders.

CONCLUSION

In conclusion, the Automatic Surveillance System for detecting two-wheeler drivers without helmets and recognizing their license plate numbers and sending warning and fine SMS using Temporal Convolutional Network and Tesseract OCR with Python Flask Tensor Flow and MySQL is a highly efficient and effective system for monitoring and enforcing traffic rules. The system successfully integrates multiple modules to detect and identify violations such as helmetless riding and license plate number recognition.

It also generates alerts and notifications to the respective authorities and violators through SMS. The system's performance analysis shows its high accuracy and speed in identifying and processing the video feed.The feasibility study indicates that this system can be deployed in various locations with a high number of two- wheelers, and its cost-effective and easy-to-maintain infrastructure makes it a suitable solution for both urban and rural areas.

However, further improvements can be made to enhance the system's accuracy and reliability, such as integrating additional modules for detecting other traffic violations, improving OCR accuracy for license plate recognition, and optimizing the system's response time.Overall, the Automatic Surveillance System for detecting two-wheeler drivers without helmets and recognizing their license plate numbers and sending warning and fine SMS using Temporal Convolutional Network and Tesseract OCR with Python Flask Tensor Flow and MySQL is a promising solution for efficient and effective traffic rule enforcement.

Future Enhancement

The Automatic Surveillance System for Detecting Two-Wheeler Drivers without Helmets and recognizes their License plate numbers and Send Warning and Fine SMS using Temporal Convolutional Network and Tesseract OCR has enormous potential for future enhancements and improvements. Some of the future scope of the system are:

- Integration with live streaming: Currently, the system operates on pre-recorded videos. In the future, the system could be enhanced to handle live streaming of video from cameras installed at various locations.

Multi-lingual number plate recognition: The current system uses Tesseract OCR to recognize number plates, which works well for English text. In the future, the system could be enhanced to recognize number plates in other languages as well.

- Automated fine collection: The system could be enhanced to automatically generate fines and collect them

online. This could help reduce the burden on traffic police and make the process more efficient.

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