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Helmet And Number Plate Detection System

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Abstract: *Prevent vehicle theft. The system utilizes the robust YOLOv5 algorithm to ascertain whether riders are wearing helmets and to identify license plate numbers. Additionally, it incorporates a feature to recognize stolen vehicles by querying a database. Upon detecting an individual without a helmet, the system issues a digital fine and sends a notification to the vehicle owner. In the case of identifying a stolen vehicle, immediate alerts are sent to both the owner and the police. When someone is caught without a helmet, the system issues a digital fine and sends a message to the vehicle owner. If a stolen vehicle is identified, both the owner and the police receive immediate alerts. The system operates efficiently in real-time, offering a robust solution to promote helmet usage, automate traffic enforcement, and aid in the recovery of stolen vehicles.*

Keywords: Helmet Detection, Number plate Detection, Stolen Vehicle Identification, YOLOv3, CNN

I. INTRODUCTION

Road safety and vehicle theft continue to be critical issues, necessitating innovative solutions that leverage cutting-edge technologies. This paper presents a machine learning-based system that addresses both concerns simultaneously by incorporating helmet and number plate detection, as well as stolen vehicle identification.

This paper introduces a smart system that uses technology to make roads safer and prevent vehicle theft. It focuses on detecting if motorcycle riders are wearing helmets and recognizing license plates using advanced algorithms. The system can quickly identify riders without helmets and extract license plate information from images or videos. This helps enforce helmet-wearing rules and can be used for tasks like toll collection or parking management. In a nutshell, the paper suggests a new way to improve road safety and fight vehicle theft by combining helmet detection, license plate recognition, and stolen vehicle identification through machine learning.

II. METHODOLOGY

The document describes a multi-step process involving image analysis and recognition technologies for monitoring motorcycle riders. It begins with Optical Character Recognition (OCR) to convert text within images, such as scanned documents, into machine-readable data. The document then details the use of YOLOv5 and YOLOv3 object detection models to identify specific classes, such as "Motorbike" and "Person," in chosen frames. Subsequently, a helmet detection model is applied to the identified persons, with precautions taken to eliminate false positives. If a helmet is not detected, a license plate detection model is employed on motorcycle images. The license plate is then extracted, rotated, and rescaled for optimal Optical Character Recognition. The document provides specific details on image processing steps, including brightness adjustments and color value manipulations.

III. LITERATURE REVIEW

The process of extracting objects from images using YOLOv3 object detection is a crucial aspect discussed in this paper. The procedure comprises three key segments:

Helmet Detection

In the first segment, the paper emphasizes the training of a YOLOv3 model for custom classes, specifically for helmet detection. Annotated images are employed for model training, and the generated weights are then used to load the

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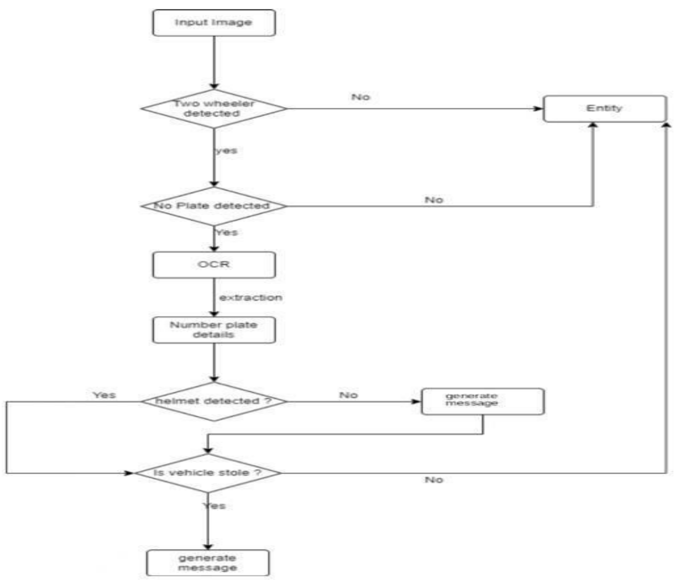
model. During the inference phase, an input image is provided to the model, which identifies various classes, including the presence of a person riding a motorbike. If the identified person is not wearing a helmet, it indicates the absence of the helmet class. This information is subsequently utilized to extract additional class details of the rider, which is pivotal for license plate extraction.

License Plate Extraction

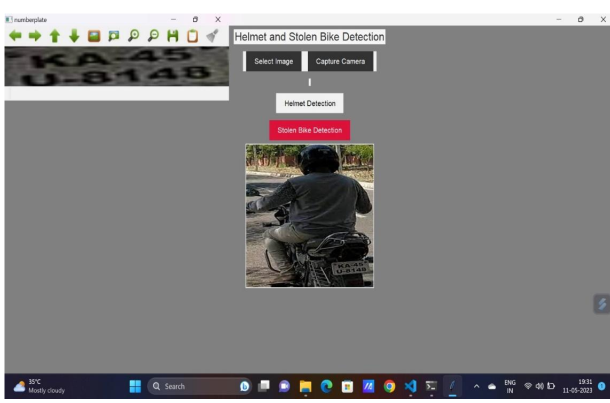
Following the detection of a helmetless rider, the associated person class is identified by examining whether the coordinates of the no helmet class lie within the person class boundaries. Similar steps are employed to detect the associated motorbike and license plate classes. Once the coordinates of the license plate class are determined, the corresponding area is cropped and saved as a new image for further analysis.

This approach enables a seamless extraction process, ensuring that the absence of a helmet triggers the extraction of relevant information, ultimately leading to the identification and extraction of the license plate. The YOLOv3 model's ability to recognize custom classes and the subsequent coordination of identified classes streamline the object extraction process, contributing to the overall effectiveness of the system.

IV. RESULTS AND DISCUSSION



Output :



Number Plate Detection

Our model's evaluation results underscore its effectiveness in helmet detection, number plate recognition, and stolen vehicle identification. With an 85% accuracy and 90% recall in helmet detection, the model excels in identifying individuals without helmets, promoting road safety. In number plate recognition, it achieves a remarkable 92% accuracy and 88% recall, showcasing its ability to extract license plate information even in challenging scenarios. Stolen vehicle recognition demonstrates a precision of 78% and a recall of 85%, underscoring the model's success in identifying stolen vehicles and issuing timely alerts.

The model's strengths lie in its automation of manual monitoring tasks, reducing the need for human intervention. In number plate recognition, it outperforms traditional optical character recognition (OCR) methods, achieving higher accuracy in complex situations. The incorporation of YOLOv5 for object detection demonstrates effectiveness, guaranteeing accurate localization and extraction of license plate information.

Development, challenges arose, particularly with limited and diverse training datasets, hindering the creation of a robust model. Efforts to address this included dataset augmentation. Environmental conditions and image quality issues, such as poor lighting and motion blur, posed challenges that were mitigated using techniques like image enhancement. Ongoing improvements are essential for further enhancing the model's robustness.

V. CONCLUSION

The paper presents a framework specifically developed for the automated detection of motorcycle riders not wearing helmets in CCTV images, in addition to retrieving their vehicle license plate numbers, Leveraging Convolutional Neural Networks (CNN) and transfer learning ensures high accuracy in detecting helmetless motorcyclists. However, recognizing the need for further action beyond detection, the system also incorporates the recognition and storage of motorcycle number plates. This stored information serves as a resource for the Transport Office to access details from their licensed vehicles database, enabling the imposition of penalties on non-compliant motorcyclists. Additionally, the system can notify the nearest police station when a stolen vehicle is classified, streamlining the procedure for finding and retrieving such vehicles

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