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VEHICLE AND HELMET DETECTION AND LICENSE PLATE EXTRACTION

Mrs S. SUNITHA
ASSISTANTPROFESSOR
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
SREYAS INSTITUTE OF ENGINEERING AND TECHNOLOGY
sunithasurarapu@sreyas.ac.in

EEDHULA CHARAN
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
SREYA SINSTITUTE OF ENGINEERING AND TECHNOLOGY
prabhucharan533@gmail.com

DIDUGUPEEY USHA LAKSHMI
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
SREYAS INSTITUTE OF ENGINEERING AND TECHNOLOGY
peeyushadidugu@gmail.com

SUDAM KOUNDINYA
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
SREYAS INSTITUTE OF ENGINEERING AND TECHNOLOGY
sudamkoundinya@gmail.com

Y. OJASVI MANI CHANDANA
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
SREYAS INSTITUTE OF ENGINEERING AND TECHNOLOGY
yenumulaojasvi246@gmail.com

ABSTRACT

In current situation, we come across various problems in traffic regulations in India which can be solved with different ideas. Riding motorcycle/mopeds without wearing helmet is a traffic violation which has resulted in increase in number of accidents and deaths in India. Existing system monitors the traffic violations primarily through CCTV recordings, where the traffic police have to look into the frame where the traffic violation is happening, zoom into the license plate in case rider is not wearing helmet. But this requires lot of man power and time as the traffic violations frequently and the number of people using motorcycles is increasing day-by-day. What if there is a system, which would automatically look for traffic violation of not wearing helmet while riding motorcycle/moped and if so, would automatically extract the vehicles' license plate number. Recent research have successfully done this work based on CNN, R-CNN, LBP, HoG, HaaR features, etc. But these works are limited with respect to efficiency, accuracy or the speed with which object detection and classification is done. In this research work, a Non-Helmet Rider detection system is built which attempts to satisfy the automation of detecting the traffic violation of not wearing helmet and extracting the vehicles 'license plate number. The main principle involved 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). All these techniques are subjected to predefined conditions and constraints, especially the license plate number extraction part. Since, this work takes video a sits input, the speed of

execution is crucial. We have used above said methodologies to build a holistic system for both helmet detection and license plate number extraction.
Keywords: deep learning, yolo algorithm, python, OCR.

INTRODUCTION

In the dynamic landscape of contemporary traffic management, the pervasive issue of non-compliance with helmet regulations among motorcycle and moped riders in India has emerged as a significant concern. This practice not only poses a direct threat to individual safety but also contributes to an alarming rise in accidents and fatalities. Recognizing the pressing need for effective traffic regulation enforcement, this research endeavors to introduce a comprehensive solution through the integration of cutting-edge technologies in computer vision and deep learning. The current scenario involves the manual monitoring of traffic violations, particularly the absence of helmets, through Closed-Circuit Television (CCTV) footage. However, this method is beset by challenges such as labor-intensive processes and time constraints, given the increasing frequency of traffic violations and the expanding population of motorcycle users. Consequently, there is a compelling need for an automated system capable of efficiently and accurately detecting non-compliance with helmet regulations and extracting relevant information, such as license plate numbers.

The proposed research aims to contribute to the field of traffic management by designing a sophisticated system for Vehicle and Helmet Detection, coupled with License Plate Extraction. The primary motivation is to address the shortcomings of existing methodologies and enhance the overall efficacy of traffic regulation enforcement. By leveraging state-of-the-art deep learning techniques, the system aspires to streamline the identification process, ensuring swift and precise detection of non-helmet usage while riding motorcycles or mopeds. The prevalence of traffic violations, specifically the failure to wear helmets, underscores the critical nature of the problem at hand. Non-compliance with helmet regulations not only jeopardizes individual safety but also poses a broader societal risk by contributing to the overall burden of road accidents. Recognizing the severity of this issue, the research aims to bridge the gap between conventional enforcement methods and contemporary technological solutions, thereby establishing a robust and efficient system for ensuring compliance with traffic regulations.

The existing system relies heavily on manual intervention, requiring traffic police to sift through extensive CCTV footage to identify instances of non-helmet usage. This approach is not only resource-intensive but also time-consuming, especially given the escalating frequency of traffic violations and the expanding population of motorcycle users. As a result, the development of an automated system becomes imperative to overcome these challenges and establish a proactive mechanism for enforcing helmet regulations. Deep Learning, a subset of artificial intelligence, has emerged as a transformative force in computer vision applications. Leveraging the capabilities of Deep Learning, this research adopts a multi-level approach to object detection for addressing the specific challenges associated with helmet detection and license plate extraction. The system employs sophisticated models such as YOLOv2 and YOLOv3 (You Only Look Once) at different levels to identify and classify objects within the input video frames.

The three-tiered object detection process begins with the identification of persons and motorcycles/mopeds using YOLOv2. This initial level establishes a foundation for subsequent analysis by pinpointing the primary elements within the video frame. Moving to the second level, YOLOv3 is deployed to specifically detect the presence of helmets on the identified motorcycles or mopeds. This stage is pivotal in isolating instances of non-compliance with helmet regulations, providing a focused approach to enhance safety measures. The final tier of object detection involves the identification of license plates on the detected vehicles, employing YOLOv2. This level completes the comprehensive analysis by extracting vital information for further processing. Subsequently, the system incorporates Optical Character Recognition (OCR) to decipher and extract the alphanumeric characters constituting the license plate number. This intricate process ensures that the system not only identifies instances of non-compliance but also captures essential data for subsequent enforcement and record-keeping. A key consideration in the development of this system is its ability to operate seamlessly in real-time, given that

it processes video inputs. The speed of execution is paramount in ensuring the practical applicability of the proposed solution to the dynamic and rapidly evolving traffic environment. The research strategically incorporates efficient methodologies and optimizations to facilitate the swift analysis of video frames, ensuring that the system operates effectively in real-world scenarios. In conclusion, the proposed research endeavors to address the prevalent issue of non-compliance with helmet regulations among motorcycle and moped riders in India. By integrating advanced deep learning techniques, the system aims to automate the detection of non-helmet usage and license plate extraction, thereby offering a comprehensive solution to enhance traffic regulation enforcement. The utilization of YOLOv2 and YOLOv3 models, coupled with OCR, establishes a robust three-tiered approach to object detection, ensuring accuracy and efficiency in identifying and processing crucial information. As traffic management continues to evolve, the adoption of innovative technologies becomes imperative to create safer and more efficient roadways.

LITERATURE SURVEY

The literature survey for "Vehicle and Helmet Detection and License Plate Extraction" encompasses a review of existing research and methodologies related to computer vision, deep learning, and image processing techniques applied to traffic management and safety. The survey includes studies that have explored helmet detection, vehicle identification, and license plate extraction in various contexts.

1. "A Survey on Object Detection in Video Surveillance of Traffic Scenes"
Authors: Xiaoyu Zhang, Hong Zhang, Xiaoyu Chen
- This survey provides a comprehensive overview of object detection techniques in video surveillance, a crucial aspect of traffic management. It discusses various algorithms, including deep learning approaches, highlighting their strengths and limitations in detecting objects such as vehicles and pedestrians.

2. "Deep Learning for Object Detection: A Comprehensive Review"
Authors: Wengang Zhou, Houqiang Li, Qilin Zhang
- This review delves into deep learning methodologies for object detection, presenting an in-depth analysis of popular models, including YOLO (You Only Look Once) and SSD (Single Shot Multibox Detector). The paper discusses the evolution of deep learning techniques and their application to real-time object detection tasks.

3. "License Plate Recognition Systems: A Survey"
Authors: Suhaila Shamsuddin, S. A. Samad, Fakhrul Zaman Rokhani
- Focusing on license plate recognition systems, this survey explores different approaches, including optical character recognition (OCR) and template matching. The paper reviews challenges and advancements in license plate extraction and recognition, providing insights into techniques applicable to the proposed project.

4. "A Review on Helmet Detection Techniques for Motorcycle Riders' Safety"
Authors: Amir Ashfaq, Laiha Mat Kiah, Ishfaq Ahmad*
- This review specifically addresses helmet detection techniques for enhancing motorcycle riders' safety. It surveys various methodologies, including traditional computer vision techniques and recent deep learning approaches. The paper discusses the importance of helmets and explores the effectiveness of different detection methods.

5. "YOLO9000: Better, Faster, Stronger" Authors: Joseph Redmon, Santosh Divvala, Ross Girshick, Ali Farhadi
- The YOLO9000 paper introduces improvements to the YOLO model, enhancing its capabilities for real-time object detection. Understanding the advancements in YOLO models is crucial for implementing efficient and accurate helmet and vehicle detection in the proposed project.

6. "An Efficient License Plate Recognition System Based on Deep Neural Networks"
Authors: K. Dinesh Kumar, M. Sundhararajan, S. Radhakrishnan
- Focused on license plate recognition, this paper introduces an efficient system based on deep neural networks. The study explores the integration of deep learning techniques for accurate and fast license

plate extraction, offering insights applicable to the license plate extraction module of the proposed project.

7. "Real-time Two-wheeler Rider Helmet Detection and Analysis using Deep Convolution Neural Network"

Authors: V. Ravi, V. Vaidehi

- This study specifically addresses real-time helmet detection for two-wheeler riders using deep convolutional neural networks. Examining the challenges associated with helmet detection, the paper provides valuable insights into improving efficiency and accuracy, aligning with the objectives of the proposed project.

8. "Traffic Surveillance System: A Survey"

Authors: Amara Tariq, Usman Qamar, Naveed Akhtar

- The survey explores various aspects of traffic surveillance systems, including object detection and tracking. It reviews traditional and modern approaches to monitoring traffic, shedding light on methodologies that can contribute to the holistic system proposed for vehicle and helmet detection.

9. "Optical Character Recognition (OCR): A Brief Review"

Authors: Poonam Panjeta, Dinesh Kumar Jain

- This review provides an overview of Optical Character Recognition (OCR) techniques, which play a crucial role in extracting license plate information. Understanding OCR methodologies is essential for optimizing the license plate extraction module of the proposed project.

10. "Deep Learning for Vehicle Detection: A Comprehensive Review"

Authors: Wenhui Li, Wei Zhang, Xiaolong Wang

- Focusing on vehicle detection, this comprehensive review explores deep learning approaches for accurately identifying vehicles in different scenarios. The insights from this review can inform the vehicle detection module of the proposed project.

In summary, the literature survey encompasses a broad range of studies, from object detection in traffic scenes to specific aspects like helmet detection and license plate recognition. By drawing upon these diverse sources, the survey aims to provide a solid foundation for understanding existing methodologies, challenges, and advancements in the field of vehicle and helmet detection, as well as license plate extraction.

PROPOSED SYSTEM

In the realm of road safety, the significance of helmets cannot be overstated, particularly for two-wheeler riders. Helmets play a crucial role in mitigating the impact of collisions and safeguarding the head from severe injuries. They reduce the chances of the skull undergoing rapid deceleration, effectively bringing the motion of the head to near-zero. The cushioning inside the helmet absorbs the impact of a collision, gradually halting the motion of the head while spreading the force over a larger area. This mechanical barrier between the head and potential contact objects significantly minimizes injuries. While traffic rules are established to instill a sense of discipline and reduce the risk of fatalities and injuries, strict adherence to these regulations is often lacking in reality. Efficient and feasible techniques are essential to overcome these challenges, especially concerning the enforcement of helmet-wearing regulations. Manual surveillance of traffic through Closed-Circuit Television (CCTV) is an existing methodology, but its limitations become apparent in the face of the increasing frequency of traffic violations and the growing number of motorcycle users.

In response to these challenges, this project proposes a sophisticated methodology for full helmet detection and license plate extraction. Leveraging advanced technologies such as YOLOv2, YOLOv3, and Optical Character Recognition (OCR), the system aims to automate the identification of traffic violations related to helmet non-compliance. The proposed methodology involves several key steps, including dataset collection, moving object detection, background subtraction, and object classification using neural networks. The existing system relies heavily on manual intervention, with traffic police scrutinizing CCTV recordings to identify instances of helmet non-compliance. This method demands significant manpower and time, making it inadequate for cities with large populations and a high volume

of vehicles. To address these shortcomings, the project introduces a system that automatically detects instances of not wearing a helmet while riding a motorcycle or moped and extracts the vehicles' license plate numbers.

Recent research has explored various approaches based on Convolutional Neural Networks (CNN), Region-based CNN (R-CNN), Local Binary Pattern (LBP), Histogram of Oriented Gradients (HoG), Haar-like features, and more. However, these endeavors have limitations in terms of efficiency and accuracy. To address these shortcomings, the project employs YOLOv2 and YOLOv3, state-of-the-art models for object detection, and OCR for license plate extraction. The project's primary focus is on detecting whether two-wheeler riders are wearing helmets. If a rider is not wearing a helmet, the system proceeds to extract the number plate of the vehicle. The implementation involves several key modules:

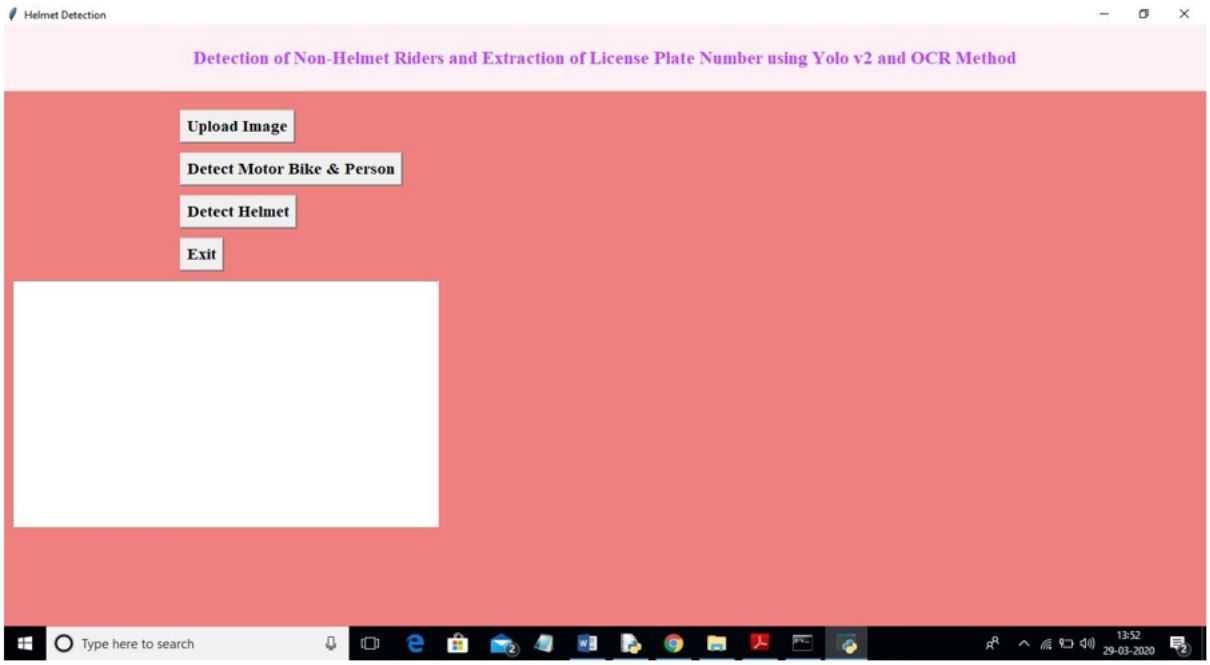
1. Object Detection with YOLOv2: The first module involves uploading an image to the application. YOLOv2 is then utilized to check whether the image contains a person with a motorbike. If the YOLO model detects both a person and a motorbike, the system proceeds to the next step.
2. Helmet Detection with YOLOv3: The second module employs YOLOv3 to determine whether the detected object is wearing a helmet. If the rider is wearing a helmet, the application stops. However, if the rider is not wearing a helmet, the system proceeds to the next module.
3. License Plate Extraction with OCR: In the third module, the system extracts the number plate data using the Tesseract OCR API in Python. The OCR takes the input image and extracts the vehicle number from it.

By implementing this comprehensive methodology, the project aims to contribute to the automation of traffic violation detection, particularly related to helmet usage, and streamline the enforcement of regulations. The integration of advanced deep learning models ensures efficient and accurate object detection, while OCR facilitates the extraction of crucial information from license plates. The need for such a system arises from the inadequacy of manual surveillance in coping with the escalating challenges posed by increasing traffic violations and the rising number of motorcycle users. The proposed methodology not only addresses these challenges but also aligns with the broader objective of enhancing road safety and minimizing injuries. The multi-step process ensures a thorough examination of each image, from detecting the presence of a person with a motorbike to verifying helmet usage and extracting license plate information. This meticulous approach is crucial in achieving accurate and reliable results, especially in a real-time setting where the speed of execution is paramount.

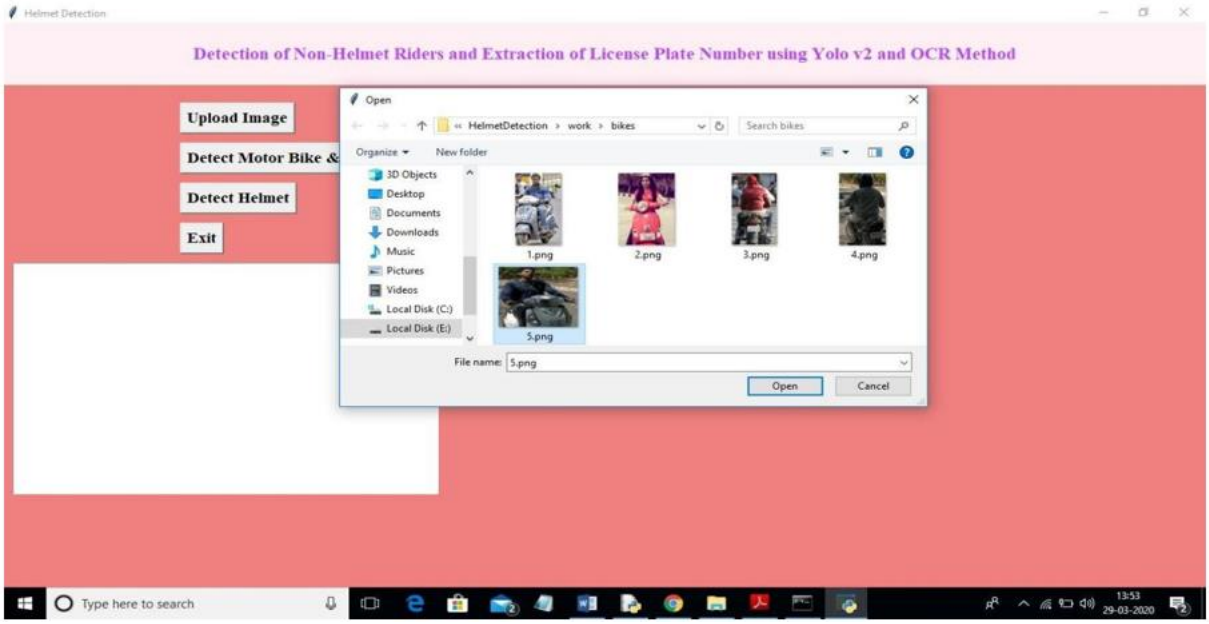
The utilization of YOLOv2 and YOLOv3, renowned for their efficiency in object detection tasks, underscores the commitment to achieving high accuracy. These models leverage the power of deep learning to process complex visual information and make real-time decisions, aligning with the project's goal of swift and precise detection of traffic violations. Moreover, the incorporation of OCR for license plate extraction adds another layer of sophistication to the system. This step ensures that essential information is not only detected but also interpreted accurately, providing a comprehensive dataset for further analysis and enforcement. Dataset collection is a pivotal aspect of the project, as the performance of deep learning models is intricately tied to the quality and diversity of the data they are trained on. The inclusion of a diverse range of images, representing various scenarios and conditions, enhances the robustness of the system and contributes to its adaptability in real-world scenarios. In conclusion, the proposed methodology for Vehicle and Helmet Detection, coupled with License Plate Extraction, represents a significant stride towards automating and enhancing traffic regulation enforcement. By addressing the limitations of manual surveillance and leveraging advanced deep learning techniques, the project aims to contribute to the broader goal of creating safer roadways and minimizing the impact of traffic-related injuries. The meticulous integration of YOLOv2, YOLOv3, and OCR ensures a comprehensive and efficient system capable of detecting non-compliance with helmet regulations and extracting vital information for enforcement purposes. As traffic management continues to evolve, the adoption of innovative technologies becomes imperative to create safer and more efficient roadways, aligning with the overarching goal of promoting public safety and well-being.

RESULTS

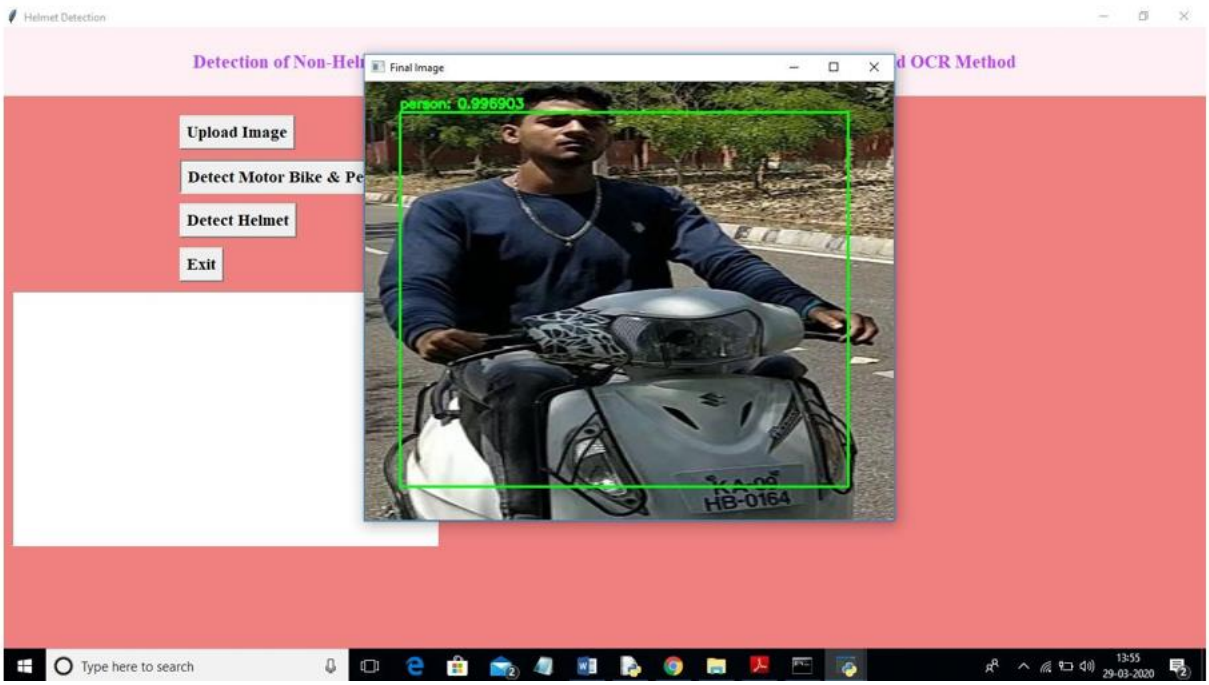
After setting path double click on ‘run.bat’ file to run project and to get below screen



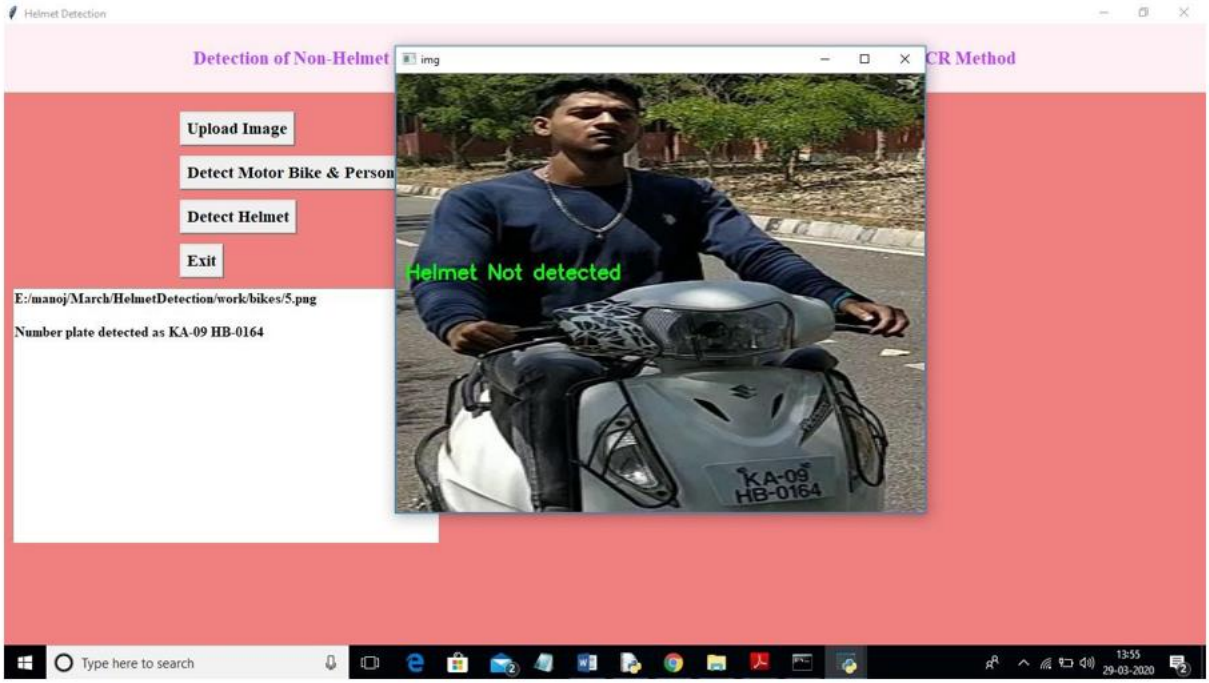
In above screen click on ‘Upload Image’ button andupload image



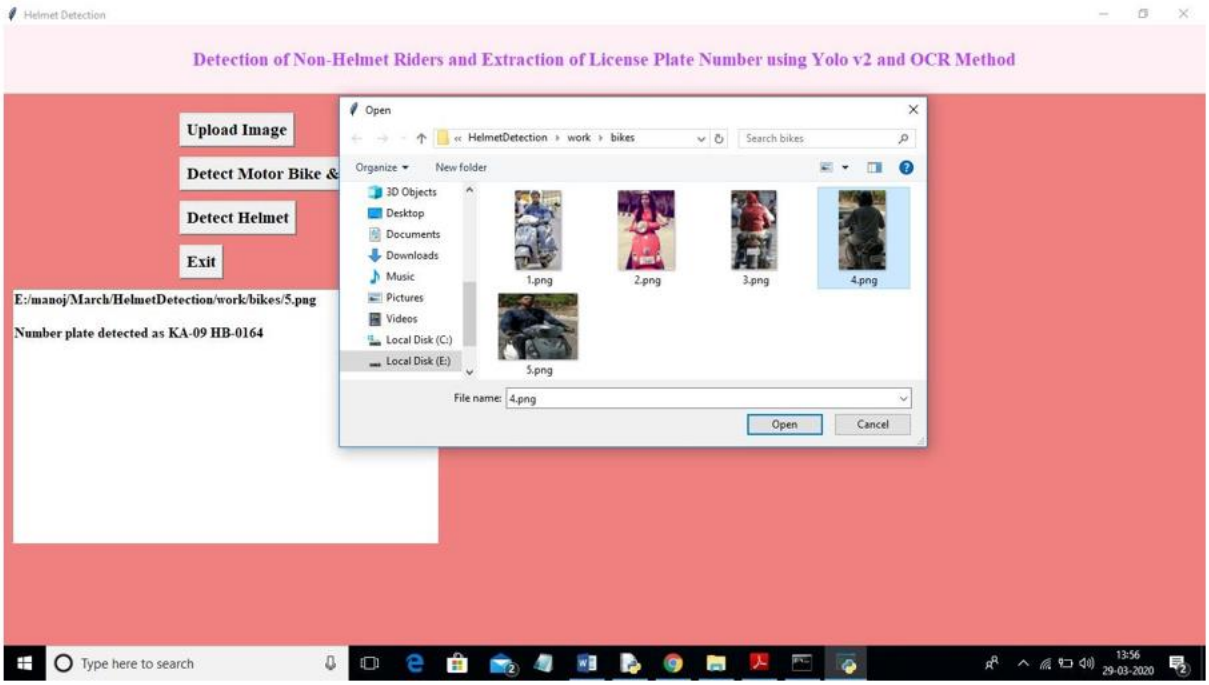
In above screen Iselected one image as ‘5.png’ and click on ‘Open’ button to load image. Now click on ‘Detect Motor Bike &Person ’button to detect whether image contains person with motor bike or not



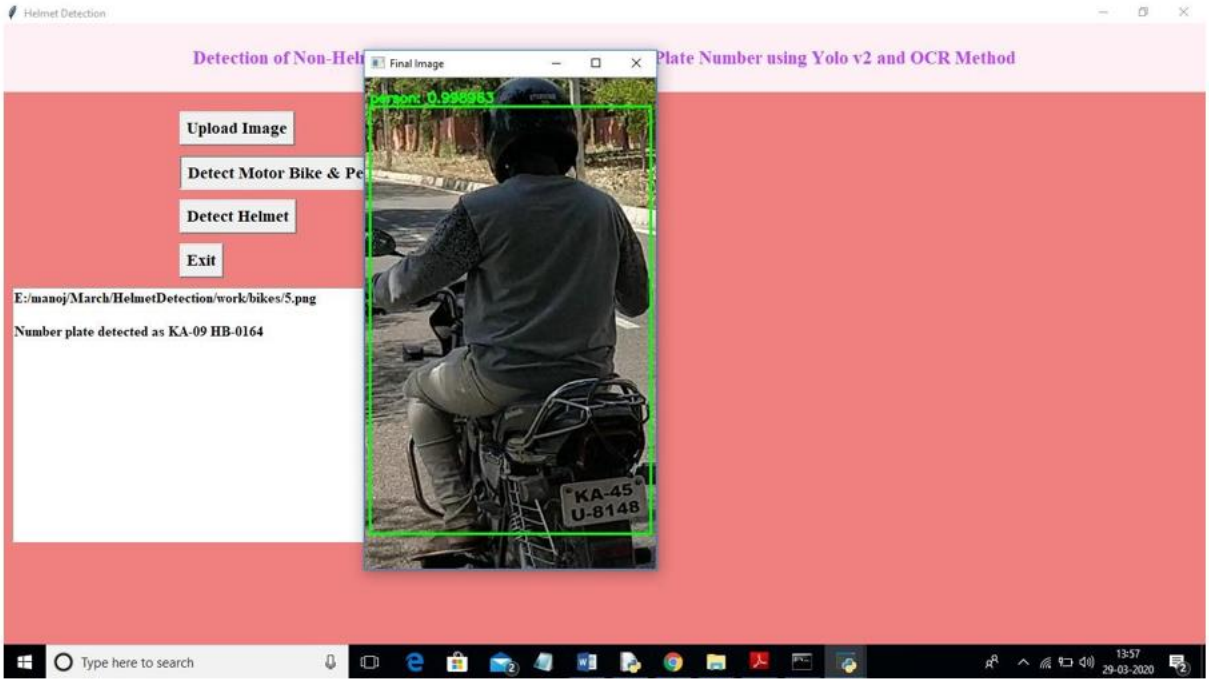
In above screen yolo detected image contains person and bike and now click on 'Detect Helmet' button to detect whether he is wearing helmet or not



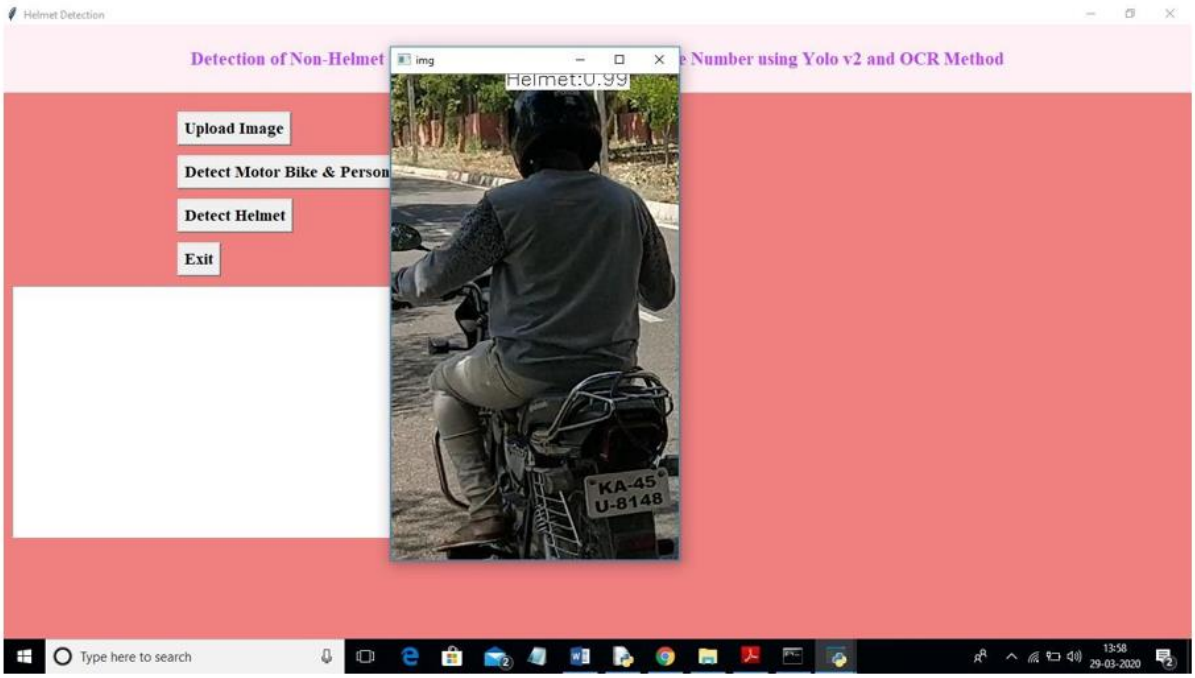
In above screen application detected that person is not wearing helmet and its extracted number from vehicle and display in beside text area. Now we will check with helmet image



In above screen I am uploading 4.png which is wearing helmet and now click on 'Detect Motor Bike & Person 'button to get below result



In above screen yolodetected person with motor bike and now click on 'Detect Helmet' button to get below result



In above screen application detected person is wearing helmet and that label is displaying around his head and application stop there itself and not scanning number plate.

Note: To implement this project and to extract number plate we have trained few images and if u want to extract for new images then send those new images to us, so we include those images in yolomodel to extract new images number plate also.

CONCLUSION

A Non-Helmet Rider Detection system is developed where a video file is taken as input. If the motor cycle 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. OCR is used for license plate number extraction if rider is not wearing helmet. Not only the characters are extracted, but also the frame from which it is also extracted so that it can be used for other purposes. All the objectives of the project is achieved satisfactorily.

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