ENHANCED CAMPUS SAFETY WITH AUTOMATED DETECTION THROUGH CCTV AND AUDIO WARNING

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ABSTRACT—This proposes an intelligent traffic monitoring system to improve campus safety. The system utilizes CCTV cameras, artificial intelligence, and audio warning systems to detect and alert drivers of potential traffic violations. The system is designed to detect helmet usage, and speed limit violations, and identify vehicles by their number plates. Once a violation is detected, the system triggers an audio warning through speakers installed on the campus to alert the driver to take corrective action. The system also captures an image of the violator's number plate for record-keeping purposes. The proposed system aims to improve campus safety by reducing the incidence of traffic violations that can lead to accidents and injuries. The real-time monitoring and alerting of drivers encourage them to follow traffic rules, thereby minimizing the risk of accidents. The proposed system's accuracy and reliability rely on the underlying technology, including computer vision, artificial intelligence, and audio speakers. Therefore, the development of the system requires a robust and efficient algorithm to analyze the video feed from the CCTV cameras and detect violations accurately. The system's implementation requires the installation of CCTV cameras at strategic locations on the campus, along with audio speakers to alert drivers. The captured data needs to be processed in real time by the system's computer vision algorithm, which can be implemented on a central processing unit or on the cloud. The proposed system offers a cost-effective, automated solution to improve campus safety and traffic management. The system's benefits include increased safety, reduced traffic violations, improved traffic flow, and efficient record-keeping of traffic violations.

Keywords—CCTV; Image processing; Safety; Risk of accidents; violations.

I.INTRODUCTION

The safety and security of educational campuses have emerged as major concerns in recent years. Incidents such as accidents, unauthorized vehicle access, and non-compliance with safety regulations pose significant risks to the well-being of students, faculty, and staff members. In response to these challenges, there is a pressing need for proactive systems that can identify potential safety issues and take appropriate actions to mitigate them. It aimed at augmenting campus security through the integration of cutting-edge technologies. Leveraging computer vision techniques, we focus on three key aspects: helmet detection, speed violation monitoring, and unauthorized vehicle identification. By accurately detecting these factors from CCTV footage, we enable real-time intervention and enforcement of safety protocols, thereby minimizing the occurrence of accidents and security breaches. The first component of our system addresses helmet detection. Wearing helmets is crucial for personal safety, particularly in areas with high vehicular traffic such as campuses. By employing state-of-the-art object detection algorithms, we can identify individuals wearing helmets from CCTV feeds in real time. This enables us to promptly intervene and enforce safety regulations, thereby reducing the risk of head injuries and promoting a culture of considering an additional tool rather than a substitute for conventional blood typing techniques.

II.EXISTING SYSTEM

The existing system for campus safety typically relies on manual surveillance and security personnel, which can be labour-intensive, time-consuming, and prone to human error. Traditional methods of monitoring safety parameters such as helmet usage, speed violations, and unauthorized vehicles often lack real-time detection and response capabilities, resulting in delayed actions and compromised security. In the case of helmet usage, manual checks and physical monitoring are commonly employed, requiring security personnel to visually inspect individuals for compliance. This approach is inefficient and subject to oversight, as it relies on the human eye to identify helmet-wearing individuals amidst the bustling campus environment. Similarly, monitoring vehicle speeds traditionally involves manual observation or the use of speed guns. These methods necessitate constant vigilance and can be challenging to implement consistently, especially in large campus areas with multiple entry and exit points. Furthermore, the reliance on manual speed detection limits the ability to promptly address speed violations and enforce speed regulations.

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III.LITERATURE SURVEY

Helmet Detection In a paper published in 2020, Fahad A Khan, Nitin Nagori, Dr Ameya Naik. The described framework system detects motorcyclists riding with and without helmets with mean average precision of 81% from the images. The three-class labels Helmet, no helmet and license plate of motorcyclists were detected from various observation sites. The model uses a sliding window over the whole image to detect the objects. Increasing the dataset may also increase precision and accuracy to detect the objects. The system can also be enhanced by making use of different framework and test the results on data for improving accuracy and by using a combination of different algorithms may help to improve accuracy. In any case, just the discovery of such motorcyclists isn't adequate for making a move against them, this framework can also be extended and combined with a license plate recognition machine system, to detect license plate automatically and store it in the database of the person riding a motorcycle without a helmet and to automatically send penalty fine to the respective person.

Disadvantages:

- Lack of Accuracy
- Limited detection range

Usingthe YOLO object detection is well suited for real-time processing and was able to accurately classify and localize all the object classes. 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. All the libraries and software used in our project are open source and hence is very flexible and cost-efficient. The project was mainly built to solve the problem of non-efficient traffic management. Hence at the end of it, we can say that if deployed by any traffic management department, it would make their job easier and more efficient.

Disadvantages:

- Delay of Detection process
- Dependency on high-quality input data

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IV.PROPOSED SYSTEM

The first component of the proposed system is helmet usage detection. Utilizing state-of-the-art object detection algorithms, such as YOLO or Faster R-CNN, the system can accurately identify individuals wearing helmets from CCTV feeds in real time. This automated detection enables prompt intervention and enforcement of safety regulations, reducing the risk of head injuries and promoting a culture of safety among campus members. Speed violation monitoring is another critical aspect of the proposed system. By analyzing consecutive frames of CCTV footage and tracking vehicle movement, the system can estimate the speed of vehicles within the campus premises. This automated speed detection allows for the identification of instances of reckless driving or over speeding, enabling immediate actions such as issuing warnings or initiating disciplinary measures. The real-time monitoring of vehicle speeds enhances the overall safety and tranquillity of the campus environment. Computer vision techniques are utilized to accurately locate and extract number plates from CCTV footage, and optical character recognition (OCR) algorithms are applied to recognize the characters on the number plates. After the detection, the detected number plate will be sent through a security personal email. This automated number plate detection facilitates the rapid identification of two-wheelers. By efficiently addressing the issue of unauthorized vehicles, the proposed system strengthens the overall security protocols of the campus.

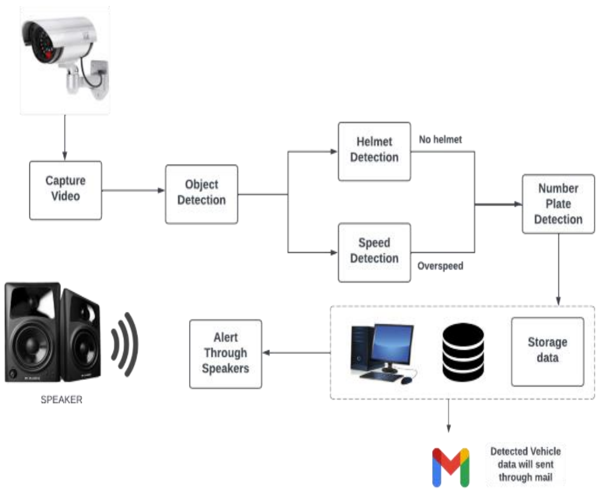

Figure 1. Enhanced Safety System

This system will be used to detect all vehicles. Firstly, it will detect the helmet after that number plate detection will have occurred.

Figure 1. Vehicle Detection and Helmet Detection

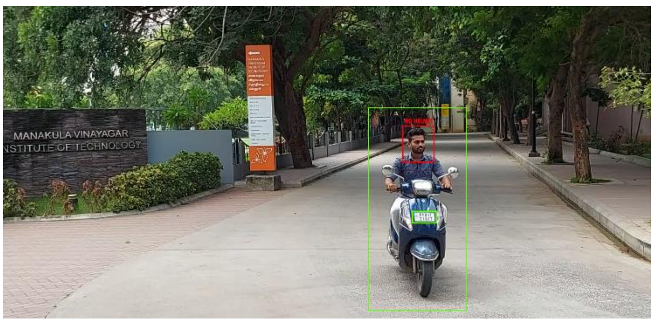

Figure 2. Number Plate and Speed Detection

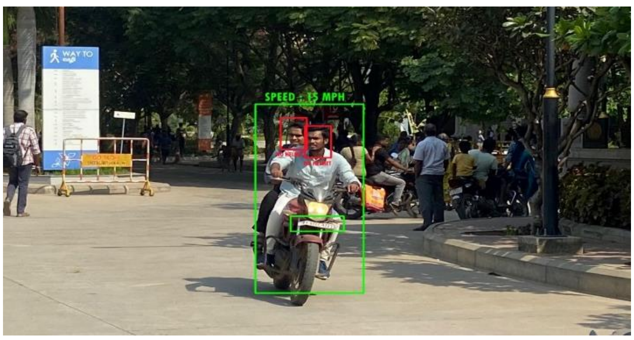

Figure 3. Extracted Number-plate

V.RESULTS AND DISCUSSION

The system successfully detects vehicles using the YOLOv3 algorithm and incorporates a helmet detection module to identify riders wearing helmets and those who are not. In addition to helmet detection, the system incorporates a speed detection module that analyzes the speed of the detected vehicles. Using image processing techniques and predefined speed limits, the system calculates the speed of each vehicle and compares it to the allowed speed limit within the campus premises. If a vehicle is detected exceeding the speed limit, regardless of whether the rider is wearing a helmet or not, the system triggers an audio warning. The audio warning serves as an immediate alert to the rider, reminding them to reduce their speed and adhere to the campus speed limit. By combining helmet detection, speed detection, and audio warnings, the system provides comprehensive safety enforcement within the campus environment. It promotes responsible riding behavior by alerting riders who are not complying with both helmet usage and speed limit regulations. The performance of the system is evaluated based on the accuracy of vehicle detection, helmet detection, and speed detection. Metrics such as precision, recall, and speed measurement accuracy are utilized to assess the system's ability to accurately identify non-compliant riders and measure their speed. The effectiveness of the audio warning system is also evaluated in terms of timely alerts and rider responsiveness.The integration of audio warnings for both helmet non-compliance and speeding contributes to an enhanced campus safety environment. The system actively identifies and alerts riders who violate safety regulations, reinforcing the importance of both helmet usage and adherence to speed limits. By providing immediate audio feedback, the system promotes immediate corrective action, reducing the risk of accidents and enhancing overall campus safety.In this project, the proposed work of the Helmet Module is implemented usingthe Dense-net algorithm with precision

Model	Precision	Recall
Dense-Net	98.6%	93.7%

Figure 4. Precision table

The above table shows the proposed work of Helmet detection using Dense-net architecture. The result it shows that the Dense net is very effective in running the detection of predicting the Helmet and no Helmet.

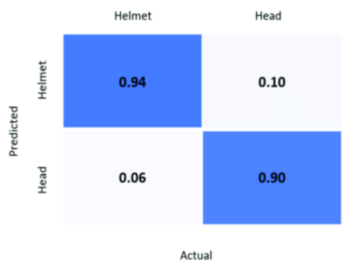

Figure 4.2 Confusion Matrix of Helmet Precision

VI.CONCLUSION

This study improves campus safety for college students. The system, which integrates a number of functions like helmet detection, number plate recognition, and vehicle speed detection, makes use of Python programming. The suggested strategy has a number of advantages for safeguarding campus safety. First, the helmet detection component makes it possible to spot those who are not wearing helmets while operating automobiles on campus. This aids in enforcing safety laws and encouraging appropriate riding habits.The device has the ability to lower the danger of head injuries in case of accidents by automatically identifying and warning people who are not wearing helmets. Additionally, the number plate recognition feature makes it possible to identify and track vehicles on campus. By ensuring that only authorized cars are present on campus and reducing the risk of unauthorized access or security threats, this can help with security and monitoring operations. In the event of questionable or unidentified vehicles, the system can create alerts or messages, making the campus environment safer. By employing this initiative, it can primarily provide safety for students, faculty, and staff, as well as lessen the number of persons who are having problems on campus.By promoting responsible riding, reinforcing safety precautions, and permitting quick remedial actions, this project helps to make the campus environment safer. The system's scalability and deployment in real-world circumstances can be improved with further developments and integration with current infrastructure, which will increase campus safety overall.

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