e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:05/Issue:10/October-2023 Impact Factor- 7.868 www.irjmets.com

ENHANCING TRAFFIC SAFETY WITH ARTIFICIAL INTELLIGENCE USING HELMET DETECTION AND ZEBRA CROSSING OBSTRUCTION

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DOI : https://www.doi.org/10.56726/IRJMETS45453

ABSTRACT

The application of artificial intelligence (AI) in improving traffic safety is highlighted in this abstract through two key features: helmet identification and zebra crossing obstruction prevention. The application of AI technology in various fields proves its capacity to reduce traffic accidents and protect pedestrians. To encourage adherence to safety standards, the first component uses computer vision techniques to identify helmet use among scooter and motorcycle riders. To ensure safe pedestrian passage, the second part focuses on using AI-driven systems to detect and prevent obstructions on zebra crossings. This study helps to reduce total traffic accidents and improves the safety of both drivers and pedestrians by addressing helmet compliance and zebra crossing safety.

Keywords: Artificial Intelligence (AI), Machine Learning (ML), Helmet Identification, Zebra Crossing, Computer Vision, Traffic Accidents.

I. INTRODUCTION

The development of artificial intelligence (AI) has created new opportunities for better traffic safety among other elements of our daily lives. Road fatalities and accidents have been a major global concern in recent years. Helmet detection and zebra crossing blockage are the two main aspects of traffic safety that are the focus of this article.

In addition, a system that will support the Green Tax Rule and Wrong Side Detection is being implemented. This field combines AI and ML to create a solid system that will enhance law enforcement, raise public awareness, and strengthen public safety. This AI-ML integration makes it feasible to improve the safety of the driving environment. In addition, we can establish a safe driving environment by minimizing accidents and outdated automobiles by implementing the Green Tax Rule and Wrong Side Detection.

The use of artificial intelligence (AI) to improve road safety has been motivated by the urgent need to lower traffic fatalities and accidents on a global scale. The main goal is to address the widespread problem of helmet non-compliance, which significantly increases the risk of severe head injuries in accidents. AI-based helmet detection systems can be crucial in reversing this negligence, encouraging careful riding, and saving lives. These systems can spot instances of non-compliance and deliver warnings or penalties, promoting safer driving habits. Additionally, AI is essential for supporting projects related to law enforcement and increasing public awareness. Authorities can quickly and accurately identify those who are breaking traffic laws by automating detection systems. This not only strengthens law enforcement but also acts as a teaching tool, raising public awareness of the importance of driving safely. AI also improves pedestrian safety, especially near zebra crossings. By spotting impediments and swiftly warning drivers of potential dangers, it accomplishes this, lowering risks and improving safety for pedestrians in these regions.

II. LITERATURE SURVEY.

The paper [1] shows that, to detect obstructive automobiles in pedestrian crossing lanes, this study uses computer vision. It analyses actual traffic footage, tracks objects, and recognizes license plates using the Ray-Casting method, the Hungarian method, and the Kalman Filter. According to the findings, there are 65.28% True Positives and 98.26% True Negatives.

By finding in [2] was recognizing zebra-crossing zones in images, the objective is to increase safety for people who are visually impaired when crossing roadways. Support vector machine (SVM)-based recognition, adaptive

histogram equalization, flood fill operations, and Hough transformations are only a few of the image processing techniques included in the methodology. Compared to other approaches, the system efficiently finds and recognizes zebra-crossing regions.

The study [3] integrates fuzzy logic with image processing to propose a novel traffic management strategy. The system intends to improve traffic control and surveillance capabilities by utilizing currently installed closed-circuit television (CCTV) cameras. It imagines a better traffic control system by connecting these cameras to traffic lights.

This [4] study develops zebra-crossing detection technology to help visually impaired people navigate outdoor spaces safely. The method makes use of the geometric features of the edges of sorted zebra-crossing stripe patterns. A directional Gabor filter and Sobel edge detection are used during preprocessing. Through geometric properties, the suggested framework effectively finds suitable areas and zebra-crossing edges.

In the next study [5] suggests a method for detecting helmets and license plates from CCTV footage that is based on OCR and YOLO. The system's ability to automatically recognize helmets and license plates in real time makes it easier to monitor, analyze, and enforce laws requiring the use of helmets.

The study [6] offers a CNN-based method for identifying helmets and obtaining license plates from bike riders who are not wearing them. The aim is to enhance safety by encouraging proper helmet usage among two-wheeler riders.

The subsequent study [7] suggests using machine learning to recognize users of two-wheelers without helmets and extract their license plates from CCTV footage. This approach aims to reduce the frequency of two-wheeler-related accidents and injuries.

Research in [8] increasing number of vehicles on the road has made the use of advanced tools such as automatic number plate recognition (ANPR) systems necessary for effective and safe traffic management. However, the ANPR system faces several challenges, including low recognition rates, long recognition times, and issues related to diverse plate formats and varying imaging conditions. This paper addresses these challenges by proposing a new neural network-based license plate recognition technique. The new method significantly improves the recognition rate, reduces the recognition time, and minimizes the standard deviation error, making it a promising advancement in the field of license plate recognition systems.

An embedded real-time Automated License Plate Recognition (ALPR) system [9] that can identify license plate numbers on moving cars is described in this abstract. It talks about how the system can be used in public spaces, parking management, and urban traffic control. To provide an alternative to ALPR, the project uses Python and the Open Computer Vision Library. In addition to reading license plates, this device also offers details on insurance and emission testing.

The [10] strategy to identify wrong-way drivers on highways is suggested in the study. There are three phases involved: learning, detection, and validation. Gaussian mixtures are used in the learning step to simulate the flow of vehicle motion. The validation stage uses an appearance-based methodology to verify the detections made during the detection stage, which detects cars and bikes travelling in the opposite direction. The method works well under a variety of circumstances, as demonstrated by tests using traffic surveillance films.

The paper [11] presents an image processing and neural network-based ambulance detection and tracking system. The technology is made to recognize ambulances in heavy traffic, assisting in effective traffic management. Traffic congestion is a fundamental problem, especially in developing nations like India and Thailand where poor road infrastructure makes it difficult for emergency vehicles to pass. When an ambulance approaches a particular intersection, the system detects it and turns the traffic lights temporarily green for 15 seconds to allow for quick passage. Ambulance routes can be optimized via geocoding, which converts addresses into position information. The idea is to outfit ambulances with this technology, which will streamline address transformation and offer a precise route plan.

The article [12] suggests an automated wrong-way vehicle identification system using video from security cameras to improve traffic safety. The You Only Look Once (YOLO) method is used for vehicle detection, centroid tracking is used for vehicle tracking in a certain area, and wrong-way vehicle detection is the last stage. The centroid tracking technique effectively tracks moving objects, while the YOLO algorithm assures

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precise object detection. The efficiency of the device under various lighting and weather circumstances is demonstrated by experimental findings. Utilizing real-time traffic management technologies and easily accessible security cameras, the suggested solution is straightforward and quick to put into practice.

III. PROPOSED SYSTEM

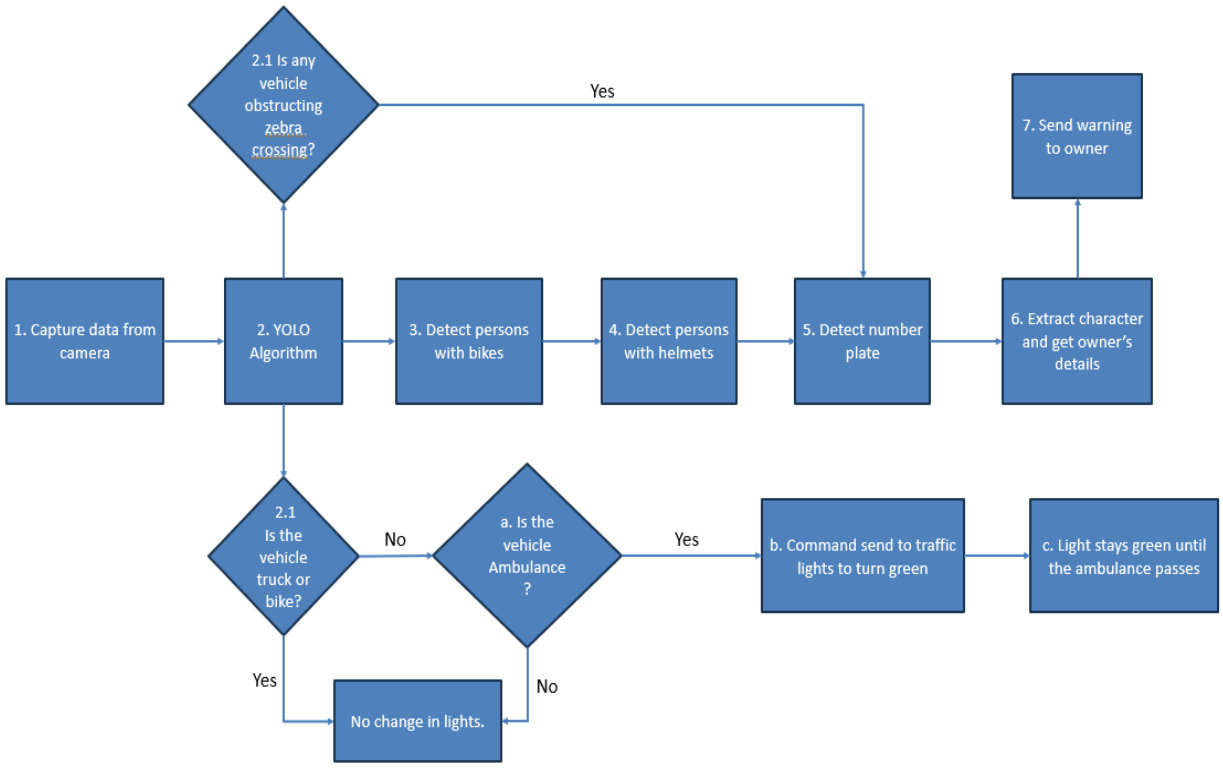

Figure 1: Proposed Project Model

IV. FUTURE SCOPE

Artificial intelligence (AI) offers a comprehensive set of tools to enhance traffic safety in multiple ways. AI systems can effectively detect helmets worn by motorcyclists and cyclists, as well as obstructions on zebra crossings, enabling immediate action in case of violations. Real-time monitoring and analysis of traffic conditions provide valuable insights to traffic management authorities, helping them identify patterns, predict hazards, and optimize traffic signals. Additionally, intelligent decision-making algorithms can automatically trigger actions to address issues such as zebra crossing obstructions, contributing to overall safety and efficiency. The scalability and adaptability of these systems ensure their effectiveness in diverse environments and varying conditions.

Beyond helmet detection and zebra crossing obstruction recognition, AI has the potential to further enhance traffic safety by detecting pedestrians, vehicles, and traffic signs, even in challenging conditions. It can also offer valuable insights through traffic forecasting based on historical and real-time data. Furthermore, AI aids in the early detection of traffic incidents, such as accidents and road closures, allowing for timely alerts to drivers and pedestrians, helping them avoid potential hazards. Collectively, AI-driven systems provide a comprehensive approach to improving traffic safety by offering real-time information, facilitating compliance with traffic regulations, and optimizing traffic flow, contributing to safer road environments.

V. CONCLUSION

The ability of AI to identify helmets and obstacles at pedestrian crossings could revolutionize road safety. By detecting non-compliant behavior, especially related to helmet use, this technology can play a vital role in reducing traffic accidents, injuries and even deaths. Real-time obstacle detection at pedestrian crossings can immediately alert drivers, reduce accidents, and protect pedestrians. In conclusion, the combination of AI and road safety constitutes a promising avenue to improve the overall road safety landscape. To ensure the success of AI-based solutions in various traffic situations, collaborative efforts are essential. Researchers, engineers,

policymakers, and the public must work together to harness the full potential of artificial intelligence to improve road safety and make our roads safer for everyone. This collaboration can lead to more advanced, efficient, and adaptive systems, significantly contributing to reducing traffic incidents and protecting lives on the road.

The study includes an extent of inventive advances and strategies that tackle computer vision, picture preparing, and manufactured insights to address basic issues in activity administration, security, and observation. These ponders collectively illustrate the potential for progressed innovative arrangements to improve different viewpoints of street security and activity control.

From vehicle obstacle discovery in person on foot crossing paths to zebra-crossing acknowledgment for outwardly impeded people, these inquire about endeavors exhibit the utility of computer vision procedures and calculations in advancing security on the street. The integration of AI, machine learning, and picture handling yields promising comes about, with tall rates of exactness and proficiency in distinguishing and observing traffic-related components.

Furthermore, the considers emphasize the part of CCTV cameras, robotized number plate acknowledgment (ANPR), and neural systems in not as it were upgrading activity administration but moreover implementing compliance with security directions. These innovations have the potential to decrease mischances, move forward law authorization, and contribute to the general security of street clients.

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