Computer Vision-Based Accident Detection and Alert System

[1] MRS.B.SURIYA. [2] DINNESH BABU R, [3] JAYASURYA R, [4] JAGADHEESH T, [5] HARISH V
[1]Assistant Professor, [2,3,4,5]UG scholars, Department of Electronics and Communication Engineering, Adhiyamaan College of Engineering (AUTONOMOUS), Hosur

ABSTRACT

Traffic accidents are an important cause of injuries and death worldwide, often worsened for delays in the emergency response. This project presents an accident detection system and alert based on computer vision designed to detect real -time vehicle accidents using live videos. When applying deep learning techniques and object detection models such as Yolo, the system identifies sudden collisions or abnormal vehicle movements. When detecting an accident, automatically captures the location of the incident using GPS and sends immediate alerts through SMS, email or phone call to contacts or emergency authorities. This intelligent system aims to reduce human intervention, improve emergency response times and contribute to safer road environments. The solution is scalable and adaptable for integration in smart cities, traffic surveillance systems and vehicle safety platforms.

I INTRODUCTION

Accidents along the way occur frequently and often result in serious consequences, including deaths, injuries and property damage. One of the main reasons for the large number of victims is the delay in the emergency response, which can be caused by factors such as human error, communication gaps or the time that detection has been detected on the site. To address this problem, we propose an accident detection and alert system based on computer vision that takes advantage of modern image processing and deep learning technologies. This system continuously analyzes the video in real time feeds the Surveilance cameras or tables of tables to detect accidents. By using advanced object detection algorithms such as Yolo (it is only seen once), the system can identify vehicles, pedestrians and their movements in video frames. When an accident is detected, based on patterns such as sudden stops, collisions or erratic driving, the system automatically sends alerts with the exact location to emergency services or pre -designed contacts.

II LITERATURE REVIEW

The detection of traffic accidents has gained significant attention due to the growing number of injuries and deaths related to traffic worldwide. Traditional methods often depend on technologies based on sensors such as accelerometers, GPS and on -board diagnoses, which, although effective, are expensive and dependent on infrastructure. On the contrary, computer vision offers a non -intrusive and scalable solution that takes advantage of deep learning and video analysis. Among the avant -garde techniques, Yolo (it is only seen once), particularly its latest Yolov5 version, stands out for its detection abilities of high -speed and precise objects, which makes it ideal for real -time traffic monitoring. The studies have demonstrated the effectiveness of Yolo in the detection of several vehicles in challenging conditions such as occlusion and low resolution. When combined with OPENCV for video and pytorch processing for the implementation of the model, YOLOV5 provides a powerful frame to detect the overcrowding of the vehicle, a possible indicator of traffic accidents. Previous works that use similar approaches often lacked modularity or complex hardware configurations were required. This project exceeds these limitations when providing a modular and scalable system capable of detecting incidents of the webcam or video foods, save short suspected video clips accidents, types and counting of registration vehicles, and store data, such as the time mark and the location of the manual time brand, in a database sqlite data for future analysis or emergency alerts. The use of SQLite still ensures light Effective data storage, which supports rapid recovery for real -time applications. Therefore, this system is based on established research and modern tools to offer a practical, efficient and profitable accident detection solution.

III EXISTING SYSTEM

Existing accident detection systems generally depend on sensor -based approaches or surveillance. Sensor -based systems use devices such as accelerometers, gyroscopes and GPS modules to detect sudden impacts or abnormal vehicle movements, but require installation in each vehicle, which makes them expensive and less feasible for large -scale implementation. Surveillance -based systems, on the other hand, use traffic chambers and basic image processing techniques, such as movement detection or substantial substration; However, these methods are often not reliable due to sensitivity to lighting, shadows and occlusion. Although some advanced systems have integrated deep learning models such as CNNS and YOLOV3 for vehicle detection and traffic monitoring, they often lack real -time detection efficiency, scalability and modular design. In addition, most existing solutions do not provide characteristics, such as saving incident video clips, recording detailed metadata (for example, vehicle type, time and location brand), or integrating with emergency alert mechanisms, which limits its practical application in the response and analysis of real world accidents.

IV DISADVANTAGES

- Limited detection criteria: existing systems depend mainly on basic parameters such as speed or sudden stops, without analyzing complex patterns such as vehicle or collisions grouping, which limits its ability to accurately detect accidents.
- There is no recording of video evidence: these systems do not keep incident video clips, which hinders the verification or analysis of events after they occur for research purposes or reports.
- Lack of metadata registration: essential details such as the type of vehicle, the number of vehicles involved, the time brand and location are not registered, reducing the usefulness of data for traffic analysis or legal processes.
- There are no real time alerts: there is no mechanism to automatically notify emergency services or interested authorities immediately after an accident is detected, delaying possible rescue efforts.
- Hardware dependence: Sensor -based systems require installation in each vehicle, which increases the cost of implementation and limits its application in public traffic monitoring scenarios.
- Environmental sensitivity: Surveillance -based systems that use traditional computer vision are highly affected by environmental factors such as lighting changes, climatic conditions and object occlusion, reducing their reliability.
- Manual monitoring is required: Many existing surveillance systems require constant human observation to identify incidents, making them intensive labor and prone to human error.
- Inflexibility in the implementation: These systems often lack modularity and scalability, which makes it difficult to update or integrate them with the modern infrastructure of the intelligent city.
- There is no centralized data storage: without a unified database or a storage system, registered data is lost or dispersed, which makes it difficult to perform or generate information from past incidents.
- Lack of system integration: existing systems are generally not integrated with other technologies such as smart traffic systems, IoT devices or cloud platforms, limiting their functionality and automation potential.

V Proposed Methodology

The proposed system uses advanced computer vision techniques and deep learning to detect real - time traffic accidents using video surveillance. The system's core is based on the Yolov5 object detection model (it is only seen once version 5), implemented with Pytorch, to identify various types of vehicles, such as cars, bicycles, buses and live food trucks live or pre -recorded videos. The process begins to continually extract frames from video feeding, which are then passed through the Yolov5 model for the detection of objects, resulting in the identification and classification of vehicles with limited boxes and trusted scores. The system uses the logic of accident detection by monitoring the sudden group or the overlap of vehicles, indicating a possible collision or abnormal behavior of traffic. When detecting an incident, the system automatically keeps a brief video clip of the event and records important metadata, including the time brand, the location admitted manually, the types of vehicles and the detection confidence. Then, these data are stored in a SQLite database for future analysis or integration with emergency alert systems. The modular and scalable design of the system allows easy integration of additional features, such as a graphical user interface (GUI), real -time alert services or cloud storage, ensuring flexibility and adaptability for future emergency improvements and emergency emergency responses

VI Block Diagram

The accident detection system and alert based on computer vision uses the live entry of the cameras, which is processed through a prepr Marcing unit for the improvement of the image and the extraction of paintings. Then, the system uses YOLO CNN for the detection of objects to identify potential accidents such as collisions, sudden stops or falls. After detection, an alert mechanism triggers emergency notifications (for example, SMS) and stores the incident in a database for a subsequent analysis. This automated system improves security by providing real -time accidents and quick response monitoring.

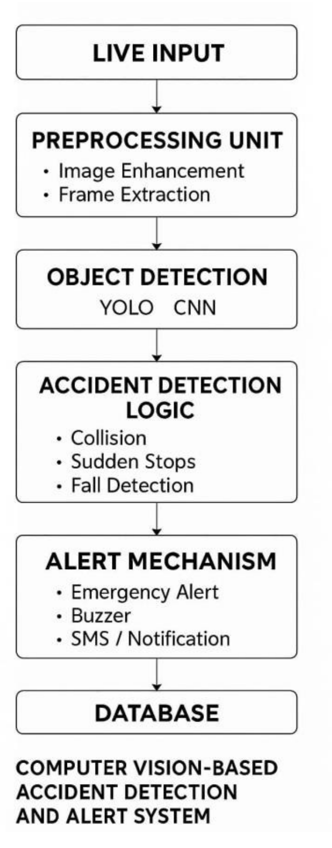


Fig.1: Basic Block Diagram of Circuit Breaker

VII ADVANTAGES

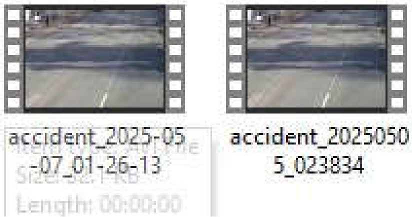
- Real -time detection: The system uses Yolov5 to detect vehicle in real time, allowing immediate identification of potential accidents or traffic yesalit Exact classification of vehicles: The system using Yolov5 can accurately classify the system different types of vehicles (cars, bikes, buses, trucks) and increase its ability to detect incidents involving different types of vehicles.
- Automatic incident recording: When an accident is detected, the system automatically saves a short video clip of the incident and ensures that the evidence is captured without human intervention.
- Detailed metadata logging: The system records basic information, such as vehicle types, number of vehicles, timestamp and location, which can be useful for analysis, reporting and integration with reaction systems to emergency situations.
- Scalability and Modularity: The system is designed to be scalable and modular, making it easier to integrate other features such as GUI, real -time warning or cloud storage in the future.
- Cost effective: The system uses easily available technologies such as OpenCV and Pytorch, which significantly reduces the cost of deployment compared to sensor -based systems or traditional operation monitoring solutions.
- Flexible integration: with modular architecture, the system can be integrated into existing operation control systems, intelligent city infrastructure or reaction networks, increasing overall road safety.
- Low hardware requirements: The system relies on existing camera supervision or webcam sources, eliminating the need for other sensors or hardware installations in vehicles or roads.
- Improved safety: The system can automatically detect accidents and capture evidence in quick decision -making, increasing response time to emergency situations and improving road safety.

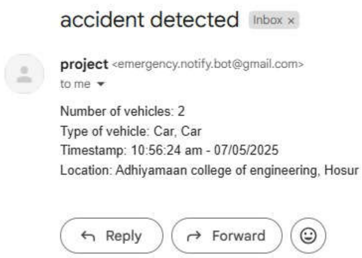
VIII APPLICATION

- Intelligent transport supervision: The system can be deployed on highways, city roads and main intersections to automatically monitor the flow of operation and detect real -time accidents, reducing the need for manual monitoring.
- Response to emergencies: The system can be integrated into emergency warning systems to announce the first respondents and emergency services immediately after the accident is detected, accelerated rescue and response time.
- Operation and reporting: metadata reporting (such as vehicle types, timestorms and location), the system allows detailed operation analysis, helps urban planners and authorities to manage traffic to understand formulas and trends such as areas susceptible to accidents or top times.
- Insurance claims and legal documentation: capture video of evidence of accidents together with detailed protocols of incidents can support insurance companies in the processing of claims and guilt.
- Vehicle and driver monitoring: The system can be adapted to monitor commercial fleets, ensuring that the vehicles are safely driven and quickly detecting any accidents or violations in fleet control.
- Integration with Smart City infrastructure: The system can be integrated with wider initiatives of intelligent cities, interconnection of accidents with automated traffic lights, intelligent road marks and other intelligent infrastructure to improve traffic management.
- Public security and awareness: public spaces such as parking lots, tunnels and bridges can benefit from accident detection systems, increasing overall safety and shortening of accidents.

IX RESULT AND CONCLUSION

The proposed accident detection system based on computer vision, which uses Yolov5, OpenCV and Pytorch, has shown promising results to detect accidents in real time supervision. The system has shown high accuracy in detecting different types of vehicles, including cars, trucks, bikes and buses, even in crowded traffic scenarios, while Yolov5 provides a reliable classification of vehicles. He was able to process video images in real time and identify potential accidents by closing or collisions of vehicles with minimal latency, allowing early intervention. After the incident detection, the system automatically saved short video clips and recorded basic metadata, such as time stamp, vehicle types, location and number of vehicles that can be used for further analysis or reports. The modular and scalable system design allows easy expansion, including functions such as real -time warning, cloud storage and integration of emergency services. Overall, the system offers an efficient, cost -effective and scalable solution for monitoring road safety and exceeds the reduction of traditional sensor -based system systems or monitoring. Provides valuable data for operation management, reaction to emergency events, and insurance requirements and can be integrated into intelligent cities infrastructure for increased traffic flow and safety. The potential of the real world deployment system in urban areas, motorways and commercial fleets makes it significant to safer roads and faster reactions to emergencies.





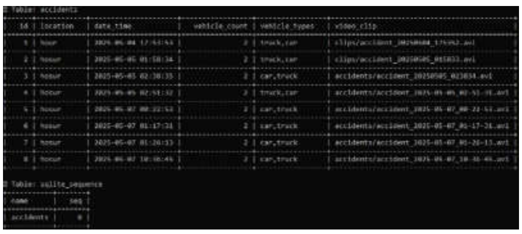


Table: accidents

id	location	date_time	vehicle_count	vehicle_types	video_clip
1	hosur	[illegible]	2	truck,car	[illegible]
2	hosur	2025-05-05 01:58:34	2	truck,car	[illegible]
3	hosur	2025-05-05 02:38:35	2	car,truck	accidents/accident_20250505_023834.avi
4	hosur	2025-05-05 02:51:32	2	truck,car	[illegible]
5	hosur	[illegible]	2	car,truck	[illegible]
6	hosur	2025-05-07 01:17:21	2	car,truck	[illegible]
7	hosur	2025-05-07 01:26:13	2	car,truck	accidents/accident_2025-05-07_01-26-13.avi
8	hosur	[illegible]	2	car,truck	[illegible]

Table: sqlite_sequence

name	seq
accidents	8

X FUTURE SCOPE

The proposed accident detection system based on computer vision has a significant potential for future improvements and wider applications. One of the main progress would be the integration of the system into existing intelligent management systems, which would allow dynamic modifications of traffic signals and road marks in response to accidents, improving traffic flow and reducing overload. Future versions could also include more sophisticated algorithms to detect dangerous behavior, such as speeding, upbringing and sudden lane changes, offering more comprehensive access to road safety. In addition, systems of reaction to real -time emergency situations could be developed to inform respondents, transport authorities and nearby drivers with precise location, acceleration Emergency intervention. The system could also benefit from storing the cloud data, allowing scalp access, long -term analysis and improved infrastructure optimization. Integration with communication to everything (V2X) could further increase safety by allowing vehicles and infrastructure to share real -time accident data and provide drivers with early warnings. In addition, the use of accumulated data on predictive maintenance accidents could help identify accident hotspots, allowing the authorities to actively solve problems with infrastructure. The system extension to include multimodal detection, such as Lidar or infrared cameras, would increase its accuracy, especially in low visibility conditions, while potential integration with autonomous vehicles could increase the avoidance of vehicle collision. With global commitment, the system could eventually support more language integration, which is adaptable to different regions. This future progress would significantly increase the ability of the system, which would make it a major tool for improving road safety and traffic management worldwide.

XI REFERENCES

1. Abhishek Kumar, R. Suresh, "Real-Time Road Accident Detection Using Deep Learning Techniques," International Journal of Innovative Research in Computer and Communication Engineering, Vol. 9, Issue 6, June 2021.
2. M. A. Rahman, M. R. Islam, and D. Park, "Automatic Road Accident Detection Techniques: A Survey," IEEE Access, Vol. 8, pp. 123761–123780, 2020. DOI: 10.1109/ACCESS.2020.2993730.
3. Manisha Patel, S. Jadhav, "Computer Vision-Based Accident Detection and Alert System Using CNN," International Journal of Computer Applications (IJCA), Volume 176 – No. 8, October 2020.
4. S. Sharma, P. Verma, "Smart Accident Detection and Alert System Using Machine Learning," International Journal of Engineering and Advanced Technology (IJEAT), ISSN: 2249 – 8958, Volume 9, Issue 5, June 2020.
5. Ujjwal Khankari, R. Malhotra, "A Smart Vision-Based Road Accident Detection and Alert System Using YOLOv5 and IoT," International Research Journal of Engineering and Technology (IRJET), Volume 8, Issue 12, Dec 2021.
6. SQLite.org, "SQLite Documentation," Available online: https://www.sqlite.org/docs.html, Accessed: May 2025.