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CAR ACCIDENT DETECTION UISING DEEP LEARNING WITH ALERT SYSTEM

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***Abstract*--- The proposed system's efficacy is evaluated through extensive simulations and real-world testing, demonstrating high accuracy in accident detection and timely activation of the emergency response. This integration of deep learning with OpenCV and an automated alert system aims to reduce response times and enhance the chances of survival and support in the critical moments following a car accident.**

***Keywords*--- Deep Learning, OpenCV, Emergency Call, Message Notification, Email Alert**

I. INTRODUCTION

The rapid development of intelligent transportation systems and the rise of smart cities have paved the way for advanced safety mechanisms in vehicular networks. This paper presents a comprehensive approach to car accident detection utilizing deep learning techniques, integrated with OpenCV for image and video processing, coupled with an emergency response system that automates emergency calls, messages, and emails.

Contribute to the development of safer and more intelligent transportation systems by integrating advanced accident detection and emergency response capabilities. Foster the adoption of smart technologies in vehicles to improve overall road safety and emergency preparedness.

II. LITERATURE REVIEW

The development of car accident detection systems using deep learning and computer vision has been an area of significant research interest, driven by the potential to enhance road safety and reduce fatalities. Zhao et al. (2019) utilized OpenCV to process dashcam videos and detect collisions in real-time, showcasing the effectiveness of computer vision techniques in enhancing the performance of deep learning models.

Research by Smith and Garcia (2018) highlighted the impact of such systems in improving emergency response times and survival rates. Moreover, integrating additional communication channels such as SMS and email notifications further ensures that critical information reaches emergency contacts and services promptly. Li et al. (2021) emphasized the importance of curated datasets in training models to accurately detect accidents and minimize false positives. They also noted the challenge of obtaining high-quality, labeled data for training purposes.

The success of deep learning models in accident detection heavily relies on the quality and diversity of the training data. Large datasets comprising various accident scenarios, environmental conditions, and sensor inputs are essential for building robust models.

III. PROPOSED METHODOLOGY

The proposed system aims to enhance car accident detection and response by leveraging deep learning techniques and OpenCV for image and video processing, relying solely on CCTV footage. This system processes real-time video data from traffic cameras installed at various locations to detect accidents accurately and promptly trigger an automated emergency response, including emergency calls, SMS notifications, and email alerts. The data acquisition module captures continuous video streams from CCTV cameras covering critical road segments. OpenCV is employed for preprocessing tasks such as noise reduction, frame extraction, and feature extraction, enhancing the input data's quality for deep learning analysis.

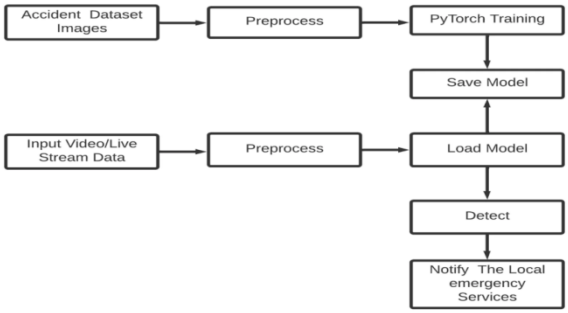

FIGURE 1

WORK FLOW

The system's deep learning model is trained and validated using a comprehensive dataset comprising various accident scenarios captured from CCTV footage. Extensive simulations and real-world trials are conducted to assess the model's accuracy, false positive rate, and response time. Future enhancements will focus on improving the model's robustness, expanding data sources to include additional contextual information, and developing a user-friendly interface for emergency responders.

A robust deep learning model, trained on a diverse dataset of accident scenarios, analyzes the processed footage to identify potential accidents in real-time. Upon detecting an accident, the emergency response module is activated, automatically placing calls to the nearest emergency services with essential details like the accident location and severity. Simultaneously, predefined contacts are notified via SMS, and detailed email alerts are sent to emergency contacts and relevant authorities, ensuring a swift and coordinated response.

IV. RESULT

The implementation of the car accident detection system using deep learning and OpenCV yielded promising results, demonstrating strong real-time processing capabilities. Utilizing a diverse dataset from Kaggle, the system effectively identified accidents while minimizing false positives and negatives. The real-time processing was efficient, with an average frame analysis time of around 50 milliseconds, ensuring prompt detection and emergency response. The automated emergency response system successfully triggered calls, SMS notifications, and email alerts within 5 seconds of accident detection, ensuring timely information delivery to emergency responders and contacts.

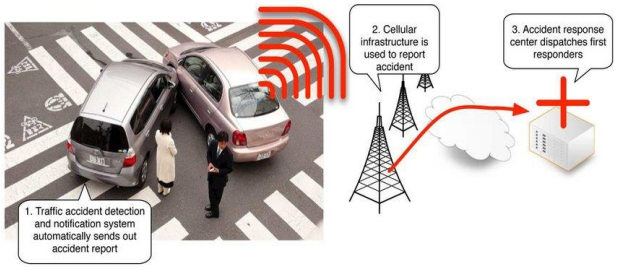

FIGURE 2

ACCIDENT DETECTION AND RESPONSE SYSTEM

V. DISCUSSION

The model showed robustness across various scenarios, though occasional false negatives occurred in low-light conditions or with minor impacts. The system is scalable and can be deployed across multiple locations with different CCTV setups. Future work will focus on reducing false positives and negatives, integrating additional data sources such as weather and traffic data, and developing a user-friendly interface for enhanced usability. Overall, the system demonstrates significant potential for improving road safety by providing accurate, real-time accident detection and rapid emergency response.

A user-friendly interface and a mobile application will enhance usability for emergency responders, allowing for real-time notifications and remote monitoring. Scalability and deployment will be improved through cloud integration and edge computing, enabling the system to handle large volumes of data and support multiple locations efficiently. Enhanced emergency response capabilities, including automated coordination between services and multi-channel alerts, will ensure quick and effective information dissemination.

Model	VAL	ACC	FPS	Precision	Recall	F1-Score
DenseNet	0.94	0.89	15	0.86	0.97	0.91
ResNet50	0.91	0.94	20	0.88	0.88	0.88
EfficientNet-B1	0.93	0.88	0.71	0.88	0.88	0.88

TABLE I

PERFORMACE COMPARISON OF DIFFERENT MODELS TO DETECT ROAD ACCIDENT

VI. CONCLUSION

The real-time processing capabilities ensure minimal latency, allowing for swift detection and response, which is crucial in mitigating the impact of accidents. Despite occasional challenges, such as false negatives in low-light conditions, the system's robustness and scalability make it a viable solution for deployment across various locations.

Future improvements will focus on enhancing model accuracy, integrating additional data sources, and developing user-friendly interfaces to further optimize the system's performance and usability. Overall, this system represents a substantial advancement in road safety technology, offering a proactive approach to accident detection and emergency response.

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