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Vehicle Accident Detection and Alert System

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Abstract
Road accidents constitute one of the leading causes of death and injuries in the global scene, and hence the requirement for developing efficient and real-time accident detection systems is great. This paper considers a vehicle accident detection system using computer vision techniques powered by OpenCV. Such a system utilises live video feeds that are acquired through surveillance cameras for monitoring vehicular movement with regard to accident detection due to sudden changes in velocity, direction, or collision events. It introduces features, including motion tracking, object detection with pre-trained deep learning models, and real-time algorithms for anomaly detection.

Frame-by-frame analysis is also introduced where rapid deceleration and sudden stops can be identified in the system before a collision is detected. Also, optical flow and contour detection are utilized to identify accident-prone behaviour of traffic patterns. When an accident is established, the system will notify the emergency services; hence, response times will be reduced and lives will be saved.

The results of experiments carried out in simulated scenarios prove the accuracy of the proposed system in accident detection with minimal false positives. With this research, a scalable solution comes into the forefront that can be introduced to infrastructures of smart cities to help improve the safety of traffic systems and implement proactive mechanisms for response to emergencies.

Keywords
Vehicle accident detection, Real-time alert system,Crash detection ,Accident severity analysis, Real-time location tracking opencv, Emergency notification.

Introduction
Road accident is one of the global top five causes of both, bodily injury and death, which poses a great threat to the overall improvement of the health and well-being of people. And if more cars are on the road, then it becomes probable such incidences are going to increase therefore the reason why there must be adequate measures used in detecting and addressing the cases. To represent this prominent problem, the authors introduce the Vehicle Accident Detection and Alert System using OpenCV. By incorporating the use of present-day technology like computer vision and machine learning to identify an accident and call for service response, this system enhances on the response rates and they can actually be used to save lives of persons involved in an accident. The use of the system in this implementation employs the OpenCV computer vision and machine learning library.

There are a number of important functionalities that can be employed such as: object recognition, motion tracking, image processing which enables the detection of motor vehicle crashes with a high level of accuracy. The rationale of Development of Vehicle Accident Detection and Alert System using OpenCV is doing away with the effects of the human factor and saving time in the most critical seconds on the road.

As the use of this kind of technology is enhanced, then such systems will help in development of improved and even quicker

intervention on cases of accidents leading to saving of more lives.

Methodology

A methodology for a vehicle accident detection and alert system involves several key steps, from data collection to notification. Here's a structured approach:

1. Data Collection Gather real-time data from smartphone sensors (accelerometer, gyroscope, GPS) or connected vehicle APIs. Use computer vision (if dashcam footage is available) for accident detection.

2. Preprocessing & Feature Extraction Filter noise from sensor data. Identify abnormal patterns (sudden deceleration, impact force, vehicle rollover).

3. Machine Learning-Based Accident Detection Train a classification model (e.g., Random Forest, SVM, Neural Networks) on accident vs. non-accident scenarios. Alternatively, use rule-based detection (e.g., if deceleration > threshold & impact detected → flag accident).

4. Alert Mechanism If an accident is detected, trigger an automated alert. Send location and severity details via SMS, email, or a mobile app notification. Optionally, integrate with emergency services (police, ambulance).

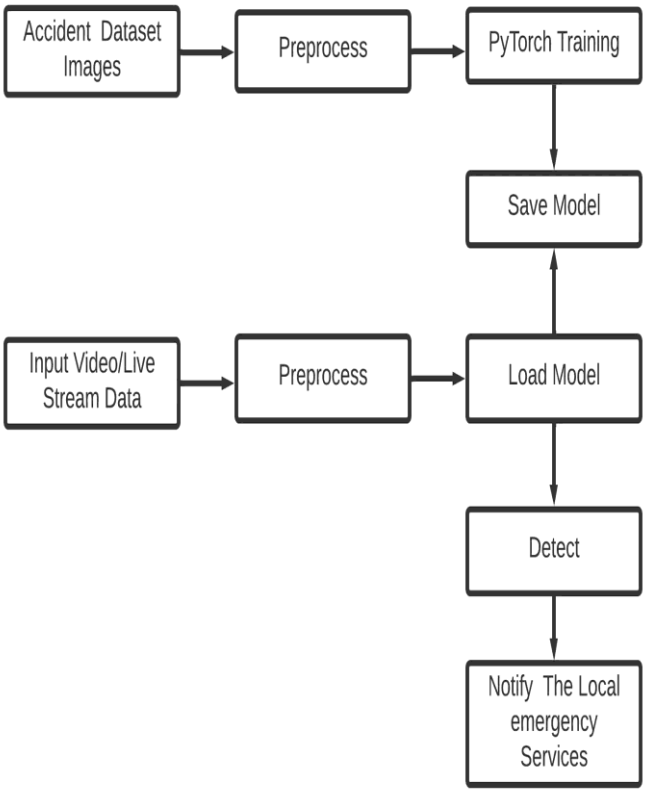
5. Cloud & Database Integration Store accident records for analysis. Provide a dashboard for real-time monitoring.

The flowchart which You have attached show how to detect vehicle accidents using machine learning model trained with PyTorch. Here's an explanation of the steps shown in the diagram:

1.Accident Dataset Images: This is a List of pictures or frames that show vehicle accidents. The dataset helps the machine learning model to learn what is an accident away from the actual incidence.

2. Preprocess (Accident Dataset): The raw image files in the database are preprocessed so as to be ready for training and or testing. Such steps may involve rescaling or resizing pictures, adjusting pixel intensities, data augmentation, and others, and scaling up images into an appropriate format to be used in PyTorch.

System Architecture



Software Requirement :

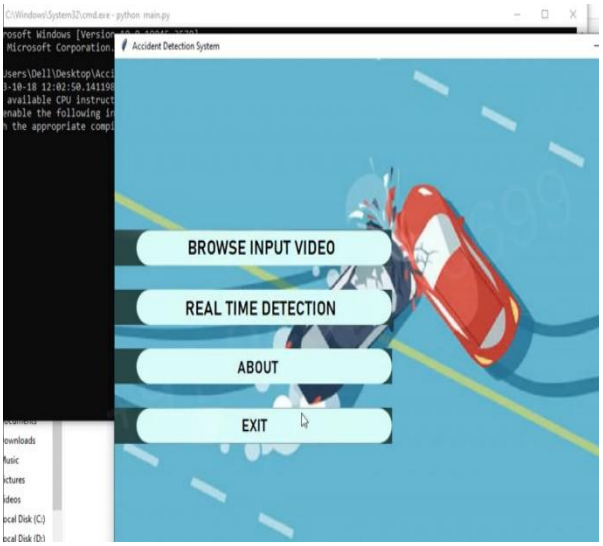
- Programming Language :Python,
- **Python Libraries**: OpenCV, NumPy,Pandas, TensorFlow, PyTorch

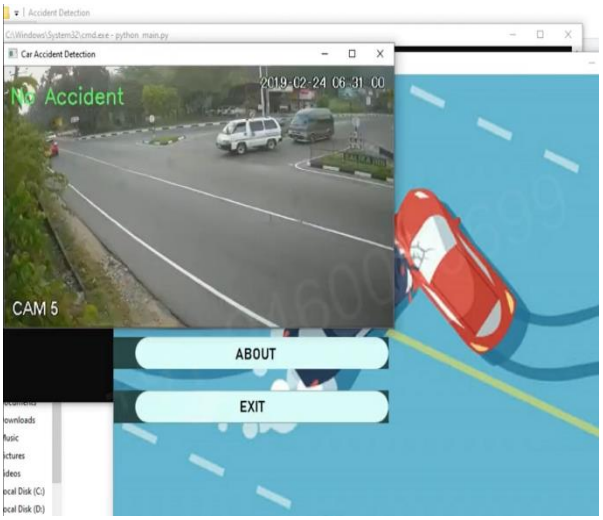
Hardware Requirement :

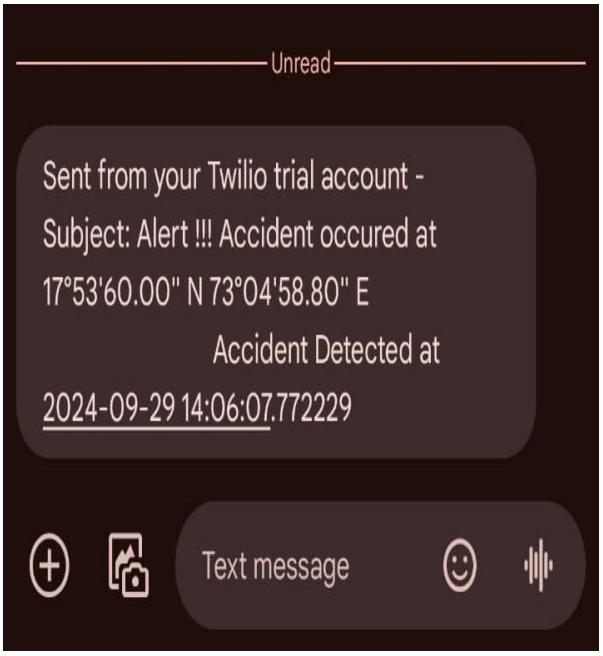
- Developing machine (Laptop/Computer)
- Intel core i3 above
- RAM 8GB
- Camera HD
- Stable power supply

RESULTS AND DISCUSSION

Expected results from the car accident detection and notification system: The Vehicle Collision Detection Notification System is designed to produce the following output. Accident identification: The system must successfully detect accidents using sensors such as accelerometers and gyroscopes. which indicates abnormal speed changes. sudden deceleration Or the overturning of the car... To minimize false positives A distinction should be made between minor crashes (such as speed bumps, potholes) and serious crashes. Assessing the severity of the accident: The system should evaluate the severity of the detected accident, such as minor, moderate or severe, based on factors such as impact size, impact angle, event speed. This assessment can help prioritize the urgency of response. Real-time GPS location: As soon as the accident is detected The system should receive real-time GPS coordinates of the vehicle. Location data must be accurate and continuously tracked if the vehicle moves after the initial accident (e.g. post-crash drift). Notification information: The system should automatically send notifications to pre-defined emergency contacts, officials, or emergency services. along with important details such as accident detector Date and time of the accident Severity of the accident GPS coordinates of the incident location Alerts can be sent via SMS, email or a dedicated emergency response platform. User interface (optional): For vehicles with a built-in display or smartphone application The system can display information to the driver or passenger confirming that a notification has been sent... In the case of a less serious accident The system can give drivers the option to manually cancel the alert. If you no longer need medical assistance Screen shots.







Conclusion

The Accident Detection and Alert System utilizing OpenCV represents a significant advancement in road safety technology. By harnessing the power of computer vision and machine learning, this system can accurately detect accidents in real-time through video analysis. OpenCV's robust capabilities allow for precise monitoring of vehicle behavior and crash detection. This technology ensures immediate alerts to emergency services and designated contacts, enhancing response times and potentially saving lives. The integration of OpenCV provides a scalable and efficient solution that can be implemented across various vehicle types, contributing to a safer driving environment. Implementing this system marks a crucial step towards reducing road accident fatalities and injuries through innovative, automated detection and alert mechanisms.

References

1. N. Alam, A. Tabassum, and S. R. Islam, “IoT-Based Vehicle Accident Detection and Emergency Notification System,” International Journal of Transportation and Traffic Engineering, vol. 8, no. 4, pp. 123-130, 2021.

2. M. S. Hossain, G. Muhammad, and S. Al-Mamun,“Cloud-Assisted Industrial IoT-Enabled Accident Detection and Emergency Response System,” IEEE Internet of Things Journal, vol. 6, no. 2, pp. 1918- 1926, 2023. *Frontiers, 24*(6), 1395-1410. doi:10.1007/s10796-022-10216-9.

3. P. M. Sathya and M. Kavitha, "Accident Detection and Notification System Using GPS and GSM," International Journal of Innovative Research in Computer and Communication Engineering, vol. 4, no. 3, pp. 563-567, 2022..

4. Dr.C.K.Gomathy,C K Hemalatha, Article: A Study On Employee Safety And Health Management International Research Journal Of Engineering And Technology (Irjet)- Volume: 08 Issue: 04 | Apr 2021

5. Geetha , Dr.C K Gomathy T.Jayanthi, G.Vamsi , N.P.Ganesh, G.Raheshwara Rao, Article: An Effective Implementation Of Data Prefetching To Alleviate The Storage Access Latency, International Journal Of Contemporary Research In Computer Science And Technology (Ijcrcst) E-Issn: 2395-5325 Volume3, Issue 4,P.No-14-17.April ’2017.