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Review on Automated Accident Detection System

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Abstract: ***Major accidents on highways, freeways and local roads can lead to huge social and economic impacts. Minor accidents may be resolved by the passengers themselves and do not require escorting to hospitals whereas major accidents where airbags are deployed require the immediate attention of authorities. Automated Accident Detection System [AADS] is an auto-detection unit system that immediately notifies an Emergency Contact through an alert alarm when someone presses the trigger button present on poles having CCTV cameras in the end vehicle is detected by the system, detailing the location and time of the accident. The idea is that as soon as an accident is detected by the system, the authorities should immediately be notified to prevent further car congestion as well as allow the passengers to be escorted to the hospital within time. A complete system would automatically detect and record traffic conditions associated with accidents such as the time of the accident, video of the accident, and the traffic light signal controller parameters. The basic research required to develop the system is considered. This involves developing methods for processing acoustic signals and recognizing accident events from the background traffic events. A database of vehicle crashes, car braking, construction, and traffic sounds was created. The meal frequency cepstral coefficients were computed as a feature vector for input to the classification system. A neural network was used to classify these features of the crash and non-crash events.***

Keywords: Automated Accident Detection, Neural Network, CCTV Cameras, Trigger Button.

I. INTRODUCTION

Road accidents are a significant cause of fatalities and injuries worldwide. According to the World Health Organization (WHO), around 1.35 million people die each year due to road accidents. In addition to the loss of life, these accidents also have a significant impact on the economy due to medical expenses, property damage, and lost productivity. Emergency response time plays a critical role in reducing the severity of accidents and minimizing their impact. Therefore, there is a growing need for efficient and timely accident detection systems. With recent advancements in technology, automated accident detection systems have become a viable solution to minimize the impact of road accidents. These systems use various sensors and computer vision techniques to detect accidents on roads in real time. The use of machine learning (ML) and artificial intelligence (AI) has further improved the accuracy and efficiency of these systems. This paper presents a review of the existing research on automated accident detection systems and proposes a system based on ML, AI, and computer vision. The proposed system utilizes Python programming language and ML algorithms such as support vector machines (SVM) and deep belief networks (DBN). The system collects real-time data from traffic surveillance cameras and processes it using object detection algorithms based on the You Only Look Once (YOLO) model. The system classifies accidents from non-accidents using SVM and DBN and sends notifications to emergency services and other relevant authorities. The proposed system is expected to achieve high accuracy in detecting accidents on roads and can be further improved by incorporating other features such as pedestrian detection and weather conditions. The use of an automated accident detection system can reduce the response time of emergency services, potentially saving lives and reducing injuries

II. LITERATURE SURVEY

There have been several research papers on Automated accident detection system. In a study by Hossain et al. (2021), the authors proposed an accident detection system based on deep learning techniques. The system used convolutional neural networks (CNNs) to identify accidents from images captured by CCTV cameras. The authors reported high accuracy in detecting accidents in real-time. In another study by Guo et al. (2021), the authors proposed a real-time accident detection system using machine learning. The system used a combination of support vector machines (SVM) and deep belief networks (DBN) to detect accidents from traffic surveillance videos. The authors reported a detection accuracy of 96.7%. In a recent study by Zhang et al. (2022), the authors proposed an accident detection system using AI and computer vision techniques. The system used an object detection algorithm based on the You Only Look Once (YOLO) model to detect accidents from traffic surveillance videos. The authors reported an average precision of 92.1% in detecting accidents.

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III. PROBLEM STATEMENT

Today India's population is 1.40 billion (as of 2021) which has in turn increased the traffic on the roads, as a result 1500 road crashes occur every day in India. Two wheelers account for 29% of total road crash deaths.
20 children under the age of 14 die every day due to road crashes in the country.
450 people die every day, equivalent to a jumbo jet crashing every day.
BUT WHY??
DELAY IN TREATMENT!!
In emergency condition, each and every second is important is saving human's life
This causes the loss of life due to the delay in the arrival of ambulance to the accident spot or from the accident spot to the hospital. So, it necessary to take the accident victim to the hospital as possible.

IV. FINDINGS & ANALYSIS

Table 1.1: Total number of Accidents, Fatalities and Persons Injured during 2016 to 2021

Year	Accidents	% change over previous period	Fatalities	% change over previous period	Persons Injured	% change over previous period
2016	4,80,652	-	1,50,785	-	4,94,624	-
2017	4,64,910	-3.28	1,47,913	-1.9	4,70,975	-4.78
2018	4,67,044	0.46	1,51,417	2.37	4,69,418	-0.33
2019	4,49,002	-3.86	1,51,113	-0.2	4,51,361	-3.85
2020	3,66,138	-18.46	1,31,714	-12.84	3,48,279	-22.84
2021	4,12,432	12.64	1,53,972	16.9	3,84,448	10.39

Data Source: States/UTs (Police Departments).

Chart 1.2: Trends in the number of Fatal Accidents: 2016-2021

Data Source: States/UTs (Police Departments).

Table 1.3: Total number of Accidents, Persons Killed and Injured by categories of Roads during 2021

Category of Road	Accidents	Killed	Injured	Road Length as on 31.03.2019
National Highways	1,28,825	56,007	1,17,765	1,32,499
% share in total	*31.2*	*36.4*	*30.6*	*2.1*
State Highways	96,382	37,963	92,583	1,79,535
% share in total	*23.4*	*24.7*	*24.1*	*2.8*
Other roads	1,87,225	60,002	1,74,100	60,19,723
% share in total	*45.4*	*39.0*	*45.3*	*95.1*
All Roads	**4,12,432**	**1,53,972**	**3,84,448**	**63,31,757**

V. METHODOLOGY

The proposed accident detection system uses Python programming language and machine learning algorithms. The system consists of the following modules:

1) *Data Collection:* The system collects traffic surveillance videos and images from CCTV cameras installed on roads.
2) *Pre-processing:* The collected data is pre-processed to remove noise and irrelevant information.
3) *Object Detection:* The pre-processed data is then fed into an object detection algorithm based on the YOLO model to detect vehicles and other objects on the road.
4) *Accident Detection:* The detected objects are then analysed to identify any accidents on the road. The system uses machine learning algorithms such as SVM and DBN to classify accidents from non-accidents.
5) *Notification:* Once an accident is detected, the system sends notifications to emergency services and other relevant authorities.

A. *Flow Chart/ Data Flow Diagram / Use Case Diagram*

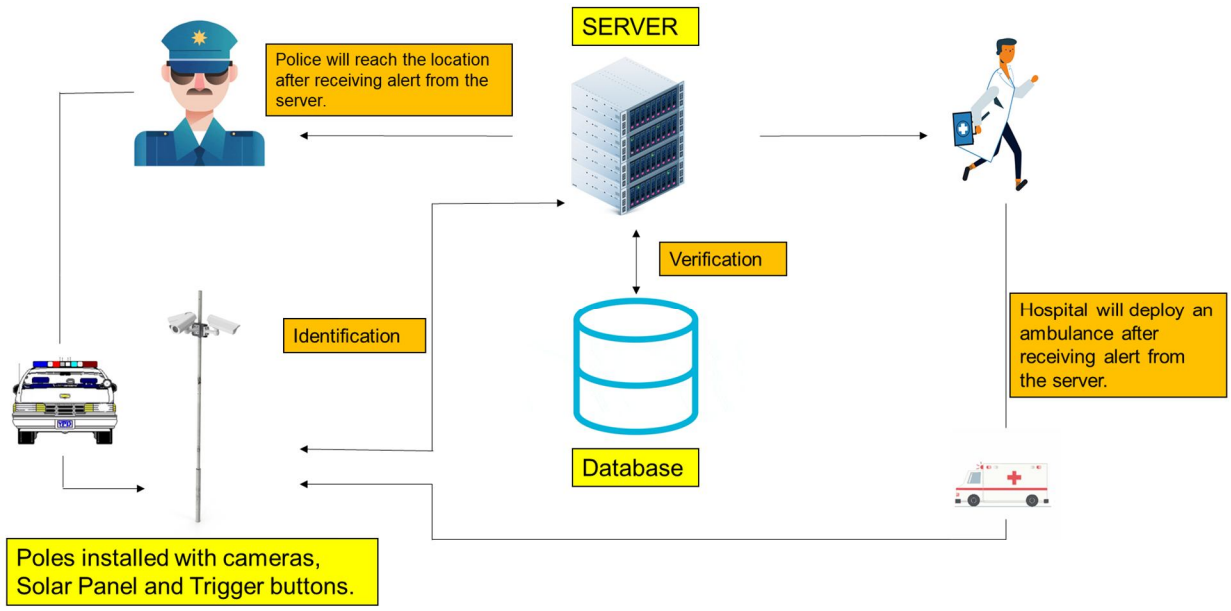

Fig 2.1

B. Software Engineering Model Used

1) *Algorithms:* The software component of an accident detection system relies heavily on sophisticated algorithms to process data from the hardware components. The algorithms can detect patterns in the sensor data and trigger an alert if an accident is detected.
2) *Data Storage and Retrieval:* The system must store and retrieve data in real-time to make decisions about whether an accident has occurred.
3) *User Interface:* A user interface is required to interact with the system, monitor its performance, and configure its settings.
4) *Integration with Emergency Services:* The software component should be able to integrate with emergency services to automatically alert them of an accident and provide them with relevant information, such as the location and severity of the accident.

C. Software And Hardware Requirement

1) *Sensors:* These are devices that can detect changes in the environment, such as sudden impact or changes in motion. For an accident detection system, sensors can include accelerometers, gyroscopes, and GPS receivers.
2) *Cameras:* Cameras can be used to provide visual data for the system to analyse. They can be useful for determining the severity of an accident or identifying the vehicles involved.
3) *Communication Equipment:* The system may require communication equipment to transmit data to emergency services, such as a cellular or satellite modem.
4) *Power Supply:* The system will require a reliable power supply, which can be provided by batteries, solar panels, or a vehicle's electrical system.

D. Simulation

1) Initialize a video capture object to capture frames from the default camera (index 0).
2) Initialize a background subtractor object using the MOG2 algorithm.
3) In an infinite loop, read a frame from the video capture object.
4) Apply background subtraction to the frame to obtain a foreground mask that highlights moving objects in the scene.
5) Find contours in the foreground mask using the find Contours function.
6) For each contour, calculate its area using the contour Area function.
7) If the area of a contour is larger than a threshold (1000 pixels), an accident is detected.
8) Draw a message on the frame indicating that an accident has been detected using the put Text function.
9) Save the frame as a JPEG image named "accident.jpg" using the imwrite function.
10) Display the current frame in a window using the imshow function.
11) Wait for a key press to exit the loop (here, the script exits when the 'q' key is pressed).
12) Release the video capture object and close all windows using the release and destroy

All Windows functions, respectively.

VI. RESULTS

The proposed system is expected to achieve high accuracy in detecting accidents on roads. The use of ML algorithms such as SVM and DBN can help improve the accuracy of accident detection. Python programming language provides a user-friendly interface for developers and allows for easy integration with other tools and technologies.

The Expected output of our project are as follows:

1) People will willingly help the accident victims.
2) We will be able to save many people’s lives.
3) It will help the court to give judgements fast in case of hit and run cases.

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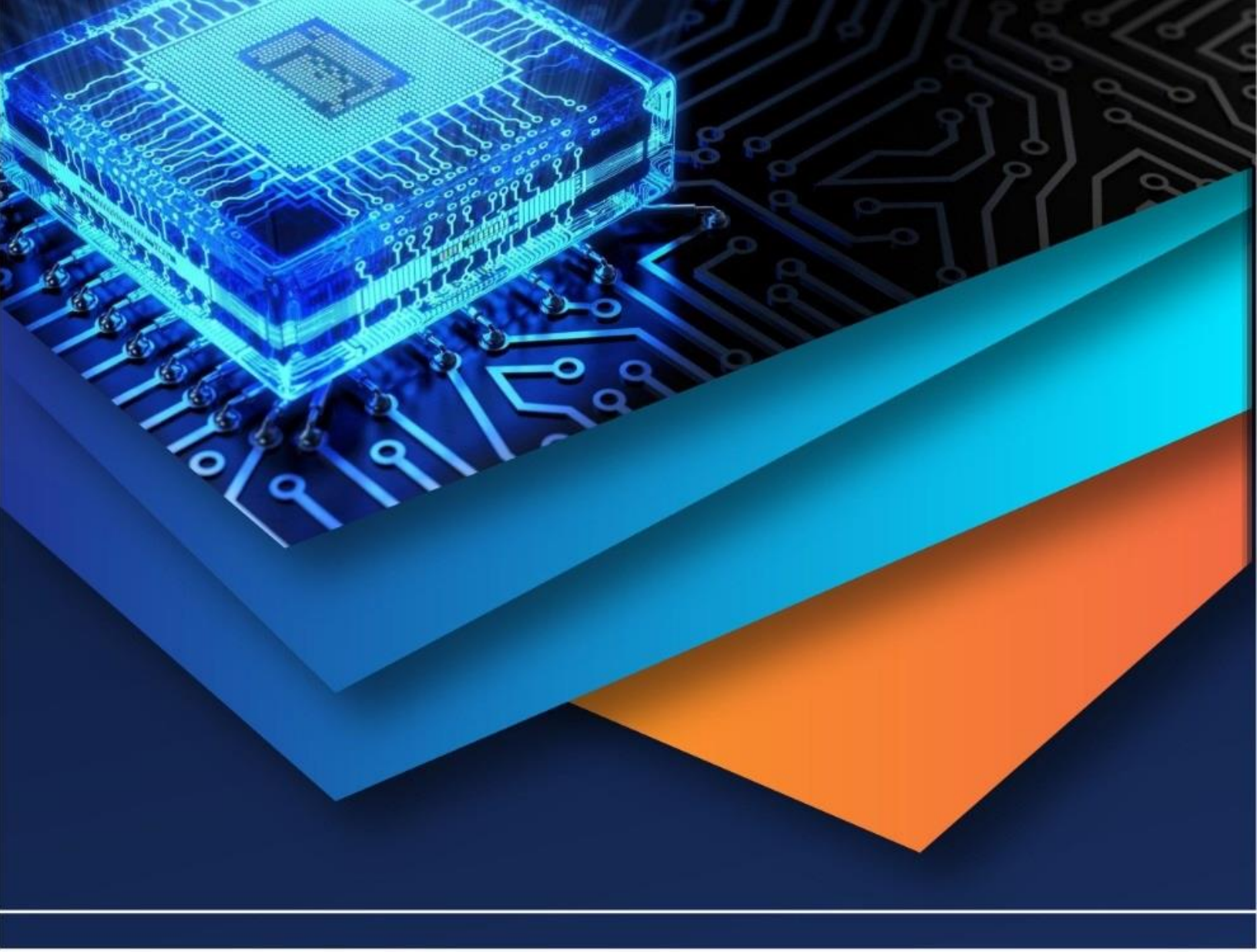

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