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ACCIDENT DETECTION AND ALERT SYSTEM USING YOLOV8 AND TWILIO

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Abstract: - A country with an ever-booming economy such as India, requires a well-developed and efficient transport system. With road transport remaining the primary mode of transport for most of India's businesses and citizens, it is crucial to have a technological emergency response system that can help to aid and mitigate road accidents. In this project, we bring forth an advanced Accident Detection and Alert System (ADAS) that uses the leading-edge YOLO (You Only Look Once) V8 algorithm, which can analyze the video footage captured by AI traffic cameras that are deployed across the Indian roadways. This algorithm has been trained to detect incidents such as vehicle crashes during mobile road traffic. Upon identifying an accident, the system promptly triggers an SMS alert message with the help of a cloud communication platform (Twilio) to relevant contact numbers such as contact numbers of emergency response departments like the police force, fire and safety, and ambulance services.

Keywords- Accident detection, YOLOv8, Twilio, SMS alert, Object Detection

I. INTRODUCTION

A country with an ever-booming economy such as India requires a well-developed transport system, and India's most extensive and efficient mode of transport happens to be roadways. India has the second-largest road network in the world after the United States, with a network of over 6.3 million km of roads [13]. Despite its vastness, the road network is not only exceedingly dense, with a road density of 1926.02 per 1000 sq. km, but also severely underdeveloped. Well-paved roads constitute only 64.7 percent of the total road length, which is comparatively much lower than that of developed countries [14]. This unfortunately contributes to the high frequency of road accidents in India.

According to the Ministry of Road Transport and Highways' annual report on road accidents, the states and Union Territories reported a total of 461,312 incidents in 2022, which caused injuries to 443,366 people [12]. The year marked an increase of 11.9 percent in accidents, 9.4 percent in fatalities, and 15.3 percent in injuries compared to 2021[1].

India's explosive economic growth and increased per capita income over the years have also led to rapid growth of vehicles in India. There has been a steady increase in the number of vehicles registered over the years [15], contributing to heavy road traffic and increased cases of road accidents.

Road accidents not only inflict physical and psychological trauma but also disrupt traffic flow, causing congestion, delays, and road damage, affecting commuters, businesses, and emergency services. While mitigation measures can help, total prevention is nearly impossible. With the help of our ADAS system, we can at the very least increase the efficiency of aid response and help in regulating India's road traffic during times of emergency.

II. PROPOSED SYSTEM

The proposed model is an Accident detection and alert system. The videos captured by traffic cameras are analyzed with the YOLOv8 object detection algorithm. If an accident event is detected, the system sends an SMS alert to the provided emergency contact via cloud-based Twilio platform.

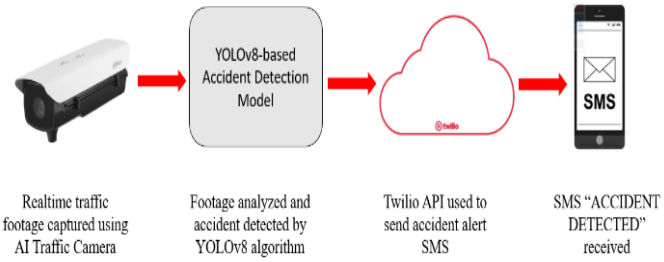

Fig 1: Model Architecture

III. METHODOLOGY

i. Dataset

The accident detection model has been trained using a custom dataset which was created using stock CCTV footage of real road accident events captured, widely available on YouTube. Over 1000 image frames were extracted from the stock footage using the OpenCV library in Python.

ii. Model Training

The custom dataset is labeled using LabelImg, a graphic image annotation tool used for labeling object bounding boxes in an image during tasks such as object detection, segmentation, and classification. The classification of the training data is done with the highly efficient YOLOv8 algorithm. YOLOv8 is capable of achieving a high level of accuracy, which is especially important for this project as multiple objects such as vehicles and pedestrians need to be identified in a scene. Moreover, YOLOv8 performs single-pass detection through the neutral network, resulting in faster interference. The architecture of YOLOv8 is given below [16].

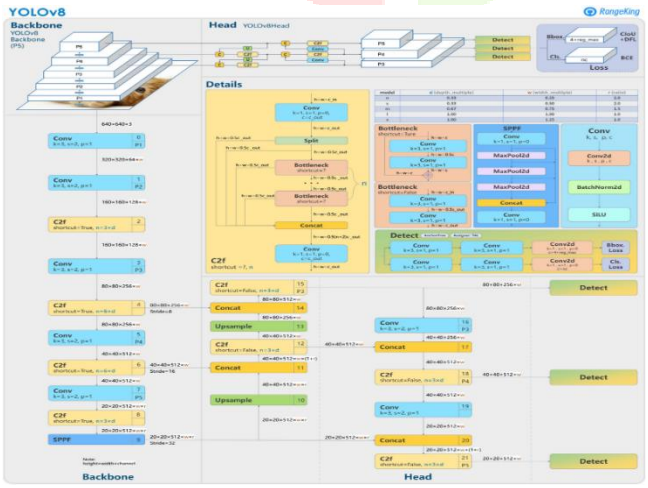

Fig 2: YOLOv8 architecture

Each mobile object i.e. cars, bikes, trucks, pedestrians, etc, present in the image is individually annotated with a class name. The frame with an accident event is given the "accident" class name. The process is then continued till all frames in the dataset have been labeled.

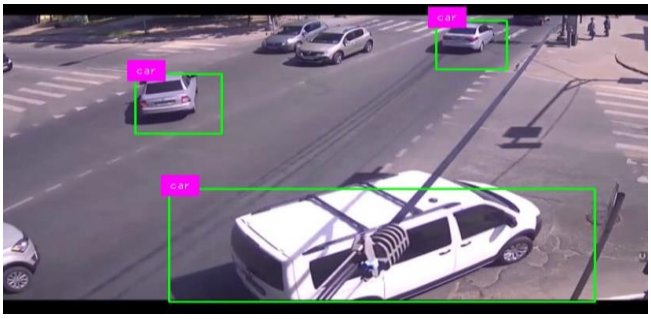

Fig 3: Annotation of mobile objects

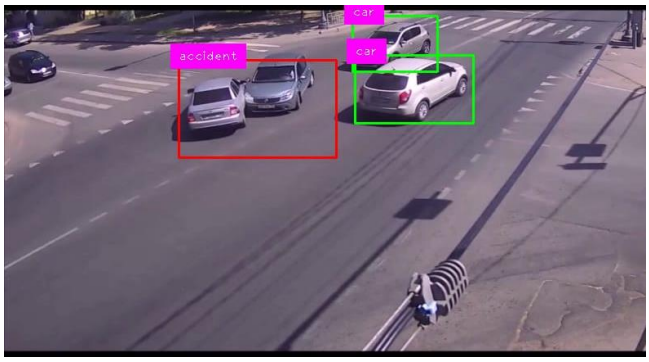

Fig 4: Classification of accident scenario

The model is finally implemented using Google Collaboratory, which uses GPU, making it much faster than local environments. Once all the shells of the collab code have been run, the accident detection model can be downloaded.

iii. Alert System

The SMS alert is achieved with the help of Twilio, a cloud communication platform. In contrast to a hardware-based alert system (GSM-based), Twilio provides a better easy-to-use API, higher coverage, and facilitates a robust SMS communication. To initialize the alert system, Twilio module is imported, and the function to send SMS alerts is defined and integrated into the accident detection model. Once an accident event is detected, the SMS alert will be received by the contact number provided in the code.

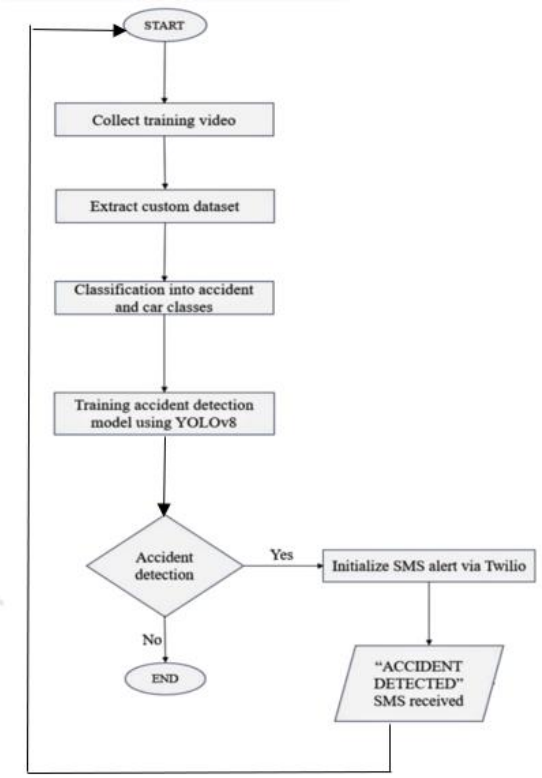

Fig 5: Flowchart of the accident detection and alert system

IV. RESULT

The ADAS system instantly sends an SMS alert upon detection of an accident. The detection model is highly efficient as it uses the latest version of YOLO technology (YOLOv8). The SMS system is also highly proficient as it uses cloud-based communication.

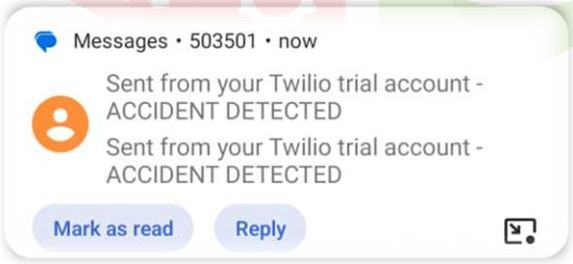

Fig 6: SMS alert

V. CONCLUSION

The ADAS system when integrated with AI traffic cameras, will make it possible for emergency response teams to be deployed as soon as an incident occurs. This would surely reduce the extent of causalities and help to resolve emergency situations as efficiently as possible.

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