AUTOMATIC ACCIDENT DETECTION AND ALERT SYSTEM USING COMPUTER VISION

ABSTRACT

Technology has emerged and grown immensely to make our human lives easy and comfortable. Even transportation has become trouble-free all because of technology. Though technology has a vast implementation in many domains, we can't hide the truth that road accidents are increasing, and road casualties are unstoppable. Though the government has made numerous efforts to control and limit road accidents, it has become inevitable. Many have lost their lives just because of someone's mistakes like rash driving, drunk driving, etc. Once the ambulance has been called in case of an accident, there may be a delay in reaching the spot due to traffic congestion which is also one of the reasons for human loss. So, to avoid such happenings in the future, we decided to introduce a system that uses computer vision to detect the accidents automatically and their severity level. The system also checks whether the post-collision fire has occurred and alerts the nearby hospital, fire station, and police station through a message. The system has several phases. To begin, the vehicle detection and tracking model utilized the YOLOv5 object detector with the DeepSORT tracker to detect and track the vehicles' movements by allocating a unique identification number (ID) to each vehicle. Second, a traffic accident and severity classification while utilizing the YOLOv5 algorithm to accurately detect and classify an accident's severity level, sending an immediate alert message to the nearest hospital if a severe accident has taken place. Finally, the ResNet152 algorithm was utilized to detect the ignition of a fire following the accident's occurrence with an automated alert being sent to the fire station if this perilous event occurred.

INTRODUCTION

According to a report submitted by the Ministry of Road Transport and Highways in the year 2021, Every year, approximately 1.5 lakh people die on Indian roads, which translates, on average, into 1130 accidents and 422 deaths every day or 47 accidents and 18 deaths every hour. The most significant factor to note here is that almost half of the RTA (road traffic accidents) victims reached the healthcare facilities after the golden hour. According to research conducted by the Department of Preventive and Social Medicine Jawaharlal Institute of Postgraduate Medical Education and Research, Puducherry, India, Unavailability of ambulances or vehicles for transport and delay in communication were the important factors that played a role in the delay. An automatic accident detection system will help us to overcome the above crisis and eventually will help us to minimize delays in rescue operations that could save many lives. The idea involves the concept of deep learning and computer vision technologies to detect accidents and classify their severity. As per the information gathered it generates alert messages to hospitals, police stations, and fire stations.

LITERATURE SURVEY

1. [1] imparts a five-phase modernized solution to detect traffic incidents in both sparse and dense traffic flow environments while considering low-visibility and differing environmental weather conditions.

2. [2] a vehicle unit is installed in the vehicle that senses the accident. If a vehicle has an accident, immediately send the location of the accident to the main server.

3. [3] The vehicle accident is observed using a vibration sensor.Also if any fire occurs, it is detected using fire sensor and an alarm message is directly sent to the fire station

4. [4] Accident Detection is done through CCTV Cameras where we pass the video of footage to the system. The system will convert those videos to frames and pass them one by one for detection purposes through Android Application.

PROPOSED SYSTEM

This proposed system aims to develop a real-time accident detection and alert system efficiently implementing deep learning and a computer vision approach.

The proposed methodology focuses on different phases,

1. Accident detection
2. Severity classification
3. Alert system
4. Ambulance unit
5. Post-collision fire
6. Traffic unit

A. Accident Detection

This is the first phase of the work where an accident is detected using real-time, CCTV-based video detection. Three versions of a convolutional neural network (CNN) known as YOLO (You Only Look Once), including the YOLOR, YOLOv5, and YOLOv4-Tiny.That algorithm is an extension of the Simple Online and Realtime Tracking (SORT) algorithm known as the DeepSORT tracker. The main problem that arises here is these datasets only tackle high-quality vehicle images for the detection of vehicles in CCTV video streams. Therefore, a custom vehicle detection image dataset vehicle instances extracted from CCTV traffic surveillance footage will be utilized. These datasets for vehicle, accidents, and fires will be obtained from various open sources, which are subsequently pre-processed and annotated

B. Severity Classification

Assessing the traffic accident's level of damage by automatically classifying its severity level into either moderate or severe is an extremely crucial factor of the proposed computer vision approach, as an alert will be sent based on the accident's severity level. A custom dataset, comprised of a combination of collected images from online sources and extracted frames from CCTV traffic accident compilation videos from YouTube has been created. The targeted accident object was labeled as either a moderate accident or a severe accident. Similarly, another custom collected dataset that procured two classes, fire, and no-fire, was created. Accordingly, burning vehicular incident images were collected and frames were extracted from YouTube videos. The real time image is compared with these data sets to produce results of the tracked vehicles classifying them into 2 sets of categories one being severity consisting of moderate and severe and the other being fire detection comprising fire and no fire

C. Alert System

The proposed work incorporates an automated alert system based on notifications as by sending an alert, the needed emergency services can immediately dispatch the necessary medical assistance and notify authorities of the accident as quickly as possible to reduce and minimize the response time of medical help. When the CCTV traffic camera detects an accident, the alert system will automatically activate and go into effective action. An email will be sent to certain centers according to the severity level assigned to each accident detected. The alert system was implemented using smtplib, which is a simple mail protocol that is accountable for sending and routing messages between servers, allowing automatic sending of emails.

D. Ambulance Unit

Once the accident has been detected the system automatically informs the nearby hospitals or any rescue teams available. Information is sent through an Email alert system with the geolocation of the accident spot along with the shortest path to reach the spot. At the same time, the ambulance unit turns ON the RF transmitter. This will lead to communication with the traffic section to reach the hospital without any delay in reaching.

E. Post-Collision Fire

Post-collision vehicle fires are one of the most hazardous traffic incidents, as they can cause a catastrophic number of casualties while risking human lives. Even though such incidents happen in a very small percentage, they tend to pose a double threat to vehicle occupants, and the loss of human lives and severe bodily injuries due to post-incident vehicle fires that must be immediately resolved. To overcome this threat, a post-collision vehicle fire incident detection model that detects the occurrence of a fire after a collision is embedded within the proposed system.

F. Traffic Unit

Whenever the traffic signal section receives information about the accident, the RF receiver in this section is turned ON to search for an ambulance near the traffic signal. Whenever the ambulance reaches near to the traffic signal (approximately 100m), the traffic signal will be made green through RF communication. Therefore, the ambulance will reach the hospital in time. Or without the RF transmitters, the density of vehicles can be checked using video processing (CPU) to make a green light in case of high traffic when emergency vehicles are detected.

CONCLUSION

The proposed method will be really helpful in automatic real time accident detection and help victims with required medical help as quickly as possible. It focuses on reducing the communication and transportation barriers that are frequently encountered in such an enormously populated country. With the new trend of developing smart cities all the CCTV cameras controlled by the government when enabled with this technology will ultimately lead to a significant decrease in the number of road accident deaths in the country.

Thank you.