

Accident Detection Using ML and AI Techniques

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Abstract - This paper employs computer vision in detecting accidents from CCTV footage and alerting Rescue systems. Computer vision is accelerating almost every domain within the industry. With the assistance of Computer Vision technologies, organisations are revolutionising the way machines accustomed to work earlier. Many times, after an accident occurs, people do not get Medical Aid services as early as possible or properly due to this lot of people losing their lives. In previous Technologies, Sensors are used for accident detection and alerts will be sent to the Relative of the Driver. But sensors can be damaged or sometimes it can not work. To overcome this we used Computer vision and AI techniques to detect Accidents and alert it through Android Application. We used the Yolov3 algorithm for detection of accidents and cars.

Key Words: YOLO, AI, ML, Firebase, OpenCV, Python.

1. INTRODUCTION

Computer vision is a field of study which enables computers to replicate the human visual system. It's a subset of artificial intelligence which collects information from digital images or videos and processes them to define the attributes. The entire process involves image acquiring, screening, analysing, identifying and extracting information. This extensive processing helps computers to know any visual content and act on that accordingly.

The motor vehicle population is growing at a faster rate than the economic and growth of population. Accidents and also the death rate due to road accidents, especially two-wheelers are also increasing at an alarming rate. Most of the accident deaths that happen are due to the shortage of immediate medical assistance, on the roads like express highways. A facility for providing immediate medical assistance to the accident area can reduce the fatality to a greater extent. Thus comes the concept of an alert system that senses the accident and its seriousness to alert the nearby center for providing ambulance or medical aid to the accident area.

To note, previous literature mainly focused on sensors and traditional approaches and some of them used algorithms like Yolov3, RCNN and many detection algorithms.

In this Project, the **CCTV system** will check whether an accident has occurred and **identify the accident**. Once the selection of accidents has been taken, the system will check for the closest center, police station and **notify** them about the incident. The **rescue team** can rush to the spot immediately with no delay because the right **location** is getting to be communicated by the **Android Application**. The system will send geolocation of accidents through Android applications to rescue systems.

Accident detection and alert systems have been extensively studied over the past several years. Research adds this field has proposed a Telematics model which contains a main module. The CCTV system is supposed to capture the situation of the accident and through GPS, send the location information to rescue systems. Another main feature is, cops also get live **CCTV footage** of the accident place.

Considering these, a vision-based accident detection model framework was developed for accident detection and alert systems. The paper is organized as follows: the second section discusses previous literature related to vision-based accident detection and alert systems. Section 3 introduces the motivational and problem definition of the project. Section 4 discusses the designs and methodology of the project. Section 5 discusses the results and observations of the project. Section 6 concludes the findings of this research.

2. LITERATURE SURVEY

V. Machaca Arceda et al [1] In this project there aim is to detect car crash accident detection in video. The first stage they used is convolutional neural network in this case they used YOLO algorithm. The second stage tracker in order to focus each car. The final stage for each car they have used the (VIF) Violent flow descriptor with a support vector machine in order to detect car crashes. It gives around 89% accuracy.

Deeksha Gour et al [2] This project is based on the neural network and deep learning of object detection along computer vision technology and several methods and algorithms. This approach will work on images, recorded videos, real-time live videos and will detect, track and compute moving objects, velocity and direction using convolutional neural networks. They used a YOLO algorithm which achieves its result by applying a neural network on the image.

Pratishtha Gupta et al [3] This project is predicated on image processing. This document presents a replacement work on traffic images during which the traffic image is processed to seek out if every individual vehicle goes within the straight or diagonal direction when it crosses the junction. Intensity values are computed on each pixel in row or column. It gives around 98% accuracy for detecting direction deviation.

Vaishnavi Ravindran et al [4] The approach is based on detecting damaged vehicles from footage received from surveillance cameras installed in roads and highways which would indicate an occurrence of road accident. Detection of damaged cars falls under a category of object detection in the field of machine vision technique. They

used a supervised learning method which works as a binary classifier to distinguish between images containing a damaged car as class 1 and images not containing it as class 0.

Sreyan Ghosh et al [5] The intent is to create a system which would detect an accident based on the live video from a CCTV camera installed on highways. The idea is to take each frame of video and run it through a deep learning convolutional neural network, which has been trained to classify frames of video into accident or non accident. It gives around 92.3%.

3. MOTIVATION AND PROBLEM DEFINITION

As the motor vehicle population is growing at a faster rate than the economic and growth of population, Accidents and also the death rate due to road accidents, especially two-wheelers are also increasing at an alarming rate. Most of the accident deaths that happen are due to the shortage of immediate medical assistance, on the roads like express highways. A facility for providing immediate medical assistance to the accident area can reduce the fatality to a greater extent. Thus comes the concept of an alert system that senses the accident and its seriousness to alert the nearby center for providing ambulance or medical aid to the accident area.

3.1 PROBLEM DEFINITION

An accident is a hit or miss event that sometimes has inconvenient or undesirable consequences, other times being inconsequential. The occurrence of such an incident may or might not have unrecognized or unaddressed risks contributing to its cause.

There are a number of causes/issues of Accident:-

1] Vehicle population is growing at a faster rate in present days the speed of accidents may be increased rapidly. due to employment the usage of vehicles like cars, bikes can be increased, because of this reason the accidents can happen due to over speed. People are going at risk because of their over speed, due to the unavailability of advanced techniques, the rate of accidents can't be decreased.

2] Drunk driving:-Another major reason for road accidents within the country is drunk driving. Drunk driving is a serious offense and as per rules laid down by the court, any driver found with more than 30 mg of alcohol in 100 ml of blood is under the influence of alcohol and may be a culprit of drunk driving. If caught in the act of drunk driving, the person in question can be imprisoned for up to 2 years or/and a fine up to Rs.3000. Driving under the influence of alcohol doesn't only endanger the driver's life but also of individuals in other vehicles on the road.

3] Road accidents caused because of animals: Animals on roads are one more reason for road accidents within the country. While crossing roads these animals may collide with vehicles on the road which may cause accidents.

4] No idea about the accident to Cops :After an accident, the policeman doesn't have any idea about the accident till the driver or an incident nearby person calls

them. Traffic increases after an accident at an accident place because of that lot people get stuck on roads.

4. DESIGN AND METHODOLOGY

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 using YOLO. If an accident is detected, Location, Accident Image, and Video footage are going to be passed to Rescue Systems through Android Application.

4.1 DETECTION

For Detection, we are using the YOLOv-3 algorithm. YOLO (You Only Look Once) real-time object detection algorithm, which is one of the foremost effective object detection algorithms that also encompasses many of the foremost innovative ideas beginning with the computer vision research community.

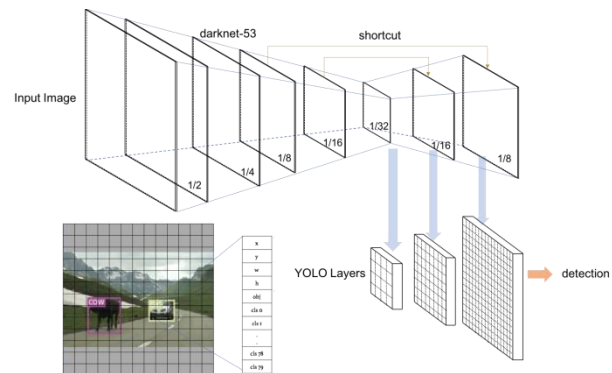


Fig -1: Yolo Layers

For Accident Detection, all Cars detected in a frame are stored and check whether those are overlapping each other or not. For Overlapping used:

$x = X$ position of Detected car in frame

$y = Y$ position of Detected car in frame

if $\text{variance}((x)^2 + (y)^2) > 200$ then all detected car's are stored. Let all this data be stored in Cars_data. Now, if $((\text{Cars_data}[i]X \text{ position} - \text{Cars_data}[i]Y \text{ position})^2 + (\text{Cars_data}[j]X \text{ position} - \text{Cars_data}[j]Y \text{ position})^2) < ((\text{Cars_data}[i](\text{width}^2 + \text{height}^2))^2 + \text{Cars_data}[j](\text{width}^2 + \text{height}^2))^2 * 0.3$) Then an Accident is detected and that frame will be passed to the Android Application.

4.2 FIREBASE

Firebase is Backend-as-a-Service (Baas). It provides developers with a selection of tools and services to assist them develop quality apps, grow their user base, and earn profit. It's built on Google's infrastructure. Firebase is categorized as a NoSQL database program, which is used to store data in JSON format.

A. Image and Video Upload:

After Detecting Accident system will store that frame pic and for video purpose the system will store next frames from that accident frame pic. After storing pic and videos successfully, the system passes a script to upload those stored information to Firebase Database.

```
db=firebase..database()  
db.child(name_of_child).push(data)
```

B. Sending GeoLocation:

For getting Geolocation we use Selenium to fetch current location through "https :// mycurrentlocation.net/". From this link we get Latitude, Longitude, and City Name and after getting this information we pass it to Firebase Database.

C. Notification :

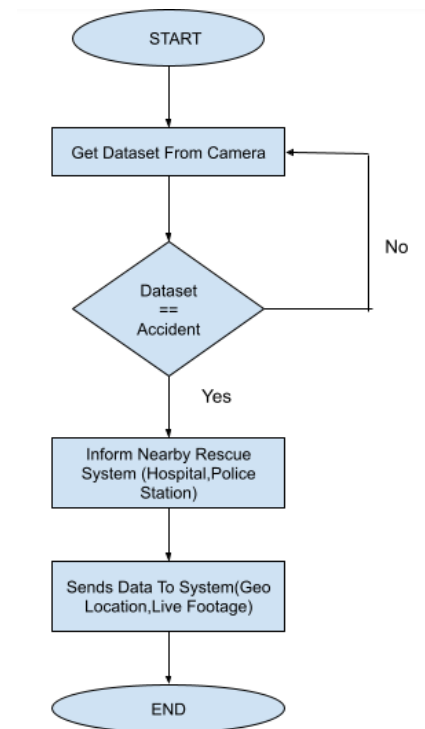
For getting Notification after detecting an accident we used FCM(Firebase Cloud Messaging) and "https:// pusher.com /". By this we pass notification with the incident place name where the incident was detected. System use pusher_push_notifications python library.

4.3 SOFTWARE AND DATASET

In this project, softwares mainly used are Pycharm for python scripting and Android Studio for building Android Application.

Dataset used in this project is https://docs.google.com/document/d/12F7l4yxNzzUAISZufEd9WFhQKSeFVVo_QsPdTsWxZh8/edit

In this dataset, there are around 1600 videos and their extracted frames. So we can use it for testing



and training our models.

4.4 WORKFLOW

Fig -2: Workflow of Module
5. RESULT AND OBSERVATION

A. Accident Detection Frame pic



Fig -3: Accident Frame

Figure 3 shows an accident detected frame. As an accident detected through the model, it stores the frame in png format.

B. Accident List in Android Application

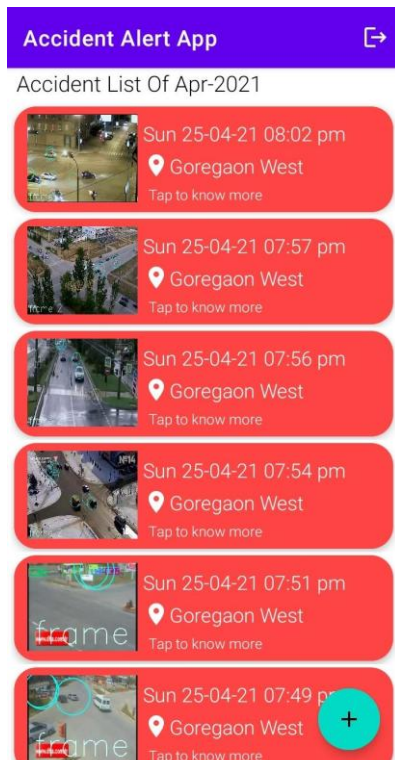


Fig -4: Accident List

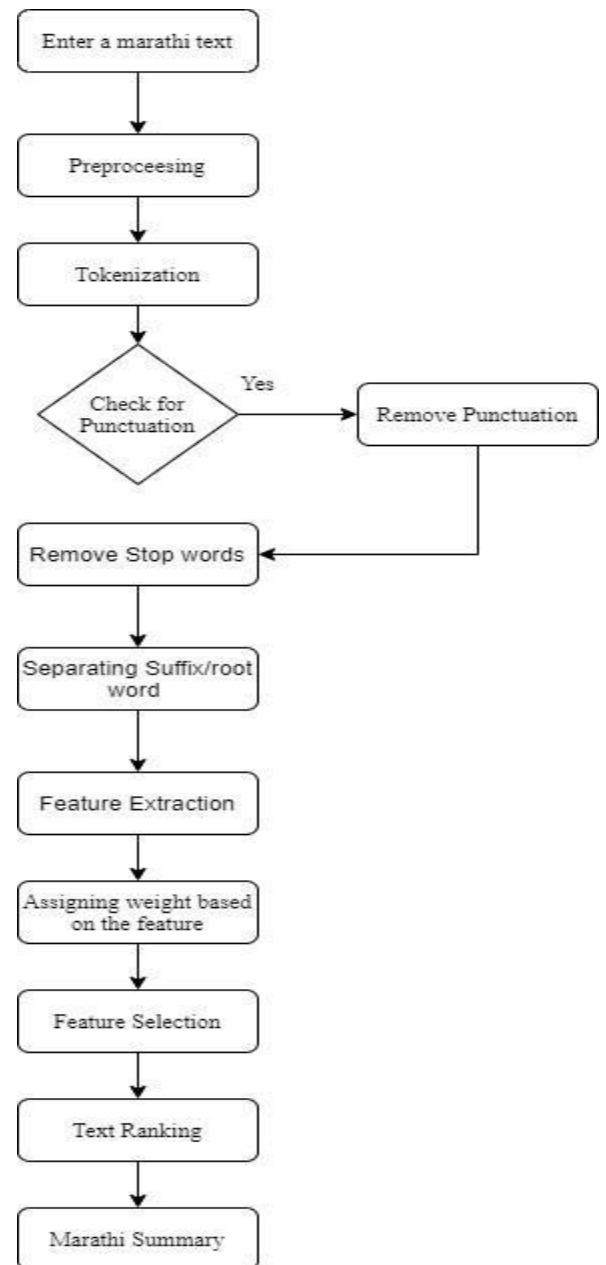


Figure 4 shows the list of accidents detected through the model as per Month wise on Android Application.

C. Accident Count Bar Graph in Android Application

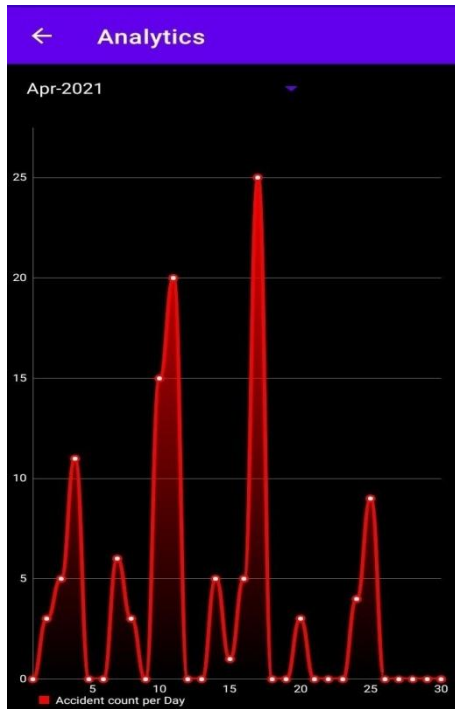


Fig -5: Accident Count Bar Graph of Month

Figure 5 shows Analytical representation of accident data on Android Application.

D. Accident Video in Android Application

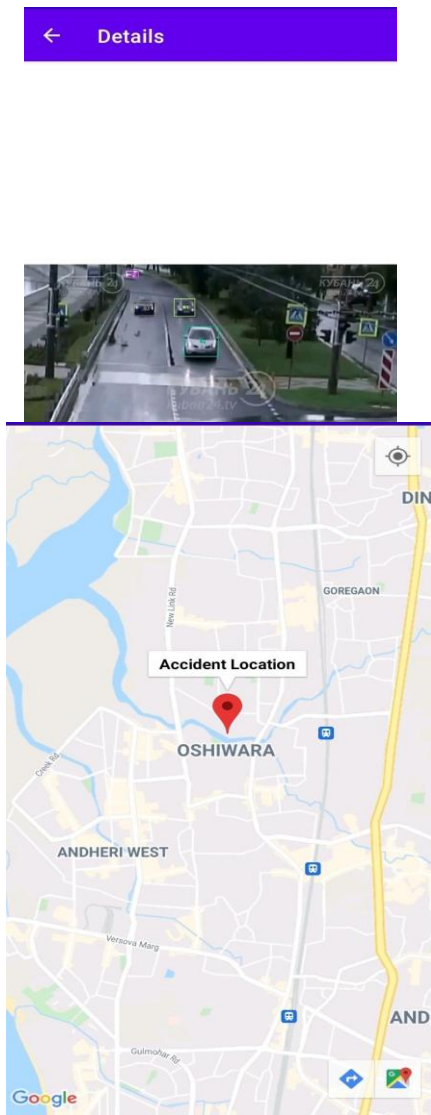


Fig -6: Accident Video

Figure 6 shows Accident video in Android Application to verify it really happened or not and also for checking who's fault during the accident.

E. Accident Detected Location in Android Application

Fig -7: Accident Detected Location

Figure 7 shows Accident detection location as accidents get detected through the model.

F. Route Guide in Android Application

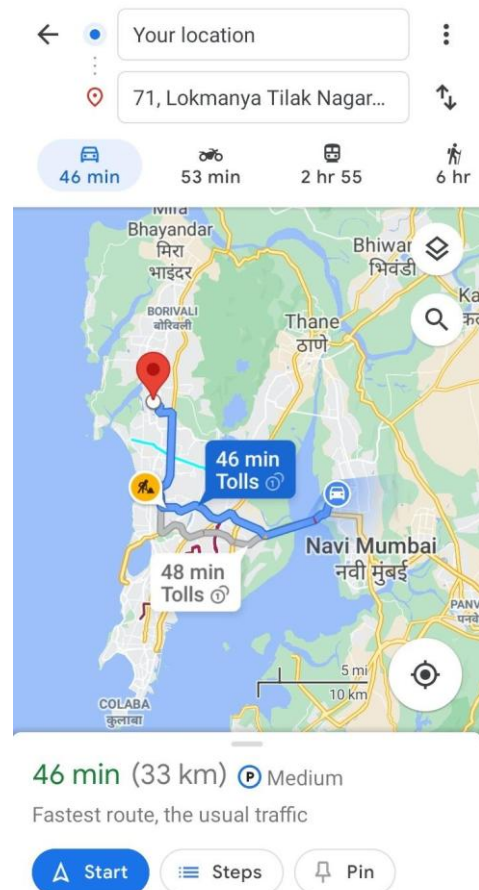


Fig -8: Route Guide by Google Maps

Figure 8 shows route guide direction to the incident place.

6. CONCLUSIONS

We proposed the system to detect an Accident by applying the YOLOv3 algorithm. After detection the system will send accident pic and accident video to Rescue systems like Police Station and Ambulance through Android Application. Also they will get Geolocation of the incident place and route guide with help of Google Maps to reach faster as possible. The system efficiently worked with invariant lighting and camera location conditions and camera quality.

7. FUTURE SCOPE

The proposed system also can be used to detect the possibility of Accident, Alcoholic Driver, can detect the number plate and if connected to a centralized system also can be used to inform the emergency contact related to the number plate or the insurance agencies.

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