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ACCIDENT DETECTION AND NOTIFICATION SYSTEM

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ABSTRACT :

Computer vision-based accident detection through video surveillance has become a beneficial but daunting task. In this paper, a neoteric framework for detection of road accidents is proposed. The proposed framework capitalizes on Mask R-CNN for accurate object detection followed by an efficient centroid based object tracking algorithm for surveillance footage. The probability of an accident is determined based on speed and trajectory anomalies in a vehicle after an overlap with other vehicles. The proposed framework provides a robust method to achieve a high Detection Rate and a low False Alarm Rate on general road-traffic CCTV surveillance footage. This framework was evaluated on diverse conditions such as broad daylight, low visibility, rain, hail, and snow using the proposed dataset. This framework was found effective and paves the way to the development of general-purpose vehicular accident detection algorithms in real-time.

KEYWORDS: Accident Detection, OpenCV, Vehicular Collision, Centroid based Object Tracking.

1.INTRODUCTION

Every day around the world, a large percentage of people die from traffic accident injuries. An influential indicator of survival rates after detecting the accident is the time between the occurrence of the accident and the arrival of emergency responders to the scene. Reductions in this time, in turn, may affect the numbers of fatalities, and this is achieved through Accident detection and notification system. The main obstacle that encounters the low-speed accident is how to differentiate whether the user is inside the vehicle or outside the vehicle walking or slow running. The proposed system consists of two phases; the detection phase which is used to detect car accidents at low and high speeds. The notification phase, which immediately after an accident is indicated, is used to send detailed information such as images, video, accident location, etc. to the emergency responder for fast recovery. The system uses a combination of techniques such as object

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detection, lane detection, and human recognition. This system is developed using a software library in python called OpenCV (Open Source Computer Vision Library). This system uses CCTV cameras that are arranged in the city to detect vehicular accidents and report them to the concerned authorities within a matter of seconds. It also records the time of the incident so that the video footage can be viewed for legal procedures.

2.LITERATURE REVIEW

EXISTING SYSTEM

To protect the vehicle and track so many advanced technologies are available nowadays. In olden days the information of accident can be transferred, but the place of accident spot cannot be identified. In any vehicle airbags are designed, airbags are used for security and safety travels. The airbag system was introduced in the year of 1968. Some systems designed to control the pressure inside the pneumatic tires on vehicles that provide different operating conditions such as lower tire pressure is desired in order to maximize traction, maneuvering through challenging terrain, pulling a heavy load out of an incline at slow speeds, crawling out of soft dirt. The pressure ranges from 15 to 45 PSI.

PROPOSED SYSTEM

Our preeminent goal is to provide a simple yet swift technique for solving the issue of traffic accident detection which can operate efficiently and provide vital information to the concerned authorities without time delay. The proposed accident detection algorithm includes the following key tasks: Vehicle Detection, Vehicle Tracking and Feature Extraction, Accident Detection. The proposed system uses object detection to detect the vehicle in the video footage and track it till the end of the frame. In case of any accident of the vehicle, the system detects and concludes that it is an accident and reports to the concerning authorities.

3.SYSTEM REQUIREMENTS

HARDWARE REQUIREMENTS:

- System : I5 PROCESSOR 2.24 GHz
- Hard Disk : 300 GB.
- Ram : 4 gb.

SOFTWARE REQUIREMENTS:

- Operating system : Windows /Ubuntu
- Coding Language : Python
- Back End : Python

4.ARCHITECTURE

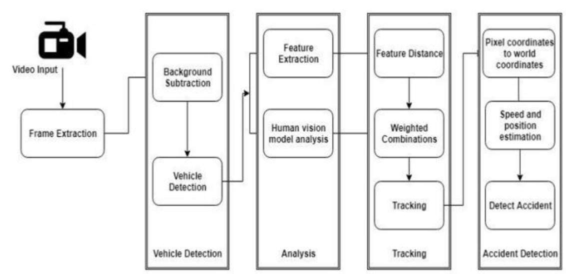

Fig1. Architecture of Accident Detection And Notification System

5. WORKING

Fig1. Architecture of Accident Detection And Notification System The goal is to provide a simple yet swift technique for solving the issue of traffic accident detection which can operate efficiently and provide vital information to concerned authorities without time delay.

The proposed accident detection algorithm includes the following key tasks:

a. Vehicle Detection

b. Vehicle Tracking and Feature Extraction

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c. Accident Detection

5.1. Vehicle Detection

This phase of framework detects vehicles in the video. The object detection algorithm used here is Canny Edge Detection through which the edges are detected and Hough Transform Algorithm. The result of this phase is an output dictionary containing all the class IDs, detection scores, bounding boxes for a given video frame.

Vehicle Tracking and Feature Extraction

Once the vehicles have been detected in a given frame, the next imperative task of the framework is to keep track of each of the detected objects in subsequent time frames of the footage. This is accomplished by utilizing a simple yet highly efficient object tracking algorithm known as Centroid Tracking. This algorithm relies on taking the Euclidean distance between centroids of detected vehicles over consecutive frames. The centroid tracking mechanism used in this framework is a multi-step process which fulfills the aforementioned requirements. The following are the steps:

1) The centroid of the objects are determined by taking the intersection of the lines passing through the mid points of the boundary boxes of the detected vehicles.

2) Calculate the Euclidean distance between the centroids of newly detected objects and existing objects.

3) Update coordinates of existing objects based on the shortest Euclidean distance from the current set of centroids and the previously stored centroid.

4) Register new objects in the field of view by assigning a new unique ID and storing its centroid coordinates in a dictionary.

5) De-register objects which haven't been visible in the current field of view for a predefined number of frames in succession.

Once the vehicles are assigned an individual centroid, the following criteria are used to predict the occurrence of a collision.

C1: The overlap of bounding boxes of vehicles

C2: Determining Trajectory and their angle of intersection. C3: Determining Speed and their change in acceleration

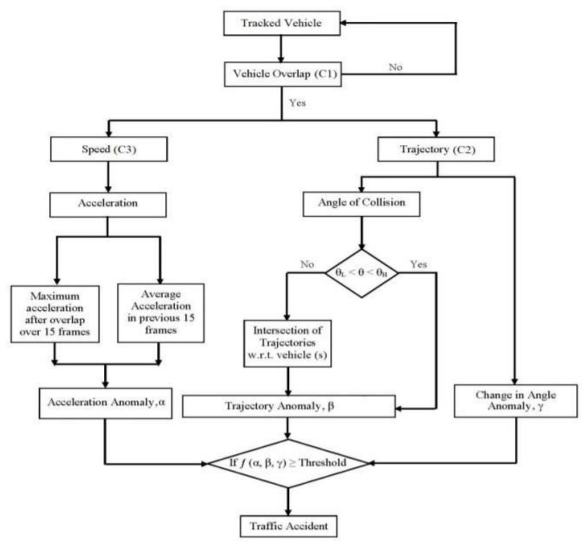

Fig 2. Workflow diagram describing the process of accident detection.

Accident Detection

This section describes the process of accident detection when the vehicle overlapping criteria has been met. We will introduce three new parameters (α, β, γ) to monitor anomalies for accident detections. The parameters are: 1) Acceleration Anomaly, α 2) Trajectory Anomaly, β 3) Change in Angle Anomaly, γ. When two

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vehicles are overlapping, we find the acceleration of the vehicles from their speeds captured in the dictionary. We find the average acceleration of the vehicles for 15 frames before the overlapping condition (C1) and the maximum acceleration of
the vehicles 15 frames after C1. We find the change in accelerations of the individual vehicles by taking the difference of the maximum acceleration and average acceleration during overlapping condition (C1). The Acceleration Anomaly (α) is defined to detect collision based on this difference from a pre-defined set of conditions. This parameter captures the substantial change in speed during a collision thereby enabling the detection of accidents from its variation. The Trajectory Anomaly (β) is determined from the angle of intersection of the trajectories of vehicles (θ) upon meeting the overlapping condition C1. 1) If θ E (θL θH), β is determined from a pre-defined set of conditions on the value of θ. 2) Else, β is determined from θ and the distance of the point of intersection of the trajectories from a predefined set of conditions. Thirdly, we introduce a new parameter that takes into account the abnormalities in the orientation of a vehicle during a collision. We determine this parameter by determining the angle (θ) of a vehicle with respect to its own trajectories over a course of an interval of five frames. Since in an accident, a vehicle undergoes a degree of rotation with respect to an axis, the trajectories then act as the tangential vector with respect to the axis. By taking the change in angles of the trajectories of a vehicle, we can determine this degree of rotation and hence understand the extent to which the vehicle has underwent an orientation change.Based on this angle for each of the vehicles in question, we determine the Change in Angle Anomaly (γ) based on a predefined set of conditions. Lastly, we combine all the individually determined anomaly with the help of a function to determine whether or not an accident has occurred. This function f(α, β, γ) takes into account the weightages of each of the individual thresholds based on their values and generates a score between 0 and 1. A score which is greater than 0.5 is considered as a vehicular accident else it is discarded. This is the key principle for detecting an accident.

6.CONCLUSION

In this project, a new framework to detect vehicular collisions is proposed. This framework is based on local features such as trajectory intersection, velocity calculation, and anomalies. All the experiments conducted in relation to this framework validate the potency and efficiency of the proposition and thereby authenticates the fact that the framework can render timely, valuable information to the concerned authorities. The incorporation of multiple parameters to evaluate the possibility of an accident amplifies the reliability of our system. Since we are focusing on a particular region of interest around the detected, masked vehicles, we could localize the accident events. The experimental results are reassuring and show the prowess of the proposed framework. However, one of the limitations of this work is its ineffectiveness for high-density traffic due to inaccuracies in vehicle detection and tracking, that will be addressed in future work. In addition, large obstacles obstructing the field of view of the cameras may affect the tracking of vehicles and in turn the collision detection.

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