VEHICLES SPEED DETECTION SYSTEM USING OPENCV

S. Santosh
KV SubbaReddy Engineering College, Kurnool, A.P, India

B Harishkumar Reddy, A. Jayasimha, M. Sravan Kumar, M. Rajasekhar
KV SubbaReddy Engineering College, Kurnool, A.P, India

Abstract

In this Project, we recommended a traffic accident detection and introduced a framework for consequently recognizing, recording, and detailing traffic accidents at crossing points. A framework with these properties would be helpful in deciding the reason for accidents and the highlights of the crossing point that sway wellbeing. Moreover, we proposed and structured the metadata vault for the framework to enhance the interoperability.

This model simply detects the accident or collisions at the traffic lights by identifying collisions at the intersection and then informing to central data, so that a life can be saved.It only detects the collisions between cars only but for future use it can be extended to other 4 wheelers as well 2 wheelers and an informing system can also be installed that redirects to Ambulance for the emergency if it detects an accident on the intersection of Traffic lights.

An implementation of the proposed technique will be performed using python programming language. This describes the methodology used for image processing for traffic accident detection classification using different libraries and algorithms with real time images.

Keywords : *Traffic Accident Detection,Image Processing, Intersection Monitoring, Python Programming, Collision Classification*

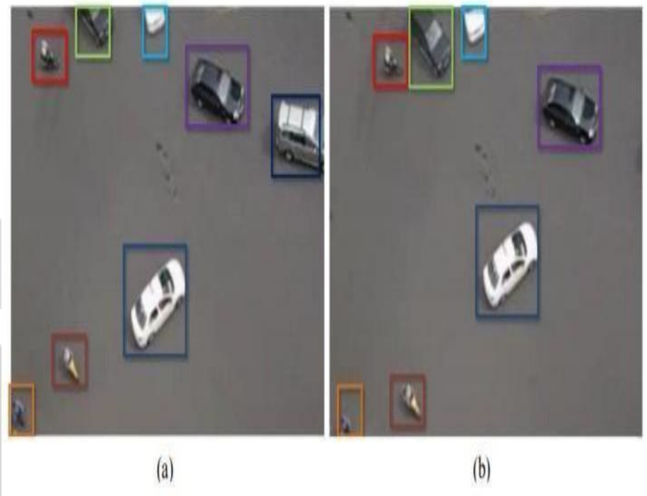
I. INTRODUCTION

Consistently, vehicular accidents cause deplorable loss of lives, cost numerous nations huge measures of cash, and produce considerable blockage to a country's transportation framework. 50%-60% of the deferrals on urban roads are related with episodes, and on urban surface lanes, an enormous level of traffic accidents and most postponements happen at or close to crossing points. Crossing points are a typical spot for crashes, which might be because of the way that there are a few clashing developments, just as a horde of various convergence structure qualities. Convergences likewise will in general experience serious crashes because of the way that few sorts of harmful accidents, for example, edge and left-turn impacts, normally happen there.

Subsequently, precise and brief detection of accidents at convergences offers enormous advantages of sparing properties and lives and limiting clog and delay. Traffic accident detection utilizing computer vision and Image processing has pulled in much consideration as of late. Ikeda et al. [1] plot a picture processing-innovation based programmed unusual occurrence detection framework. This framework is utilized to distinguish four kinds of episodes, to be specific

1) Stopped vehicles
2) Slow vehicles
3) Fallen articles
4) Vehicles that have endeavored path progressive changes.

Although, lot of study has been done to make a structure that can identify an accident through video observation, real-time execution of every one of these frameworks have not been realized at this point. Real-time execution of an accident detection through video with traffic reconnaissance has consistently been trying since one needs to find some kind of harmony between the speed of the framework and the exhibition of the frameworks, for example, accurately recognizing accidents and furthermore diminishing bogus caution rate. Preferably we need a framework that could augment the quantity of edges handled every second simultaneously ready to accomplish a worthy execution rate. This carries us to the objective of this examination. The motive of this exploration is to build up an accident detection module ati roadway crossing points with video processing that is appropriate for real-time usage. In this proposal we built up an accident detection module that utilizes the parameters separated from the distinguished and followed vehicles which can accomplish great real-time execution.



A significant stage in programmed vehicle crash checking frameworks is the detection vehicles in every video outline and precisely following the vehicles over numerous edges. With such following, vehicle data, for example, speed, change in speed and change in direction can be resolved to encourage the procedure of crash detection. As appeared in the Figure 1.1 [1] given the recognized vehicles, following can be seen as a correspondence issue in which the objective is to figure out which distinguished vehicle in the following edge compares to a given vehicle in the present edge. While for a human expert, the errand of following can regularly be performed easily, this assignment is very trying for a computer. In this way in this proposition more accentuation has been given to the real-time execution of vehicle detection and following.

As shown in Figure 1.1, given the identified vehicles, following can be seen as a correspondence issue in which the objective is to figure out which recognized vehicle in the following casing compares to a given vehicle in the present edge. While for a human expert, the undertaking of following can regularly be performed easily, this errand is very trying for a computer. In this way in this proposal more accentuation has been given to the real-time usage of vehicle detection and tracking.As appeared in the Figure given the identified vehicles, following can be seen as a correspondence issue in which the objective is to figure out which distinguished vehicle in the following edge relates to a given vehicle in the present edge.

II. LITERATURE SURVEY

Various regular road occurrence detection calculations have been created in the previous quite a few years. Methods dependent on choice trees for design acknowledgment, time arrangement examination, Kalman channels, and neural systems have been endeavored however met with changing degrees of accomplishment in their detection execution [2]. Then again, just a couple of analysts have researched the detection of traffic crashes at crossing points [2].

In 2005, Green et al. [4] assessed a sound-incited video recording framework used to break down the explanations behind traffic crashes at convergences. The framework naturally records potential episodes when initiated by sound (horns, conflicting metal, screeching tires, and so forth.). It was conveyed in 2001 at the crossing point of Brook and Jefferson Streets in Louisville, KY. The transportation engineers utilized this data to make a few upgrades to the crossing point, which brought about 14% decrease in accidents. Another examination portrayed in a 2001 report thought about the improvement of a framework for naturally recognizing and revealing traffic crashes at convergences [4] the investigation would decide crashes legitimately from the acoustic sign of the accident.

An acoustic database of ordinary traffic sounds, development sounds, and crash sounds was created utilizing the hints of crash tests, routine traffic sounds at crossing points, and development sounds from building destinations. Tests indicated that the false alarm rate (FAR) (false positive) was 1%. The end was that the framework should have been additionally assessed in circumstances with routine traffic stream and accident events.

Traffic Accident Detection and Informing System

Traffic Accident Detection and Informing System is an image-impelled moving picture recording and detailing system used to investigate and assess the event of traffic crashes at convergences. The system comprises of a charge-coupled-gadget camera situated on the edge of the crossing point to get a perspective on occurrences, an image processing unit that identifies images that could be identified with a traffic crash, an advanced video recorder (DVR) that has recorded all the circumstances of the convergence for the past about fourteen days, and a correspondence unit that send the AMPs to the TMC. At the point when the Accident Detection and Informing System recognizes an occasion that could be a crash and catches the AMPs (which incorporate 5 s before the occasion and 5 s after the occasion) from the DVR, the system sends the AMPs to the TMC by the virtual private system.

III.EXISTING SYSTEM

Video-Based Speed Detection:

- Most existing systems use CCTV or surveillance camera footage to detect and track vehicles.
- OpenCV is widely used for object detection (vehicles) and tracking (e.g., using centroid tracking or Kalman filters).
- Speed is calculated based on the time it takes a vehicle to move between two reference points with known distance.

Background Subtraction and Motion Detection:

- Frame differencing and background subtraction are used to identify moving objects (vehicles).
- Contours and bounding boxes help isolate each vehicle for tracking.

Pre-trained Object Detection Models:

- Models like Haar Cascades, HOG + SVM, or more advanced DNNs (YOLO, SSD) are integrated with OpenCV for better vehicle detection accuracy.

Use of Fixed Cameras:

- Most systems assume the camera is static and mounted at a known height and angle to calculate distances accurately.

Offline and Semi-Automated Approaches:

- Some implementations require manual configuration of frame regions, road lanes, and distance calibration.

Disadvantages:

1. **Accuracy Depends on Camera Angle and Calibration:**
   - Speed estimation is highly sensitive to camera position, height, and angle.
   - Misalignment leads to inaccurate distance measurement, affecting speed calculations.
2. **Limited to Static Cameras:**
   - Most systems only work with fixed cameras.
   - They cannot be used in moving vehicles (e.g., police patrol cars) for dynamic speed detection.
3. **Environmental Sensitivity:**
   - Performance drops in low light, rain, fog, or poor video quality.
   - Shadows and reflections may cause false detections.

4. **Manual Setup Required:**
   - Users often need to manually set reference points and calibrate distance in video frames.
   - This makes deployment tedious and not scalable.
5. **Low Real-Time Performance:**
   - On low-end hardware, real-time tracking and speed computation can lag, especially when multiple vehicles are present.
6. **Difficulty with Occlusions and Lane Changes:**
   - When vehicles overlap or change lanes suddenly, tracking gets confused, affecting both detection and speed calculation.
7. **No License Plate Integration:**
   - Most OpenCV-based systems do not integrate automatic number plate recognition (ANPR), limiting enforcement applications.
8. **Basic Object Detection Models:**
   - Traditional models (e.g., Haar, HOG) have lower accuracy compared to modern deep learning-based models like YOLO or SSD.

IV. PROPOSED SYSTEM

The proposed system aims to accurately detect vehicle speed in real-time using a combination of OpenCV and deep learning models integrated with camera-based tracking. Key components include:

1. **Advanced Object Detection:**
   - Use deep learning models like YOLOv8 or SSD MobileNet for accurate vehicle detection.
   - These models are pre-trained and capable of real-time detection with high precision.
2. **Real-Time Object Tracking:**
   - Implement tracking algorithms such as Deep SORT or Kalman Filter to maintain vehicle identity across frames.
   - Helps to handle occlusions and lane changes more robustly.
3. **Speed Calculation:**
   - Speed is calculated based on the time taken by a vehicle to cross two virtual lines (distance known) in the frame.
   - The time difference is computed using frame timestamps.
4. **Automatic Calibration:**
   - Incorporate a calibration module that adjusts for camera angle and field of view using reference objects or markers.
   - Reduces manual setup effort.
5. **Optional ANPR Integration:**

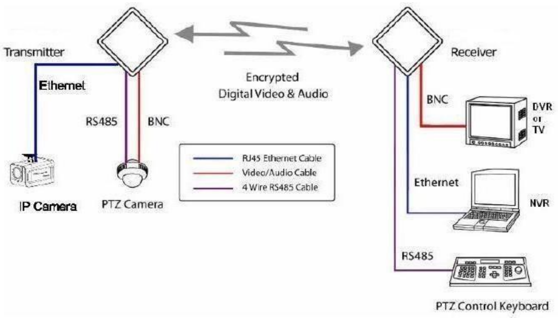
   Add a license plate recognition module for identifying and logging speeding vehicles.

6. **User Interface and Alerts:**

   Provide a dashboard or alert system to display vehicle speed and raise alarms when it exceeds the limit.

7. **Cloud or Local Database Logging:**

   Store detected vehicle speeds, timestamps, and optionally license plates for analysis or reporting.



Advantages:

1. **High Detection Accuracy:**

   Deep learning models improve detection precision and recall, even under challenging conditions.

2. **Robust Tracking:**

   Advanced tracking handles occlusions, multiple vehicles, and lane changes efficiently.

3. **Real-Time Processing:**

   The system is optimized for real-time detection and speed calculation on mid- to high-end GPUs.

4. **Reduced Manual Configuration:**

   Automatic calibration eliminates the need for manual distance or perspective setup.

5. **Scalability:**

   Easily deployable across multiple surveillance cameras in smart cities or highways.

6. **Environmental Adaptability:**

   Performs better in varying lighting and weather conditions using noise reduction and contrast enhancement techniques.

7. **Integrated Enforcement (Optional):**

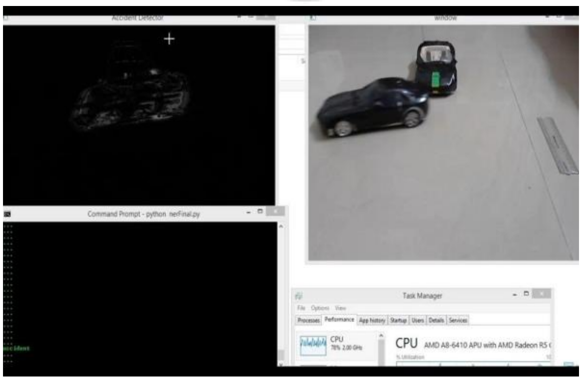
   When combined with ANPR, the system can automate speed violation recording and enforcement.

8. **Cost-Effective Alternative:**

   Provides a low-cost solution compared to radar or LiDAR-based systems, making it suitable for widespread use.

V. RESULTS

Positive Trials:-



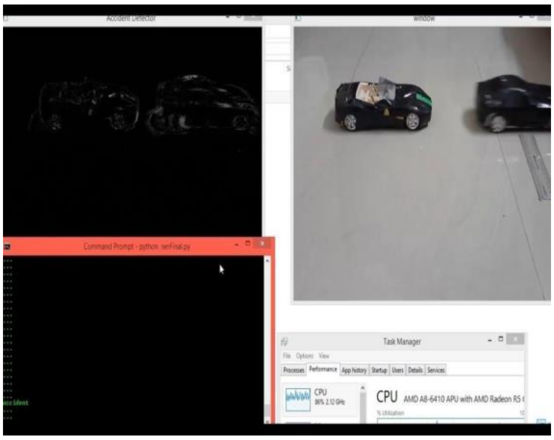
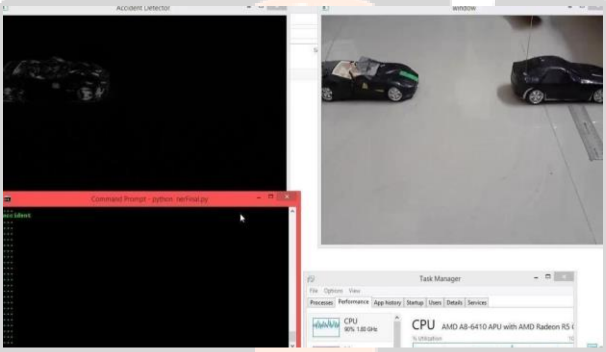
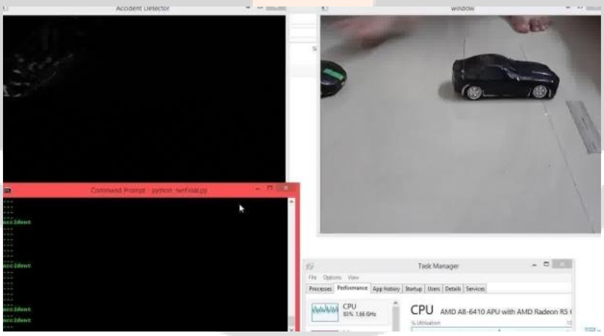


Fig : Results of accident detection from back side

Fig : Results of accident detection from side wise





VI. CONCLUSION

We can have demonstration of a promising approach for an image processing system for automatically detecting, recording, and reporting traffic accidents at an intersection. An important measure in the accident detection algorithm is a low false alarm rate.

So, here we can conclude that till now we have seen the methods for detecting the vehicle accident and approaches to reach the final result. We have tried to implement all those approaches and algorithms for the final outcome of our project and try to have maximum efficiency using all those algorithms.

So overall till now we have detected the cars only as source, In real time image/video. So the system only can detect cars and any other moving objects and also detect when there is collision between two objects.

Future Scope

Lists of things for future scope-

1. To improve the performance of the detection and tracking algorithm, problems created by shadows.
2. To make the vehicle detection and tracking algorithm operate under night conditions.
3. To collect more traffic data from different camera angles to make the algorithm robust to various conditions and situations.
4. To optimize and increase the processing speed of the detection and tracking algorithm.
5. To improve the classifier so that the system can detect all types of moving objects with greater efficiency.
To implement the Informing system in real time when an accident occurs

VII. REFERENCES

[1] Y. Zhang, R. Q. Hu, L. M. Bruce, N. Balraj, and S. Arora, "Development of real-time automated accident detection system at intersections," in 83rd Annu. Meeting Transportation Research Board, Washington, DC, 2004.

[2] W. Hu, X. Xiao, D. Xie, T. Tan, and S. Maybank, "Traffic accident prediction using 3-D model-based vehicle tracking," IEEE Trans. Veh. Technol., vol. 53, no. 3, pp. 677–694, May 2004.

[3] H. Ikeda, T. Matsuo, Y. Kaneko, and K. Tsuji, "Abnormal incident detection system employing image processing technology," in Proc. IEEE Int. Conf. Intell. Transp. Syst., Tokyo, Japan, Oct. , pp. 748–752, 1999.

[4] M. Kimachi, K. Kanayama, and K. Teramoto, "Incident prediction by fuzzy image sequence analysis," in Proc. IEEE Int. Conf. VNIS, , pp. 51–57, 1994.

[5] M. M. Trivedi, I. Mikic, and G. Kogut, "Distributed video networks for incident detection and management," in Proc. IEEE Intell. Transp. Syst. Conf. ,
pp. 155–160, 2000.

[6] J. Blosseville, J. Morin, and P. Lochegnies, "Video image processing application: Automatic incident detection freeways," in Proc. Pacific Rim Transp. Technol. Conf., Jul. 25–28, 1993.

[7] J. Versavel and B. Boucke, "Sparing lives and saving time: A unified approach to automatic incident detection," in Proc. Int. Symp. Automotive Technol. and Autom., Dublin, Ireland, Sep. 25–27, 2000.

[8] P. Michalopoulos and R. Jacobson, "Field implementation and testing of machine vision based incident detection systems," Transp. Res. Rec.: J. Transp. Res. Board, no. 1394.

[9] X. Jin, D. Srinivasan, and R. L. Cheu, "Comparative appraisal of adaptive ANN-based freeway incident detection models," in Proc. IEEE 5th Intell. Transp. Syst. Conf., Singapore, 2002.

[10] D. Srinivasan, W. H. Loo, and R. L. Cheu, "Traffic incident detection using particle swarm optimization," in Proc. IEEE Int. SIS, 2003.