Video Based Vehicle and Pedestrian and Detection

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Abstract— Pedestrian and Vehicle detection system is very important as far as today's fast growing world is concerned where the traffic is rising at an exponential rate, with the implementation of this system we will ensure highest standards of road safety and make sure that everyone on the roads is safe. According to NCRB alone in 2019 road accidents have killed 1.54L innocent people in India. Moreover it has also been recorded that 60-70% of these accidents are due to over speeding. This is a serious issue of concern where high quality work and preventive measures are required in order to prevent such cases, and this research paper is one such attempt to do so. This project will help road safety authorities all around the world to work more precisely and also collect data so that custom rules can be formulated as per the need of the area. And drivers will get notified immediately as well regarding any pedestrian on the road. Ultimately leading to more vigilance and lowering the accident rate to a huge extent. This system can also be integrated by automobile companies into their cars, featuring automatic slowing down of cars in case of obstructions are detected. This technology is largely going to benefit the humanity.

Keywords: Vehicle Detection, Pedestrian Detection, Camera, GPU, Road Safety

I. INTRODUCTION

Transportation is one of the most basic requirements for any city to maintain links between its economic and social movement. With the current scenario the use of transportation has increased exponentially and so is the risk of accidents. Due to machinery failure or lack of concentration of driver millions of people around the world die unnaturally every year. This issue has been neglected for a very long time now, but now is the high time that we start working smartly against such critical things in order to safeguard the citizens and in fact all the living population around the world.

This software will provide experts with analysis of different parts of the roads throughout the world helping in better road safety rules formulation.

There are various successful methods for pedestrian and vehicle detection but the method we will be using will be with the help of Machine Learning and OpenCV. The main purpose of using Machine Learning Technology and OpenCV is that other technologies once implemented can't be easily upgraded or modified as per the changes required, but with this idea we get the freedom of implementing and making things better as per the feedback by the users easily by training our Machine Learning Model on newer upgrades as required for the safety guidelines.

II. PROBLEM FORMULATION

Detecting Pedestrians and Vehicles is a quite challenging task for OpenCV especially in cities, We may come across a ton of different scenarios for example few people standing together or some different kind of car having some unique design which our trained model is not yet capable of handling but the best part here is because of the robustness of our method we can make things possible. Train our model on new stuff every time by updating it.

The main aim of this project is to:

1) Make roads safer for everybody because every single life is important.
2) Help people to get the most out of technology.
3) Help authorities in rule better formulation and better evaluation of things in order to put all the stuff in the right direction.

III. MERITS OF PROPOSED SYSTEM

- Accidents involving vulnerable road users, such as pedestrians, bicyclists, and motorcyclists, have increased over the past few years. These can be prevented to a large scale.
- The data obtained can be used to develop regulated traffic management systems.
- This system can be implemented in Auto-Driving vehicles, and the scope is very large because that is where the future of automobile industry is going towards e.g. Tesla can be the biggest and probably the best examples.
- Other than vehicles this system is implementable in robots as well.
- Using the data generated by the system, we can predict the amount of traffic in future at a particular location and therefore which will allow people to choose the paths for smooth travel before even starting their journey.
- Moreover in future with upgradation of this system we can detect illegal or suspicious activities.
- This model is scalable and will continue working for decades without getting outdated, because of the fact it's based on A.I and does not require any special hardware for performing its operations. All we need is a regular video feed and the system is good to go.

IV. WORK PLAN

1) Designing a Front End UI which is user friendly and easy to manage and use. As per the demand.
2) Training our Machine Learning Model with highest precision so that detection is as close as possible to accuracy.
3) Coding and using the already made Machine Learning Model in the OpenCV with the help of python.
4) Integrating frontend and backend as per the user or device requirements.
5) Testing and fixing any bugs detected.
6) Upgrading for any possible issues or performance problems.
7) Work on the feedback received from customers.
8) Results.

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V. TOOLS

- Backend – Python, OpenCV, Machine Learning.
- Frontend – HTML, JavaScript, Android (for developing an android app), CSS, Bootstrap.
- Applications – PyCharm, Android Studio, VSCode.

VI. LITERATURE REVIEW

The most challenging intelligent system applications that would be useful in advanced driver assistance systems are pedestrian and vehicle detection (ADAS).With numerous recently suggested ffeature extraction and classification techniques, which can be used in distinguishing pedestrian images from non-pedestrian images, this need to detect pedestrians is quenched.

In the past, several approaches to pedestrian detection and object detection in general have been suggested by researchers.

One such feature extraction technique is histograms of directed gradients HOG which were obtained close to perfect results when implemented in combination with linear support vector machine SVM on the MIT pedestrian dataset.

Besides, using another dataset called 'INRIA', consisting of human images with different backgrounds and pose variations, the output of HOG was proven higher.

In a period of ten years, the development of pedestrian detection techniques was analyzed in-depth where HOG was the most frequently used technique in conjunction with other approaches.

On several databases, including INRIA and Caltech USA, about 40 plus feature extraction methods were tested using three separate detector categories; deformable part model DPM, deep networks, and decision forests.

VII. FEASIBILITY ANALYSIS

Carrying out feasibility analysis of any project is extremely important because if the project is not feasible in any way suppose either financially or logically even trying to implement is a waste of time and recourse because ultimately it will prove to be useless.

Our project is quite good when talking about its feasibility in fact it is quite cheaper, far better and much more stable as compared to other such technologies in the market which are using heavy resource and are not as effective and versatile as this technique is.

A. Operational Feasibility

- Processing power used by the software is not much because we use a special technique and convert the frame to be processed into Black and White then apply the detection algorithm on it, thus saving a lot of computational power.
- The system is easy to use and implement on almost any basic device.
- Minimal hardware setup is required i.e., a mobile device with a CPU and a camera.

B. Economic Feasibility

- Since the hardware required is minimal for operation and for implementation as well, therefore this project is pretty feasible economically as well.

VIII. FUNCTION OF THE SYSTEM

This system basically does the processing of data in few simple steps

1) The developer feeds the system pre-trained Machine Learning model.
2) The OpenCV library then uses the physical camera to capture the video feed.
3) Then the captured video feed is converted into Black and White before processing.
4) Since B & W is easier to process than RGB.
5) Then with the help of already fed model in the software using HaarCascades models, the software classifies between the objects and shows them to the users as required.

This is the basic functioning structure of our model.

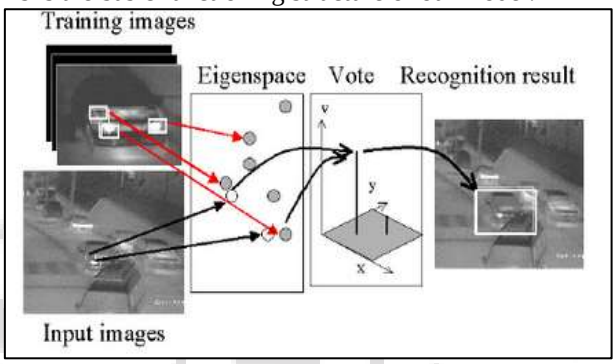

Fig. 1:

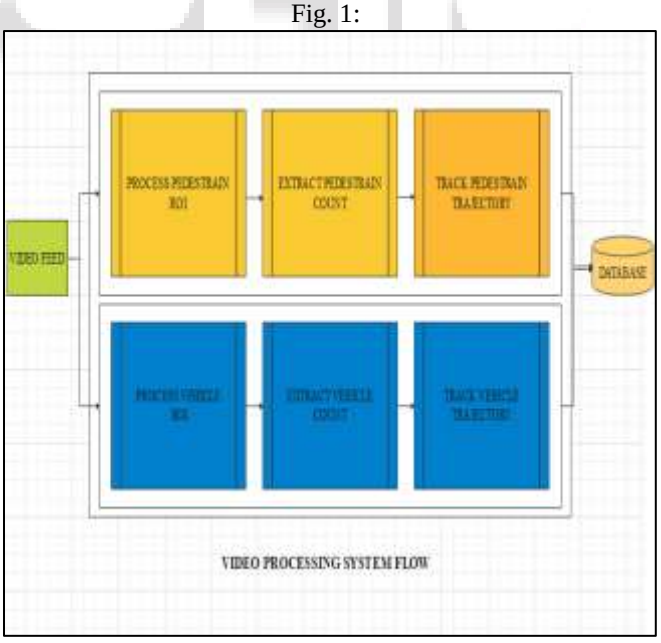

Fig. 2:

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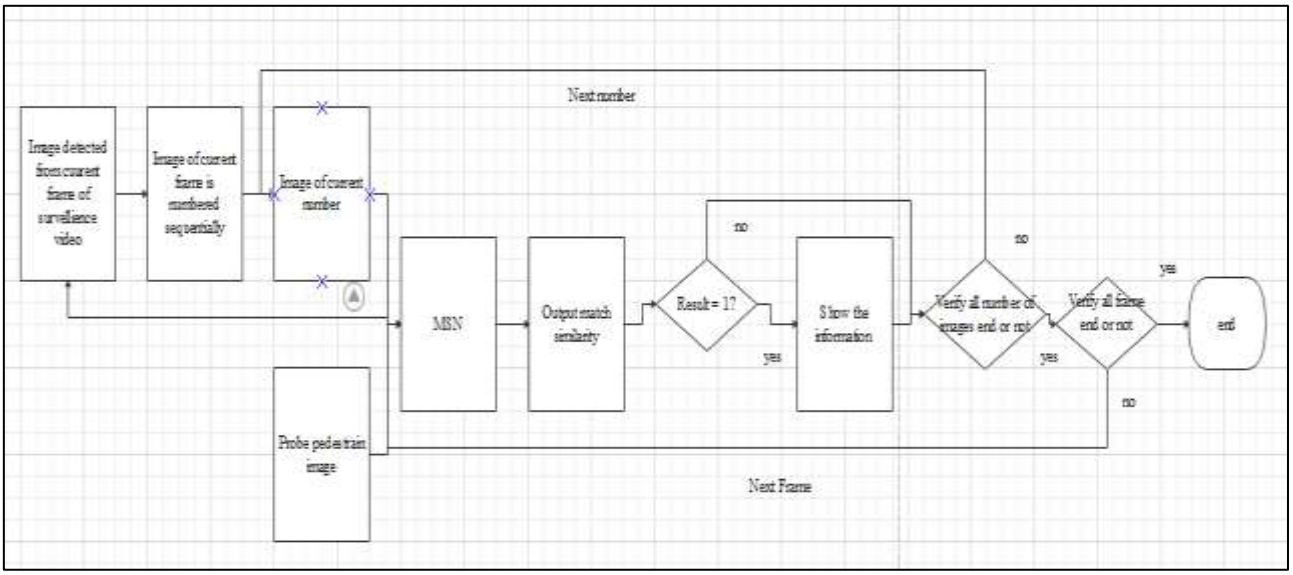

Fig. 3

IX. LIMITATIONS

The current limitations of this project are very minimalistic and can be easily overcome by implementing it with IOT devices which include the line-of-sight is a fundamental drawback of this Technique e.g., A pedestrian behind the tree, or a car or truck with some obstruction in its view, or an unclear camera may cause problems. Using wireless communication to transmit detected information among vehicles or between vehicles and pedestrians.

Poor lighting conditions and poor or broken camera can also lead to improper and inaccurate results however the limitations associated with this project can very easily be removed or at least minimalised to a very large extent when implemented on a huge scale.

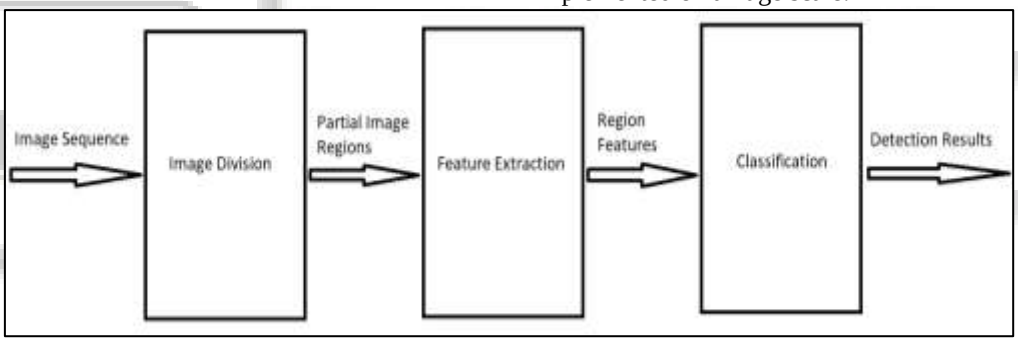

Fig. 4:

The future scope of this software is great and with such setup and low maintenance cost with high accuracy guaranteed this product will stay in market for years and years to come.

Moreover the design and targeted usage of this software is so robust and strong that we hardly need to worry about its future, it will prove to be useful for decades to come.

In future the entire system compatibility will be improved in such a way that a hardware implementation will be done. A radar sensor will be attached to the bumper of the vehicle for measuring distance between the pedestrian and vehicle. Once the distance is measured, it will be easier to measure the pedestrian crossing the road and an auto-brake function and a sound warning will be incorporated to stop the vehicle. Thus, the traffic scenario can be improved significantly.

X. CONCLUSION

The proposed project is based on improving the safety of pedestrian crossing the road at an intersection. From the past five year pedestrian death rate analysis, it can be seen that there is a high increase in the accidents occurring at the intersections. It will also help in preventing car crashes thus making our roads a lot safer than yesterday, and with its improving intelligence we can always expect better results. The main python based app will be doing all other main functionalities like processing the video feed, passing the extracted data to the database and fetching all the new data to be processed. Moreover in order to make sure the processing is fast, smooth and efficient we will convert the feed images to black and white before processing because the processing of RGB images will require much more computational power and would not be efficient and useful enough to give fast and live results required by the user. In fact the leading company like Tesla does the same for fast processing of computational data. Moreover the accuracy also gets improved with this method because Haar like features work really well with dark and light parts in the picture making processing smooth easy and accurate. Other than this it will also provide us with analytical data which will help us form better rules for traffic management, road safety and of course predicting daily commune ways in a much better and a safe way.

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