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Real Time Vehicle Counting Using Computer Vision

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Abstract: Vehicle detection and counting leads to efficient handling of road traffic. Counting and detection of vehicles in a zone or time is one of the key aspects of intelligent traffic management system. Traffic congestion can be managed effectively, if the numbers of vehicles that are to pass through a junction can be counted and pre-estimated in time. A vehicle detection and counting system plays an important role in an intelligent transportation system, especially for traffic management. Surveillance video cameras are commonly used in the traffic monitoring, which can provide video stream for vehicle detection and counting. This paper proposes a video-based method for vehicle detection and counting system based on computer vision technology.Vehicle counting is done by using a virtual detection zone. Vehicle counting process provides appropriate information about traffic flow analysis and traffic congestion prediction. The acceptable techniques is used to achieve traffic flow analysis and traffic congestion prediction on roadways. Further, the monitoring details are used for examination and forecast of traffic flow. The performed experiments demonstrate the effectiveness of this computer vision based technology.

IndexTerms **– Vehicle Counting, Vehicle Detection, Virtual Detection Zone, Computer Vision, MOG Background Subtractor .**

I. INTRODUCTION

Traffic problem is an important issue happening in many cities in the world. There are many important causes of the traffic problem. The number of people moving into an urban area has grown substantially, leading to a dramatic increase in the number of vehicles. However, roadway capacity has grown relatively slow and become insufficient. This causes an imbalance between the numbers of vehicles and roads, resulting in road traffic congestion, especially in large cities. An inadequacy of public transportation systems also causes the same problem. Another cause is an inefficient traffic administration due to a lack of real-time traffic information. The traffic problem mentioned earlier seems to be more severe in the future if it is not solved appropriately. This study is significant to local traffic management authorities that is looking for a machine-based improvement in traffic monitoring and management. It also benefits the units in charge of route planning.

Vehicle detection and counting are one of the basic steps in effective traffic management. It is also one of the key data in transportation planning. With the rapid development of multimedia, wireless communication and cloud computing technology, video has become the main carrier of information in applications of management purposes. Video based real-time vehicle monitoring has become an important part of intelligent traffic systems, and counting is its basic function .

Computer vision - an analysis and interpretation of images and videos captured by a digital camera has gained more popularity and been used in many fields including industry, robotics, medicine, etc. Computer vision has also been applied for solving traffic and transportation problems. This paper proposes a method of vehicle count analysis and traffic congestion prediction based on computer vision technology and several techniques.

The remaining part of the paper is organized as follows; II contains Literature survey done in particular area. III includes the Requirements. IV Methodology of Proposed System . V contains Results and Discussions and VI includes Conclusion.

II. LITERATURE SURVEY

In paper [1] authors proposed a method to calculate the total amount of moving vehicles based on its type with computer vision based with staged: ROI selection, image segmentation with Gaussian Mixture Model method, filtering process, blob detection and tracking, and vehicles classification with Fuzzy Clustering Means.

In paper [2] authors proposed a method to calculate the number of vehicles passing on the road using the virtual

line. They applied background subtraction to isolate moving objects and K-nearest neighbor (KNN) as a method to subtract the background, in order to apply counting algorithm.This technique gave a success rate exceeding 95%.

In Paper [3] the author developed a model that is able the classify and count local vehicles in Metro Manila using deep neural networks specifically Faster R-CNN, DeepSORT and OpenCV.

In paper [4] the author uses background subtraction technique to find foreground objects in a video sequence.And to detect moving vehicles more accurately, several computer vision techniques, including thresholding, hole filling and adaptive morphology operations, are then applied. Finally, vehicle counting is done by using a virtual detection zone , which has an accuracy of around 96%.

In paper [5] the authors used Computer Vision to detect and count the vehicles. They included that the vehicle counting will be done with the assistance of a virtual discovery zone. The trial results show ordinarily the exactness and precision of the deliberate vehicle counting , it is around 96%.

III. REQUIREMENTS

3.1 Software Requirements

- Operating System : Windows 7 / 8/ 10
- Language Used : Python
- IDE : Anaconda , Notebook
- Libraries : OpenCV , NumPy , Pandas , Matplotlib

3.2 Hardware Requirements

- Processor : Intel core i3
- Ram : 4 GB
- Hard Disk : 120 GB
- WebCam : Any model can be used

IV. METHODOLOGY OF PROPOSED SYSTEM

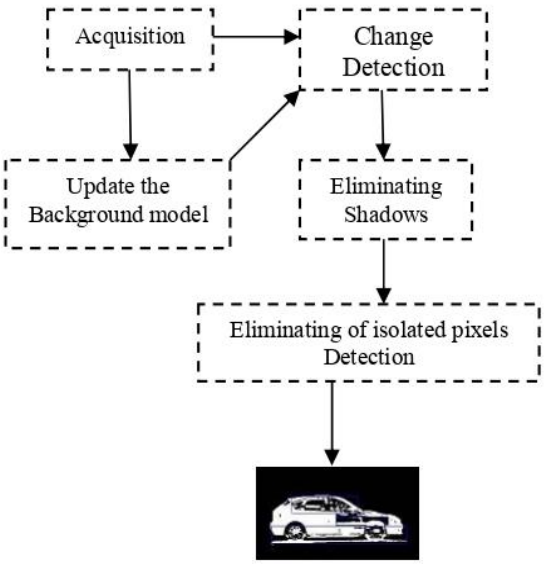

Fig 1: Motion Detection Process

In our proposed system, we use digital image processing and computer vision methods along with Background Subtractor algorithm to make the vehicle counting process provide appropriate results.

The above figure shows the motion detection process using algorithms and frameworks. First,the object is detected by eliminating the ordinary background and enhace it with filtering process by using Background Subtractor algorithm. Secondly, the shadows are removed and pixel ratio are adjusted by Gaussian Mixtures.Finally,the enhaced object is produced .

4.1 OpenCV

OpenCV (Open source computer vision) provides a real-time optimized Computer Vision library, tools, and hardware. It is a library of programming functions mainly aimed at real-time computer vision. OpenCV is a great tool for image processing and performing computer vision tasks.

4.2 MOG Background Subtractor

MOG uses a method to model each background pixel by a mixture of K Gaussian distributions (K is 3 to 5). The weights of the mixture represent the amount of time that those colors were present in the scene. The probable background colors are those which remain longer and more static. MOG is an approach which modelises each pixel of the background as a mixture of Gaussians to conform to the road, the vehicle and the shadows. Firstly, we must characterize each pixel by its intensity, and by a simple heuristic, we determine the darkest component for the labeled as the shadow, the component that has the greatest variance is labeled as the vehicle, and the other as the road.

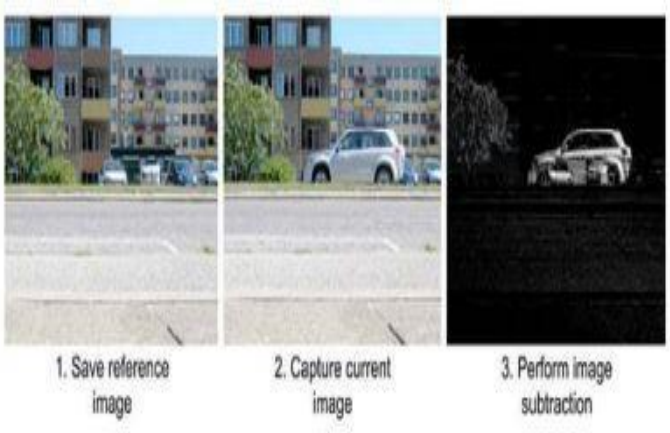

Fig 2 : Working of MOG Background Subtractor

At this level, we find different methods with two major detection families: Detection without modeling of the background and Detection with modeling of the background. The methods of the first category are based on the difference between images which consist in subtracting two successive images in order to have the moving pixels.

4.3 Digital Image Processing

A digital image is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels.

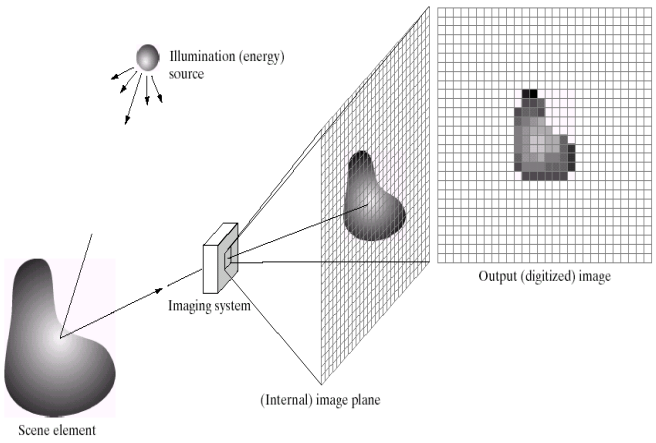

Fig 3 : Digital Image Processing

Pixel values typically represent gray levels, colours, heights, opacities etc. Digitization implies that a digital image is an approximation of a real scene.
Common image formats include:

- 1 sample per point (B&W or Grayscale)
- 3 samples per point (Red, Green, and Blue)
- 4 samples per point (Red, Green, Blue, and "Alpha", a.k.a. Opacity)

V . RESULTS AND DISCUSSIONS

From experimental analysis it is shown that the vehicles are detected at an accuracy rate of about 97% and vehicles are tracked at a rate of about 98.26% as shown below.

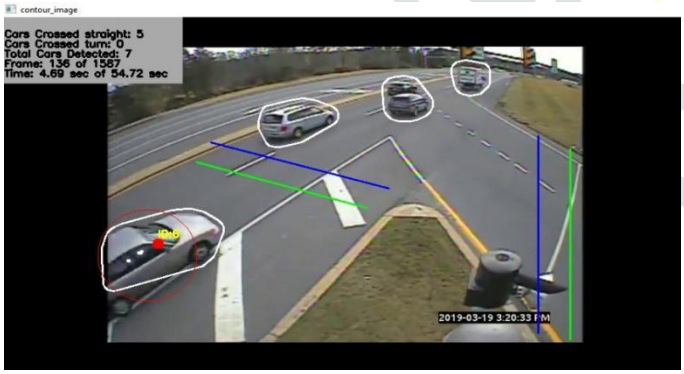

Fig 4 : Vehicles detected in straight lane.

In the above figure,the vehicles are moving in a single straight lane. The vehicles are detected and counting has been updated every second when each and every vehicle crosses the virtual detection zone . In this output no vehicles are entered from the right lane, so the count is mentioned as zero in cars crossed turn.

Fig 5 : Vehicles detected from both straight and adjacent lane.

In the above figure, vehicles are detected from both the straight lane and from the adjacent lane , and the vehicle countings are updated separately for straight lane and adjacent lane. Also the total vehicles count is updated by adding the sum of vehicles crossing the virtual detection zones set in both the lanes.

Finally information regarding time and frames per second are also calculated seperately and updated every second .

VI . CONCLUSION

This paper presented a detailed description of using computer vision techniques to achieve vehicle detection and counting . This helps in attaining a better and efficient traffic management system which is must for the modern digital world. Experimental results show that the accuracy of the proposed vehicle counting system is around 97%.

There are some more work needed in reducing the limitations and occlusions present in the image. We plan in the future to further improve this process to achieve our goals.

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