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Design of Traffic Monitoring System and Vehicle Counting Technique Using an Approach of Background Subtraction

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ABSTRACT: In this modern era as the population is increased rapidly the utilization of vehicles has also risen tremendously, the majority of accidents are caused by driver failures to obey transportation rules. An effective traffic management system is needed for controlling congestion and improving road safety precautions. In this paper, the background detection algorithm can be used with the Gaussian mixture model (MOG2) for detecting a foreground mask. After applying filtering methods to remove noise in the frames, they are binary threshold, morphological, erosion, and dilation. Further, apply contour methods to shape and object analysis of the frames. Finally, the preprocessing pipeline method is done by merging all three operations for counting moving vehicles. Experiment results are performed with Open CV and Python programming language. The proposed method is effective to detect and count the running vehicle accurately in video samples taken from various events, namely in the morning and afternoon hours.

KEYWORDS: Foreground Detection Algorithm Using MOG algorithm, Filtering, Contours method, Preprocessing pipeline Method.

I. INTRODUCTION

Traffic accidents in metropolitan cities are a major cause of deaths, injuries, and resource damage every year. Travel difficulties leading to serious atmospheric infection, sound pollution, frustrating waiting times, and accidents may cause blocking of roads this impacts health and economical conditions. Congestion has become progressively overcrowded due to the growing number of vehicles, and huge crowds of people resulting in death every year from road collisions. If the transportation status can be systematically controlled with video monitoring, such events can be overcome a lot, and moving will be more efficient. Background techniques are used in many areas of computer vision applications such as video surveillance, optical motion capture, and human-activity identification. This foreground method is used to detect changes in image sequences to identify variation from the current frame and foreground frame for analyzing moving objects in the different scenes. Movement detection Based on the foreground deduction method is needed to handle several crucial situations; such as shadow and noise regions, variations of the objects in the scene, sudden change in illumination condition.

The proposed system uses a video approach for vehicle classification and also, computing moving objects, based on a computer vision technique. Vehicle counting helps to take precautionary measures towards the improvement of street blockages and it also enhances the flow of transportation. This paper aims to build a vehicular system for transportation management systems. Object detection is used to detect moving objects in all frames using the foreground detection method. Next, filtering methods are used for eliminating noises in the images. Then ultimately contour operations will be used for detecting and calculating the number of vehicles.

II. DESIGN SYSTEM

Vehicle recognition and counting schemes play an essential role in a traffic key system for controlling the flow of vehicle conveyance and improving the quality of road safety standards to reduce congestion and also limiting the number of occasions. **Object detection** is a computer technology related to the digital image processing field that is used for instances of objects such as pedestrian detection, and image segmentation, in video frames. The proposed method workflow is explained in fig1, where the input video image is taken and processed with a background detecting method to find the foreground mask in a video sequence, and then after applying filtering methods for image enhancement, further applying contours for shape **formation,** finally pipeline method is used for vehicle enumeration. The proposed method steps are illustrated in the below paragraphs.

A. Background subtraction technique.
B. Filtering approach.
C. Contours for object analysis.
D. The preprocessing pipeline procedure

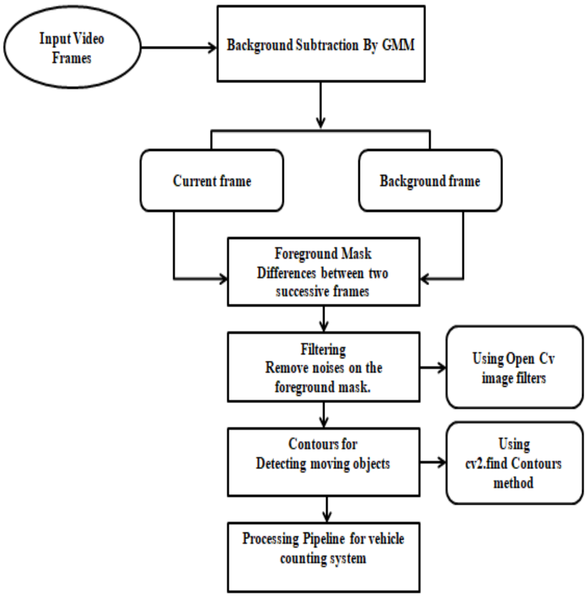

Fig.1. the Proposed Architecture.

A. Background subtraction technique.

Foreground subtraction provides the fundamental application in computer vision for a video surveillance system such as motion tracking, suspicious event analysis, and object recognition. **Background subtraction** is an efficient way to obtain foreground objects. In this process, the current frame being deducted from the background frame is called a foreground detection, using the Gaussian mixture model (MOG2), where each pixel is a mixture of K Gaussian probability distribution, for detecting moving vehicles captured from the stationary camera, this method gives better flexibility to variations in the scenes due to illumination and weather conditions.

B. Filtering approach.

The filtering technique is essentially used to remove noise in an image and further identify the boundaries for edge detection, and also enhances the frequency of frames. This filtering technique is essentially used to remove noise in an image and further enhances the frequency of frames. Image filtering is used for modifications of the images and eliminating unwanted objects. The filtered methods are:

Threshold: the process involves weighing each pixel of an image with a predefined threshold value, and divides all the pixel of an input image into a lower and higher intensity level. Thresholding is used in image partitioning techniques for creating binary level images such as a grayscale image, where each pixel represents the intensity of only one channel for indicating the brightness of the pixel.

Dilation: It is used to fill holes and bridge gaps in the frame sequences for brightening the images and make the object bolder by expanding the related set of 1s in a binary level picture.

Erosion: is used to diminish the size of an image, by removing the outer layer of the pixel, for removing bridges, and sharpen the corners.

Morphological operations are used for noise elimination and extraction of relevant components segments. **Opening:** is an erosion followed by dilation operations, used to remove pixel points in the frame for smoothing the edge, and thinning the frame sequences. **Closing:** is a dilation followed by erosion operations, used to remove gaps in the image areas.

C. Contours for object analysis.

The design of this processor is to remove a background image, capture moving objects, furthermore identify them by cv2.findContours method, and then filter off by width and height of the frames. Objects are recognized from their shape extraction for better efficiency, and all the edges are linked together with a similar colour or intensity level called contours. This process required converting an image into a binary form, which should be the result of a threshold image, then applying the find contours () method for image analysis for the identification of objects in images.

D. The preprocessing pipeline procedure.

The outcome of one result is the information of the next iteration, known as **the processing pipeline,** which is a collection of functions transferred in a series to get desired results. It can be used for the improvement of the image analysis.

III. SIMULATION RESULTS

The initial step is extracting all reference frames from the video sequences, Frame removal is followed by foreground deduction. The frame is subtracted from the background frame from all the successive frames. Filtration method was performed to eliminate those undesired objects and then apply the mathematical morphological process to noise removal, region filling, and boundary extraction of connected segments, using opening and closing methods toward expanding and shrinking the frame sequences, next applying contours for object classification finally, the processed pipeline is used to for counting the vehicles.

The background deduction is at the beginning stage where the original image is collected from stable CCTV cameras, and it will be processed with a foreground algorithm using the MOG method to create a binary image form shown in fig 2.

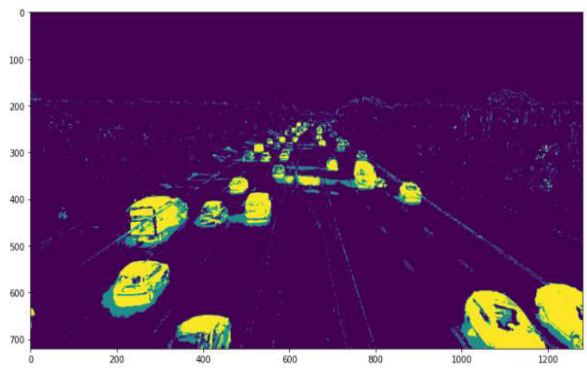

Fig 2 the background subtraction was done using the MOG algorithm for all successive frames.

The next step is a **filtering process** using a binary threshold, erosion, and dilation for the subtracted background frames, to remove noises in the images, and then progress with morphological operations to discard the unwanted object that is not required for the frame analysis.

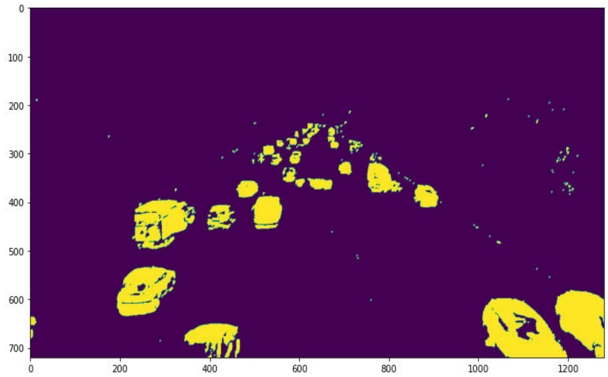

Fig 3 filtering operations are used to remove unwanted noise for better enhancement of the image.

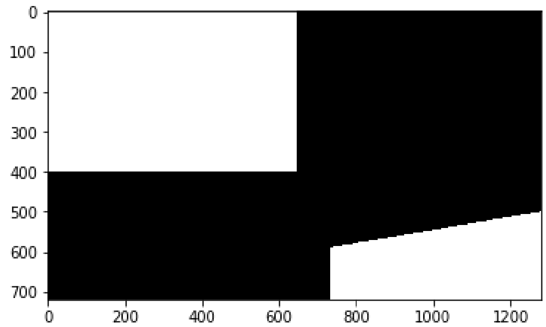

Fig 4 The binary image for the green mask area to detect objects in the zone.

The green mask in the frame is the exit zone, which is used to count vehicles using vector algorithms, the parameters required:-

- **If path == 1**, for each path, find the centroid from the recently detected objects which will have the shortest distance measure.
- **If the path is 1**, find the minimum distance between the current points.

Finally, **the contour method** is used for object analysis and frame representation to detect vehicles. After the object is detected, the centroid technique is used to find a weighted median of all the pixels. And then a rectangle box is used from the method of cv2.findcountours () for object labeling and prediction then further using preprocessor pipeline for successive frames for vehicle classification and counting.

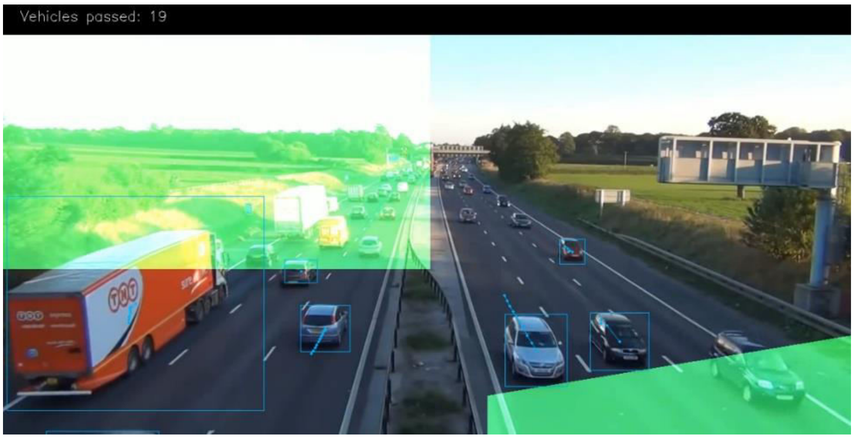

Fig 5 The vehicle is detected and tracked are marked in a rectangular box for counting the moving objects, then the counted vehicles are displayed at the top.

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IV. CONCLUSION

The majority of traffic accidents are caused by driver failures to obey traffic regulations. Object detection is a field in computer vision for high-value tasks such as surveillance, traffic management, counting, Vehicle number plate detection, and recognition. The video processing uses the background subtraction method for foreground detection by the MOG method, and after filtering, methods are used to remove noise in the frames and improve the images. It then further applies contour operations for shape and object analysis to detect the objects, finally, the preprocessor pipeline is used for successive frames to track the objects and count the number of vehicles. Experiment results are performed with Open CV and Python programming language. The proposed method is effective to detect and count the running vehicle accurately in video samples taken from various events, namely in the morning and afternoon hours.

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