# Image Processing Based Tracking And Counting Vehicles Using OpenCV

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***Abstract*—** The increasing volume of vehicular traffic in urban areas necessitates efficient and accurate methods for monitoring and managing traffic flow. This research focuses on the development of an image processing-based system for tracking and counting vehicles in real-time scenarios. The proposed methodology employs advanced computer vision techniques to address the challenges posed by varying lighting conditions, occlusions, and diverse vehicle types. This algorithm employs innovative strategies to distinguish between individual vehicles, preventing the occurrence of double counting. The efficiency and accuracy of the proposed system are evaluated using a diverse dataset representative of real-world traffic scenarios. The potential applications of the proposed system extend to traffic management, urban planning, and the development of intelligent systems

**Keywords —** Digital picture processing, automated operation, pc vision, Haar-like functions, cascade classifier, automobile detection, traffic manipulate.

## I .INTRODUCTION

The escalating boom of urbanization and the corresponding surge in vehicular site visitors pose giant challenges to the efficient management of transportation systems. In reaction to those challenges, there is a growing need for advanced technology which could automate the monitoring and evaluation of traffic flow. Picture processing-based tracking and counting of vehicles have emerged as a promising approach to address these issues. Traditional methods of visitors tracking frequently depend on manual statement or simple sensor-primarily based approaches, which may additionally lack the accuracy and scalability wanted for latest complex visitor's eventualities. Picture processing, leveraging computer imaginative and prescient algorithms and strategies, has proven to be a transformative era on this context. The number one objective of photo processing-based totally tracking and counting of automobiles is to harness the energy of visual statistics captured through surveillance cameras or other imaging gadgets. This method gives a dynamic and real-time information of visitor's patterns, permitting government to make informed decisions approximately site visitors management, infrastructure planning, and public protection. In this research paper, the main objective is to count and track vehicles in a lane. We take a live video or video to track or count vehicles, a certain area is selected as an area of interest, cars are detected using Haar-like features, and the cars are tracked until they leave the selected area or area of interest.

In many cities, vehicle identification and counting is a vital aspect that aids in managing and guiding visitors. The movies or video stops are divided into sections, which are essentially containers that were transformed into gray boxes and grassy boxes. A specific location is

selected as the point of interest, and the car will then be detected using standard features like Haar. Until the car becomes intruding, it remains stationary. When objects are compared to the previous frame and if there is less than the maximum width and height of each coordinate in the frame, we consider that the vehicle is balanced. Those pixels that differ more from their width and peak will be reduced to only two.

## II. LITERATURE REVIEW

| S.NO | Paper Name | Author | Year | Technology Used | Gap Analysis /Future Scope |
|---|---|---|---|---|---|
| 1. | A vehicle detection and counting device the usage of OpenCV and the haar cascade algorithm. | Aman Preet Singh Gulati | 2014 | OpenCV and haar cascade algorithm | Vehicle counting and vehicle detection uses the OpenCV library to perform all image processing and classification of vehicles and buses for each image and video. The cascade classifier is used to detect and count cars and buses. |
| 2. | Vehicle Counting, Classification & Detection using YOLO3. | Angshuman Roy | 2022 | YOLO3 | In this paper, the authors targeted on the detection and classification of motors, heavy motor automobiles, mild motor vehicles on the street and counting the wide variety of vehicles passing on the street. |
| 3. | Even though the camera is still moving, the optical direction of the message changes depend upon the flow of | Horn and Schunck | 2009 | Optical Flow | It can handle temporary shapes that can be divided into groups rather than amorphous areas in a spatial arrangement. |

| | | | | | |
|---|---|---|---|---|---|
| | the object. To search for lighting techniques in pictures. | | | | |
| 4. | The unique intensity transition property is used to compare objects inside the snap shots with a Newton-Raphson new release. | Lucas and Kanade | 1981 | Image Registration Technique | It may discover a healthy despite fewer information and it can additionally hit upon matters, even an item rotates, scales or cuts. |
| 5. | Item detection is achieved using change detection in a series of pics. From MRF Spatial coherence is progressed by using changing the labeling of the thresholds. | JM McHugh, J Konrad, V Saligrama, P Jodoin. | 2009 | Adaptive Background subtraction with Markov Randomly Field | Reaching higher performance through becoming a statistical version,non-parametric heritage model and MRF model might also differ thresholds. |
| 6. | A model for automatic vehicle detection, using both spatial and secondary detection and tracking techniques, is proposed in this paper. | Hsu-Yung Cheng, Chih-Chia Weng, Yi-Ying Chen. | 2019 | Improved dynamics Bayesian network | Items are detected primarily based on colorations, form and houses pixel extraction depth, then aspect detection is accomplished clever part detector. |

## III. PROPOSED METHODOLOGY

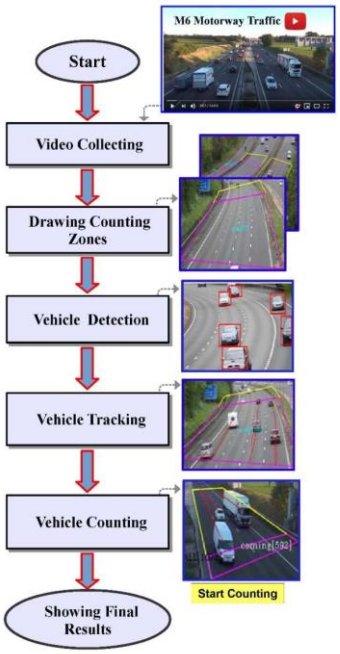


Fig1. Process Flow Diagram

These are the steps which are used in tracking and counting of vehicles.

- INPUT FRAMES OR VIDEO COLLECTING:

The input frame is obtained from a video stream or a series of images captured by cameras, drones, or other sensors in the surveillance area.

- VEHICLE DETECTION:

Using object detection algorithms, the system identifies and locates vehicles within the input frame. Each detected vehicle is usually represented by a bounding box that indicates its position in the image.

- VEHICLE TRACKING:

The tracking algorithm then follows the detected vehicles across consecutive frames. Creates associations between detected objects in the current frame and objects from the previous frame, enabling continuous tracking.

- VEHICLE COUNTING:

In this the counting of vehicles were done, a counter was initialized in the system, as when the vehicle was detected and tracked then the counter got incremented and then the counter got updated.

**REGION BASED TRACKING METHOD**- In vicinity-based totally monitoring methods, a selected vicinity of moving objects consisting of motors (balls) is tracked for automobile localization. those areas are segmented by way of subtracting the modern-day photo from the previous picture. model-based totally vehicle popularity, tracking and class is being developed, that is efficient and more dependable in numerous situations. This technique took under consideration the unique positions and speeds of transferring vehicles till they had been visible, and labored on consecutive visitors scenes recorded through a static car reputation digicam. automobile numbering and vehicle classification in site visitors control gadget turned into illustrated.The flow of traffic and the move ment of cars, buses, trucks, etc. The classif ication of vehicles is explained, and strate gies for eliminating false spots and decolor ization rules areused to segment traffic acc urately and reliably.

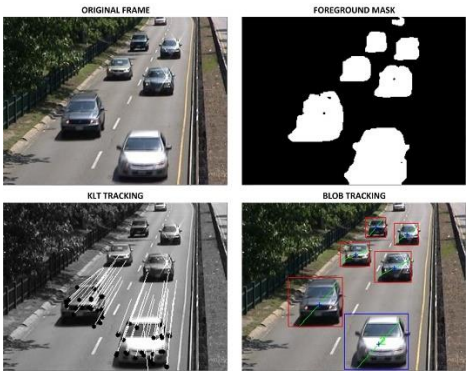


Fig2. Region where we can Track

**3D MODEL BASED TRACKING METHODS**- Those model-primarily based monitoring techniques consist of occlusion detection, roadside trees, shadows in transferring automobiles, and use the stable block 3D version to suit differing types and sizes of vehicle pics with the aid of changing the vertices to fit even in . by way

of converting the proportions of the location, width and height of the prototype with appreciate to the preceding pix, it achieves effective vehicle detection and monitoring. classification of more than one shifting vehicles inclusive of small cars (eg: bicycle, motorcycle), medium-sized vehicles (eg: passenger automobile, van, and so on.), heavy vehicles (eg: trucks) is performed within the New framework the article provided a three-dimensional model-based full tracking vehicle detection and tracking based on percentage of nearby feature groups. The advantage of this approach is that it is more flexible in terms of traffic detection and monitoring and is more reliable for many tasks.

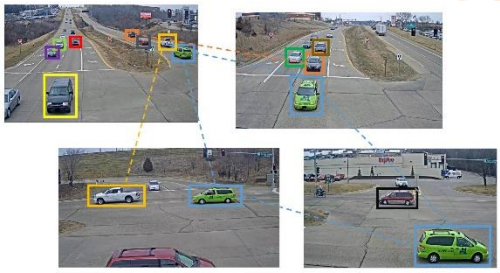

Fig3. Model can track various vehicle at same time

**FEATURE BASED TRACKING METHODS**- The whole tracking-based method uses SURF (Strong Acceleration Function) feature descriptors of large-area functional units to classify cars in smart surveillance movies, and is effective in classifying comparable and unique classes. The line-based shading method uses an extended method to remove all shadows from occluded images. There is also an automatic vehicle monitor and a distribution system for on-site visitor tracking.

**COLOR AND PATTERN BASED TRACKING METHODS**- It is a method that uses the color and sample of the vehicle image in traffic monitoring. The method used for front and rear segmentation, vehicle shifting, shadow removal, vehicle speed, vehicle type, vehicle location and equipment has proven itself. Dyeing in special climatic conditions, insensitive to minor conditions. Complete the lane in real time with vehicle and location controls to avoid collisions and ensure public safety on roads and highways. The three primary phases of this system are the 1D model, secondary stage analysis, and analysis stage. All stages are sequential. Smart cars are essential in the automotive industry and require close attention to detail. Vehicle tracking involves the use of various algorithms such as the Panning algorithm, Cam Shifting algorithm and optical sliding, SURF, etc. The suggested algorithm is a matching one that utilizes the histogram-based kernel function of the target traffic. A large block area is necessary to accurately track the vehicle's mileage. The Cam algorithm employs a one-dimensional histogram as if the object's foreground or background is identical, and it can be used for face detection using the same feature. When the foreground and background objects are indistinguishable, the SURF algorithm is associated with the 2D Haar wavelet response. However, its long calculation time renders it unsuitable for monitoring the properties of time. To differentiate between objects (foreground) and artifacts in an image, the optical drift method is utilized. This is determined by the distance from the cell to the location.

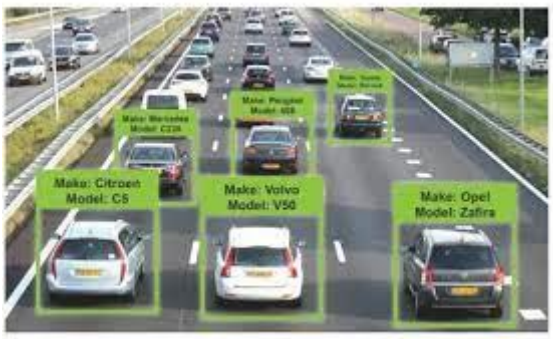


Fig4. Color and pattern of different cars

## IV. APPLICATIONS

1.Track Visitor activity, public transport and parking.

2. Video surveillance of the oven and detection of smoke.

3. Vehicle number and type.

4. Car speed monitoring.

5.Gazing every day sports in department stores and entertainment parks.

## V.CONCLUSION

Vehicle detection and calculation is done in Python using OpenCV and its mileage is used to optimize traffic. A simple interface was created for users to select areas of interest for evaluation and then classify vehicles and calculate their types using the photo technique. This solution can be used to allocate parking spaces, monitor traffic, and more. It's miles an smooth approach of implementation with low cost. This gadget isn't effective in detecting vehicle occlusion, which affects each type and counting accuracy. this will be considered as one of the limitations of this system.

## VI. FUTURE SCOPE

The future scope of image processing based on tracking and counting vehicles is promising and diverse, with applications across various industries. Here are some potential directions in which this field may evolve:

**1.Smart Traffic Management:-** Integration with smart city initiatives for efficient traffic management. Dynamic traffic signal control based on real-time vehicle counts and flow patterns.

**2. Parking management: -** Intelligent parking solutions that provide real-time information on available parking spaces. Automated ticketing and payment systems based on vehicle entry and exit tracking.

**3.Security and Surveillance:-** Enhanced surveillance systems for public safety and law enforcement. Automated detection of suspicious or abandoned vehicles.

**4.Transportation Planning:-** Data-driven insights for urban planners to optimize road infrastructure. Predictive modeling for future traffic patterns and infrastructure needs.

**5.Supply Chain and Logistics:-** Monitoring and optimization of vehicle movements in logistics and supply chain management. Automated inventory tracking in shipping yards and distribution centers.

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