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Vehicle Detection, Tracking and Counting Objects For Traffic Surveillance System Using Raspberry-Pi

MR. MAJETI V N HEMANTH KUMAR[1], MR. B.VASANTH[2]
[1] *[M.Tech]/ECE, Student, EMBEDDED SYSTEMS (ES), JNTU (A), Anantapuramu, Andhra Pradesh, India*
[2] *M.Tech, Member of Technical Staff, Seer Akademi, Hyderabad, Andhra Pradesh, India*

Abstract—Vehicle detection in digital image sequences is one of the key technologies of Intelligent Transportation Systems. Traffic Surveillance System is being more and important with the increasing number of vehicles. Our Embedded project is to design and develop a low cost feature which is based on embedded platform for tracking and counting the vehicles for traffic surveillance system using webcam. Our embedded project uses webcam which is located at traffic surveillance system. The webcam combines video sensing, video processing and Communication within a single device. It captures a video stream like vehicles, no. of vehicles in the area, computes the information and transfers the compressed video stream to the ARM micro controller. Our project uses ARM11 micro controller. The webcam is connected to the controller through USB device. The controller vehicles and no. of vehicles on remote controlled PC through Ethernet and also the information is displayed on LCD unit.

Index Terms—Raspberry Pi, Web camera, QT, OPEN CV, I2C

Keywords—Background elimination, Frame difference, Object identification, Background

I. INTRODUCTION

The result of the increase in vehicle traffic, many problems have appeared. For example, traffic accidents, traffic congestion, traffic induced air pollution and so on. Traffic congestion has been a significantly challenging problem. It has widely been realized that increases of preliminary transportation infrastructure, more pavements, and widened road, have not been able to relieve city congestion. As a result, many investigators have paid their attentions on intelligent transportation system (ITS), such as predict the traffic flow on the basis of monitoring the activities at traffic intersections for detecting congestions. To processes the information and monitors the results as better understand traffic flow, an increasing reliance on traffic surveillance is in a need for better vehicle detection at a wide-area. Automatic detecting vehicles in video surveillance data is a very challenging problem in computer vision with important practical applications, such as traffic analysis and security.

Vehicle detection and counting is important in computing traffic congestion on highways. The main goal Vehicle detection and counting in traffic video project is to develop methodology for automatic vehicle detection and its counting on highways. A system has been developed to detect and count dynamic vehicles efficiently. Intelligent visual surveillance for road vehicles is a key component for developing autonomous intelligent transportation systems. The entropy mask method does not require any prior knowledge of road feature extraction on static images. Detecting and Tracking vehicles in surveillance video which uses segmentation with initial background subtraction using morphological operator to determine salient regions in a sequence of video frames. Edges are be counting which shows how many areas are of particular size then particular to car areas is locate the points and counting the vehicles in the domain of traffic monitoring over highways.

Automatic detecting and tracking vehicles in video surveillance data is a very challenging problem in computer vision with important practical applications, such as traffic analysis and security. Video cameras are a relatively inexpensive surveillance tool. Manually reviewing the large amount of data they generate is often impractical. Thus, algorithms for analyzing video which require little or no human input is a good solution. Video surveillance systems are focused on background modeling, moving vehicle classification and tracking. The increasing availability of video sensors and high performance video processing hardware opens up exciting possibilities for tackling many video understanding problems, among which vehicle tracking and target classification are very important. A vehicle tracking and classification system is described as one that can categorize moving vehicles and further classifies the vehicles into various classes.

II. PROPOSED SYSTEM ARCHITECTURE

This system structure is computationally efficient and can run in a real-time basis while retaining very respectable detection rates. However, this kind of systems contain some inevitable problems caused by the object occlusion where larger vehicle with partially occluded smaller vehicle are typically considered as one object because foreground detection methods are not intrinsically designed to segregate multiple occluded vehicle. In another case, the appearance of larger vehicle or vehicle's shadow occluding the adjacent lanes also is known to trigger false detection Consequently, the merit of using computer vision as a surveillance tool has been limited by focusing strictly on building reliable systems that can perform in real-time.

III. OVERVIEW OF THE RELATED WORK

An overview of the moving vehicle detection in a video sequence. The system makes use of an existing video sequence. The first frame is considered as the reference frame. The subsequent frames are taken as the input frames. They are compared and the background is eliminated. If a vehicle is present in the input frame, it'll be retained. The detected vehicle is thus tracked by various techniques, namely, adaptive background method and blob analysis method.

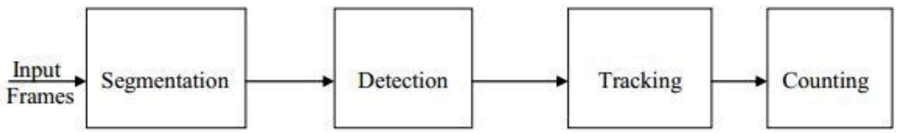

Figure 1: overview of vehicle detection and counting system

IV. OPEN CV

Open CV is an open source project an important part of the library as the implementation of those crafty data structures and algorithms you can find in Open CV. Therefore, the source codes for the tutorials are part of the library.

Computer vision is a rapidly growing field, partly as a result of both cheaper and more capable cameras, partly because of affordable processing power, and partly because vision algorithms are starting to mature. Open CV itself has played a role in the growth of computer vision by enabling thousands of people to do more productive work in vision. With its focus on real-time vision, Open CV helps students and professionals efficiently implement projects and jump-start research by providing them with a computer vision and machine learning infrastructure that was previously available only in a few mature research labs.

V. BACKGROUND REGISTRATION

A general detecting approach is to extract salient regions from the given video clip using a learned background modelling technique. This involves subtracting every image from the background scene. The first frame is assumed as initial background and thresholding the resultant difference image to determine the foreground image. A vehicle is a group of pixels that move in a coherent manner, either as a lighter region over a darker background or vice versa. Often the vehicle may be of the same color as the background, or may be some portion of it may be aged with the background, due to which detecting the vehicle becomes difficult. This leads to an erroneous vehicle count.

VI. FOREGROUND DETECTION

Detecting information can use to refine the vehicle type and also to correct errors which are caused due to occlusions. After registering the static vehicles the background image is subtracted from the video frames to obtain the foreground dynamic vehicles. Post processing is performed on the foreground dynamic vehicles to reduce the noise interference.

VII. IMAGE SEGMENTATION

Image segmentation steps as follows:

- The segmentation of vehicle regions of interest. In this step, regions which may contain unknown object have to be detected.
- Next step focuses on the extraction of suitable features and then extraction of vehicles. The main purpose of feature extraction is to reduce data by means of measuring certain features that distinguish the input patterns.
- The final is classification. It assigns a label to a vehicle based on the information provided by its descriptors. The investigation is made on the mathematical morphology operators for segmentation of a gray-scale image.

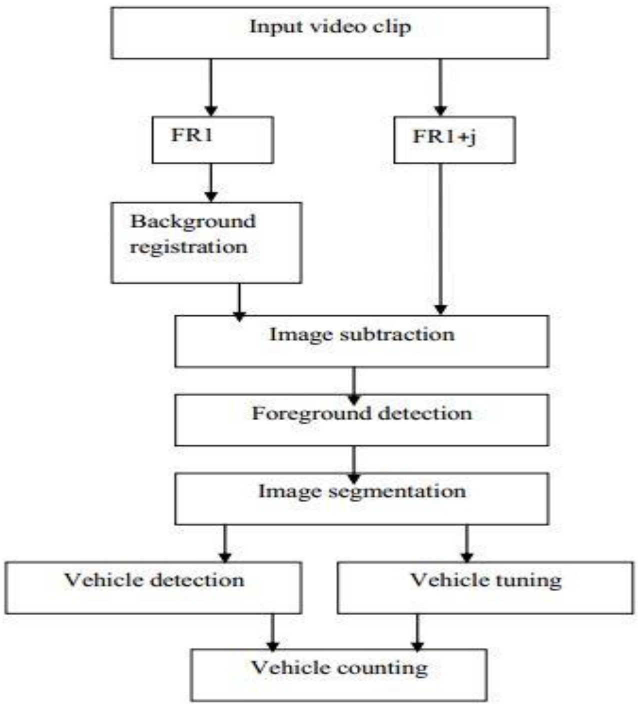

Figure 2: Architecture of vehicle detection, tracking and counting

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A. Vehicle Detection

Adaptive background subtraction uses the current frame and the reference image. Difference between the current frame and the reference frame is above the threshold is considered as moving vehicle. Optical flow method can detect the moving vehicle even when the camera moves, but it needs more time for its computational complexity, and it is very sensitive to the noise. The motion area usually appears quite noisy in real images and optical flow estimation involves only local computation. So the optical flow method cannot detect the exact contour of the moving vehicle.

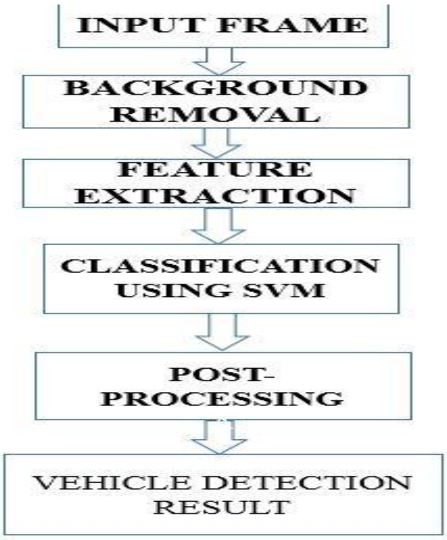

Figure 3: Vehicle detection flowchart

B. Vehicle Tracking

Vehicle tracking involves continuously identifying the detected vehicle in video sequence and is done by specifically marking the boundary around the detected vehicle. Vehicle tracking is a challenging problem. Difficulties in tracking vehicles can arise due to abrupt vehicle motion, changing appearance patterns of the vehicle and the scene, non-rigid vehicle structures, vehicle to-vehicle and vehicle-to-scene occlusions, and camera motion.

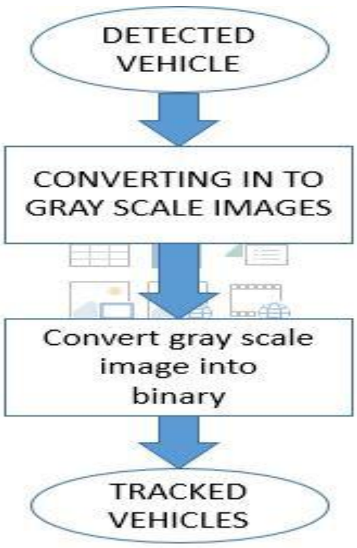

Figure 4: Vehicle tracking flowchart

C. Vehicle Counting

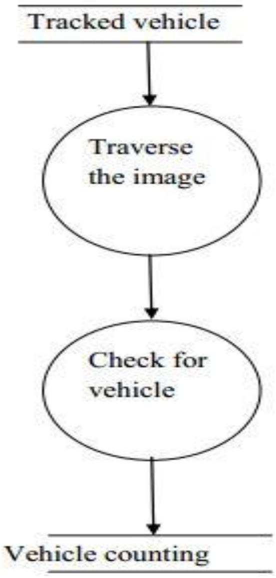

Figure 5: Vehicle counting flowchart

VIII. BLOCK DIAGRAM

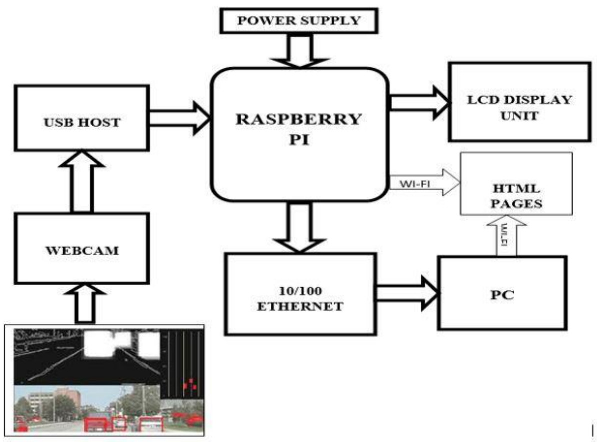

Figure 6: Block diagram of vehicle detection, tracking and counting objects

This system captures the gestures from web-cam which is connected to micro controller through USB host and the image is processed by means of image processing technique. Here we are using Open CV library to detect a frontal hand as an image using its Haar-Cascade hand Detector, this will increase the human computer interaction. If any gesture is recognized by the camera, a rectangular box will appear on monitor. The identified gestures are sends to Raspberry PI board and we can perform TV related functions. In this way we are implementing single camera dedicated television control system using gesture drawing.

IX. SOFTWARE SPECIFICATIONS AND FRAMEWORK

Software specifications:

1. Operating System : Linux
2. QT for Embedded Linux

1. Linux Operating System:

Linux or GNU/Linux is a free and open source software operating system for computers. The operating system is a collection of the basic instructions that tell the electronic parts of the computer what to do and how to work. Free and open source software (FOSS) means that everyone has the freedom to use it, see how it works, and changes it. There is a lot of software for Linux, and since Linux is free software it means that none of the software will put any license restrictions on users. This is one of the reasons why many people use Linux. A Linux based system is a modular Unix-like operating system

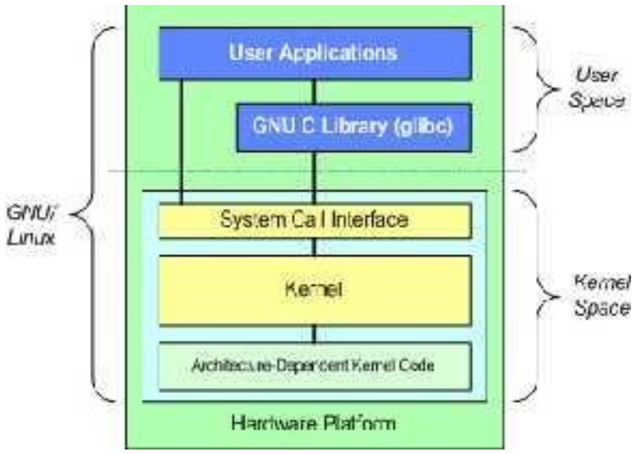

Figure.7: Linux OS Architecture

It derives much of its basic design from principles established in UNIX during the 1970s and 1980s. Such a system uses a monolithic kernel, the Linux kernel, which handles process control, networking, and peripheral and file system access. Device drivers are either integrated directly with the kernel or added as modules loaded while the system is running.

2. QT for Embedded Linux:

QT for Embedded Linux is a C++ framework for GUI and application development for embedded devices. It runs on a variety of processors, usually with Embedded Linux. QT for Embedded Linux provides the standard QT API for embedded devices with a lightweight window system.

X. HARDWARE IMPLEMENTATION

A. Raspberry Pi Board

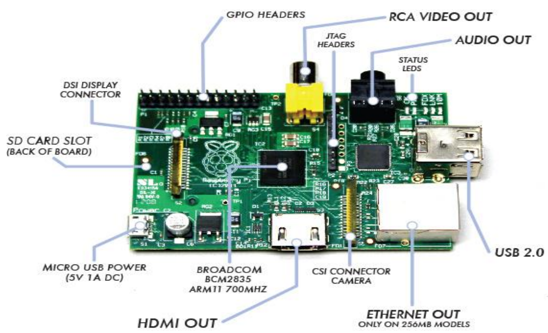

Figure 8: Raspberry Pi Development Board

The Raspberry Pi has a Broadcom BCM2835 system on a chip (SoC), which includes an ARM1176JZF-S 700 MHz processor, Video Core IV GPU, and was originally shipped with 256 megabytes of RAM, later upgraded (Model B & Model B+) to 512 MB. It does not include a built-in hard disk or solid-state drive, but it uses an SD card for booting and persistent storage, with the Model B+ using a Micro SD. Model B is the higher-spec variant of the Raspberry Pi, with 512 MB of RAM, two USB ports and a 100mb Ethernet port. It's our most popular model: you can use it to learn about computing; to power real-world projects (like home breweries, arcade machines, musical root vegetables, robot tanks and much more); as a web server; a bit coin miner; or you can just use it to play Mine craft.

B. UVC Driver Camera

Figure 9: UVC Driver Camera

A UVC (or Universal Video Class) driver is a USB-category driver. A driver enables a device, such as your webcam, to communicate with your computer's operating system. And USB (or Universal Serial Bus) is a common type of connection that allows for high-speed data transfer. Most current operating systems support UVC.

XI. RESULTS

1. Detection Phase Of Moving Cars

Figure 10: Testing for the Vehicle Detection of a moving cars.

2. Tracking Phase of Moving cars

Figure 11: Testing for Vehicle Tracking by Matrix Scan of a moving cars

3. Counting Phase of Moving cars

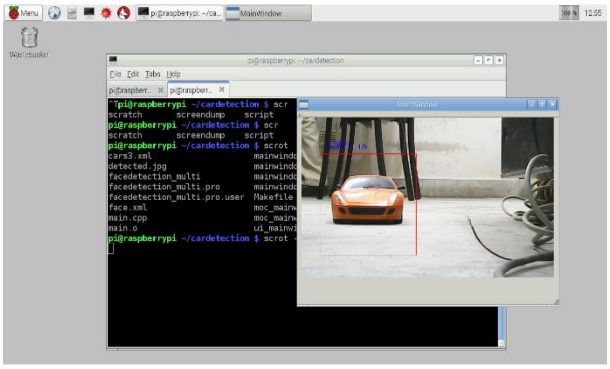

Figure 12: Testing for Vehicle counting of moving cars.

4. Monitoring vehicle tracking through IP address based

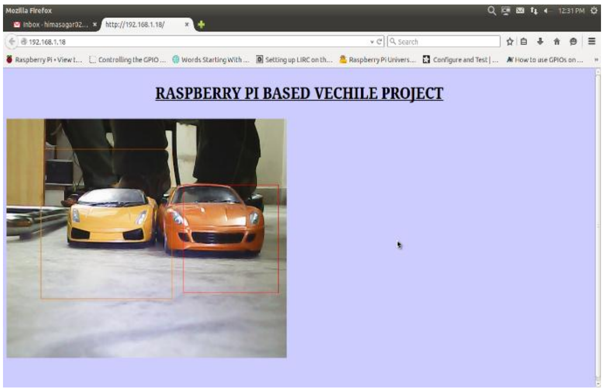

Figure 13: snapshot of detection and tracking of vehicles

XII. CONCLUSION

A system has been developed to detect and count dynamic vehicles on highways efficiently. The system effectively combines simple domain knowledge about vehicle classes with time domain statistical measures to identify target vehicles in the presence of partial occlusions and ambiguous poses, and the background clutter is effectively rejected. The experimental results show that the accuracy of counting vehicles was 96%, although the vehicle detection was 100% which is attributed towards partial occlusions.

The computational complexity of our algorithm is linear in the size of a video frame and the number of vehicles detected. As we have considered traffic on highways there is no question of shadow of any cast such as trees but sometimes due to occlusions two vehicles are merged together and treated as a single entity.

XIII. FUTURE SCOPE

Several future enhancements can be made to the system. The detection and tracking and counting of moving vehicle can be extended to real-time live video feeds. Apart from the detection and extraction, process of recognition can also be done. By using recognition techniques, the vehicle in question can be classified. Recognition techniques would require an additional database to match with the given vehicle. The system is designed for the detection and tracking and counting of a multiple moving vehicle. It can be further devised to alarming system.

REFERENCES

[1] http://ieeexplore.ieee.org/xpl/articleDetails.jsp?reload=true&arnumber=6112843
[2] https://www.behance.net/gallery/Vehicle-Detection-Tracking-and-Counting/4057777
[3] www.raspberrypi.org
[4] M.Sankari and C. Meena ,“Adaptive Background Estimation and object detection applying in Automated visual surveillance” (IJCSIS) International Journal of Computer Science and Information Security, Vol. 8, No. 4, July 2010
[5] H.S. Mohana, Aswatha Kumar and Shiva kumar Malnad College of Engineering, Hassan, Karnataka,” Vehicle Counting And Classification Using Kalman Filter And Pixel Scanner Technique And Its Verification With Optical Flow Estimation”, Global Journal of Computer Science and Technology 46 Vol. 10 Issue 8 Ver. 1.0 September 2010
[6] http://opencvsrf.blogspot.in/2013/10/smooth-images.html
[7] http://www.byteparadigm.com/applications/introduction-to-i2c-and-spi-protocols/
[8] P.M.Daigavane and Dr. P.R.Bajaj , Real Time Vehicle Detection and Counting Method for Unsupervised Traffic Video on Highways Mrs
[9] https://en.wikipedia.org/wiki/Kalman_filter
[10] www.w3schools.com
[11] Viola and Jones, "Rapid object detection using a boosted cascade of simple features", Computer Vision and Pattern Recognition, 2001
[12] https://en.wikipedia.org/wiki/Background_subtraction
[13] http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=6555527&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs_all.jsp%3Farnumber%3D6555527
[14] http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=6868357&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs_all.jsp%3Farnumber%3D6868357