Moving Vehicle Detection for Measuring Traffic Count Using OpenCV

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Moving Vehicle Detection for Measuring Traffic Count Using OpenCV

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***Abstract*—System in this paper is designed and implemented with Visual C++ software with Intel's OpenCV video stream processing system to realize the real-time automatic vehicle detection and vehicle counting. Expressways, highways and roads are getting overcrowded due to increase in number of vehicles. Vehicle detection, tracking, classification and counting is very important for military, civilian and government applications, such as highway monitoring, traffic planning, toll collection and traffic flow. For the traffic management, vehicles detection is the critical step. Computer Vision based techniques are more suitable because these systems do not disturb traffic while installation and they are easy to modify. In this paper we present inexpensive, portable and Computer Vision based system for moving vehicle detection and counting. Image from video sequence are taken to detect moving vehicles, so that background is extracted from the images. The extracted background is used in subsequent analysis to detect and classify moving vehicles as light vehicles, heavy vehicles and motorcycle.**

The system is implemented using OpenCV image development kits and experimental results are demonstrated from real-time video taken from single camera. We tested this system on a laptop powered by an Intel Core Duo (1.83 GHZ) CPU and 2GB RAM. This highway traffic counting process has been developed by background subtraction, image filtering, image binary and segmentation methods are used. This system is also capable of counting moving vehicles from pre-recorded videos.

***Index Terms*—Computer Vision; OpenCV; Segmentation; Video Detection**

I. INTRODUCTION

Traffic counts, speed and vehicle classification are fundamental data for a variety of transportation projects ranging from transportation planning to modern intelligent transportation systems [1]. Still 'Traffic Monitoring' and 'Information Systems' related to classification of vehicles rely on sensors for estimating traffic parameters. Currently, magnetic loop detectors are often used to count vehicles passing over them [2]. Vision-based video monitoring systems offer a number of advantages over earlier methods. In addition to vehicle counts, a much larger set of traffic parameters such as vehicle classifications, lane changes, parking areas etc., can be measured in such type of systems.

In large metropolitan areas, there is a need for data about vehicle classes that use a particular highway or a street. A classification and counting system like the one proposed here can provide important data for a particular decision making agency [3]. Our system uses a single camera mounted on a pole or other tall structure, looking down on the traffic scene. It can be used for detecting and classifying vehicles in multiple lanes and for any direction of traffic flow.

II. RELATED WORK

For many years tracking moving vehicles in video streams has been an active area of research in computer vision. In real time system described in [4] uses a feature-based method along with occlusion reasoning for tracking vehicles in congested traffic scenes. In order to handle occlusions, instead of tracking entire vehicles, vehicle sub-features are tracked. A moving object recognition method described in [5], uses an adaptive background subtraction technique to separate vehicles from the background. The background is modeled as a slow time-varying image sequence, which allows it to adapt to changes in lighting and weather conditions. Other popular video based traffic counting systems use high-angle cameras to count traffic by detecting vehicles passing digital sensors. As a pattern passes over the digital detector, the change is recognized and a vehicle is counted. The length of time that this change takes place can be translated into speed estimates.

When driving in the dark environment, drivers normally turn on the headlights to obtain a clear vision on the road. These headlamps produce illumination on the ground and this region will be classified as moving object. This headlight detection method includes high-intensity region detection and classification for cars and bikes is described in [6].

Despite the large amount of literature on vehicle detection and tracking, there has been relatively little work done in the field of vehicle classification. This is because vehicle classification is an inherently hard

problem [7]. Moreover, detection and tracking are simply preliminary steps in the task of vehicle classification.

I. VIDEO SUBSYSTEM DESIGN

Vehicles detection must be implemented at different environment where the light and the traffic status changing. In our proposed system, we accept the traffic flow video from a camera and convert video into frames extract reference backgrounds and performs detection of moving objects.

The system we propose consists of three stages.

1) System Initialisation: System gets initialised and set up in this stage. Camera records continuous stream of data and sends to the system for analysis

2) Background Subtraction: In this stage, a set of frames are taken into focus and on successive analysis and operations background subtraction takes place.

3) Vehicle Detection: In this stage, using the subtracted background image all the moving vehicles/objects can be tracked and counted

Our system works in two modes, pre-recorded video mode and real-time camera mode. We can provide pre-recorded traffic flow video for detection and counting of vehicles. Real time camera mode application accepts the video from the camera and tracks the vehicles.

A classification system like the one proposed here can provide important data for a particular design scenario. Our system uses a single camera mounted on a pole or other tall structure, looking down on the traffic scene. It can be used for detecting and classifying vehicles in multiple lanes and for any direction of traffic flow. The system requires only the camera calibration parameters and direction of traffic for initialization.

II. MOVING OBJECT DETECTION IN OPENCV

OpenCV stands for Open Source Computer Vision Library and is designed in C & C++ specifically for increased computational efficiency, supported by most Operating Systems. OpenCV for providing effective solutions for complex image processing and vision algorithm for real time application for UG and PG students projects. Computer Vision (CV) applications require extensive knowledge of digital signal processing, mathematics, statistics and perception [8].

Example applications of the OpenCV library include Human-Computer Interaction, Object Identification, Segmentation and Recognition, Face Recognition, Gesture Recognition, Camera and Motion Tracking, Ego Motion, Motion Understanding, Stereo and Multi-Camera Calibration and Depth Computation and Mobile Robotics [9]. OpenCV library contains over 500 functions which can be used in above application areas. OpenCV has many powerful image processing functions [10].

In this system simple camera initialization is performed using following code.

```
//Check if camera is working
if (!input)
{ printf("\n\t Input Error");
}
```

III. SYSTEM DESIGN

A. Resolution setting

Before capturing the video stream from web camera, it is expected to check current screen resolution. This application may not produce desired results, if the resolution is less than 1024 x 768. It is recommended to change the resolution to 1024 x 768 or higher for optimal performance. Most of the applications need to perform such classification and counting on existing stored video. For this purpose the option for counting vehicles from store video is given.

B. Object detection

This part is coded by using Microsoft visual C++ with OpenCV library. System is designed to start getting images from web camera. Every frame will be processed to find a moving object in the video. Activity diagram of the proposed system shown in the Fig 1.

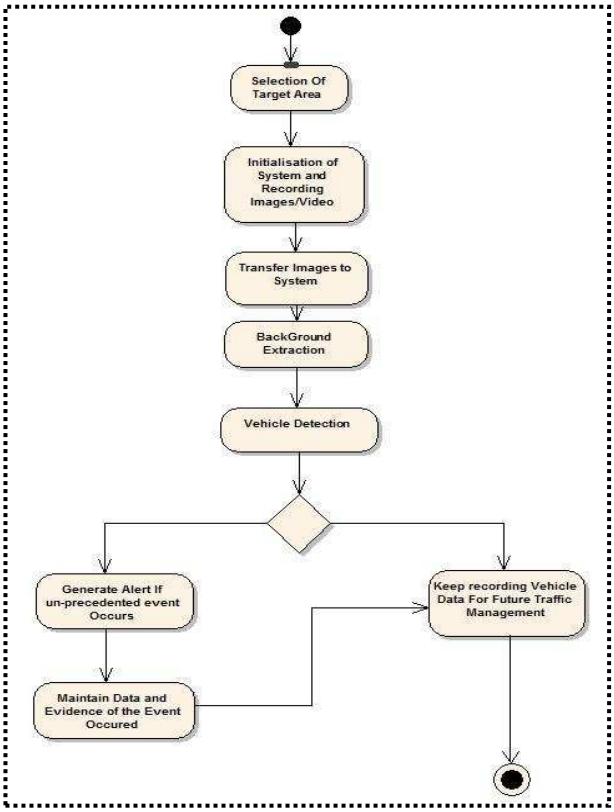

Figure 1. Activity diagram for vehicle detection

C. Interface Design

This part is designed up by using Microsoft Visual Studio. Interface is build to enable user to interact with the system and give various options for detecting vehicles. Since the system runs on two different modes, we need to give an option of activating camera for real-time and detecting vehicles for pre-recorded mode.

Fig 2 shows the interface of the system which provides several functions as given below:

- Activating camera in color mode and grayscale mode

- Detect vehicles
- Detect vehicles from pre-recorded video stream
- Browse and play existing videos

Videos are stored in standard .avi format using XVID Codec. If you intend to perform vehicle detection on any video, there is need to convert the video to standard .avi format using XVID codec. Videos after detection are stored in the C:\Vehicle Detection System\Saved Videos folder. You may access them from there if needed in the future.

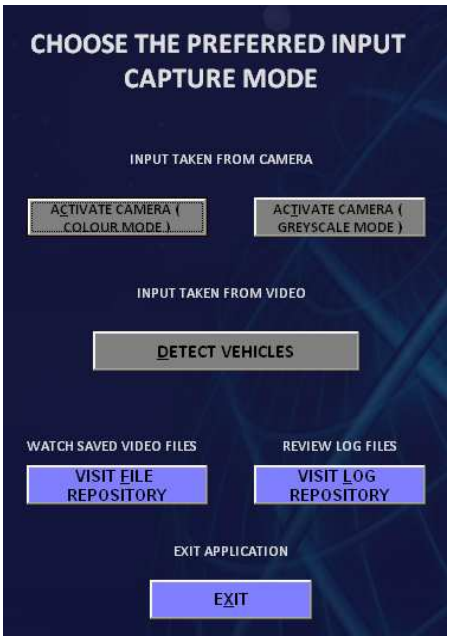

Figure 2. User Interface

Fig. 3 shows the interface after click on activating camera in color mode. While activating camera on color or grayscale mode the screen resolution is to be provided.

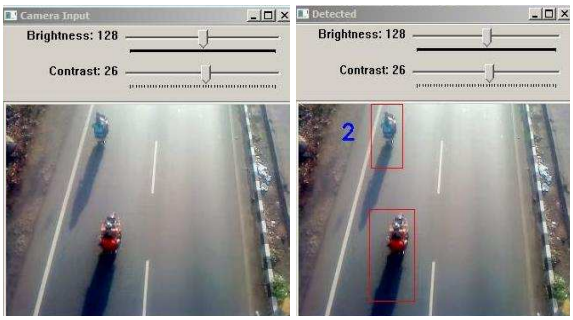

Figure 3. (a) Input Video, (b) Detected Objects(two wheelers)

D. vehicle counting and classification

In this work, the detected vehicle regions will be classified as light vehicles, heavy vehicles and motorcycles. We create a log of a text file giving following details.

- Number of Detected Light Vehicles
- Number of Detected Heavy Vehicles
- Number of Detected Motor-Cycles
- Total Number of Detected Vehicles
- Time and Date of Recording

These log files are stored in particular order on secondary storage device, depending upon the date.

IV. EXPERIMENTAL RESULTS

We tested this system on a laptop powered by an Intel Core Duo (1.83 GHZ) CPU and 2GB RAM. equipped with iNTEX IT- 305 WC camera. We tested the system on image sequences of highway scenes. The system is able to track and classify most vehicles successfully. Figs. 4-5 show some results of our system.

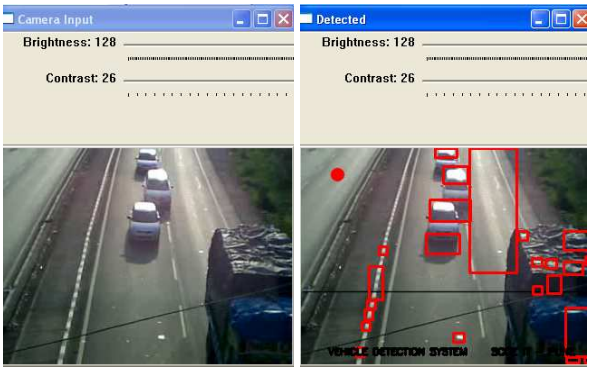

Figure 4. Detecting vehicles by pre-recorded video

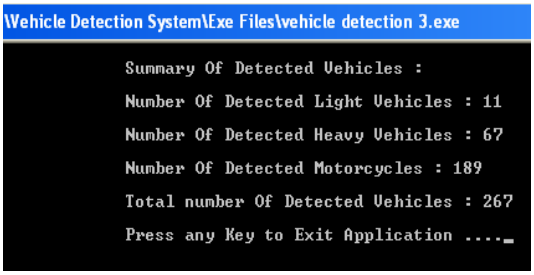

Figure 5. Classification of detected vehicles

List of video recorded and log files can be seen by clicking on Visit Log Repository button. We get the following options given in the Fig 6.

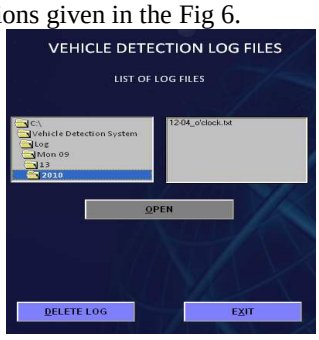

Figure 6. Log Repository

V. CONCLUSIONS

Due to increase in expressway, highways and traffic congestion, there is a huge amount of potential applications of vehicle detection and tracking on expressway and highways. In this paper we have demonstrated vision based system for effective detection and counting of vehicles running on roads.

The main aim of our system is to detect the moments of vehicles by analyzing camera pictures with the help of computer vision. Vehicle counting process accepts the video from single camera & detects the moving vehicles and counts them. Vehicle detection and counting system on highway is developed using OpenCV image development kits.

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