A Novel Approach for Vision Based Vehicle Detection in Traffic Surveillance System using Machine Learning Techniques

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Abstract: *Traffic analysis has been a problem that city planners have deal with for years. We consider road situation analysis tasks for traffic control and ensuring safety. Analysis of traffic may account for the number of vehicles in an area per some arbitrary time period and the class of vehicles. The vehicles are counted and time for the vehicles in a lane is allocated.*

Keywords: Traffic analysis, Arbitrary, vehicles count, Safety, Traffic control.

1. INTRODUCTION

Rising traffic congestion is an inescapable condition in large and growing metropolitan areas across the world. Traffic congestion is primarily a problem rather the solution for our basic mobility problem is that too many people want to move at the same times each day. The efficient operation of both economy and traffic systems requires that people should save time and energy. Mismanagement of traffic results in long waiting times, loss of fuel and money. Therefore, having a fast, economical and efficient traffic control system for national development is of greater importance.

Monitoring and controlling city traffic is becoming a major problem in many countries. Current traffic control techniques involving magnetic loop detectors buried in the road, infra-red and radar sensors on the side provide limited traffic information and require separate systems for traffic counting and for the traffic control system. Inductive loop detectors do provide a cost-effective solution but the defect is that they are subjected to a high-failure rate when installed in poor road surfaces, decrease pavement life and obstruct traffic during maintenance and repair. With the increase in number of vehicles on the road, the Traffic Monitoring Authority has to find new methods of overcoming this issue and equipment to improve the present state of traffic control. The simplest way for controlling traffic is using a timer in light for each lane. Another way is to use electronic sensors in order to detect vehicles, count them and allocate time based on the count. Besides, the highway and roads are incapable of meeting the requirement of increasing number of vehicle. Instead of working on roads to accommodate the growing traffic, various techniques have been devised to control the traffic on roads like installing embedded controllers at the junction.

Keeping the above said difficulties in view, We propose a system for controlling the traffic light by image processing to prevent traffic congestion. One way to improve traffic flow and Safety of the current transportation system is to apply automation and Intelligent control methods. The system will detect the density of vehicles through images instead of using electronic sensors embedded in the pavement.

This project has been implemented by using OpenCV software. OpenCV(Open Computer Vision) is used for the image processing. It is the field of informatics which teaches the computers to see. It is a way computers gather and interpret visual information from the surrounding environment and aims to have SMART way for signal management which will ultimately be a cost effective solution. The system includes a camera placed facing a lane that will capture images of the road on which we want to control traffic. These images are efficiently processed to know the traffic density. According to the processed data from OpenCV, a controller will send command to the traffic LED timer to show

particular time on the signal for the vehicles to move. The basic idea of the project is to get count of vehicles in each lane and allocate time for each lane dynamically. Inbuilt libraries are used to detect object in each image based on training set which is in form of XML. We also use the HAAR CASCADE ALGORITHM. The Cascade classifier gives the vehicle density of the road. Cascade classifier is used to detect the objects in the video stream. This algorithm is capable of differentiating vehicles from other objects.

This project will help to reduce traffic congestion and unnecessary waiting at Signals. The main aim in designing and developing this project is to reduce the waiting time of each lane of the vehicles .This project is mainly used at junctions because traffic at junctions is very high.

2. Literature Survey

Manual Controlling: Manual controlling as the name itself indicates that it requires man power to control the traffic. Traffic police are allotted for a required area or city to control traffic. The traffic police will carry sign board, sign light and whistle to control the traffic. They will be instructed to wear specific uniforms in order to control the traffic. The disadvantage is that we need more man power and traffic police needs to be trained.

Pejman niksaz proposed the "Automatic Traffic Estimation Using Image Processing". He stated two phases of vehicle detection. The first phase deals with the conversion of RGB into gray scale for image enhancement. The second phase involves the application of gamma correction on gray images.

Boon Chin yeo proposed the "Vehicle detection for Thermal vision based traffic monitoring system using principal component analysis". He stated that HoG is a feature descriptor for the detection and recognition of objects. The change in the brightness does not affect the detection and recognition of the object.

Hai wang proposed the "A multistep framework for vision based vehicle detection". His method consists of two steps. The first step is the vehicle candidate generation and the second step is for candidate verification. A clustering technique is defined for selecting and grouping of super pixels into vehicle candidate.

3. Existing System

The existing system is where the traffic is being monitored by either traffic police or by sensors to measure the density which are attached near the signals. The time allocated to each lane in a junction does not adjust to the change in traffic density of a particular lane. At present a fixed amount of time is allocated to each lane. If the number of vehicles is more than a limit, then the lane requires more time for the vehicle to move. If there is only one vehicle then the time required is very less. If there is no vehicle in the lane then the lane requires no time to be allocated.

Disadvantages:

- Increase in fuel consumption.
- Delay in traffic clearance.
- Increase air pollution.

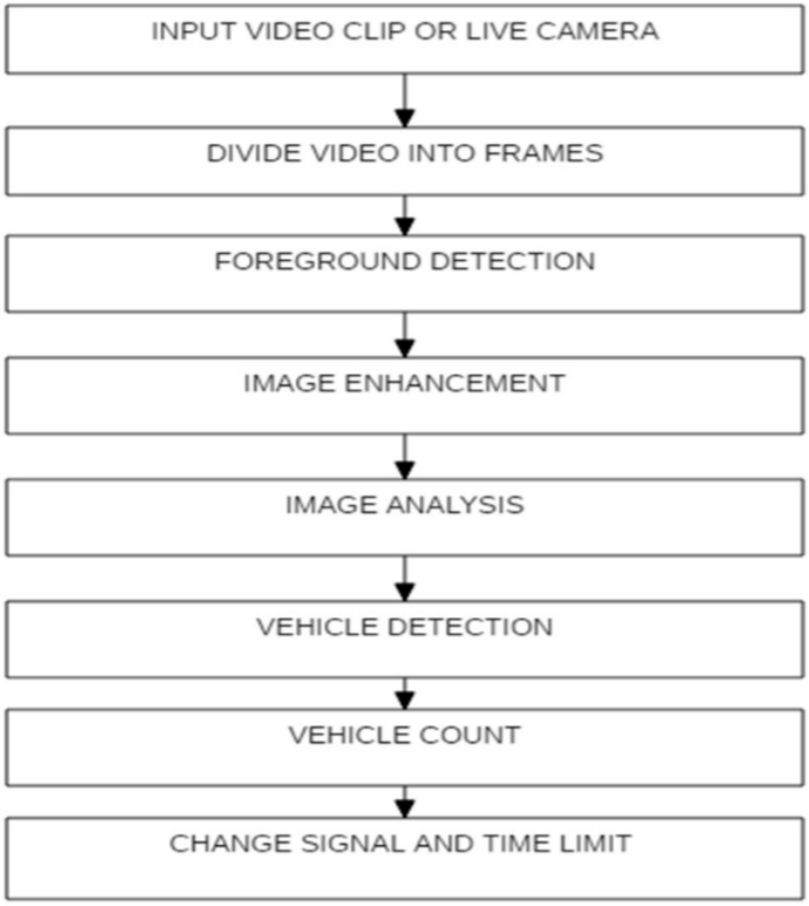
4. Proposed Approach

The main goal of the proposed work is to improve the Traffic Control by adding the necessary additional features and new technologies into the application. We propose a system for controlling the traffic signal by image processing. The vehicles are detected by the system through images instead of using electronic sensors embedded in the pavement or manual traffic handling. A camera will be placed alongside the traffic light. It will capture images. Image processing is a better technique to control the traffic signal. The images are processed and the density of vehicles in a lane is calculated. Based on the density of vehicles in the lane the time for each lane is allocated. Base time is also added for the display for yellow signal.

Advantages:

- Decrease traffic congestion.
- Decrease fuel consumption.
- Decrease air pollution.

5. Methodology of proposed system



The video clip captured by the camera is divided into frames. These frames undergo foreground detection process. The image is enhanced and analyzed. The vehicle can be detected and counted. Based on the count of vehicles The time for each lane is allocated.

6. Implementation

Spyder:

Spyder is a powerful scientific environment written in Python, for Python, and designed by and for scientists, engineers and data analysts. It features a unique combination of the advanced editing, analysis, debugging and profiling functionality of a comprehensive development tool with the data exploration, interactive execution, deep inspection and beautiful visualization capabilities of a scientific package.

Furthermore, Spyder offers built-in integration with many popular scientific packages, including NumPy, SciPy, Pandas, IPython, QtConsole, Matplotlib, SymPy, and more. Beyond its many built-in features, Spyder's abilities can be extended even further via firstand third-party plugins. Spyder can also be used as a PyQt5 extension library, allowing you to build upon its functionality and embed its components, such as the interactive console or advanced editor, in your own software.

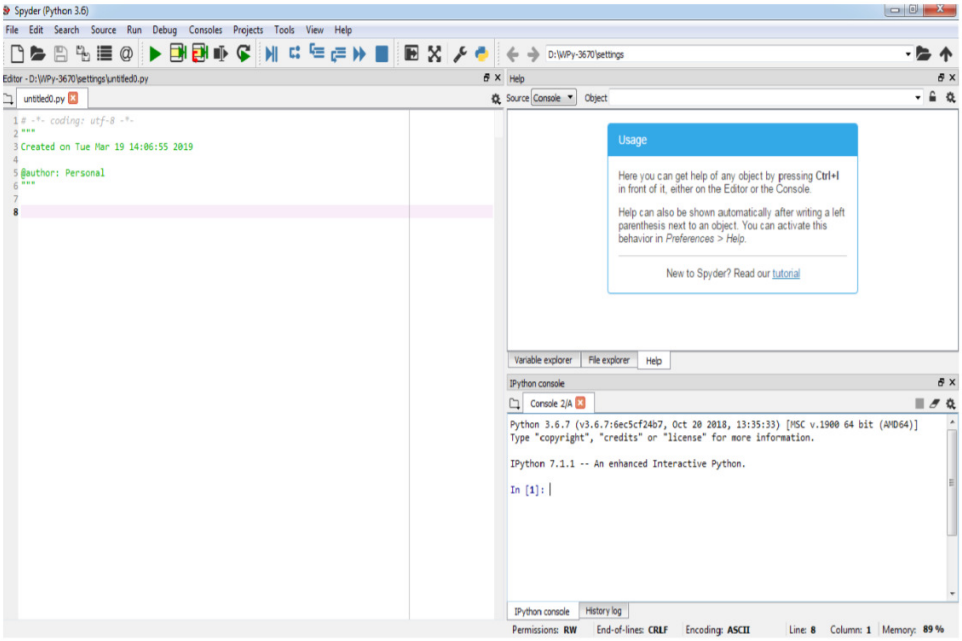


Fig:Spyder environment

OPENCV:

OpenCV (Open Source Computer Vision Library) is an open source computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products. Being a BSD-licensed product, OpenCV makes it easy for businesses to utilize and modify the code.

The library has more than 2500 optimized algorithms, which includes a comprehensive set of both classic and state-of-the-art computer vision and machine learning algorithms. These algorithms can be used to detect and recognize faces, identify objects, classify human actions in videos, track camera movements, track moving objects, extract 3D models of objects, produce 3D point clouds from stereo cameras, stitch images together to produce a high resolution image of an entire scene, find similar images from an image database, remove red eyes from images taken using flash, follow eye movements, recognize scenery and establish markers

to overlay it with augmented reality, etc. OpenCV has more than 47 thousand people of user community and estimated number of downloads exceeding 14 million. The library is used extensively in companies, research groups and by governmental bodies.

Along with well-established companies like Google, Yahoo, Microsoft, Intel, IBM, Sony, Honda, Toyota that employ the library, there are many startups such as Applied Minds, VideoSurf, and Zeitera, that make extensive use of OpenCV.

OpenCV's deployed uses span the range from stitching streetview images together, detecting intrusions in surveillance video in Israel, monitoring mine equipment in China, helping robots navigate and pick up objects at Willow Garage, detection of swimming pool drowning accidents in Europe, running interactive art in Spain and New York, checking runways for debris in Turkey, inspecting labels on products in factories around the world on to rapid face detection in Japan.

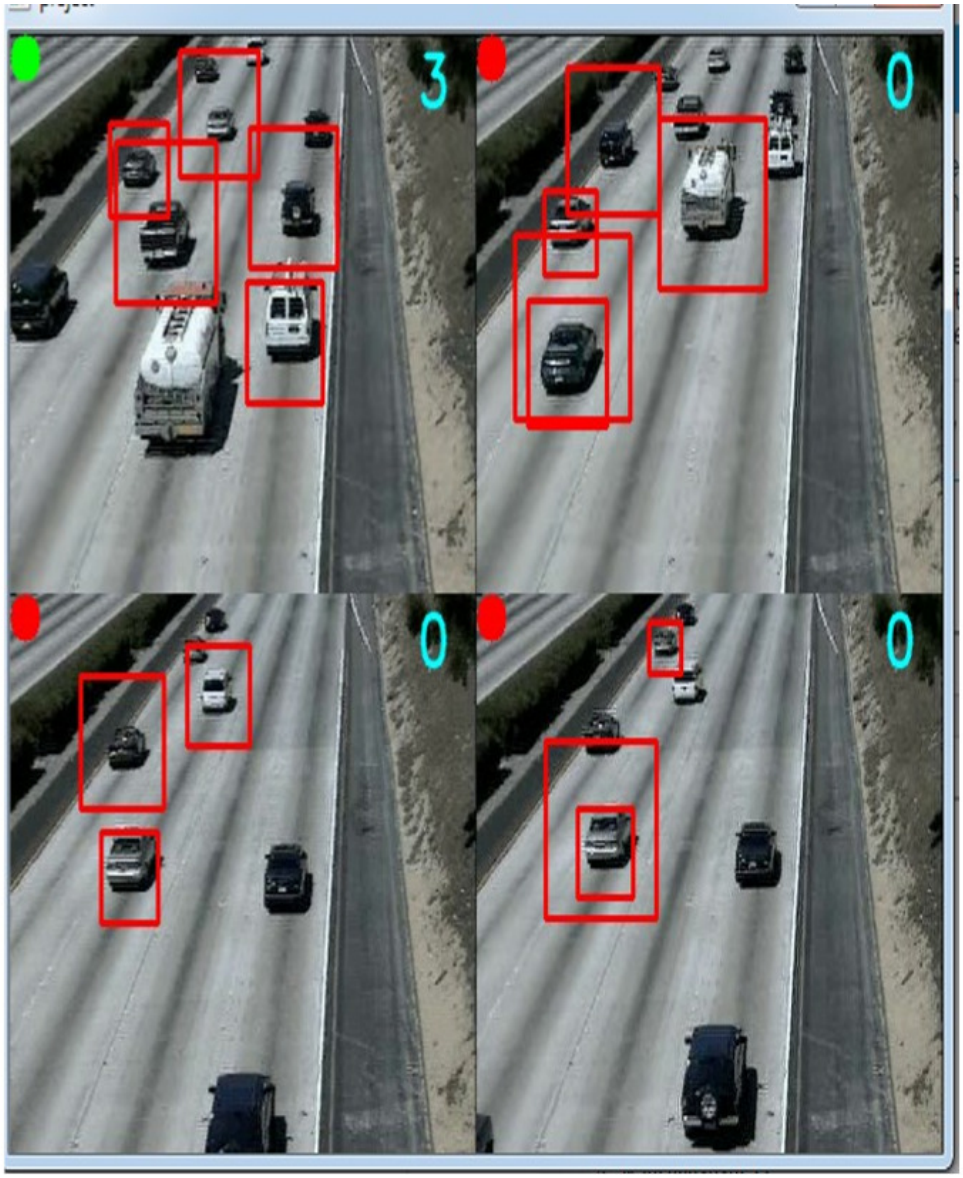
It has C++, Python, Java and MATLAB interfaces and supports Windows, Linux, Android and Mac OS. OpenCV leans mostly towards real-time vision applications and takes advantage of MMX and SSE instructions when available. A fullfeatured CUDAand OpenCL interfaces are being actively developed right now. There are over

500 algorithms and about 10 times as many functions that compose or support those algorithms. OpenCV is written natively in C++ and has a templated interface that works seamlessly with STL containers. OpenCV is becoming widely known in computer vision field for its library that mainly built for computer vision computation. Another notable feature is the library is cross-platform, which is usable in Windows, Linux and MacOS. Such high portability reduces burdens and works if port of system is needed. Nowadays, OpenCV has huge collection of popular computer vision computation algorithm, and optical flow is one of them.

7. Working Model

The cameras are placed along the lane or at traffic signal. The video captured by the camera is divided into frames. Each frame is processed for the detection of vehicles. The total number of vehicles are counted. Each vehicle is given one second for movement and the base time for yellow signal is three seconds. The total time allocated for the lane is equal to the sum of number of vehicles in each lane and base time. The vehicles can move during green signal and has to stop during red signal. Yellow signal is a warning signal which helps to warn the drivers that they have stop in three seconds.

8. Results



9. Conclusion & Future Directions

In this paper, the controlling of vehicles using image processing technique is presented. The images are captured at the road lanes. The captured images are processed and the density of vehicles is estimated. The advantage of the proposed system is that it is of low cost, easy setup and relatively good accuracy and speed. The usage of OpenCV software makes it accurate. Image processing technique is the best for the monitoring of traffic at junctions. It shows that it can reduce the delay in traffic clearance and saves time. It is accurate in detecting vehicle presence because it uses actual traffic images. It is a real time application. The present system uses a single camera for monitoring traffic at an intersection. By using a separate camera for each road at an intersection can improve the system efficiency further. The vehicle objects can also be categorized into various classes depending upon the geometrical shape of vehicle for blocking the passage of large vehicles e.g. trucks during day time. The emergency mode can be refined further by

installing a GPS receiver in ambulance so that the base station will keep track of the ambulance location on a continuous basis and clear the road whenever will be required.

10. Refrences

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