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Traffic Detection And SignalControl Using Open CV

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Abstract— The stuffing of urban traffic is becoming one of the critical issues with increasing population and automobiles in cities. Traffic jams not only cause extra delay and stress for the drivers, but also increase fuel consumption, add transportation costs, and increase air pollution. Our proposed system aims to design a traffic controller based on Computer Vision that can adapt to the current traffic situation. It uses the images from the CCTV cameras at traffic junctions for real-time traffic density calculation by detecting the vehicles at the signal and setting the green signal time accordingly. We have used object detection techniques like OpenCV in order to detect the number of vehicles for each direction. We then set the timers of these traffic signals according to vehicle density in each direction and hence the system becomes adaptive. This helps tooptimize the green signal times, and traffic is cleared at a much fasterrate than a static system, thus reducing the unwanted delays, congestion, and waiting time, which in turn will reduce the fuel consumption and pollution.

Keywords— vehicle detection, green signal timer, traffic control

I.INTRODUCTION

With the ever increasing number of vehicles on the road, the Traffic Monitoring Authority has to find new methods of overcoming such a problem and equipment to improve the state- of-the-art of traffic control. The simplest way for controlling traffic is using a timer in light for each phase.We propose a system for controlling the traffic light by image processing to prevent traffic congestion. The system will detect the density of vehicles and pedestrians through images instead of using electronic sensors embedded in the pavement.

II.ABOUT THE PROPOSED WORK

A. Literature Survey

There are 3 conventional systems-
Manual Controlling , Automatic Controlling and Electronic Sensors. The methods, which are used at present is really efficient in fact. But there are drawbacks in this controlling..

1. The manual controlling system requires a large number of manpower.
2. Conventional traffic lights uses a timer for every phase, which is fixed and does not adapt according to the real-time traffic on that road.
3. Electronic sensors i.e proximity sensors or loop detectors are usually based on sophisticated and expensive technologies and thus limited budget will reduce the number of facilities. That the inadequate infrastructure cannot handle the issue of traffic is also an decisive reason.

Our project is designed to develop a system which performs execution based on density of vehicles i.e counting of vehicles, using image processing. It concludes that video processing is a better technique for calculation of traffic density and controlling the state change of traffic light also use of OpenCV software In this system 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.

B. Project Objective

The main objective of this project is to design a traffic light controller based on Computer Vision that can adapt to the current traffic situation and to improve the Traffic Control by adding necessary features and new technologies into the application. We propose a system for controlling the traffic lightby image processing. The vehicles are detected by the system through images instead of using electronic sensors embedded in the pavement which are feed from the CCTV cameras at traffic junctions for real-time traffic density calculation by detecting the vehicles at the signal and set the green signal time accordingly. The vehicles are detected to obtain a more accurateestimate of the green signal time.

C. Proposed Work

In this section, the proposed work is elaborated at a high-level scope. Here we can understand the working nature of theproject.

System Architecture:

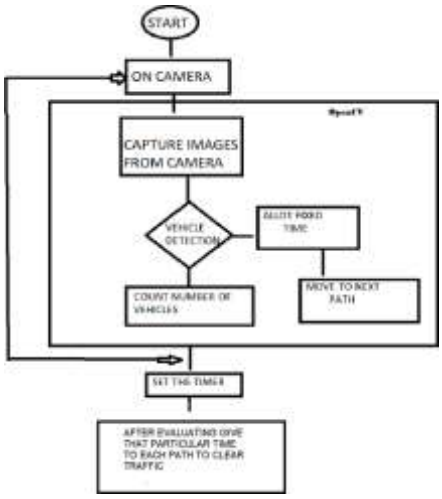

Fig.2.1 System Architecture

A. Image Capturing

At first, System includes a camera placed facing a lane that will capture images of the road on which we want to control
traffic. Those cameras will capture image sequences. The image sequence will then be analysed using digital image processing. Image processing is done by using OpenCV.

B. Vehicle detection and Calculating traffic Density

After detecting Vehicles using OpenCV, we use
HAARCASCADE ALGORITHM the cascade classifier gives
The vehicle density count on the road Cascade classifier is used to detect the objects in the video stream. This algorithm is capableof differentiating vehicles from different objects.

C. Calculation of green signal time

Based on the density of the vehicles green signal count will be allotted for every path. In our project the time given for
each vehicle is 2 seconds. If the number of the vehicles in one path is 5 then, the total green signal time given for that path willbe ->
4(fixed time) +5*2(each vehicle 2 sec)-2(last 2 sec yellow light will be displayed)

->F + Vc * 2 - 2
->4 + 5*2 - 2
->12 sec

Despite there is no vehicles in a path there will be a fixedtime for 4 sec for Pedestrains to cross.

D. Updating Traffic signal timer

When green signal timer ends for a path then it moves clockwise direction and jumps to the next path and starts detecting the vehicles. A line of vehicles waiting to be served by a phase in which the flow rate from the front of the queue. Slowly moving vehicles joining the rear of the queue are usually considered part of the queue. A faster moving line of vehicles is often referred to as a moving queue or a platoon ;

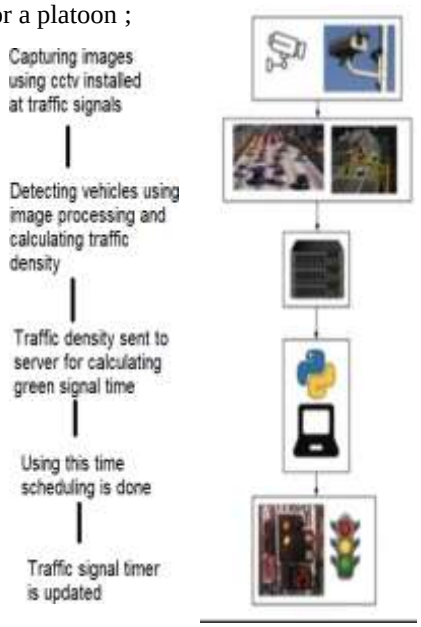

Fig2.2 flow chartIII.MODULES

The modules used in our project are

- Frame Division
- Detecting Objects
- Signal timing

➢ Frame Division: Dividing video into frames and store the frames in a folder. For these, we have to provide video as input and we got frames as output.

➢ Detecting objects: The frames which are stored in the folder, should give as input to program to detect vehicles in each frame and get count from each frame.

➢ Signal timing: After getting count from each lane ,we have to allocate timing for green signal based on vehicle count dynamically in clockwise manner.

What is Computer Vision?

Computer vision is a field of study which encompasses on how computer see and understand digital images and videos. Computervision involves seeing or sensing a visual stimulus, make sense of what it has seen and also extract complex information that could be used for other machine learning activities.

What is Image Processing?

Image processing is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it. It is a type of signal dispensation in which input is image, like videoframe or photograph and output may be image or characteristics associated with that image. Usually Image Processing system includes treating images as two dimensional signals while applying already set signal processing methods to them. The twotypes of methods used for Image Processing are Analog and Digital Image Processing. Analog or visual techniques of image processing can be used for the hard copies like printouts and photographs. Image analysts use various fundamentals of interpretation while using these visual techniques. The image processing is not just confined to area that has to be studied but on knowledge of analyst. Association is another important tool inimage processing through visual techniques. So analysts apply a combination of personal knowledge and collateral data to image processing. Digital Processing techniques help in manipulation ofthe digital images by using computers. As raw data from imagingsensors from satellite platform contains deficiencies. To get over such flaws and to get originality of information, it has to undergo various phases of processing.

Haar Cascade classifiers

Object Detection using Haar feature based cascade classifiers is An effective object detection method proposed by Paul Viola andMichael Jones in their paper, "Rapid Object Detection using a Boosted Cascade of Simple Features" in 2001. It is a machine learning based approach where a cascade function is trained from a lot of positive and negative images. Positive images – These images contain the images which we want our classifier to identify .Negative Images – Images of everything else, which do not contain the object we want to detect. The algorithm needs a lot of positive images (images of vehicles) and negative images (images without vehicles) to train the classifier. Then we need to extract features from it. They are just like our convolutional kernel. Each feature is a single value obtained by subtracting sum of pixels under the white rectangle from sum of pixels under the black rectangle. Now, all possible sizes and locations of each kernel are used to calculate lots of features. For each feature calculation, we need to find the sum of the pixels under white and black rectangles. To solve this, they introduced the integral image. However large your image, it reduces the calculations for a given pixel to an operation involving just four pixels. It makes things super-fast. An easy way to do vehicle detection is by using Haar Cascades .The haar-cascade cars3.xml was trained using 526 images of cars from the rear (360 x 240 pixels, no scale). The images were extracted from the Car dataset proposed by Brad Philip and Paul Updike taken of the freeways of southern California.

Functional Requirements

The Functional Requirements Specification gives the operations and activities that a system must be able to perform. Functional requirements should include functions performed by specific screens, outlines of work-flows performed by the system .A videowas given as input , which is further divided into frames . The frames was given as input to detection code which detect the objects based on training set. Count from each lane can be calculated and allocate signaling time dynamically. The output was in the form of signaling time .

Non-Functional Requirements

In systems engineering, a non-functional requirement is are requirement that specifies criteria that can be used to judge the operation of a system, rather than specific behaviours. The non- functional requirements can be considered as quality attributes ofa system.

Performance: The time required to divide the video into frames . Reliability: The system should be 90% reliable. Since it may need some maintenance or preparation for some particular day, the system does not need to be reliable every time.so, 80% reliabilityis enough.

Efficiency: Based upon the density of vehicles signaling time willbe dynamically allocated.

Availability: It is available in all the metropolitan cities.

Maintainability: The system should be optimized for supportability, or ease of maintenance as far as possible.

1V.RESULTS AND OBSERVATION

In Our project we developed a simulation to simulate the movement of vehicles across a traffic intersection having traffic lights with a timer. It contains a 4-way traffic intersection with traffic signals controlling the flow of traffic in each direction.

Fig 4.1.vehical density

Fig 4.2 green signal timer

Each signal has a timer on top of it which shows the time remaining for the signal to switch from green to yellow, yellow red , or red to green. The movement of Vehicles are controlled according to the signals and the vehicles around them. Count of the vehicles detected also displayed on the top.

Fig4.3 Signal timer printed on Terminal

V.CONCLUSIONS

The study showed that image processing is a better technique to control the state change of the traffic light. It shows that it can reduce the traffic congestion, can help reduce accidents happening at the signals and avoids the time being wasted by a green light onan empty road. It is also more consistent in detecting vehicle presence because it uses actual traffic images.

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