REAL TIME SMART TRAFFIC SIGNAL AND TRAFFIC DENSITY CONTROL SYSTEM WITH PEDESTRIAN CROSSING BASEDON IMAGE PROCESSING

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Abstract

There's a huge increase in car user’s day by day, Traffic blockings and traffic jams have become very common these days. In this paper, an arrangement for the traffic in highways is estimated by image processing method has been proposed. This Paper will be implemented by Mat lab software and it aims to anticipate abundant traffic in highways. Through this surveillance mechanism we intend to present an advance in absolute traffic management at junction. It computes time by time for every lane before enabling the signal. We use canny edge detection mechanism to detect the edges.

Keywords: Surveillance, Traffic, Canny detection, MATLAB, Image processing.

1. Introduction

In this modern world the population is increasing rapidly as well the usage of vehicles is also increased due to this the traffic conjunction and traffic jam happens continuously. To unravel this problem making new roads on facilities is that it makes the surroundings more congested.

So for that reason there is a need to change the system rather than making new infrastructure twice, Instead of working on roads to accommodate the growing traffic various techniques have been devised to control the traffic on roads like embedded controllers that are installed at the junction. If one lane has less traffic and the other lane with huge traffic but the duration of green light for both lanes is same then this is the waste of available resources and is inefficient.

If the lane with higher traffic density should switch on the green signal light for a longer period than the lane with the lesser density. This technique is based on the measurement of the traffic density by correlating the live traffic image with a reference image. The higher the difference is, higher traffic density is detected.
2. Overview

This study also proposes emergency vehicle detection, with a limited scenario; another technique is proposed which is based on neural networks, which identify the vehicles and traffic density by processing the traffic videos. They improved object detection using image segmentation and noise removal operations. In another technique is proposed to control the traffic signal by using image processing, in which they first selected the reference image which is the image with no vehicles or less vehicles and every time matching real time images with that reference image. On the basis of the percentage of matching traffic lights controlled. But in this technique image matching is performed by the edge detection. The reference subtraction is a complex technique, with limited outcomes.

This paper presents a density analyser scheme based on counting the number of vehicles in the present image, which provides us more accurate information for signal decision making. Edge detection allows user to observe those features of an image where there is a more or less abrupt change in grey level or texture indicating the end of one region in the image and the beginning of another. Many edge detection techniques have been developed for extracting edges from digital images.

There are many techniques used for this traffic control system here we use canny detection for edge detection. Edge detection technique specially addresses the problem of image enhancement, segmentation, recognition and registration. Here we are using six modules to overcome this traffic conjunction based on image processing.

3. Related Works

Various experiments have been undertaken & many methods have been proposed in smart control of traffic signal. They focuses on the necessity of intelligent traffic system and the similar way to implementation with embedded system tools this because of object counting method and detection of emergency vehicles there by control the traffic signal based on the priority outcomes.

This helps the emergency casualties to be attended quickly without panic of traffic conjection. In another way, the density counting algorithm works by comparing the real time frame by searching the vehicle in the road area. This will compare the lane from one direction to another direction in order to control the traffic signal smartly. And in another techniques edge detection helps to find the traffic density Traffic congestion has been causing many critical problems and challenges in the major and most populated cities. The increased traffic has led to more waiting times and fuel wastages. Due to these congestion problems, people lose time, miss opportunities, and get frustrated. It aims to prevent heavy traffic in highways. GSM technique is used to handle emergency. The authorized emergency vehicle
like Police, fire-fighter or ambulance are given priority to cross the intersection after the request raised by them with the help of SMS send as it approach the intersection. The signal remains on till it crosses the junction and can be put off to resume the normal operation by sending other SMS.

4. Proposed Algorithm

In this paper, an arrangement that estimates the traffic in highways by application processing has been proposed and as a aftereffect a bulletin is apparent to acquaint the amount of cars in highway. This activity will be implemented by Mat lab software and it aims to anticipate abundant traffic in highways. Through this surveillance we intend to present an advance in absolute cartage ascendancy arrangement at intersection. It computes time anniversery time for every alley before enabling the signal. Arrangement is able abundant to accommodate antecedence to accustomed emergency cars with the advice of GSM at a accurate intersection One change is affected the cartage botheration is to advance an able cartage ascendancy arrangement which is based on the altitude of cartage body on the alley application absolute time video and angel processing techniques. The system starts with an image acquisition process in which the live video is processed by the stationary camera, mounted on any pole. Then one frame per second continuously extracts from the live video and processed each frame by converting it into grayscale. For the reference image an empty road image was selected, when there is no traffic on the road. The second step is the image cropping in which, the targeted area is selected, the area where the vehicles are present and 3 filtered out unnecessary surrounding information. Next phase, determines the presence of objects in live video by taking the absolute difference of each extracted frame with the reference image. Digital image processing is meant for processing digital computer. It is the use of computer algorithm to perform image processing on digital images. It is a technology widely used for digital image operations like feature extraction, pattern recognition, segmentation, image morphology etc. Edge detection is a well developed field on its own within image processing. Edge is the important characteristic of image. Edges characterize boundaries and are therefore a problem of fundamental importance in image processing. Edges typically occur on the boundary between two different regions in an image. Edge detection allows user to observe those features of an image where there is a more or less abrupt change in gray level or texture indicating the end of one region in the image and the beginning of another. It finds practical applications in medical imaging, computer guided surgery diagnosis, locate object in satellite images, face recognition, and finger print recognition ,automatic traffic controlling systems, study of anatomical structure etc. Many edge detection techniques have been developed for extracting edges from digital images.
Fig. 1 Traffic Density Control System.

These are the events are proposed for which the model will work on:

- E1 - Pedestrian Go
- E2 - Pedestrian Stop
- E3 - Vehicle Go
- E4 - Vehicle Stop
- E5 - Vehicles Be Ready
- E6 - Pedestrian Hurry up

Following system takes place in the proposed model: In Reference to the above events, the proposed work is modelled for pedestrian crossing with Smart traffic signal.

The following sequence of algorithm of switching signals with smart traffic signal is proposed below in an orderly manner.

These Steps are carried out.

Step1: Start.

Step2: Check if pedestrian exist.

Step3: Check the vehicles in each lane.

Step4: Set the time value for each lane.

Step5: Initialise event E5.

Step6: Initialise event E1 and E4 simultaneously.

Step7: Initialise event E6.

Step8: Initialise event E2 and E3 simultaneously.

Step9: Step4 to step5 are followed in orderly manner.
Step10: Initialise event E7 if essential.

Step11: Stop.

At times, there will be either more pedestrians and no vehicles or vice versa. Those situations are represented in a logical matrix representation. These logical representations will be taken in consideration for the lanes.

5. Implementation

At Scenario where Pedestrians exist & Vehicles exist we follow the usual sequence this is because the density is equal. At scenario when only pedestrians exist we follow E1 & E4 will be followed. At both the scenarios where pedestrians don’t exist we follow only event E2 & E3 this is because vehicles can’t be stopped at a sudden rate. So we follow events E2 & E3.

In our proposed system we use smart traffic signals with the help of surveillance camera present at the junctions. The camera will capture the density of vehicles in each lane. As per the density to the number of vehicles in each lane, the time for respective green signal is given which varies time to time. If there are same numbers of vehicles in the lane, the signal will follow the basic timer. In case an emergency vehicle such as an ambulance is detected, priority is given for that. For a scenario where two ambulances are detected, the one nearer to the junction gets the priority.

<table>
<thead>
<tr>
<th></th>
<th>Pedestrians Exist</th>
<th>Pedestrians Doesn’t Exist</th>
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<tbody>
<tr>
<td>Vehicles Exist</td>
<td>Usual Flow of Sequence followed</td>
<td>E2 &amp; E3 are followed</td>
</tr>
<tr>
<td>Vehicles Doesn’t Exist</td>
<td>E1 &amp; E4 are followed</td>
<td>E2 &amp; E3 are followed</td>
</tr>
</tbody>
</table>

![Logical Matrix Representation Of a Lane at different scenarios](image)

Object based classification:

Object can be classified as vehicles, birds, floating clouds, swaying tree and other moving objects. There are two types of object based classification they are 1. Shape based classification 2. Motion based classification 3. Color based classification 4. Texture based classification

Shape based classification:

Different descriptions of shape information of motion regions such as representations of points, box and blob are available for classifying moving objects. Input features to the network is mixture of image-based and scene-based object parameters such as image blob area, apparent aspect ratio of blob bounding box and camera zoom.
Classification is performed on each blob at every frame and results are kept in histogram. Motion-based classification:

Non-rigid articulated object motion shows a periodic property, so this has been used as a strong cue for moving object classification. Optical flow is also very useful for object classification. Residual flow can be used to analyze rigidity and periodicity of moving entities. It is expected that rigid objects would present little residual flow where as a non-rigid moving object such as human being had higher average residual flow and even displayed a periodic.

Color-based classification

Unlike many other image features (e.g. shape) color is relatively constant under viewpoint changes and it is easy to be acquired. Although color is not always appropriate as the sole means of detecting and tracking objects, but the low computational cost of the algorithms proposed makes color a desirable feature to exploit when appropriate. To detect and track vehicles or pedestrians in real-time color histogram based technique is used. According to a Gaussian Mixture Model is created to describe the color distribution within the sequence of images and to segment the image into background and objects. Object occlusion was handled using an occlusion buffer.

Texture-based classification

Texture based technique counts the occurrences of gradient orientation in localized portions of an image, is computed on a dense grid of uniformly spaced cells and uses overlapping local contrast normalization for improved accuracy.

<table>
<thead>
<tr>
<th>Methods</th>
<th>Accuracy</th>
<th>Computational Time</th>
<th>Comments</th>
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</thead>
<tbody>
<tr>
<td>Shape based</td>
<td>Moderate</td>
<td>low</td>
<td>Simple pattern-matching approach can be applied with appropriate templates. It does not work well in dynamic situations and is unable to determine internal movements well.</td>
</tr>
<tr>
<td>Motion based</td>
<td>Moderate</td>
<td>high</td>
<td>Does not require predefined pattern templates but struggles to identify a non-moving human.</td>
</tr>
<tr>
<td>Color based</td>
<td>High</td>
<td>high</td>
<td>It creates a Gaussian Mixture Model to describe the color distribution within the sequence of images and to segment the image into background and objects</td>
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</tbody>
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Vehicle detection techniques

Model based detection: The emphasis is on recovering trajectories and models with high accuracy for a small number of vehicles. The most serious weakness of this approach is the reliance on detailed geometric object models.

![Model Based Detection](image1)

**Fig 2 : Model Based Detection.**

Region based tracking It detects each vehicle blob using a cross correlation function. Vehicle detection based on background subtraction.

![Potential segmentation problem](image2)

**Fig 3-Potential segmentation problem.**

Active contour based detection Tracking is based on active contour models, or snakes. Representing object in bounding contour and keep updating it dynamically. It reduced computational complexity compared to the region based detection.

![Active Contour Detection](image3)
Feature based detection Tracks sub-features such as distinguishable points or lines on the object. Effectiveness improved by the addition of common motion constraint.

![Figure 4: Bounding Counters.](image)

![Figure 5: Features are grouped together.](image)

![Figure 6: Vehicle Tracking Procedure.](image)

Table 2: Recommendations for surveillance.

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<thead>
<tr>
<th>REAL-TIME WORK ZONE SYSTEM FUNCTIONS AND SUB-FUNCTIONS</th>
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<tr>
<td>Advanced Warning</td>
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<td>Work Zone</td>
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6. Conclusion

In our proposed model, we estimate the density of the vehicles in each lane based on weights. The surveillance is done based on the density detection. Priority is given to the emergency vehicles & various modes of vehicles are used. The propose model ensures road safety & enforces strict traffic control.
7. Future Works

The accuracy will be better if we use thermal image processing. It’s because we can’t ensure the weather. at extreme weather situations, we cannot estimate properly. So thermal image processing will ensure the rate of success in all weather conditions. Cloud computing techniques can be used for further enhancements of data.

References


