A Survey on IntelligentTraffic Control System Using Image Processing

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***Abstract*—The present traffic control systems depends upon the manual operation which leads to unnecessary wastage of fuel and time, which again leads to increase in the traffic congestion. More time is wasted at the signals even if there are no vehicles on the lane because the signals have fixed timing for all roads which is not dependent of traffic queue. Some non-uniform illuminations that come from artificial light sources affect the night-time surveillance. Artificial light sources result in glow that the objects or the vehicles present near the light sources will not be visible. Web camera is fixed and the images of all the four lanes will be captured. The method used in this paper removes the effect of glow through image gradient decomposition. The enhanced image is obtained through Poisson solver. The real time vehicle density is measured to control the traffic system using canny edge detection algorithm and the vehicle count is calculated for each path or road and comparison is made with the other roads. The green signal and red signal are received by the roads with the maximum vehicles and minimum vehicles respectively.**

Keywords—Traffic congestion; digital camera, image processing;

I. INTRODUCTION

Traffic light control systems are not effective in major cities of developing countries that have resulted in heavy traffic jam. The signals that have fixed timings are not advantageous because they won't pay attention for the actual road conditions and resulting in the traffic congestion [1]. Large number of vehicles leads to traffic congestion which is caused due to the economic development and population. The solution of this problem is, the people should use the small sized vehicles such as bicycles, motor cycles, etc [2].Some applications of automatic vehicle detection systems are traffic response system, track parting warning system, traffic signal controller, spontaneous traffic density estimation and spontaneous vehicle accident detection and these systems are the solutions to road traffic control system [3]. It is very important to track the traffic congestion changes and response appropriately in the real time [5].

II. RELATED WORK

Number of attempts has been made to develop a system for traffic control through image processing. In 2018 Boris Alpatov, Pavel Babayan and Maksim Erkshov [9] suggested Vehicle detection and counting algorithm for detection of vehicles and vehicle count number in an image, Road marking detection algorithm for straight line detection in an image. The proposed algorithms evaluate the parameters of the traffic flows and allow solving the real time traffic problems under different observed conditions. In 2018 Anju Jaison, Evita Varghese, Gopika K, Krishnadas [12] used OpenCV for image processing in which the density of vehicles and pedestrian from images are taken and compared with other images. If the density of vehicles is more than a particular limit and the density of pedestrian is normal, then vehicle mode will be on and vice versa. If both the densities are more than limit, then there will be a traffic cycle which gives equal time interval for both teams to cross the signal. In 2017 Simin Wang and team [7] proposed layer separation method for exploiting an image decomposition method is to separate input image into glow layer and non-glow layer and also used Poisson solver method to find the final fusion result. In this paper [7], the glow is completely removed from image which results in the object visibility near artificial light sources. These images are fused with content weight in gradient domain. In 2017 Taqi Tahmid and Eklas Hossain [6] proposed Canny edge detection algorithm for measuring the traffic density, Gaussian algorithm for eliminating the noises, Sobel gradient algorithm to compute intensity gradient and Time allocation algorithm for allocating time for individual image. In 2014 Prem Kumar Bhaskar, Suet-Peng Young [3] used Prewitt Edge detection algorithm, Sobel algorithm, Gradient based edge detection and Laplacian operators to control the traffic light state changes. It reduces traffic jam and minimizes the time. Compatible for detection of current vehicles since it uses current traffic images. In 2014 Md.Munir Hasan, Gobinda Saha, Aminul Hoque and Md.Badraddoja Majumder [2] proposed two methods to evaluate traffic density and the methods are Gradient magnitude and direct subtraction. Traffic density is determined by measuring the total area that is occupied by vehicles on road. In 2010 Umar Farooq and team [1] used ROI method to filter the unwanted things present in an image. Sobel edge detection method to detect the edges found in the resulting image.

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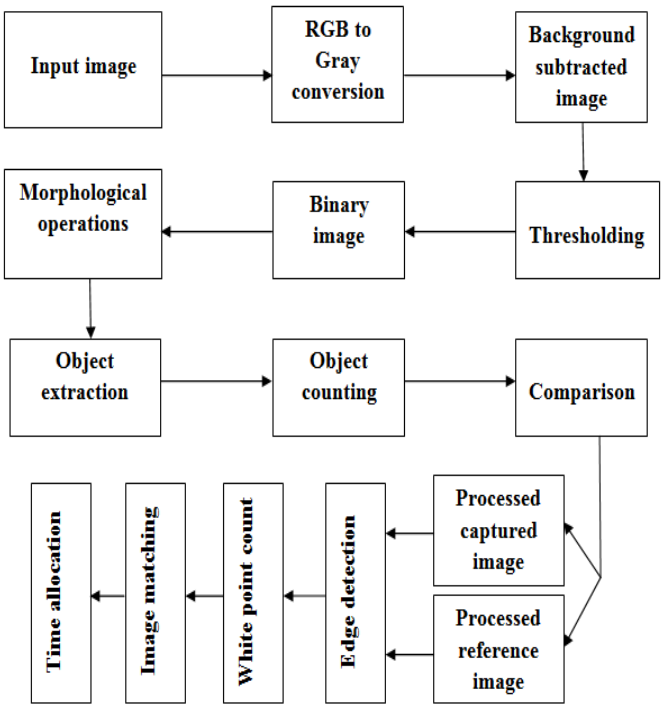
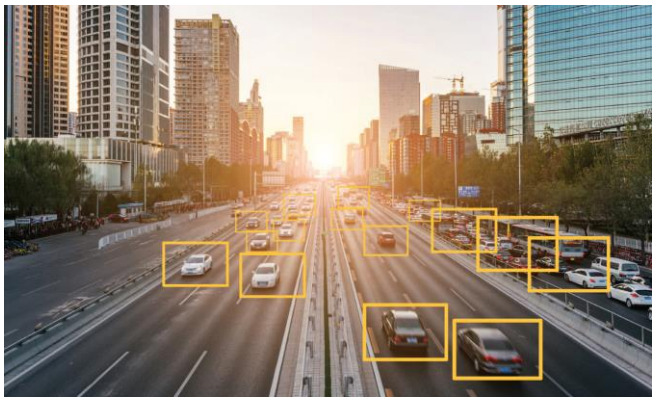
III. SYSTEM ARCHITECTURE



1. IMAGE ACQUISITION/RESIZING/RESCALING

Initially, setup with the four lanes is designed. Web camera captures the images. Conversion of RGB image to gray conversion is done using gray scale image.

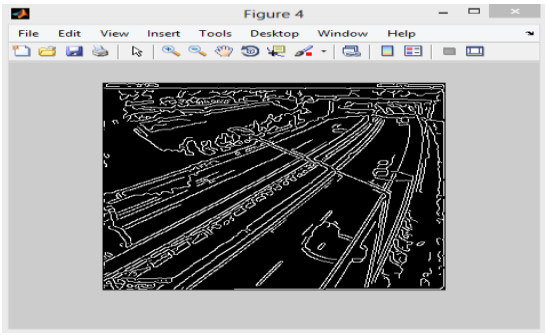


2. IMAGE ENRICHMENT

Image enrichment- it is the process that adjusts the digital images in such a way that the results will be more suitable for further analysis or display.

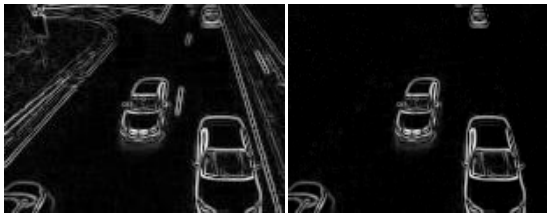
3. IMAGE SEGMENTATION

Binarization- grayscale image is converted to binary image and this conversion uses level of thresholding. By implementing Otsu Thresholding algorithm, Thresholding level can be computed. It is the process of converting each pixel of image into 1 bit and the values 0 or 1 are assigned which depends upon the mean value of the pixel called binarization. The mean value is 1 when the value is greater otherwise value is 0.



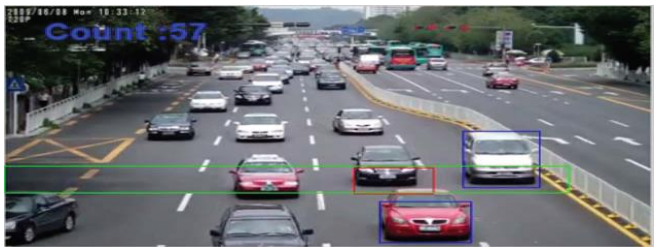
4. MORPHOLOGICAL OPERATIONS

Unwanted objects in the image such as trees, human beings, etc are removed using morphological operations.



5. OBJECT COUNTING

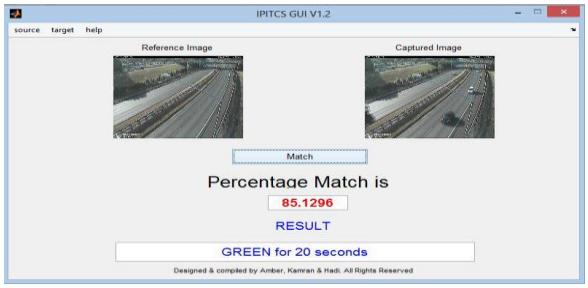
One vehicle is equal to one object. The vehicles at each lane are present after the implementation of image segmentation and morphological operations. The number of vehicles is counted at each lane.



6. DECISION MAKING

A system is proposed in which calculates the traffic density with current time density by comparing the reference image against captured image. Here, the reference image is the empty road image. Less time period for green signal will be allocated for each lane. The allocated signal period can be controlled according to the percentage of matching. It is

done by comparing the white point counts of two images and white point counts are depicted. Due to its high performance, canny edge detector operator is preferred. Percentage matching is done for various sample images and traffic time allocation. Image matching is done by comparing edges that were detected which is the best approach to identify the vehicle length with proper accuracy.

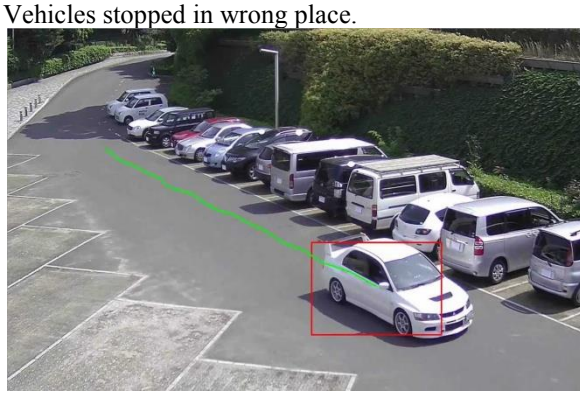


IV. CHALLENGES

The challenges to be faced are;

- Detection of accidents.

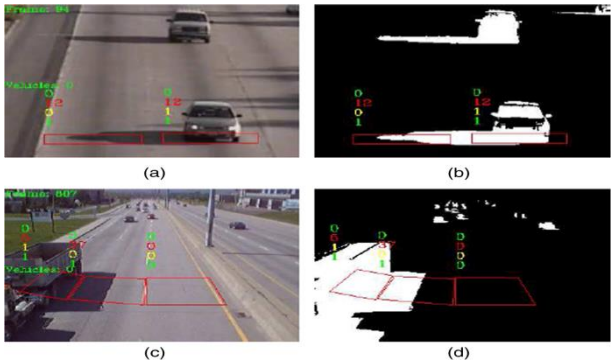
- Vehicles stopped in wrong place.



- Obtaining of traffic flow statistics.

- Intra vehicular spacing – two vehicles standing very close to each other are counted as 1.

- Moving shadows and glares that are caused by different positions of sun and hence, the shadow of the vehicle and the vehicle count is taken.



V. RESULTS AND CONCLUSION

The edge detection algorithms [4] like Sobel and Prewitt are less accurate and take more processing time than canny edge detection algorithm [6].

Otsu thresholding algorithm [5] is more efficient as it analyzes and detects the different traffic density in the image.

The effect of glow in the night time images is completely removed using Gradient domain image enhancement algorithm [7].

The thresholding algorithm [8] is less efficient than [5] because the method based on static background fails in real environment.

Vehicle detection and counting algorithm [10] is more accurate and is more efficient because it allows solving the considered or viewed problem in the real-time under different observed conditions.

Web camera which continuously rotates, grabs the images of all tracks and these images are taken as input. The conversion of gray scale is made from extracting input image and background subtraction image. The inverse of Thresholded image is taken. The unwanted objects are removed using morphological operations and the vehicle count for each lane is calculated. All the lanes are compared and the green signal is given to the lane with maximum vehicles and remaining lanes are received with red light signal. The images are continuously extracted from the camera. Once the edge detection is completed then the comparison is done between sample and reference image is calculated. By the result time is allocated for each individual image using time allocation algorithm.

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