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Density Based Smart Traffic Control System Using Canny Edge Algorithm

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***Abstract* -There is an urgent need to deploy cutting-edge technology and equipment to enhance the current state of the art in traffic management since the issue of urban traffic congestion is only becoming worse. This is due to the fact that the issue is just growing worse. It is now plainly clear that the conventional approaches—such as timers or human control—are insufficient to address the problem as it now stands. In the context of this project, it has been proposed to create a system that can control traffic flow by continuously monitoring the present vehicle density via the use of cunning edge detection and digital image processing. When compared to the present methods, this powerful traffic control system delivers notable advantages in response time, vehicle management, automation, reliability, and overall efficiency. Vehicle management, overall efficiency, overall efficiency, and overall efficiency are the four areas into which these improvements may be divided. Additionally, utilising three example images of various traffic circumstances, the whole process of image collection, edge detection, and eventually green signal allocation is given with pertinent schematics. These schematics are used in conjunction with the photos. This phase of the process includes the acquisition of images, the detection of edges, and the distribution of green signals.**

***Keywords* – Edge Detection, CCTV, MSE, PSNR, LOG.**

I.INTRODUCTION

One of the biggest issues modern civilization is now dealing with is street congestion, which is a problem that exists in all major cities worldwide. According to a recent study by the World Bank, the average speed of automobiles in Dhaka has decreased from 21 km/h to 7 km/h during the last 10 years. According to inter-metropolitan area study, traffic congestion reduces the degree of regional competitiveness and redistributes economic activity by slowing the rate of rise in county gross output or the rate of increase in employment in the metropolitan area. There is an urgent need for a totally new traffic management system that makes use of cutting-edge technology to make the most of the infrastructures that are already in place since an already congested traffic system is experiencing a rise in the number of automobiles it can accept. Building new motorways, flyovers, elevated expressways, and other forms of infrastructure requires a lot of time, money, and planning. As a result, emphasis should be given to making better and more careful use of the existing infrastructure. Analyze traffic data.

The total number of cars is calculated by some of the employees, while the total number of pixels is counted by others. These methods have yielded some hopeful results when it comes to gathering traffic data. Although rickshaws and auto-rickshaws are the most popular modes of transportation in South Asian nations, the computation of the number of vehicles may provide erroneous results if the intra vehicular spacing is extremely tiny (two vehicles that are near to one another may be counted as one). Additionally, while determining the number of pixels, insignificant objects like pedestrians and walkways are counted as cars. Some studies have recommended scheduling time only based on how much traffic is there. However, people who often drive in lanes with less traffic could find this to be a problem. The study presented here proposes an intelligent traffic control system that uses image processing as a tool to gauge the volume of traffic. The drawbacks of the current, almost obsolete traffic management system have been shown, and the merits of the alternative traffic control system that has been proposed have been discussed. Four different sorts of traffic scenes have been photographed as examples in order to achieve this aim. The sample photographs and the reference image are compared to see how comparable they are once the edge detection procedure is complete. Due to this proximity, time allocation has been carried out according to the process for allocating time to each individual photo.

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A. Proposed System

If one wants to successfully extract the pertinent traffic data from the CCTV film, edge detection is an approach that is crucial. This tool makes it easy to remove the necessary data while leaving the remainder of the picture alone. There are several edge detection techniques to choose from. Regarding noise reduction, detecting sensitivity, level of accuracy, and a number of other important aspects, they differ from one another. Prewitt, Canny, Sobel, Roberts, and LOG stand out as having the most accreditation of any of them, despite the fact that the great majority of them have attained it. It has been noted that the Canny edge detector has improved accuracy in the identification of objects that have a larger entropy, PSNR (Peak Signal to Noise Ratio), MSE (Mean Square Error), and execution time when compared to the Sobel, Roberts, Prewitt, Zero crossing, and LOG detectors. Regardless of how the detector is used, this is the case. This is always the case, regardless of the entropy level of the item. The various edge detection techniques that are presently on the market are compared and contrasted in this article. By comparing a photo taken with real-time traffic information to a picture of a road that is vacant that acts as a reference image, this study hopes to create a system that can measure the density of traffic. By contrasting the two photographs, this will be done. Here is an illustration of the block diagram for the recommended traffic control strategy.

II LITERATURE REVIEW

T. Tahmid and E. Hossain, "Density based smart traffic control system using canny edge detection algorithm for congregating traffic information," 2017 3rd International Conference on Electrical Information and Communication Technology (EICT), 2017, pp. 1-5, doi: 10.1109/EICT.2017.8275131.

Congestion in urban areas is becoming more problematic; hence, it is essential to make use of more cutting-edge methods and technology in order to progress the current state of the art in traffic management. It is now abundantly clear that the approaches that are currently being used, which may include timers or human control, are inadequate to cope with this problem. This article provides a recommendation for a system that can regulate traffic by monitoring the vehicle density in real-time using clever edge detection and digital image processing. The system would be able to do this by employing digital picture processing and cunning edge detection. This advanced system for controlling traffic provides considerable advances over the technologies that are already in use in terms of reaction time, the management of vehicles, automation, dependability, and overall effectiveness. The entire process of image collection, edge identification, and green signal allocation is explained with appropriate schematics, and the final findings are confirmed by hardware implementation. In addition, four example photographs depicting various traffic circumstances are used. These photographs are used to illustrate the process. In order to better understand this, we utilised the four images that were provided as examples.

Real time density-based traffic control system K. Kalyan Chakravarthy1 , L V S Raghu Vamsi2 , K. Siva Narayana Reddy3 , M Naveen Kumar4 , Prof. V Anil Kumar5

There is traffic congestion in the majority of the cities throughout the globe, despite the fact that there are several traffic management systems in place but they are not up to par. This is owing to the fact that there is traffic congestion in today's globe as a consequence of a huge rise in the number of cars due to an increase in population. The current traffic light system is based on the idea of a set time, which means that the signal timing is evenly distributed to each and every side of the junction and cannot be changed depending on the volume of traffic. This system has been in use for a while. We created a project to dynamically manage the flow of traffic in order to find a solution to this issue. We are use cameras, image processing software, and Arduino to control the traffic signals in order to accomplish this aim. The junction highways' captured images are loaded into image processing software, which produces a calculation that establishes the vehicle density. Once the system has computed the data, it will automatically choose the duration of each traffic signal depending on the number of vehicles using each route. In light of density A sophisticated traffic light control system that can also identify emergency vehicles is made possible by image processing. Gaurita R. Choukekar,

The development of efficient and quick transit and transportation networks is necessary for the economic growth of any nation. Because ineffective management and congestion result in lost time, fuel, and money, it is necessary to implement a traffic management system that is prompt, efficient, and cost-effective. The monitoring and control of traffic has developed into a critical concern in today's world. A sophisticated traffic management system is required since the number of users is increasing on a daily basis and has to be handled in an effective manner. Effective management of traffic may be accomplished via the use of a variety of strategies. However, given that real-time situations are in a constant state of flux, there is no approach that can be considered optimal, and there is also no system that is capable of continuously adapting to these shifting variables.

There is two standard traffic control system such as

1) Manual traffic control: This involves human resources. There are traffic police assigned to that region, and he will carry a signboard, a sign light, and a whistle.
2) Automatic control: Powered by electronic sensors and timers. The timings are altered in accordance with the sensor's determination of the vehicle's availability.

However, it has too many flaws and is not a system that is effective or flexible.

We presented a method for managing a density-based smart traffic light management system in this project, with the intention of achieving certain objectives:

- Differentiate between the presence and absence of vehicles in the captured road image.
- Ensure that the traffic light turns red whenever the road is unoccupied.
- Ensure that the traffic light turns green in proportion to the number of vehicles present, with the duration of the green light being adjusted based on a calculation..

It's possible to employ Mat Lab software to put in place the suggested system, which has efficient traffic management as its primary aim and concentrates on it as its primary purpose. Due to the fact that the camera was positioned just above the intersection's traffic signal, the whole roadway could be seen from that vantage point. The video is shown as a succession of frames that follow one another, and each frame in the movie is compared to the first frame, which is the source of the data on the density of autos. On the screen is also shown the total number of vehicles. The allocation time is shown as it should be in accordance with the present technique of traffic management. The green light turned yellow as a direct result of this event.

After that, an emergency vehicle detection system is used to assist in identifying an ambulance together with other emergency vehicles, so drawing more attention to the impacted lane. After that, they are transferred to the hardware, which consists of an ATMEGA 8 microprocessor for operating the traffic light and a USART module for transmitting control data to the microcontroller. Both of these components are connected to each other through a USART module. The only logical conclusion to draw from this is that someone is in command of the traffic light.

The user is able to choose the area based on his own preferences by using the information on the traffic density that is offered on the Android application. It provides information on the current traffic situation in addition to facts on a variety of websites. This status information might be used to choose a certain area to go to in order to reach the destination. This easy application does not incur any additional fees since it is so simple.

III. SYSTEM DESIGN

A. Block Diagram

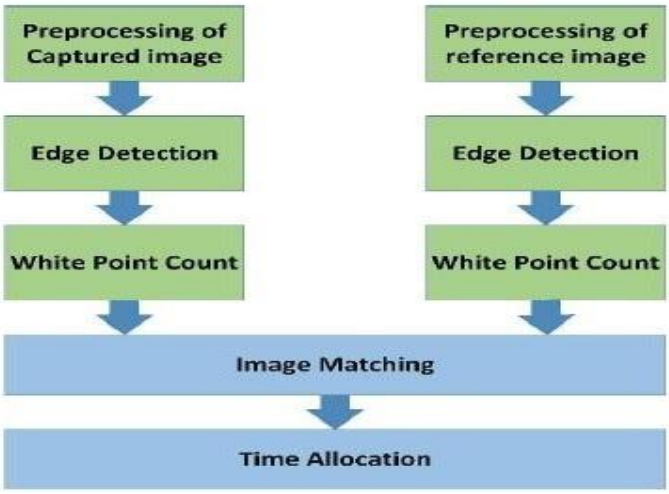


Figure 1 Block Diagram of Proposed density based smart traffic control system

In order to make the raw photos simpler to work with for the edge detection algorithm, picture preprocessing is done at this step of the process. Four more images of diverse traffic situations are chosen after the first reference image, which is a picture of an empty road. All of the photographs are reduced to 400 by 400 pixels using the following formula to maintain a constant spatial resolution and increase computational efficiency.

B. Canny Edge Alogorithm

The human eye has the amazing ability to analyse a picture quickly and determine what it is about when it comes to categorising photos (label). Regardless of whether the result is a sketch or a picture, it is quite amazing that it is able to achieve this.

The Canny edge detector is an edge detection operator that uses a multi-stage method to recognise a wide range of edges in images. John F. Canny was the one who created it in the year 1986. The strategy works because of a computational theory of edge detection that Canny created. This theory explains why the method works.

An edge detector with several stages is the Canny filter. It uses a filter that is generated from a Gaussian and is based on its derivative to compute the gradients' intensity. The Gaussian filter is used to reduce the amount of noise in the image. Then, by removing pixels from the gradient that are not at their maximum, the potential edges are thinned down until they are 1-pixel curves. In order to determine whether edge pixels should be kept or removed, hysteresis thresholding is utilised to the gradient magnitude.

The low threshold, the high threshold, and the width of the Gaussian are three variables that may be changed for the Canny (the width increases according to the amount of noise in the picture).

The Canny edge detection algorithm is composed of 5 steps:

1. Noise reduction
2. Gradient calculation
3. Non-maximum suppression
4. Double threshold
5. Edge Tracking by Hysteresis
6. After applying these steps, you will be able to get the following result:

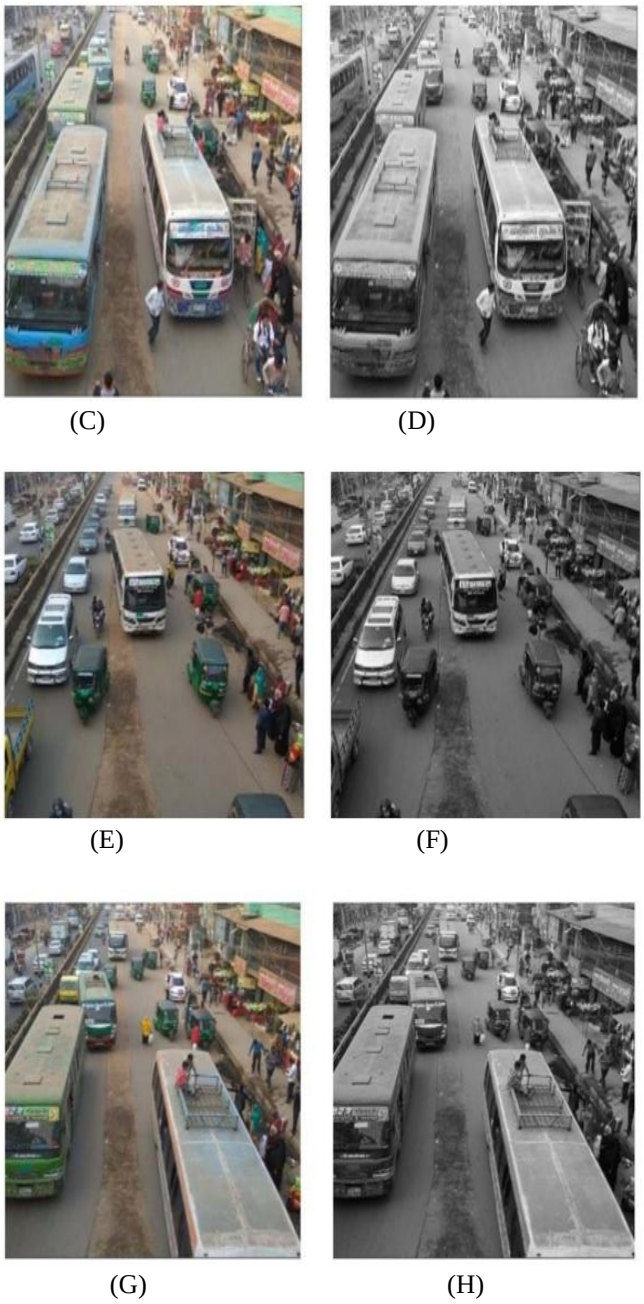
Grayscale images form the foundation of the algorithm, which brings us to the last point that must not be overlooked. Therefore, in order to proceed with the processes that were just described, it is necessary to convert the picture to grayscale first.

Figure 2 Original image on the left — Processed image on the right

IV EXPERIMENTS, RESULTS AND OBSERVATIONS

A. Sample Image and Reference images

(A) (B)



(C) (D)

(E) (F)

(G) (H)

Figure 3 Image Processing of sample and reference images

B Edge Detection And White Point Count

To differentiate between diverse shapes, the edge detection approach is used. It is used in this work in order to isolate the numerous car-related contours from the background image. The canny edge detector was chosen for this experiment after a variety of edge detectors were examined. To reduce unwanted roughness, the images are first smoothed using a Gaussian filter programme.

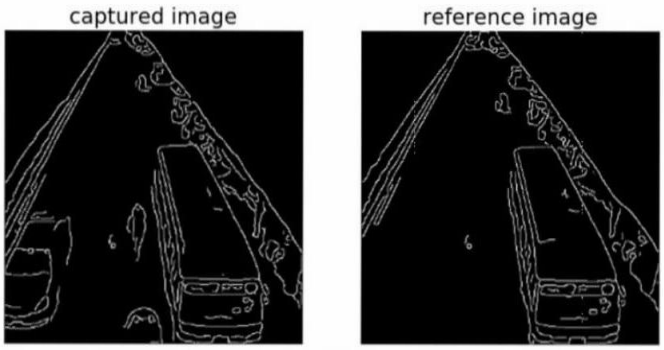


Figure 4 Edge Detection

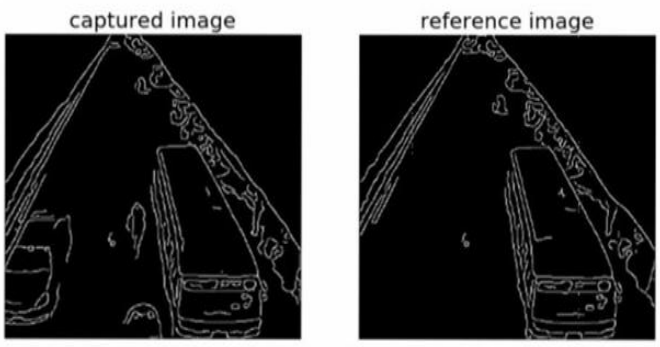
C Percentage Matching And Time Allocation

The degree to which the sample image and the reference image are similar may be used to estimate the number of automobiles on the road since the reference image is simply an image of an empty road. The effects of irrelevant edges shown in the example photographs, such as the edges of routes, islands, and so on, are made null and void when they are compared to the reference image. This is because these edges are present in the reference picture as well. The proportion of matches discovered is calculated using the calculation below,

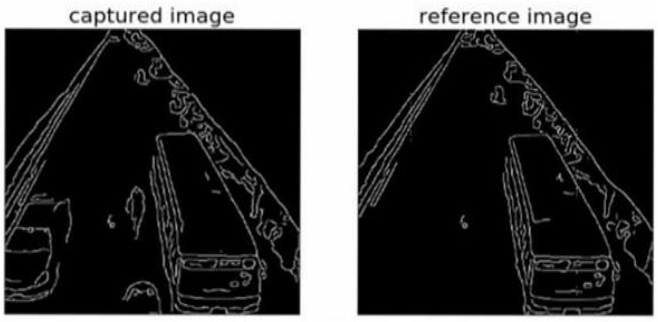
%match =Total number of white points in reference image *100
Total number of white points in sample image

How much time is provided to the green signal is based on the percentage of matching between subsequent lanes. The recommended temporal distribution is predicated on an assumption.

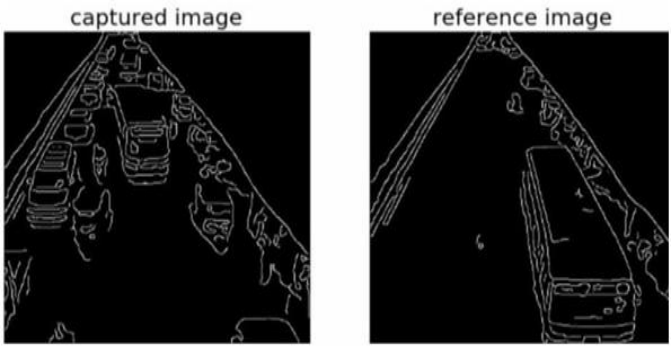
The distribution of time in the contemporary age may depend on a number of factors, including, among others, the number of automobiles and the volume of traffic at nearby intersections. For instance, the procedure will need additional time if the queue of cars waiting to be cleared is much larger than typical. Furthermore, it would be very damaging if traffic at the nearby junctions became even worse as a result of vehicles arriving from other crossroads.



Similarity in percentage : 63.45%
Turn on green light for 40 seconds



Similarity in percentage : 82.36%
Turn on green light for 20 seconds



Similarity in percentage :75.77%
Turn on green light for 30 seconds

Figure 6 Percentage Matching and Time Allocation

Table 1: Green signal allocation table.

Similarity in Percentage	Allocated Green Signal Time
0%-50%	60 seconds
51%-60%	50 seconds
61%-70%	40 seconds
71%-80%	30 seconds
81%-100%	20 seconds

CONCLUSION

In this paper, a smart traffic control system that uses image processing as a tool for determining the density of the traffic has been proposed. The drawbacks of the current, almost obsolete traffic management system have been shown, and the merits of the alternative traffic control system that has been proposed have been discussed. Four different sorts of traffic scenes have been photographed as examples in order to achieve this aim. The sample photographs and the reference image are compared to see

how comparable they are once the edge detection procedure is complete. Due to this proximity, time allocation has been carried out according to the process for allocating time to each individual photo.

REFERENCES

[1] T. Tahmid and E. Hossain, "Density based smart traffic control system using canny edge detection algorithm for congregating traffic information," 2017 3rd International Conference on Electrical Information and Communication Technology (EICT), 2017, pp. 1-5, doi: 10.1109/EICT.2017.8275131.

[2] Real time density-based traffic control system K. Kalyan Chakravarthy1 , L V SRaghu Vamsi2 , K. Siva Narayana Reddy3 , M Naveen Kumar4 , Prof. V Anil Kumar5.

[3] Density Based Smart Traffic Light Control System and Emergency Vehicle Detection Based On Image Processing Miss. Gaurita R. Choukekar1, Mr. Akshay G. Bhosale2.