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Density Based Smart Traffic Control System Using Canny Edge Detection Algorithm for Congregating traffic information

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Abstract
As the problem of urban traffic congestion intensifies, there is a pressing need for the introduction of advanced technology and equipment to improve the state-of-theart of traffic control. The current methods used such as timers or human control are proved to be inferior to alleviate this crisis. In this paper, a system to control the traffic by measuring the realtime vehicle density using canny edge detection with digital image processing is proposed. This imposing traffic control system offers significant improvement in response time, vehicle management, automation, reliability and overall efficiency over the existing systems. Besides that, the complete technique from image acquisition to edge detection and finally green signal allotment using four sample images of different traffic conditions is illustrated with proper schematics and the final results are verified by hardware implementation.
Keywords: Traffic, Density, image acquisition

INTRODUCTION

Traffic congestion is one of the major modern-day crisis in every big city in the world. Recent study of World Bank has shown that average vehicle speed has been reduced from 21 km to 7 km per hour in the last 10 years in Dhaka [1]. Intermetropolitan area studies suggest that traffic congestion reduces regional competitiveness and redistributes economic activity by slowing growth in county gross output or slowing metropolitan area employment growth [2].As more and more vehicles are commissioning in an already congested traffic system, there is an urgent need for a whole new traffic control system using advanced technologies to utilize the already existent infrastructures to its full extent. Since building new roads, flyovers, elevated expressway etc. needs extensive planning, huge capital and lots of time; focus should be directed upon availing existing infrastructures more efficiently and diligently. glean traffic data. Some of them count total number of pixels [3], some of the work calculate number of vehicles [4- 6].These methods have shown promising results in collecting traffic data. However, calculating the number of vehicles may give false results if the intravehicular spacing is very small (two vehicles close to each other may be counted as one) and it may not count rickshaw or auto-rickshaw as vehicles which are the quotidian means of traffic especially in South-Asian countries. And counting number of pixels has disadvantage of counting insubstantial materials as vehicles such as footpath or pedestrians. Some of the work have proposed to allocate time based solely on the density of traffic. But this may be disadvantageous for those who are in lanes that have less frequency of traffic.

LITERATURE SURVEY

A Anjani research on the smart traffic control system availing image processing and using canny edge detection as an instrument for measuring the density of the traffic. the image of CCTV is taken and processed through the canny edge detection and counting the white pixels and calculating the green time using matching probability with reference image [1].

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Taqi Tahmid proposes a traffic control system have been presented For this purpose, four sample images of different traffic scenario. Upon completion of edge detection, the similarity between sample images with the reference image has been calculated. Using this similarity, time allocation has been carried out for each individual image in accordance with the time allocation algorithm [3].

S. Lee's research on the system uses a camera-based density measurement method to estimate traffic flow and detect traffic congestion. The density measurement method uses the number of vehicles passing through a certain area over a period of time to estimate traffic flow. The system also uses Canny edge detection to detect the presence of vehicles at intersections and estimate their speed and direction of movement [4].

P. Ramya research on The system consists of three main modules: image processing, fuzzy logic control, and signal control. The image processing module uses Canny edge detection to detect the edges of vehicles in real-time video footage captured by cameras installed at intersections. The fuzzy logic control module then uses the edge density information to determine the appropriate signal timings based on the traffic volume and congestion level [5].

H. Jahanbakhsh research on The Canny edge detection algorithm is used to extract the edges of vehicles in the video input, which are then passed to an ANN to estimate the number of vehicles in each lane and their speeds. This information is then used to dynamically adjust the signal timings to optimize traffic flow [6].

V. Rajkumar proposes a smart traffic control system that uses Canny edge detection and image processing techniques to detect and classify vehicles, estimate traffic flow, and optimize traffic signal timings. The system is designed to improve traffic flow and reduce congestion on urban roads. The proposed system includes a camera-based vehicle detection module that uses Canny edge detection and morphological operations to extract vehicle features and classify them using machine learning algorithms [7].

EXISTING SYSTEM

Traffic congestion is one of the major modern-day crisis in every big city in the world. Recent study of World Bank has shown that average vehicle speed has been reduced from 21 km to 7 km per hour in the last 10 years in Dhaka. Intermetropolitan area studies suggest that traffic congestion reduces regional competitiveness and redistributes economic activity by slowing growth in county gross output or slowing metropolitan area employment growth.As more and more vehicles are commissioning in an already congested traffic system, there is an urgent need for a whole new traffic control system using advanced technologies to utilize the already existent infrastructures to its full extent. Since building new roads, flyovers, elevated expressway etc. needs extensive planning, huge capital and lots of time; focus should be directed upon availing existing infrastructures more efficiently and diligently.
Previously different techniques had been proposed, such as infra-red light sensor, induction loop etc. to acquire traffic date which had their fair share of demerits. In recent years, image processing has shown promising outcomes in acquiring real time traffic information using CCTV footage installed along the traffic light.

PROPOSED SYSTEM

Edge detection technique is imperative to extract the required traffic information from the CCTV footage. It can be used to isolate the required information from rest of the image. There are several edge detection techniques available. They have distinct characteristics in terms of noise reduction,

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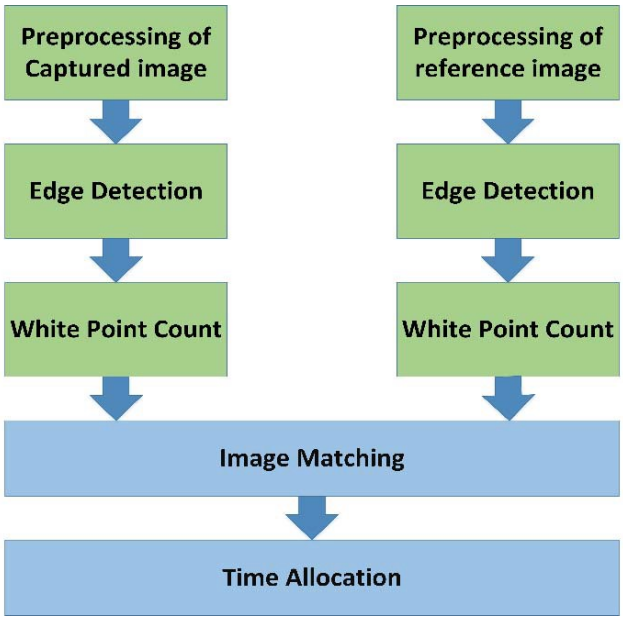
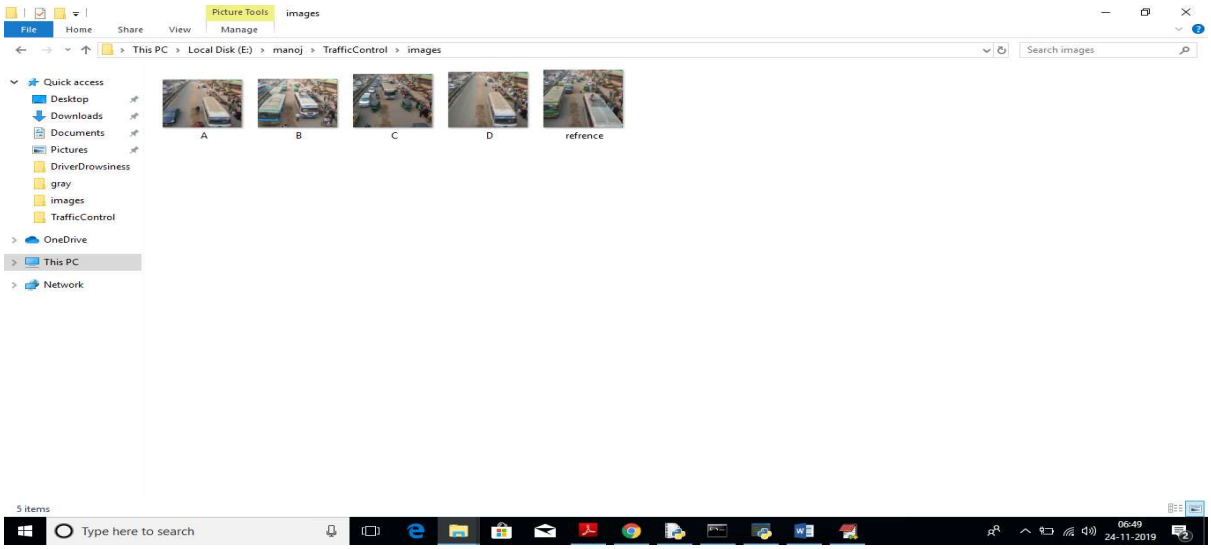
detection sensitivity, accuracy etc. Among them, Prewitt, canny,Sobel, Roberts and LOG are most accredited operators. It has been observed that the Canny edge detector depicts higher accuracy in detection of object with higher entropy, PSNR(Peak Signal to Noise Ratio), MSE(Mean Square Error) and execution time compared with Sobel, Roberts, Prewitt, Zero crossing and LOG.Here is a comparison between distinct edge detection techniques. a system in which density of traffic is measured by comparing captured image with real time traffic information against the image of the empty road as reference image is proposed. Here, in figure 1, the block diagram for proposed traffic control technique is illustrated.

ARCHITECTURE



RESULTS

To implement this project we are using 4 input images given in paper and on reference image. Below are the images screen shots saved inside images folder



We can upload above 4 images to application to calculate traffic signal time.

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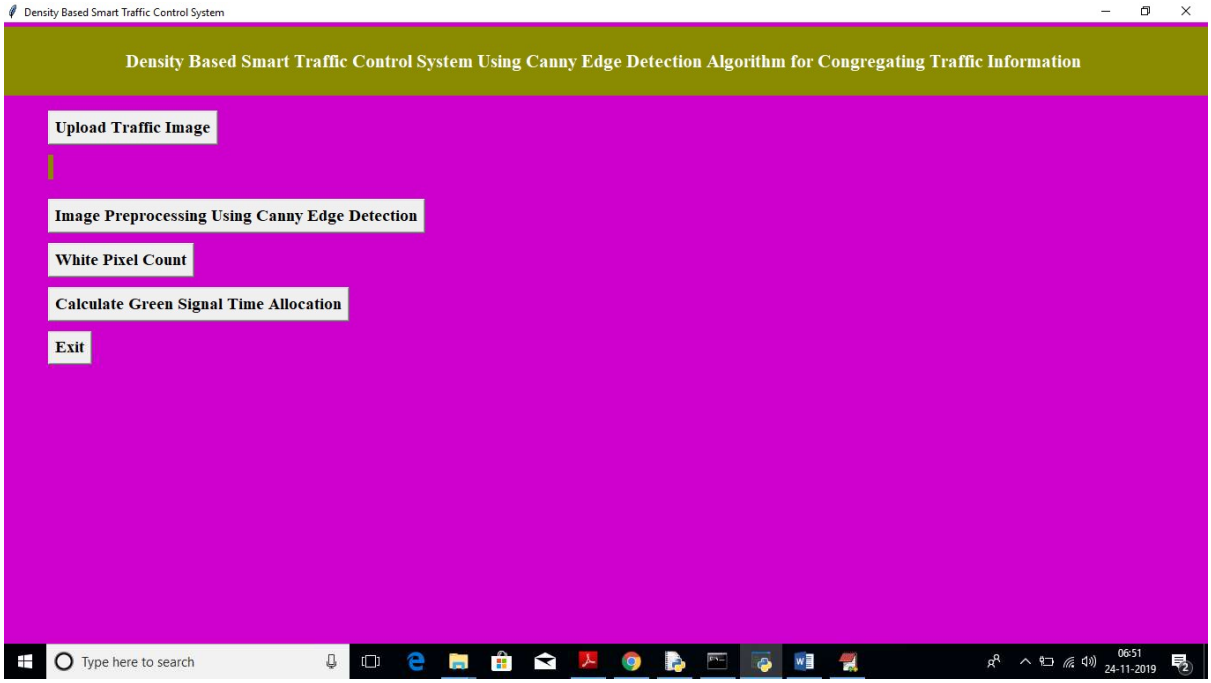
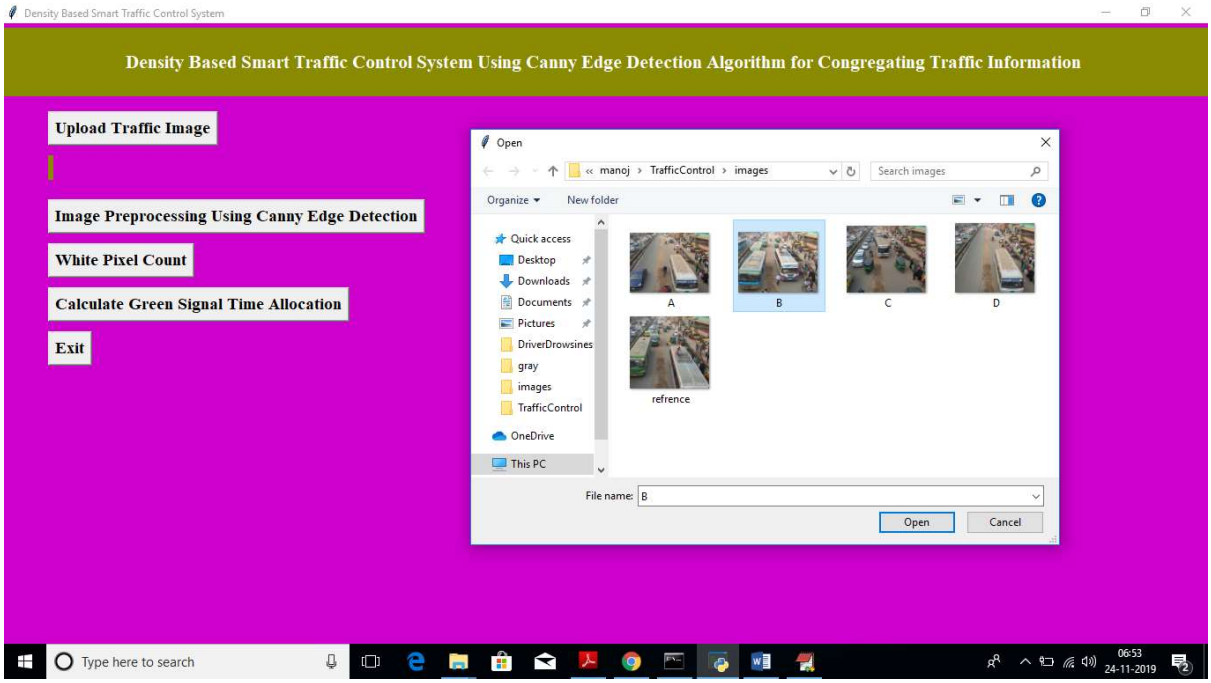
To run this project double click on ‘run.bat’ file to get below screen



In above screen click on ‘Upload Traffic Image’ button to upload image.



In above screen I am uploading image B and now click on ‘Open’ button to load image

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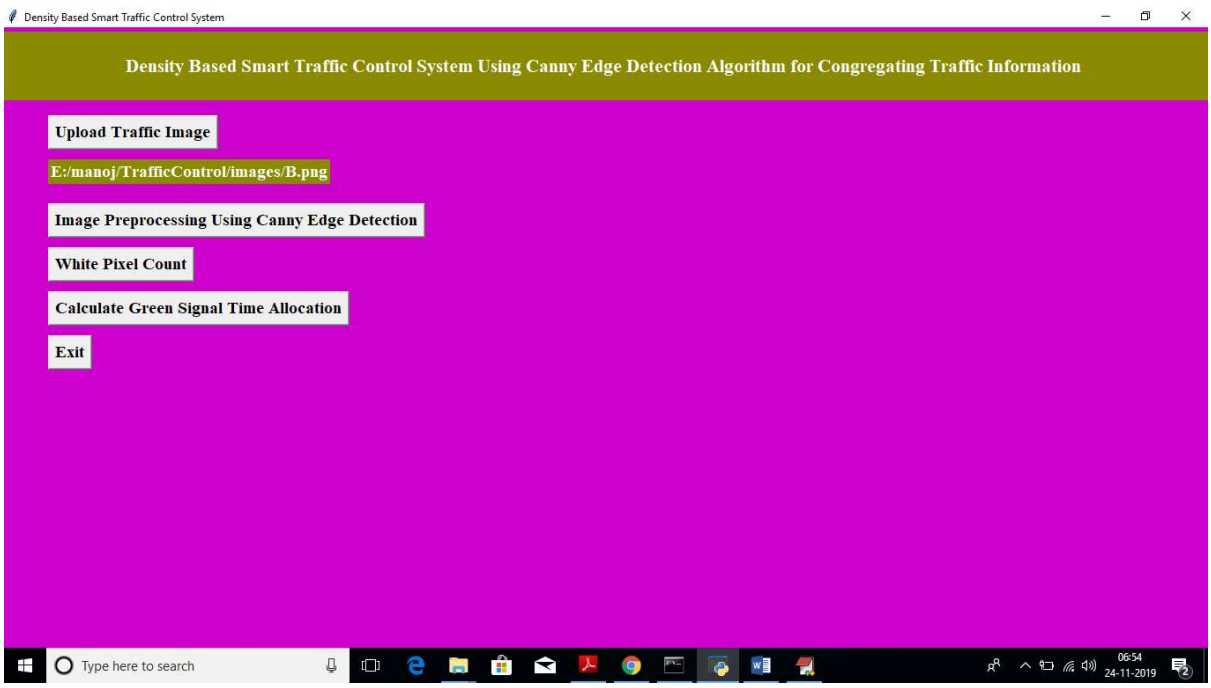
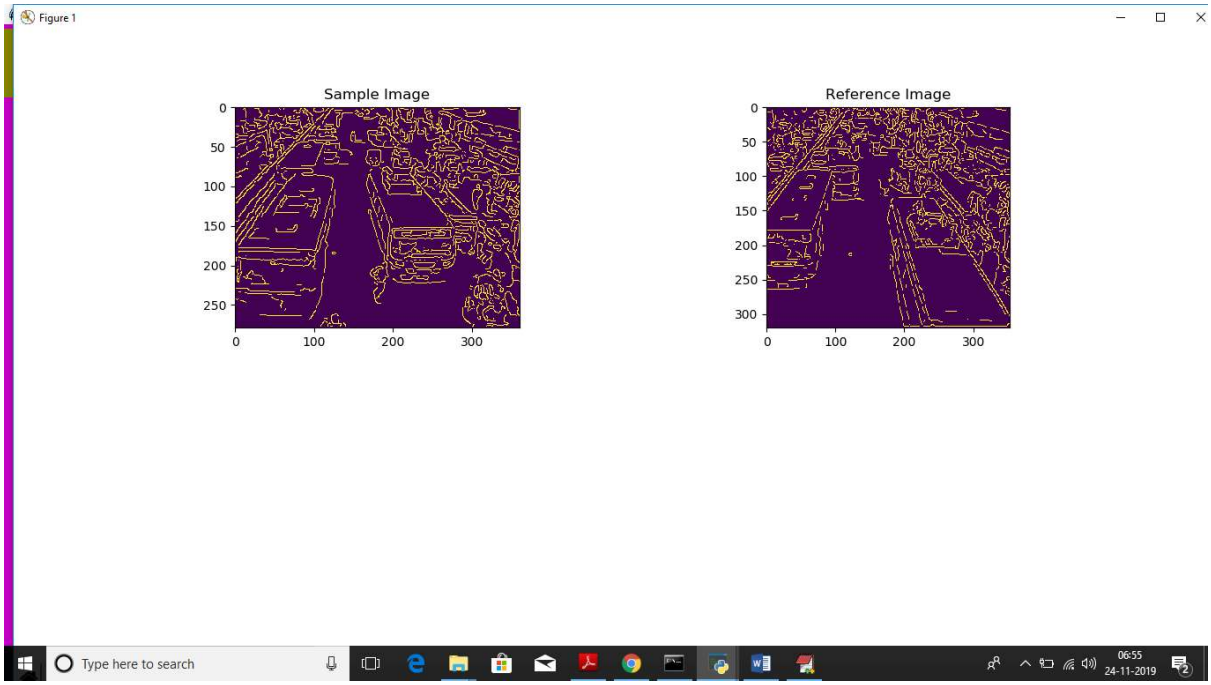


In above screen we got message as input image loaded. Now click on 'Image Pre-processing Using Canny Edge Detection' button to apply Gaussian filter and to get canny edges, after clicking button wait for few seconds till you get below screen with edges



In above screen left side image is the uploaded image and right side is the 'Reference Image', Now close this above screen and click on 'White Pixel count' button to get white pixels from both images

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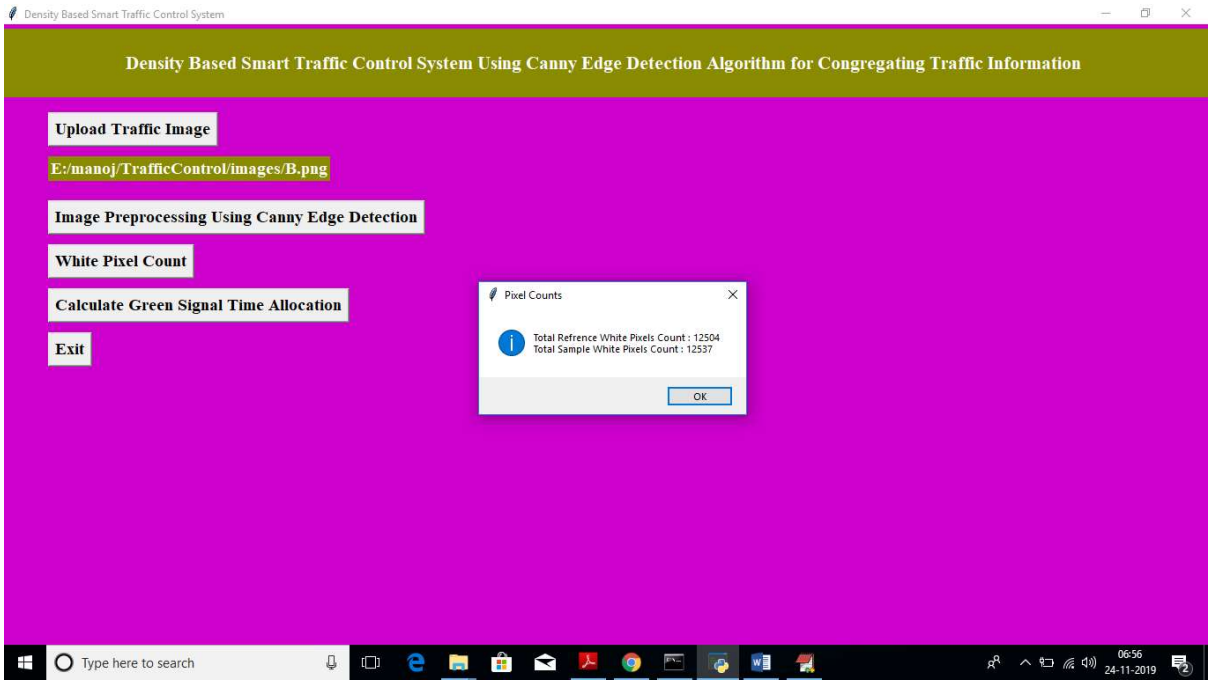
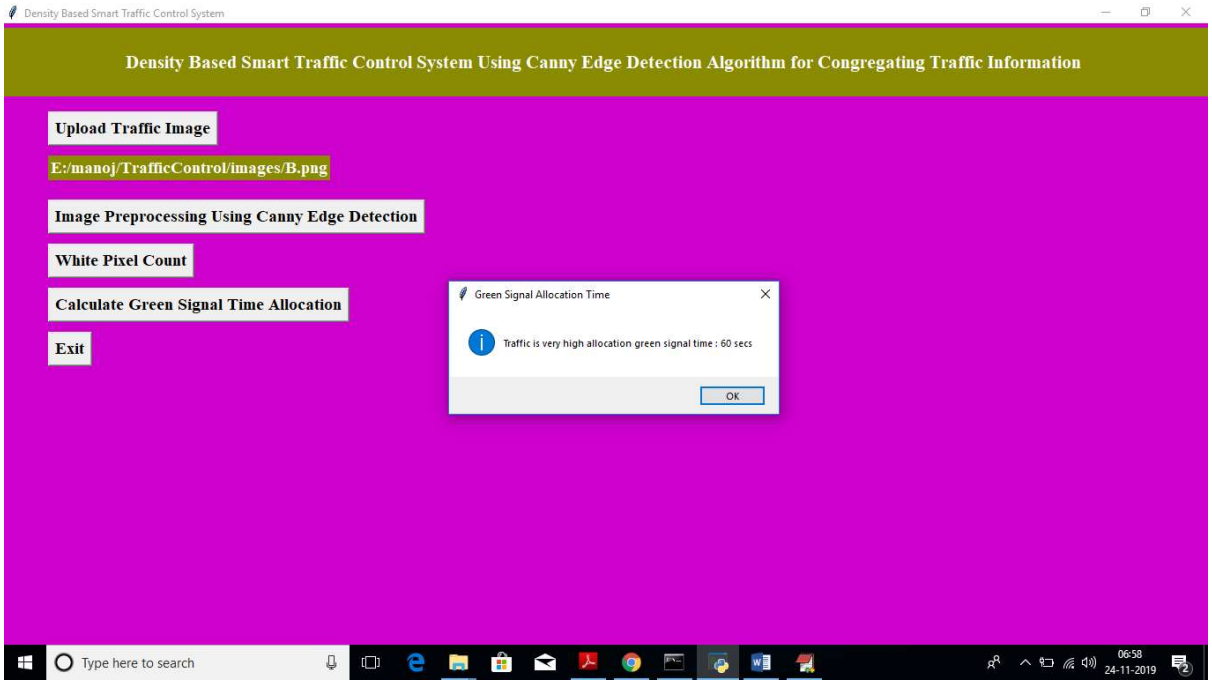


In above screen dialog box we can see total white pixels found in both sample and reference image. Now click on 'Calculate Green Signal Time Allocation' button to get signal time



For that uploaded image we got message as it contains high traffic and signal time must be 60 seconds. Similarly you can upload any image and get output. Below is the output for image A

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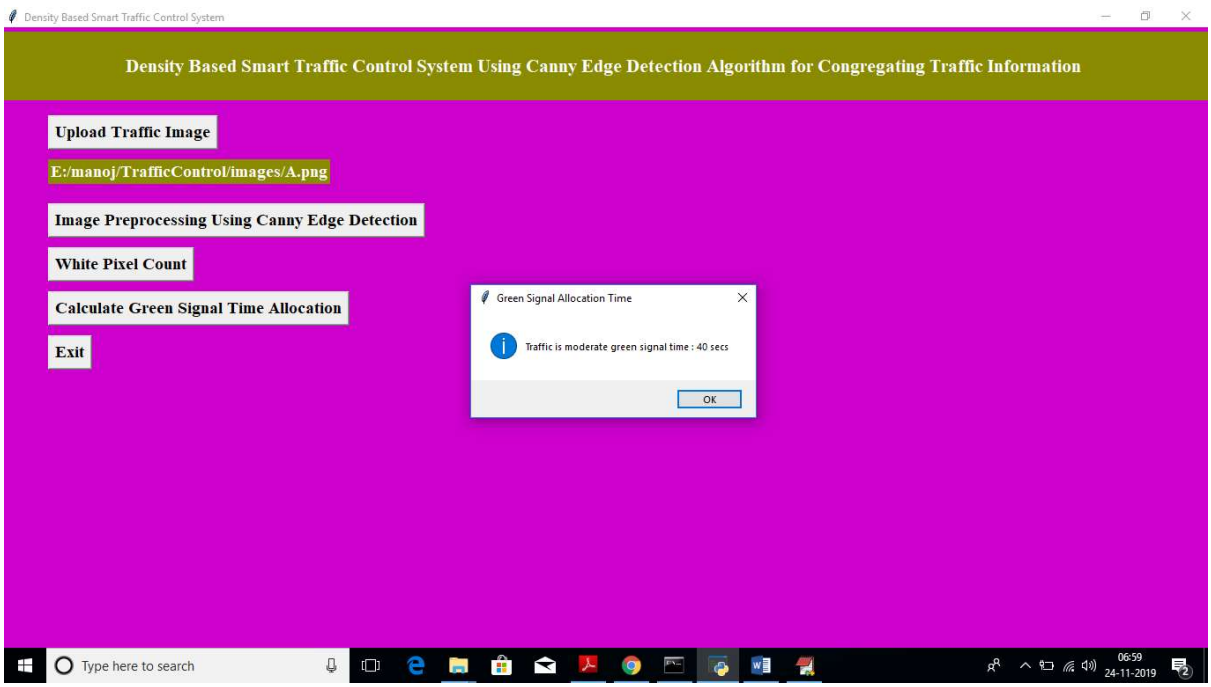

Above time for image A

CONCLUSION

In this paper, a smart traffic control system availing image processing as an instrument for measuring the density has been proposed. Besides explaining the limitations of current near obsolete traffic control system, the advantages of proposed traffic control system have been demonstrated. For this purpose, four sample images of different traffic scenario have been attained. Upon completion of edge detection, the similarity between sample images with the reference image has been calculated. Using this similarity, time allocation has been carried out for each individual image in accordance with the time allocation algorithm. In addition, similarity in percentage and time allocation have been illustrated for each of the four sample images using Python programming language. Besides presenting the schematics for the proposed smart traffic control system, all the necessary results have been verified by hardware implementation.

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