Density Based Smart Traffic Control System Using Canny Edge Detection

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CHAPTER 1 INTRODUCTION

1.1. 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 Inter-metropolitan 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. 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.

1.1.1 Modules:

1.1.2 :Upload Image Module:

In this module current traffic image will be uploaded to application and then convert colour image into Gray Scale image format to have pixels values as black and white colour.

1.1.3 Pre-process module:

In this module Gaussian Filter will be applied on uploaded image to convert image into smooth format. After applying filter Canny Edge Detection will be applied on image to get edges from the image. Each vehicle will have white colour pixels and non-vehicle will have black colour pixels.

1.1.4 Pre-process module:

In this module Gaussian Filter will be applied on uploaded image to convert image into smooth format. After applying filter Canny Edge Detection will be applied on image to get

edges from the image. Each vehicle will have white colour pixels and non-vehicle will have black colour pixels.

1.1.5 White Pixel Count Module:

Using this module we will count white pixels from canny image to get complete traffic count.

CHAPTER 2 LITERATURE SURVEY

It describes the concept to control or automate green traffic signal allotment time based on congestion available at road side using Canny Edge Detection Algorithm. To implement this technique we are uploading current traffic image to the application and application will extract edges from images and if there is more traffic then there will be more number of edges with white colour and if uploaded image contains less traffic then it will have less number of white colour edges. Empty edges will have black colour with value 0. By counting number of non-zeroes white pixels we will have complete idea of available traffic and based on that we will allocate time to green signal. If less traffic is there then green signal time will be less otherwise green signal allocation time will be more. To compare current traffic we will take one reference image with high traffic and comparison will be done between uploaded image white pixels and reference image white pixels. Using below code we will allocate time to green signal.

2.1 Existing 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, 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.To implement this technique we are uploading current traffic image to the application and application will extract edges from images and if there is more traffic then there will be more number of edges with white colour and if uploaded image contains less traffic then it will have less number of white colour edges.

2.1.1 Drawbacks of Existing System:

Traffic control signals may result in a re-entrant collision of vehicles. Man power is required.
They may cause a delay in the quick movement of traffic.

2.2 Proposed System:

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.
Each lane will have a minimum amount of green signal duration allocated. According to the percentage of matching allocated traffic light duration can be controlled. The matching is achieved by comparing the number of white points between two images. The entire image processing before edge detection i.e. image acquisition, image resizing, RGB to gray conversion and noise reduction is explained in section II. At section III, canny edge detection operation and white point count are depicted. Canny edge detector operator is selected because of its greater overall performance.

2.2.1 Advantages:

It is advantageous to convert RGB images into grayscale for further processing. When converting an RGB image to grayscale, it is pertinent to5 consider the RGB values for each pixel and make as output a single value reflecting the brightness of that pixel. One of the approaches isto take the average of the contribution from each channel:(R+B+C)/3.
Significant improvement in response time. Vehicle management automation.
Overall efficiency.
Exact time is allocated at the signal.

2.3 FEASIBILITY STUDY:

The feasibility of the project is analyzed in this phase and business proposal is put forth with a very general plan for the project and some cost estimates. During system analysis the feasibility study of the proposed system is to be carried out. This is to ensure that the proposed system is not a burden to the company. For feasibility analysis, some understanding of the major requirements for the system is essential.
Three key considerations involved in the feasibility analysis are,

2.2.1 ECONOMICAL FEASIBILITY

2.2.2 TECHNICAL FEASIBILITY

2.2.3 SOCIAL FEASIBILITY

2.2.1 ECONOMICAL FEASIBILITY:

This study is carried out to check the economic impact that the system will have on the organization. The amount of fund that the company can pour into the research and development of the system is limited. The expenditures must be justified. Thus the developed system as well within the budget and this was achieved because most of the technologies used are freely available. Only the customized products had to be purchased.

2.2.2 TECHNICAL FEASIBILITY:

This study is carried out to check the technical feasibility, that is, the technical requirements of the system. Any system developed must not have a high demand on the available technical resources. This will lead to high demands on the available technical resources. This will lead to high demands being placed on the client. The developed system must have a modest requirement, as only minimal or null changes are required for implementing this system.

2.2.3 SOCIAL FEASIBILITY:

The aspect of study is to check the level of acceptance of the system by the user. This includes the process of training the user to use the system efficiently. The user must not feel threatened by the system, instead must accept it as a necessity.

The level of acceptance by the users solely depends on the methods that are employed to educate the user about the system and to make him familiar with it. His level of confidence must be raised so that he is also able to make some constructive criticism, which is welcomed, as he is the final user of the system.

REQUIREMENT ANALYSIS

2.1 INTRODUCTION:

The project involved analyzing the design of few applications so as to make the application more users friendly. To do so, it was reallyimportant to keep the navigations from one screen to the other wellordered and at the same time reducing the amount of typing the user needs to do. In order to make the application more accessible, the browserversion had to be chosen so that it is compatible with most of the Browsers.

2.2 REQUIREMENT SPECIFICATION

2.2.1 Functional Requirements:

In software engineering, a functional requirement defines a system or its component. It describes the functions a software must perform. A function is nothing but inputs, its behavior, and outputs. It can be a calculation, data manipulation, business process, user interaction, or any other specific functionality which defines what function a system is likely to perform. Functional software requirements help you to capture the intended behavior of the system. This behavior may be expressed as functions, services or tasks or which system is required to perform.

Graphical User Interface with the User.

2.2.2 Non –Functional Requirements:

A non-functional requirement defines the quality attribute of a software system. They represent a set of standards used to judge the specific operation of a system. Example, how fast does the website load? A non-functional requirement is essential to ensure the usability and effectiveness of the entire software system. Failing to meet non-functional requirements can result in systems that fail to satisfy user needs.

2.2.3 Software Requirements:

For developing the application the following are the Software Requirements:

1. Python
2. Django

Operating Systems supported

1. Windows 7
2. Windows XP

3. Windows 8

Technologies and Languages used to Develop

1. Python

Debugger and Emulator

- Any Browser (Particularly Chrome)

2.2.4 Hardware Requirements:

For developing the application the following are the Hardware Requirements:

- Processor: Pentium IV or higher
- RAM: 256 MB
- Space on Hard Disk: minimum 512MB

PYTHON:

Python is a general-purpose interpreted, interactive, object-oriented, and high level programming language. An interpreted language, Python has a design philosophy that emphasizes code readability (notably using whitespace indentation to delimit code blocks rather than curly brackets or keywords), and a syntax that allows programmersto express concepts in fewer lines of code than might be used in languages suchas C++or Java. It provides constructs that enable clear programming on both small and large scales. Python interpreters are available for many operating systems. CPython , the reference implementation of Python, is open source software and has a community-based development model, as do nearly all of its variant implementations. CPython is managed by the non-profit Python Software Foundation. Python features a dynamic type system and automatic memory management. It supports multiple programming paradigms, including object oriented, imperative, functional and procedural, and has a large and comprehensive standard library.

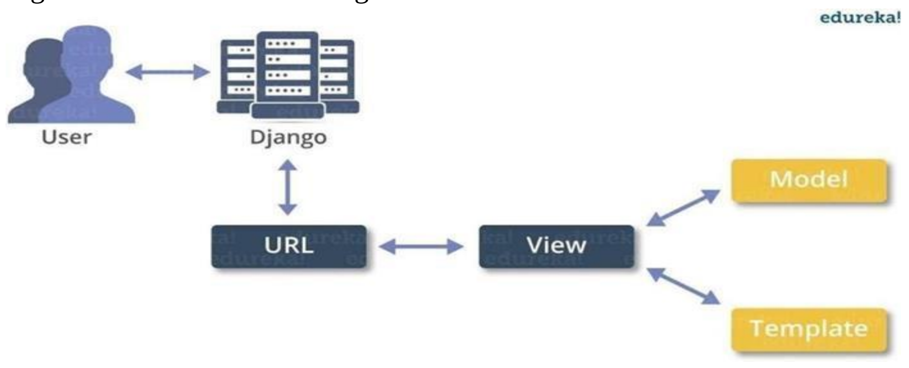
DJANGO

Django is a high-level Python Web framework that encourages rapid development and clean, pragmatic design. Built by experienced developers, it takes care of much of the hassle of Web development, so you can focus on writing your app without needing to reinvent the wheel. It’s free and open source.
Django's primary goal is to ease the creation of complex, database-driven websites. Django emphasizes reusability and "pluggability" of components, rapid development, and the principle of don't repeat yourself. Python is used throughout, even for settingsfiles and data models.

Django also provides an optional administrative create, read, update and delete interface that is generated dynamically through introspection and configured via admin model.

INPUT DESIGN:

Figure 2.1 Architecture Design Network



CHAPTER 3 DESIGN METHODOLOGY

The input design is the link between the information system and the user. It comprises the developing specification and procedures for data preparation and those steps are necessary to put transaction data in to a usable form for processing can be achieved by inspecting the computer to read data from a written or printed document or it can occur by having people keying the data directly into the system. The design of input focuses on controlling the amount of input required, controlling the errors, avoiding delay, avoiding extra steps and keeping the process simple. The input is designed in such a way so that it provides security and ease of use with retaining the privacy. Input Design considered the following things:

➢ What data should be given as input?

➢ How the data should be arranged or coded?

➢ The dialog to guide the operating personnel in providing input.

➢ Methods for preparing input validations and steps to follow when error occur.

OBJECTIVES:

1. Input Design is the process of converting a user-oriented description of the input into a computer-based system. This design is important to avoid errors in the data input process and show the correct direction to the management for getting correct information from the computerized system.
2. It is achieved by creating user-friendly screens for the data entry to handle large volume of data. The goal of designing input is to make data entry easier and to be free from errors. The data entry screen is designed in such a way that12 all the data manipulates can be performed. It also provides record viewing facilities.
3. When the data is entered it will check for its validity. Data can be entered with the help of screens. Appropriate messages are provided as when needed so that the user will not be in maize of instant. Thus the objective of input design is to create an input layout that is easy to follow.

OUTPUT DESIGN:

A quality output is one, which meets the requirements of the end user and presents the information clearly. In any system results of processing are communicated to the users and to other system through outputs. In output design it is determined how the information is to be displaced for immediate need and also the hard copy output. It is the most important and direct source information to the user. Efficient and intelligent output design improves the system's relationship to help user decision-making.

1. Designing computer output should proceed in an organized, well thought out manner; the right output must be developed while ensuring that each output element is designed so that

people will find the system can use easily and effectively. When analysis design computer output, they should Identify the specific output that is needed to meet the requirements.

2. Select methods for presenting information.

3. Create document, report, or other formats that contain information produced by the system. The output form of an information system should accomplish one or more of the following objectives.

- Convey information about past activities, current status or projections of the Future.
- Signal important events, opportunities, problems, or warnings.Trigger an action.
- Confirm an action.

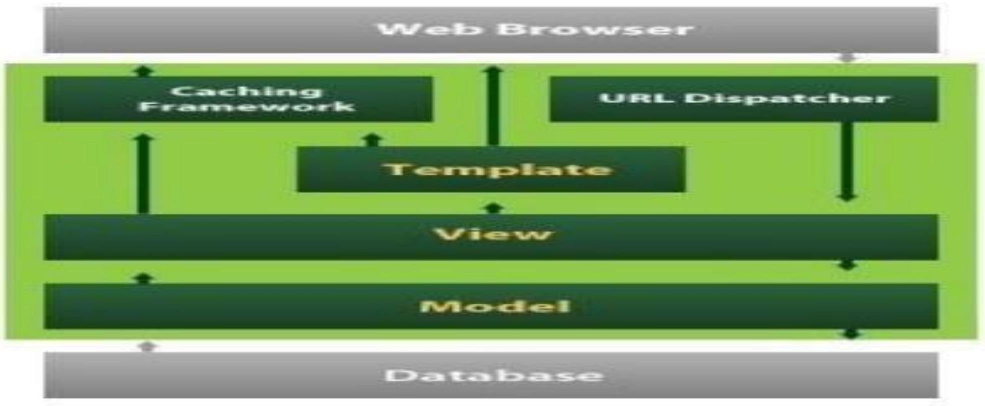


Figure 3.1 Output Design

3.1 PROPOSED SYSTEM ARCHITECTURE:

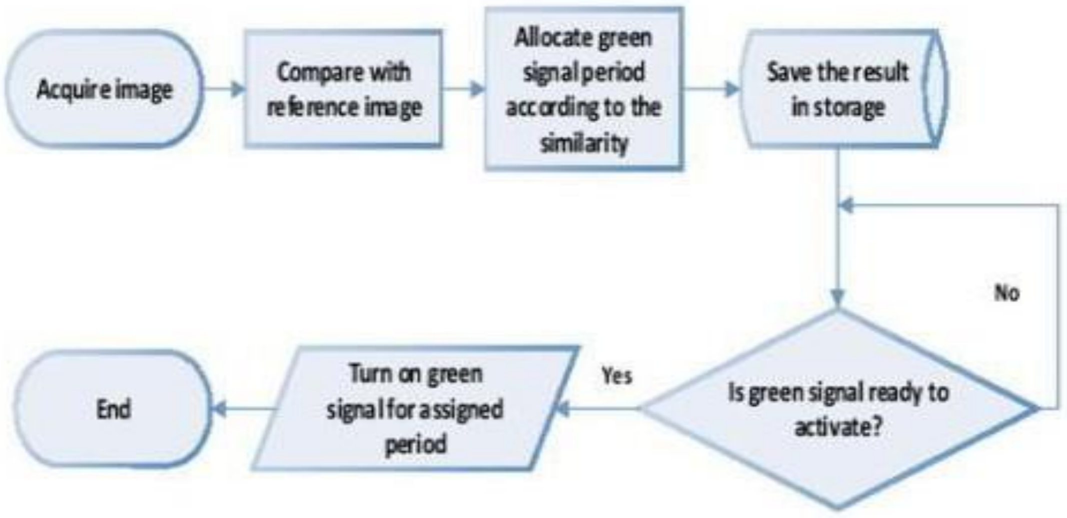

Acquire image
Compare with reference image
Allocate green signal period according to the similarity
Save the result in storage
No
Is green signal ready to activate?
Yes
Turn on green signal for assigned period
End

Figure 3.1.1 System Architecture

3.2 UML DIAGRAMS:

A UML diagram is a diagram based on the UML (Unified Modeling Language) with the purpose of visually representing a system along with its main actors, roles, actions, artifacts or classes, in order to better understand, alter, maintain, or document information about the system. Mainly, UML has been used as a general-purpose modeling language in the field of software engineering. However, it has now found its way into the documentation of several business processes or workflows. For example, activity diagrams, a type of UML14 diagram, can be used as a replacement for flowcharts. They provide both a more standardized way of modeling workflows as well as a wider range of features to improve readability and efficacy. The goal is for UML to become a common language for creating models of object- oriented computer software. In its current form UML is comprised of two major components: a Meta- model and a notation. In the future, some form of method or process may also be added to; or associated with, UML. The Unified Modeling Language is a standard language for specifying, Visualization, Constructing and documenting the artifacts of software system, as well as for business modeling and other non software systems. The UML is a very important part of developing objects oriented software and the software development process. The UML uses mostly graphical notations to express the design of software projects. GOALS:

The Primary goals in the design of the UML are as follows:

1. Provide users a ready-to-use, expressive visual modeling Language so that they can develop and exchange meaningful models.
2. Provide extendibility and specialization mechanisms to extend the core concepts.
3. Be independent of particular programming languages and development process.
4. Provide a formal basis for understanding the modeling language.
5. Encourage the growth of OO tools market.13
6. Support higher level development concepts such as collaborations, frameworks, patterns and components.
7. Integrate best practice.

3.2.1 USE CASE DIAGRAM:

Use case diagrams are a set of use cases, actors, and their relationships. They represent the use case view of a system. A use case represents a particular functionality of a system. Hence, use case diagram is used to describe the relationships among the functionalities and their internal/external controllers. These controllers are known as actors.

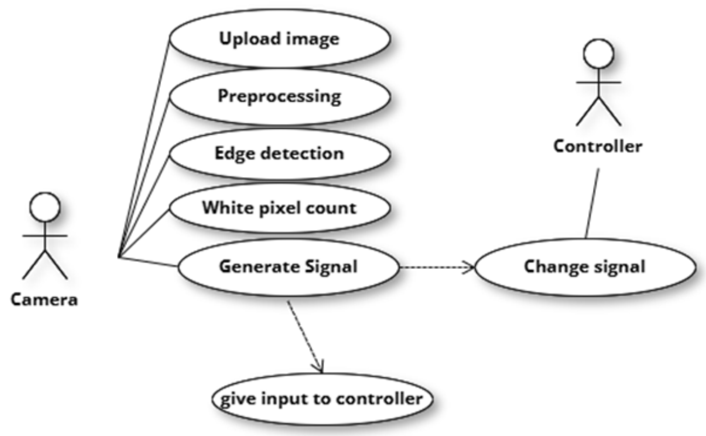


Figure 3.2.1 Use Case Diagram

3.2.2 SEQUENCE DIAGRAM:

A sequence diagram is an interaction diagram. From the name, it is clear that the diagram deals with some sequences, which are the sequence of messages flowing from one object to another. Interaction among the components of a system is very important from implementation and execution perspective. Sequence diagram is used to visualize the sequence of calls in a system to perform a specific functionality.

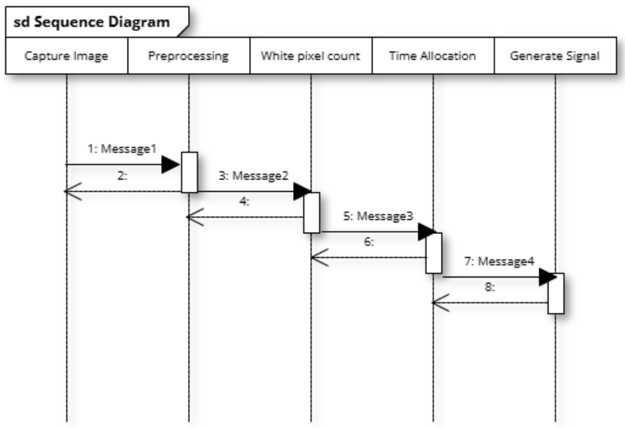


Figure 3.2.2 Sequence Diagram

3.3.3 ACTIVITY DIAGRAM:

Activity diagrams are graphical representations of workflows of stepwise activities and actions with support for choice, iteration and concurrency. In the Unified Modelling Language, activity diagrams can be used to describe the business and operational step-by- step workflows of components in a system. An activity diagram shows the overall flow of control. An activity diagram focuses on condition of flow and the sequence in which it happens. We describe or depict what causes a particular event using an activity diagram.

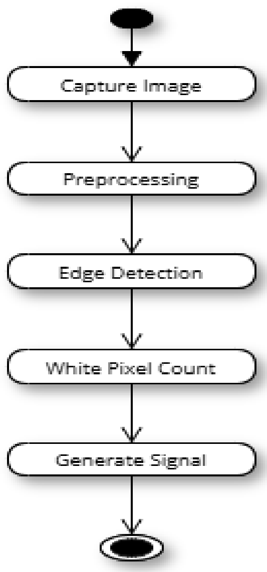


Figure 3.3.3 Activity Diagram

3.3.4 CLASS DIAGRAM:

Class diagrams are the most common diagrams used in UML. Class diagram consists of classes, interfaces, associations, and collaboration. Class diagrams basically represent the object-oriented view of a system, which is static in nature. Active class is used in a class diagram to represent the concurrency of the system. Class diagram represents the object orientation of a system. Hence, it is generally used for development. Since classes are the building block of an application that is based on OOPs, so as the class diagram has an appropriate structure to represent the classes, inheritance, relationships, and everything that OOPs have in their context. It describes various kinds of objects and the static relationship between them.

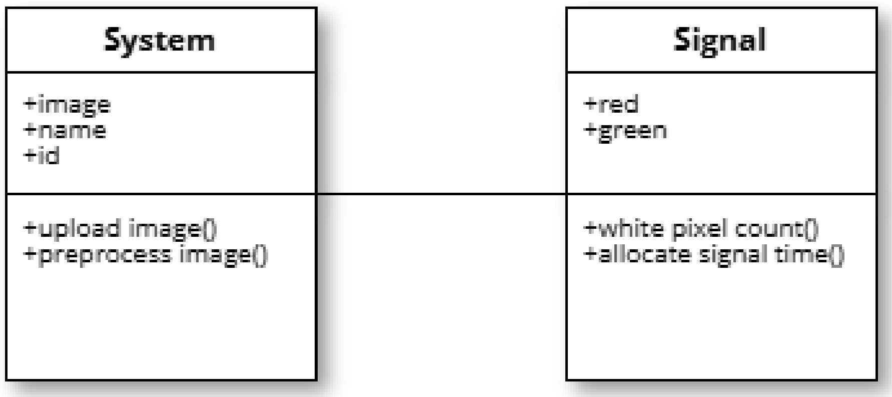
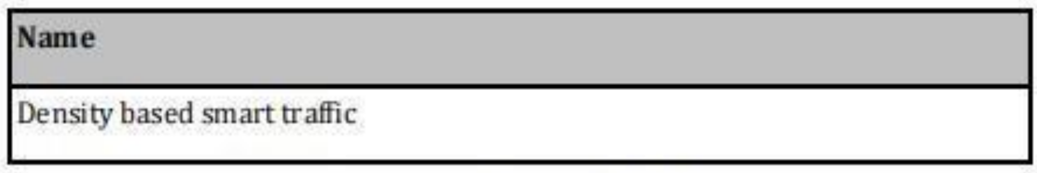


Figure 3.3.4 Class Diagram

3.4 DATA DESIGN:

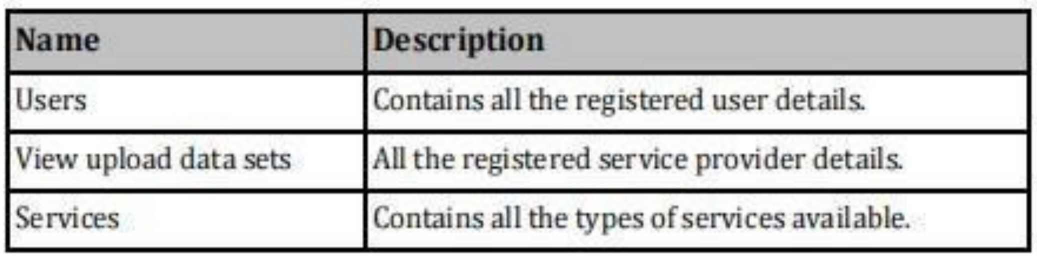
3.4.1 Databases SQLite



Name
Density based smart traffic

Table 3.10.1 SQLite Database

3.4.2 Tables



Name	Description
Users	Contains all the registered user details.
View upload data sets	All the registered service provider details.
Services	Contains all the types of services available.

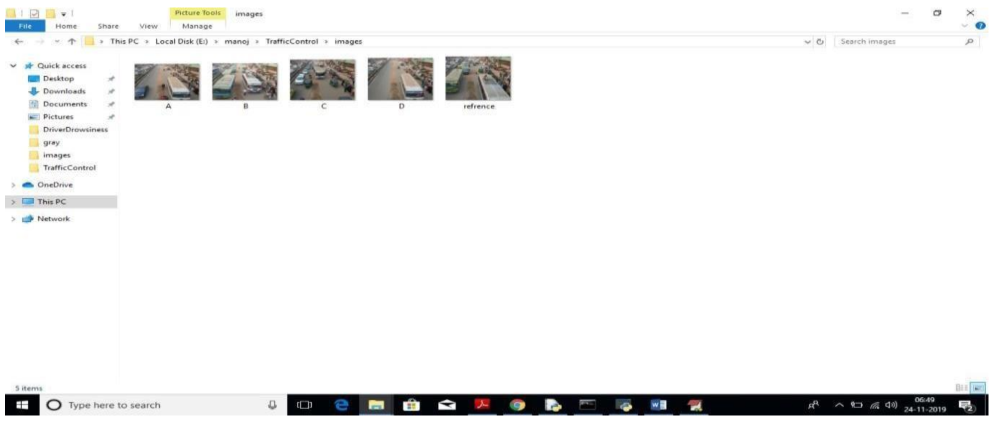
Table 3.10.2 List of Database Tables

CHAPTER 4

IMPLEMENTATION

4.1 SCREENSHOTS & CONCLUSIONS:

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

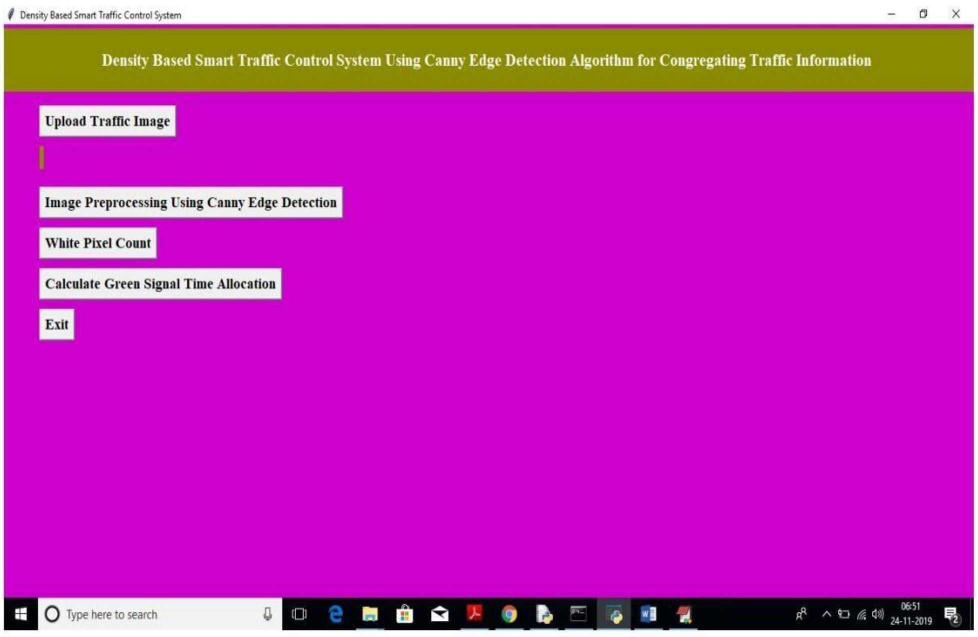

Density Based Smart Traffic Control System
Density Based Smart Traffic Control System Using Canny Edge Detection Algorithm for Congregating Traffic Information
Upload Traffic Image
Image Preprocessing Using Canny Edge Detection
White Pixel Count
Calculate Green Signal Time Allocation
Exit

Fig : 4.1.1 In above screen click on ‘Upload Traffic Image’ button to upload image.

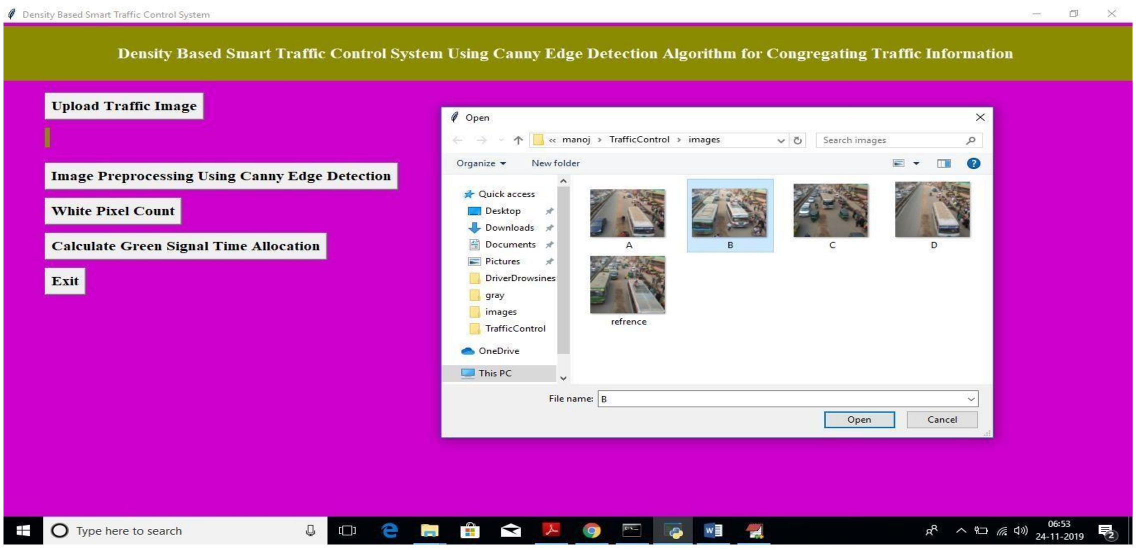

Density Based Smart Traffic Control System
Density Based Smart Traffic Control System Using Canny Edge Detection Algorithm for Congregating Traffic Information
Upload Traffic Image
Image Preprocessing Using Canny Edge Detection
White Pixel Count
Calculate Green Signal Time Allocation
Exit
Open
« manoj › TrafficControl › images
A
B
C
D
refrence
File name: B
Open
Cancel

Fig : 4.1.2 In above screen I am uploading image B and now click on ‘Open’ button to load image.

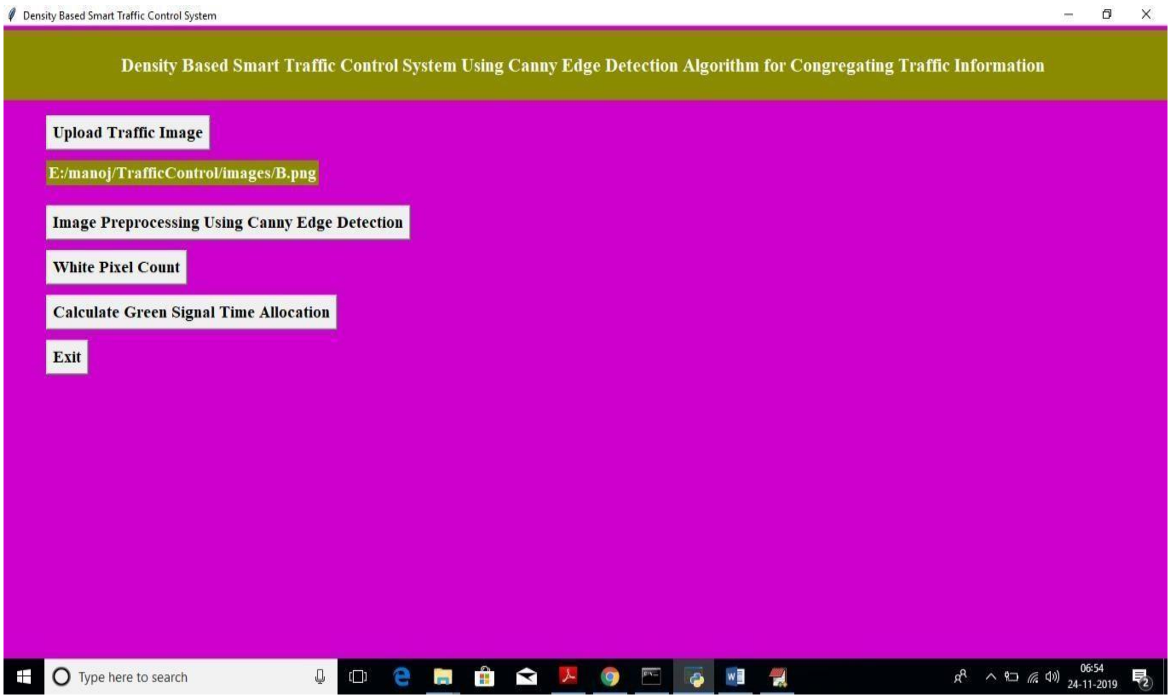

Density Based Smart Traffic Control System
Density Based Smart Traffic Control System Using Canny Edge Detection Algorithm for Congregating Traffic Information
Upload Traffic Image
E:/manoj/TrafficControl/images/B.png
Image Preprocessing Using Canny Edge Detection
White Pixel Count
Calculate Green Signal Time Allocation
Exit

Fig : 4.1.3 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.

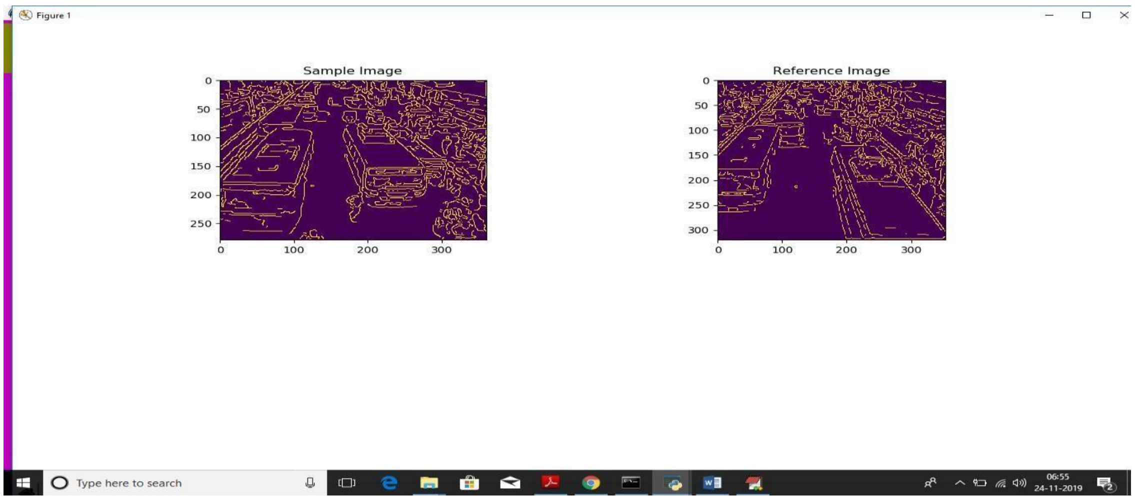
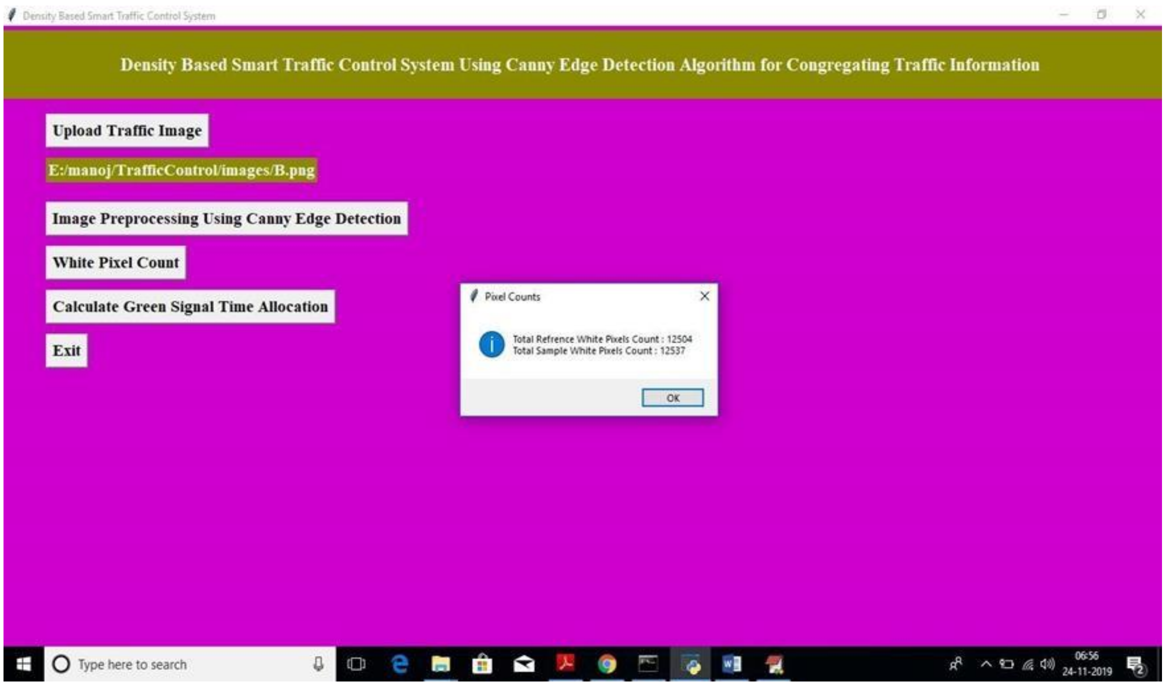


Fig : 4.2.4 In above screen left side image is the uploaded image and right side is the ‘Reference Image’, Now close this above screen and click on ‘White Pixel count’ button to get white pixels from both images.


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

Upload Traffic Image

E:/manoj/TrafficControl/images/B.png

Image Preprocessing Using Canny Edge Detection

White Pixel Count

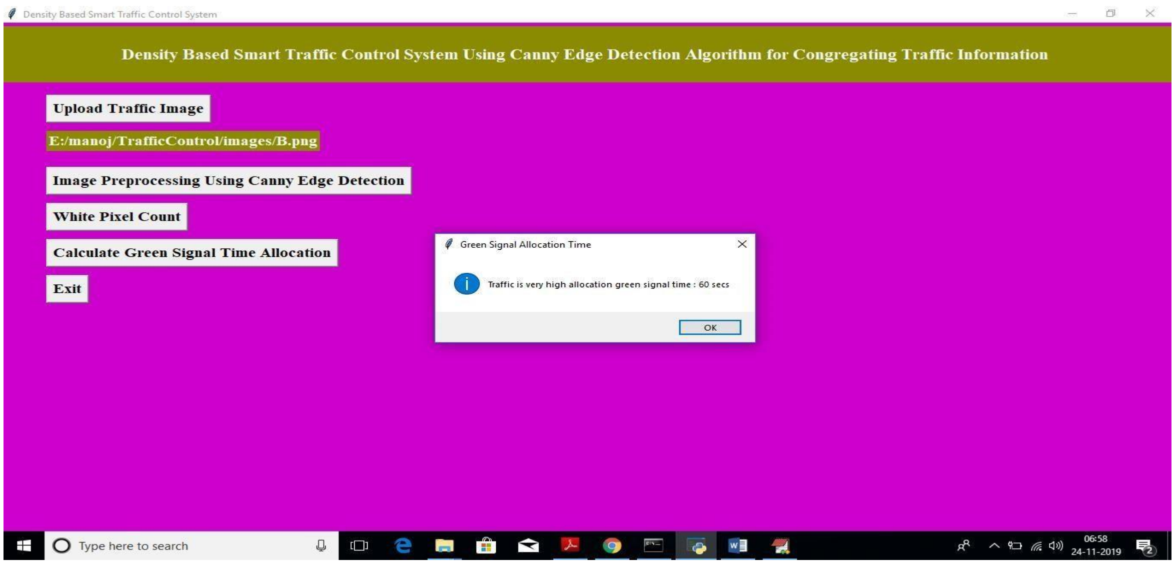
Calculate Green Signal Time Allocation

Exit

Pixel Counts

Total Refrence White Pixels Count : 12504
Total Sample White Pixels Count : 12537

Fig : 4.2.5 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.


Density Based Smart Traffic Control System
Density Based Smart Traffic Control System Using Canny Edge Detection Algorithm for Congregating Traffic Information
Upload Traffic Image
E:/manoj/TrafficControl/images/B.png
Image Preprocessing Using Canny Edge Detection
White Pixel Count
Calculate Green Signal Time Allocation
Exit
Green Signal Allocation Time
OK
Type here to search
06:58
24-11-2019

Traffic is very high allocation green signal time : 60 secs

Fig : 4.2.6 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.

CHAPTER 5 TESTING

The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, sub assemblies, assemblies and/or a finished product It is the process of exercising software with the intent of ensuring that the Software system meets its requirements and user expectations and does not fail in an unacceptable manner. There are various types of test. Each test type addresses a specific testing requirement**.**

5.1 System Testing:

The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, sub assemblies, assemblies and/or a finished product It is the process of exercising software with the intent of ensuring that the Software system meets its requirements and user expectations and does not fail in an unacceptable manner. There are various types of test. Each test type addresses a specific testing requirements.

5.2 TESTING METHODOLOGIES:

5.2.1 Unit testing:

Unit testing involves the design of test cases that validate that the internal program logic is functioning properly, and that program inputs produce valid outputs. All decision branches and internal code flow should be validated. It is the testing of individual software units of the application .it is done after the completion of an individual unit before integration. This is a structural testing, that relies on knowledge of its construction and is invasive. Unit tests perform 36 basic tests at component level and test a specific business process, application, and/or system configuration. Unit tests ensure that each unique path of a business process performs accurately to the documented specifications and contains clearly defined inputs and expected results.

5.2.2 Integration testing:

Integration tests are designed to test integrated software components to determine if they actually run as one program. Testing is event driven and is more concerned with the basic outcome of screens or fields.
Integration tests demonstrate that although the components were individually satisfaction, as shown by successfully unit testing, the combination of components is correct and consistent. Integration testing is specifically aimed at exposing the problems that arise from the combination of components.

Functional testing

Functional tests provide systematic demonstrations that functions tested are available as specified by the business and technical requirements, system documentation, and user manuals.

Functional testing is centered on the following items:
Valid Input : identified classes of valid input must be accepted. Invalid Input : identified classes of invalid input must be rejected. Functions : identified functions must be exercised.
Output : identified classes of application outputs must exercised.
Systems/Procedures : interfacing systems or procedures must be invoked. Organization and preparation of functional tests is focused on requirements, key functions, or special test cases. In addition, systematic coverage pertaining to identify Business process flows; data fields, predefined processes, and 37 successive processes must be considered for testing. Before functional testing is complete, additional tests are identified and the effective value of current tests is determined.

System Test

System testing ensures that the entire integrated software system meets requirements. It tests a configuration to ensure known and predictable results. An example of system testing is the configuration oriented system integration test. System testing is based on process descriptions and flows, emphasizing pre driven process links and integration points.

5.2.3 White Box Testing:

White Box Testing is a testing in which in which the software tester has knowledge of the inner workings, structure and language of the software, or at least its purpose. It is purpose. It is used to test areas that cannot be reached from a black box level.

5.2.4 Black Box Testing:

Black Box Testing is testing the software without any knowledge of the inner workings, structure or language of the module being tested. Black box tests, as most other kinds of tests, must be written from a definitive source document, such as specification or requirements document, such as specification or requirements document. It is a testing in which the software under test is treated, as a black box.you cannot “see” into it. The test provides inputs and responds to outputs without considering how the software works.

Unit Testing

Unit testing is usually conducted as part of a combined code and unit test phase of the software lifecycle, although it is not uncommon for coding and unit testing to be conducted as two distinct phases.

Test strategy and approach

Field testing will be performed manually and functional tests will be written in detail.

Test objectives

- All field entries must work properly.
- Pages must be activated from the identified link.
- The entry screen, messages and responses must not be delayed.

Features to be tested

- Verify that the entries are of the correct format
- No duplicate entries should be allowed
- All links should take the user to the correct page.

Integration Testing

Software integration testing is the incremental integration testing of two or more integrated software components on a single platform to produce failures caused by interface defects.
The task of the integration test is to check that components or software applications, e.g. components in a software system or – one step up – software applications at the company level – interact without error.

Test Results: All the test cases mentioned above passed successfully. No defects encountered.

5.2.5 Acceptance Testing:

User Acceptance Testing is a critical phase of any project and requires significant participation by the end user. It also ensures that the system meets the functional requirements.

Test Results: All the test cases mentioned above passed successfully. No defects encountered

CHAPTER 6 CONCLUSION AND FUTURE SCOPE

6.1 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.

6.2 Scope for future work:

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.

SAMPLE CODE:

```
from tkinter import messagebox from tkinter import *
from tkinter import simpledialog import tkinter
from tkinter import filedialog import numpy as np
from tkinter.filedialog import askopenfilename import numpy as np
from CannyEdgeDetector import * import skimage
import matplotlib.image as mpimg import os
import scipy.misc as sm import cv2
import matplotlib.pyplot as plt



main = tkinter.Tk()
main.title("Density Based Smart Traffic Control System") main.geometry("1300x1200")

global filename  global refrence_pixels global sample_pixels

def rgb2gray(rgb):

r, g, b = rgb[:,:,0], rgb[:,:,1], rgb[:,:,2]
gray = 0.2989 * r + 0.5870 * g + 0.1140 * b return gray
def uploadTrafficImage(): global filename
filename = filedialog.askopenfilename(initialdir="images") pathlabel.config(text=filename)

def visualize(imgs, format=None, gray=False): j = 0
plt.figure(figsize=(20, 40))  for i, img in enumerate(imgs):
if img.shape[0] == 3:
img = img.transpose(1,2,0) plt_idx = i+1
plt.subplot(2, 2, plt_idx) if j == 0:
plt.title('Sample Image') plt.imshow(img, format) j = j + 1
elif j > 0:
plt.title('Reference Image') plt.imshow(img, format)

plt.show()

def applyCanny(): imgs = []
img = mpimg.imread(filename) img = rgb2gray(img) imgs.append(img)
edge = CannyEdgeDetector(imgs, sigma=1.4, kernel_size=5, lowthreshold=0.09,
highthreshold=0.20, weak_pixel=100)
```

```
imgs = edge.detect()
for i, img in enumerate(imgs): if img.shape[0] == 3:
img = img.transpose(1,2,0) cv2.imwrite("gray/test.png",img) temp = []
img1 = mpimg.imread('gray/test.png') img2 = mpimg.imread('gray/refrence.png') temp.append(img1)
temp.append(img2) visualize(temp)

def pixelcount():
global refrence_pixels global sample_pixels
img = cv2.imread('gray/test.png', cv2.IMREAD_GRAYSCALE) sample_pixels = np.sum(img == 255)

img = cv2.imread('gray/refrence.png', cv2.IMREAD_GRAYSCALE) refrence_pixels = np.sum(img == 255)
messagebox.showinfo("Pixel Counts", "Total Refrence White Pixels Count :
"+str(sample_pixels)+"\nTotal Sample White Pixels Count : "+str(refrence_pixels))


def timeAllocation():
avg = (sample_pixels/refrence_pixels) *100 if avg >= 90:
messagebox.showinfo("Green Signal Allocation Time","Traffic is very high allocation green signal time : 60
secs")
if avg > 85 and avg < 90:
messagebox.showinfo("Green Signal Allocation Time","Traffic is high allocation green signal time : 50 secs")
if avg > 75 and avg <= 85:
messagebox.showinfo("Green Signal Allocation Time","Traffic is moderate green signal time : 40 secs")
if avg > 50 and avg <= 75:
messagebox.showinfo("Green Signal Allocation Time","Traffic is low allocation green signal time : 30 secs")
if avg <= 50:
messagebox.showinfo("Green Signal Allocation Time","Traffic is very low allocation green signal time : 20
secs")


def exit(): main.destroy()



font = ('times', 16, 'bold')
title = Label(main, text='                    Density Based Smart Traffic Control System Using Canny Edge
Detection Algorithm for Congregating Traffic Information',anchor=W, justify=CENTER)
title.config(bg='yellow4', fg='white') title.config(font=font) title.config(height=3, width=120) title.place(x=0,y=5)


font1 = ('times', 14, 'bold')
upload = Button(main, text="Upload Traffic Image", command=uploadTrafficImage) upload.place(x=50,y=100)
upload.config(font=font1)

pathlabel = Label(main) pathlabel.config(bg='yellow4', fg='white') pathlabel.config(font=font1)
pathlabel.place(x=50,y=150)
```

```
process = Button(main, text="Image Preprocessing Using Canny Edge Detection",
command=applyCanny)
process.place(x=50,y=200) process.config(font=font1)

count = Button(main, text="White Pixel Count", command=pixelcount) count.place(x=50,y=250)
count.config(font=font1)

count = Button(main, text="Calculate Green Signal Time Allocation",
command=timeAllocation)
count.place(x=50,y=300) count.config(font=font1)

exitButton = Button(main, text="Exit", command=exit)
exitButton.place(x=50,y=350) exitButton.config(font=font1)


main.config(bg='magenta3') main.mainloop()
import cv2 import os
import numpy as np from test1 import * import numpy as np import skimage
import matplotlib.pyplot as plt import matplotlib.image as mpimg import os
import scipy.misc as sm def rgb2gray(rgb):
r, g, b = rgb[:,:,0], rgb[:,:,1], rgb[:,:,2]
gray = 0.2989 * r + 0.5870 * g + 0.1140 * b return gray
def visualize(imgs, format=None, gray=False): plt.figure(figsize=(20, 40))
for i, img in enumerate(imgs): if img.shape[0] == 3:
img = img.transpose(1,2,0) plt_idx = i+1
plt.subplot(2, 2, plt_idx) plt.imshow(img, format)
plt.show()

def auto_canny(image, sigma=0.33):
# compute the median of the single channel pixel intensities v = np.median(image)
# apply automatic Canny edge detection using the computed median lower = int(max(0, (1.0 - sigma) * v))
upper = int(min(255, (1.0 + sigma) * v)) edged = cv2.Canny(image, lower, upper) return edged

filename = 'images' imgs = []
#for root, dirs, files in os.walk(filename): #       for fdata in files:
#       img = mpimg.imread(root+'/'+fdata) #    img = rgb2gray(img)
#       imgs.append(img)
```

```
#t = test1(root+'/'+fdata) #img = t.detect()
#image = cv2.imread(root+'/'+fdata) #image = cv2.resize(image, (400,400))
#image = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY) #image = cv2.GaussianBlur(image, (5, 5), 0)
#grad_x = cv2.Sobel(gray, cv2.CV_16S, 1, 0, ksize=3, scale=1, delta=0,
borderType=cv2.BORDER_DEFAULT)
#grad_y = cv2.Sobel(gray, cv2.CV_16S, 0, 1, ksize=3, scale=1, delta=0,
borderType=cv2.BORDER_DEFAULT)
#abs_grad_x = cv2.convertScaleAbs(grad_x) #abs_grad_y = cv2.convertScaleAbs(grad_y)
#grad = cv2.addWeighted(abs_grad_x, 0.5, abs_grad_y, 0.5, 0)

#gray =
cv2.Canny(image,25,255,L2gradient=False)#cv2.Canny(grad,100,200,L2gradient=True)
#cv2.imwrite("gray/"+fdata,img)

img = mpimg.imread('images/D.png') img = rgb2gray(img) imgs.append(img)
t = test1(imgs, sigma=1.4, kernel_size=5, lowthreshold=0.09, highthreshold=0.20,
weak_pixel=100)
imgs = t.detect()
for i, img in enumerate(imgs): if img.shape[0] == 3:
img = img.transpose(1,2,0) cv2.imwrite("gray/D.png",img)

img = mpimg.imread('images/refrence.png') img = rgb2gray(img)
imgs.append(img)
t = test1(imgs, sigma=1.4, kernel_size=5, lowthreshold=0.09, highthreshold=0.20,
weak_pixel=100)
imgs = t.detect()
for i, img in enumerate(imgs): if img.shape[0] == 3:
img = img.transpose(1,2,0) cv2.imwrite("gray/refrence.png",img)

img = cv2.imread('gray/D.png', cv2.IMREAD_GRAYSCALE) pixel1 = np.sum(img == 255)
print('Number of white pixels:', pixel1)

img = cv2.imread('gray/refrence.png', cv2.IMREAD_GRAYSCALE) pixel2 = np.sum(img == 255)
print('Number of white pixels:', pixel2) avg = (pixel1/pixel2) *100
print(avg)  #cv2.waitKey(0) #cv2.destroyAllWindows()

img = cv2.imread('gray/D.png', cv2.IMREAD_GRAYSCALE) pixel1 = np.sum(img == 255)
print('Number of white pixels:', pixel1)
img = cv2.imread('gray/refrence.png', cv2.IMREAD_GRAYSCALE) pixel2 = np.sum(img == 255)
print('Number of white pixels:', pixel2) avg = (pixel1/pixel2) *100
print(avg)  #cv2.waitKey(0) #cv2.destroyAllWindows() from scipy import ndimage
from scipy.ndimage import convolve

from scipy import misc import numpy as np

class CannyEdgeDetector:
```

```
def __init__(self, imgs, sigma=1, kernel_size=5, weak_pixel=75, strong_pixel=255, lowthreshold=0.05,
highthreshold=0.15):
print(imgs) self.imgs = imgs self.imgs_final = []
self.img_smoothed = None self.gradientMat = None self.thetaMat = None self.nonMaxImg = None
self.thresholdImg = None self.weak_pixel = weak_pixel self.strong_pixel = strong_pixel self.sigma = sigma
self.kernel_size = kernel_size self.lowThreshold = lowthreshold
self.highThreshold = highthreshold return

def gaussian_kernel(self, size, sigma=1): size = int(size) // 2
x, y = np.mgrid[-size:size+1, -size:size+1] normal = 1 / (2.0 * np.pi * sigma**2)
g =  np.exp(-((x**2 + y**2) / (2.0*sigma**2))) * normal return g

def sobel_filters(self, img):
Kx = np.array([[-1, 0, 1], [-2, 0, 2], [-1, 0, 1]], np.float32)
Ky = np.array([[1, 2, 1], [0, 0, 0], [-1, -2, -1]], np.float32)
Ix = ndimage.filters.convolve(img, Kx) Iy = ndimage.filters.convolve(img, Ky)

G = np.hypot(Ix, Iy)
G = G / G.max() * 255 theta = np.arctan2(Iy, Ix) return (G, theta)


def non_max_suppression(self, img, D): M, N = img.shape
Z = np.zeros((M,N), dtype=np.int32) angle = D * 180. / np.pi
angle[angle < 0] += 180


for i in range(1,M-1): for j in range(1,N-1):
try:
q = 255
r = 255

#angle 0
if (0 <= angle[i,j] < 22.5) or (157.5 <= angle[i,j] <= 180):
q = img[i, j+1]
r = img[i, j-1] #angle 45
elif (22.5 <= angle[i,j] < 67.5):
q = img[i+1, j-1]
r = img[i-1, j+1] #angle 90
elif (67.5 <= angle[i,j] < 112.5):
q = img[i+1, j]
r = img[i-1, j] #angle 135
elif (112.5 <= angle[i,j] < 157.5):
q = img[i-1, j-1]
r = img[i+1, j+1]

if (img[i,j] >= q) and (img[i,j] >= r): Z[i,j] = img[i,j]
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else:
Z[i,j] = 0


except IndexError as e: pass

return Z
def threshold(self, img):

highThreshold = img.max() * self.highThreshold; lowThreshold = highThreshold * self.lowThreshold;

M, N = img.shape
res = np.zeros((M,N), dtype=np.int32)

weak = np.int32(self.weak_pixel) strong = np.int32(self.strong_pixel)

strong_i, strong_j = np.where(img >= highThreshold) zeros_i, zeros_j = np.where(img < lowThreshold)
weak_i, weak_j = np.where((img <= highThreshold) & (img >= lowThreshold)) res[strong_i, strong_j] = strong
res[weak_i, weak_j] = weak

return (res)

def hysteresis(self, img):

M, N = img.shape  weak = self.weak_pixel
strong = self.strong_pixel

for i in range(1, M-1): for j in range(1, N-1):
if (img[i,j] == weak): try:
if ((img[i+1, j-1] == strong) or (img[i+1, j] == strong) or (img[i+1, j+1] ==
strong)


strong)):

or (img[i, j-1] == strong) or (img[i, j+1] == strong)
or (img[i-1, j-1] == strong) or (img[i-1, j] == strong) or (img[i-1, j+1] ==

img[i, j] = strong else:
img[i, j] = 0 except IndexError as e:
pass
return img def detect(self):
imgs_final = []
for i, img in enumerate(self.imgs):
self.img_smoothed = convolve(img, self.gaussian_kernel(self.kernel_size, self.sigma))
self.gradientMat, self.thetaMat = self.sobel_filters(self.img_smoothed)
```

self.nonMaxImg = self.non_max_suppression(self.gradientMat, self.thetaMat) self.thresholdImg = self.threshold(self.nonMaxImg)
img_final = self.hysteresis(self.thresholdImg) self.imgs_final.append(img_final)

return self.imgs_final

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