URBAN STREET CLEANLINESS ASSESSMENT USING MOBILE EDGE COMPUTING AND DEEP LEARNING

A PROJECT REPORT SUBMITTED

In partial fulfillment of the requirement for the award of the degree of

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE AND ENGINEERING

SUBMITTED BY

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CHADALAWADA RAMANAMMA ENGINEERING COLLEGE

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CERTIFICATE

This is to certify that the Project Report entitled " **URBAN STREET CLEANLINESS ASSESSMENT USING MOBILE EDGE COMPUTING AND DEEPLEARNING**" is a bonafide work done by C .GunaSekhar (18P11A0513) , G . SreeVani (18P11A0529) , K . Muni Swetha (18P11A0545) in the Department of COMPUTER SCIENCE AND ENGINEERING and submitted toChadalawadaRamanamma Engineering College, Tirupati during the period **2020-2021** under our supervision and guidance.

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INTERNAL EXAMINER

EXTERNAL EXAMINER

DECLARATION

I hereby declare that the mini project report titled "**Urban StreetCleanliness Assessment Using Mobile Edge Computing And Deep Learning**" is the genuine work carried out by us,inB.Tech(computer science and Engineering)Degree course in chadalawadaRamanammaEngineeringcollege,tirupati.

I declare that this written submission represents my ideas in my own words and where others' ideas or words have been included. I adequately cited and referenced the original sources.

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ABSTRACT

The process of smart city construction, city managers always spend a lot of energy and money cleaning street garbage due to the random appearances of street garbage.First the high-resolution cameras installed on vehicles collect street images. Mobile edge servers are used to store and extract street image information temporarily.Second, these processed street data is transmitted to the cloud data centre for analysis through city networks.At the same time, Faster R-CNN (Faster Region-Convolutional Neural Network) is used to identify street garbage categories and count the number of garbage. Finally, the results are incorporated into the street cleanliness calculation framework to ultimately visualize street cleanliness levels, which provides convenience for city managers to arrange clean-up personnel_effectively.

TABLE OF CONTENTS

CHAPTER **PAGE NO.**

CHAPTER-1

1.1 INTRODUCTION

Object detection is a central task in computer vision, with applications ranging across the process of smart city construction, city managers always spend a lot of energy and money cleaning street garbage due to the random appearances of street garbage,As deep network solutions become deeper and more complex, they are often limited by the amount of training data available. With this in mind, to spur advances in analyzing and understanding images, Open CV or Google AI has publicly released the Open Images dataset. Open Images follows the tradition of PASCAL VOC, Image Net and COCO, now at an unprecedented scale.In this project we to implement the consequently, visual street cleanliness assessment is particularly important. However, existing assessment approaches have some clear disadvantages, such as the collection of street garbage information is not automated, and street cleanliness information is not real-time best performing algorithm for automatically detecting objects. Finally, the results are incorporated into the street cleanliness calculation framework to ultimately visualize street cleanliness levels, which provides convenience for city managers to arrange clean-up personnel effectively.

Street cleaning is an important city service, which involves a set of activities concerning the cleanliness of the street (usually defined as pavements and adjoining edges of roads and grassed and planted areas). Therefore, it involves street-sweeping (whether manual or machine), litter-picking, the uplift of fly-tipped refuse and the removal of graffiti and flyposting. When the street cleaning service is ineffective, the evidence isvisible. And it could cause a significant impact on the quality of life and the attractiveness of its neighbourhoods, towns and cities. Moreover, people believe that there are the links between environmental problems and other forms of disorder and crime

in cities. On the other hand, good quality street cleaning service in a city provides and contributes the good environmental quality in its communities and neighbourhoods, which can help urban development, make places attractive to tourists, investors and mobile workers. Moreover, the effective street cleanliness could reduce the costs in cleaning underground water systems for cities. For this reason, researchers around the world are studying automated approaches, using a cleaning vehicle with cameras to capture the streets regularly and collect street information, such as street pictures, geographical location, date and time. Besides, existing object detection algorithms are used to detect images in the remote cloud platform. Finally, the detection results are sent to the city managers for decision making.

CHAPTER-2

2.1 LITERATURE REVIEW

1. The framework provides an idea for realizing sustainable development of a smart city. The conceptual model could also be used to synchronize and optimize city's investments. We have studied about practical usage of smart cities.

2. The proposed vision is achieved by providing a common access mechanism to the heterogeneous data sources offered by the city, which reduces the complexity of accessing the city's data whilst bringing citizens closely to a prosumer(double consumer and producer) role and allowing to integrate legacy data into the cities' data ecosystem.

3. This system is proposed to classify waste in an automatic way as an application of computer vision in Colombian high schools. Computer vision system classifies waste automatically in three modules 1. Image acquisition, 2. Image processing 3. Robotic modules.

4. The purpose of this research paper is to propose the Anti-Litterbugs Campaign as a more viable alternative to improve and maintain urban cleanliness.

5. The proposed a system examines initiatives by the UK national government to facilitate urban technological innovation through a range of strategies, particularly the TSB Future Cities Demonstrator Competition.

6.The cleanliness status of streets is collected using mobile stations connected via city network analysed in cloud and presented to the city administrator.

CHAPTER-3

3.SYSTEM ENGINEERING

3.1 EXISTING SYSTEM

We describe a novel edge computing framework. There is an edge layer between cloud servers and terminals. We configure edge servers (micro datacenter's) to handle a part of services from devices at the edge layer. It can also store data resources temporarily and transmit data resources in Time. Faster R-CNN is used to identify street garbage categories and count the number of garbage. A multilayer assessment model across different layers is used. The whole city is divided into 5 layers: city, area, block, street, point. Every layer will carry out street cleanliness calculation. We provide a public garbage data set collected by ourselves, which can be used as a benchmark for evaluating street garbage detection and street cleaning. Furthermore, we use the data set to give a visual street cleaning map for Mysore District, In Karnataka, and India. The application validates the feasibility and usability of the proposed approach. The results are useful for improving and optimizing city street cleanliness.

An image classification or image recognition model simply detects the probability of an object in an image. In contrast to this, object localization refers to identifying the location of an object in the image. An object localization algorithm will output the coordinates of the location of an object with respect to the image. In computer vision, the most popular way to localize an object in an image is to represent its location with the help of bounding boxes

3.2 DISADVANTAGES OF EXISTING SYSTEM

1. Need a large dataset
2. Because you need a large dataset, training time is usually significant
3. Takes lots of time to train and stuff
4. With the availability of large amounts of data, faster GPUs, and better algorithms.

3.3 PROPOSED SYSTEM

Smart city construction has become the focus of the whole society. Smart cities use intelligent methods to sense and handle urban activities through the Internet of Things, cloud computing and other technologies, which can improve the quality of service in all aspects of society and economy. Meanwhile, smart cities can also achieve the purpose of reducing costs and resource consumption. Currently, many scholars in the world have done many researches related to smart cities. Bangalore proposed a planning framework called "Smart City Reference Model". Urban planners can use the framework to define the smart city concept and apply an urban layout to green, interconnected, open, integrated, smart, and innovative concepts. The framework provides an idea for realizing sustainable development of a smart city. The recent practical application is to analyze smart city planning in big cities such as Mumbai, Chennai, and Kolkata combined a smart city and life cycle concept to create a suitable information and knowledge sharing platform in a smart city. It aims to solve the problem of

unreasonable arrangement, lacking planning and internal coordination of large activities in the city, which can achieve the goal of organizational consistency and efficiency.

3.4 ADVANTAGES OF THE PROPOSED SYSTEM

- Object detection is breaking into a wide range of industries, with use cases ranging from personal security to productivity in the workplace.

- It can also be used within a visual search engine to help consumers find a specific item powerful image analysis and objects detection.

CHAPTER-4

4.SYSTEM DESIGN

4.1 SYSTEM ARCHITECTURE

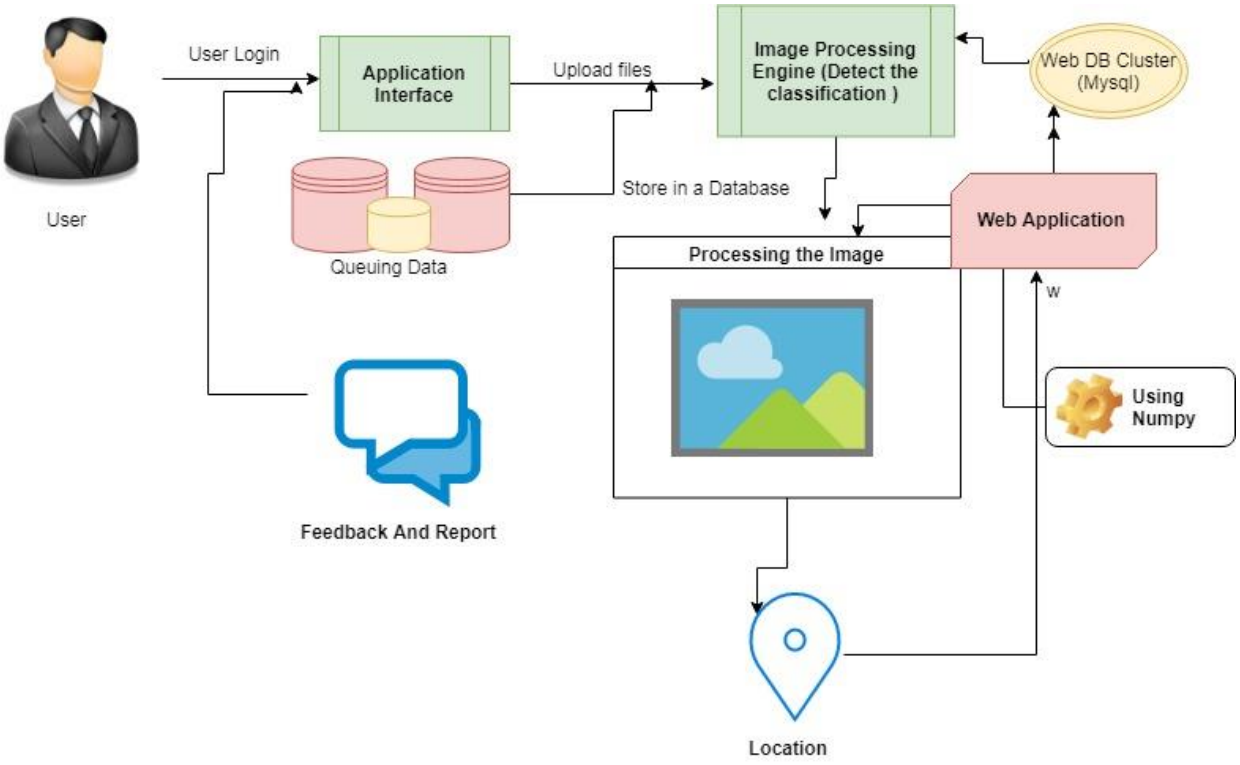
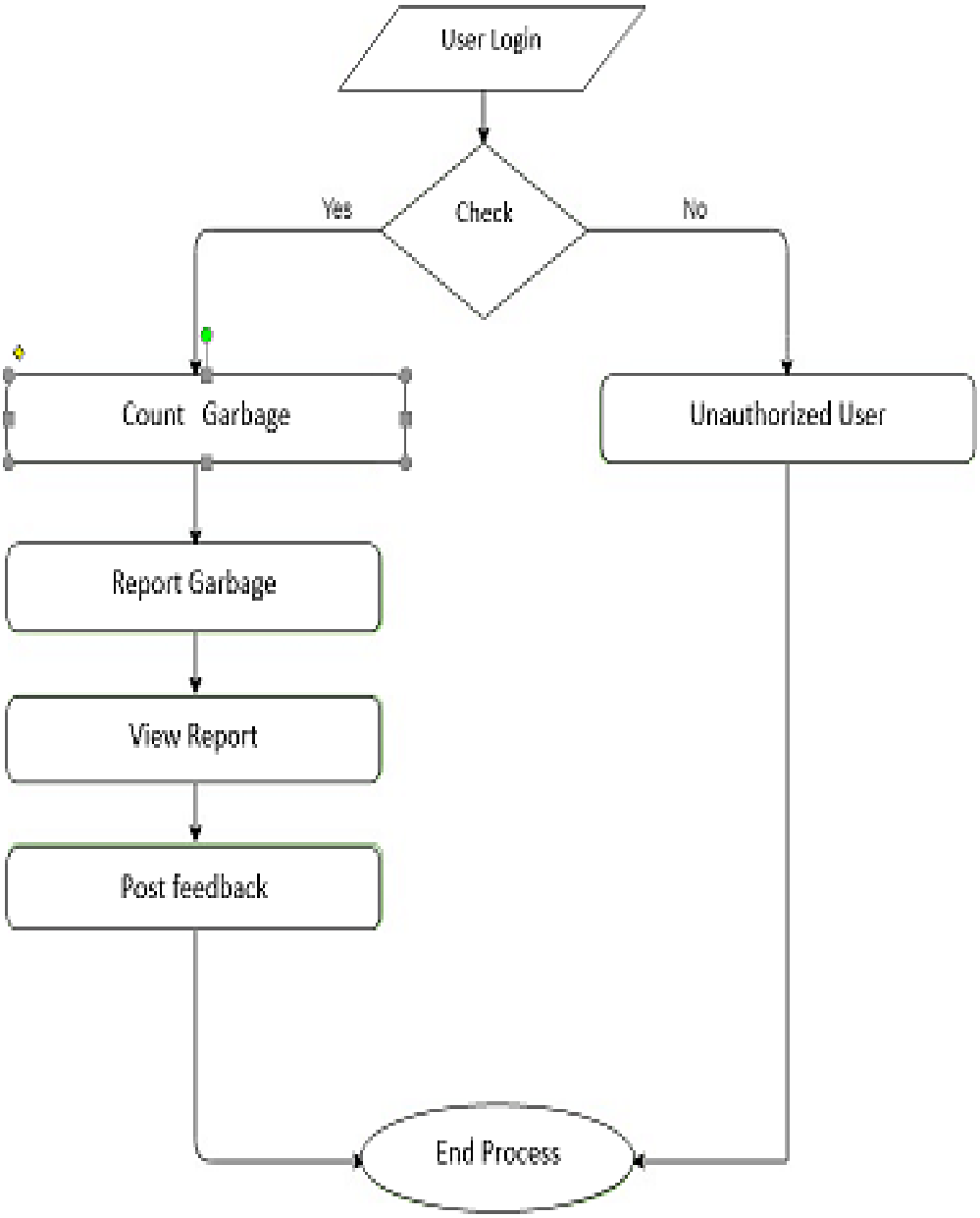


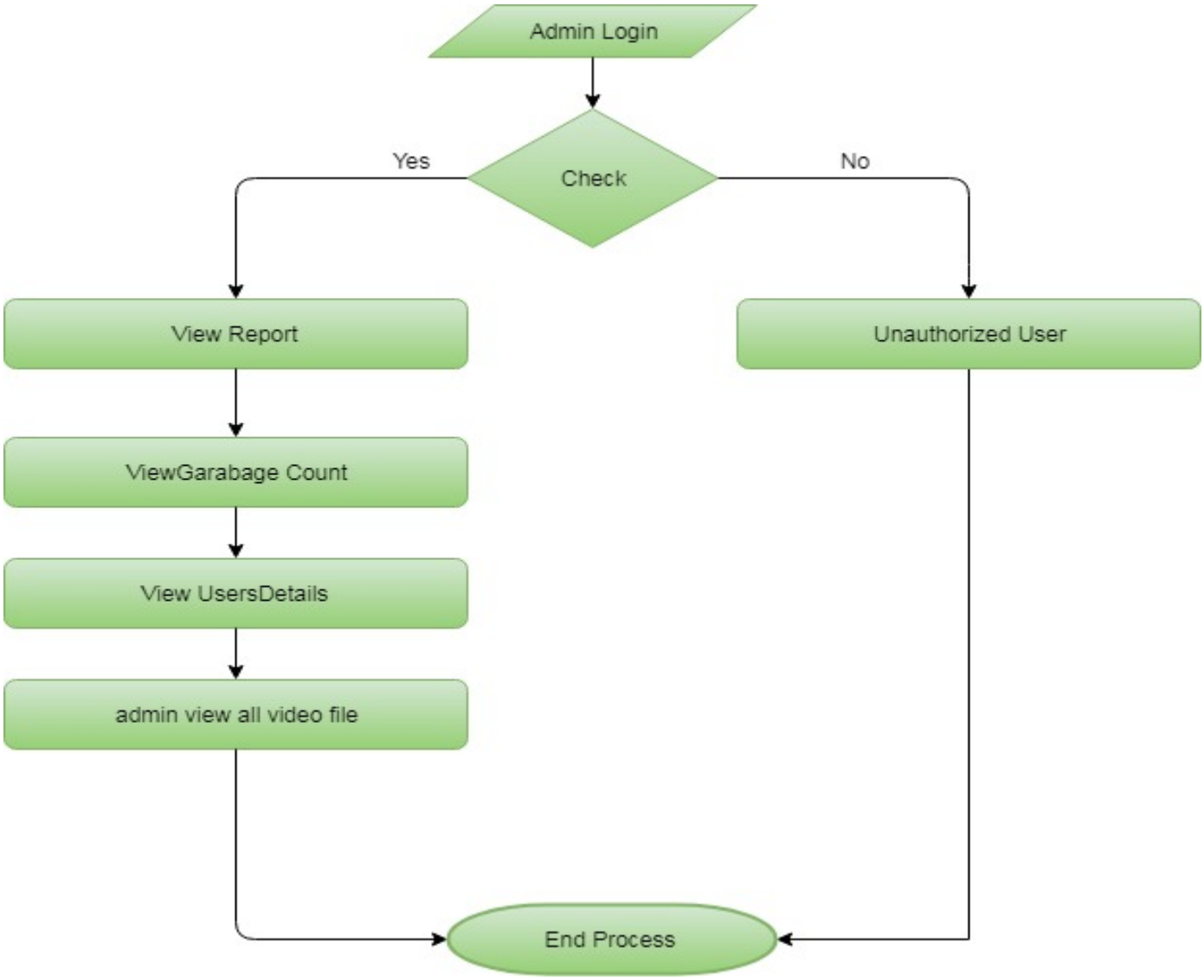
Fig:4.1 system architecture

4.1dataflowdiagrams

a.user



b.Admin



4.3 SYSTEM REQUIREMENTS

4.3.1 SOFTWARE REQUIREMENTS

For developing the application the following are the Software Requirements:

1.Python
2.Django
3.MySql
4.MySqlclient
5.WampServer 2.4

4.3.2 HARDWARE REQUIREMENTS

For developing the application the following are the Hardware Requirements:
Processor: Pentium IV or higher
RAM: 2GB
8 GB available hard disk space (32-bit) or 20 GB (64-bit)

4.4 MODULES:

MODULES:

1. Upload Images:

Uploading the image is done by user. Authorized person is uploading the new arrivals to system that are listed to users. Images can be uploaded with its attributes.

2. Approach Overview:

Edge computing can reduce latency and resources. Compared with traditional cloud computing, the main difference is that some services are processed on the edge in advance when a large amount of data is generated. R-CNN is also widely used in image recognition. Based on the above work, we design a novel urban street garbage detection and cleanliness assessment approach.

3. Data Collection and Mobile Edge Processing:

During the data collection stage, the main task is to collect garbage and street images needed by the assessment approach.

We use edge servers to complete two tasks. The first task is to improve the performance of the entire system. During this stage, when object detection is performed, image data collected is first input into the CNN network and then the size of pictures is modified to the suitable size. We believe that if image data is preprocessed in the edge server, it can reduce the overall time of the entire system.

4. Image Detection Using Neural Network (R-CNN):

We have already introduced that our street garbage detection is based on the Faster R-CNN algorithm. Below, we describe the detection algorithm in detail from three parts: network design , network training, and street garbage detection.

5. OPENCV:

OpenCV is a library of programming functions mainly aimed at real-time computer vision. OpenCV is a cross-platform library using which we can develop real-time computer vision applications. It mainly focuses on image processing.

CHAPTER-5
CODING AND IMPLEMENTATION

5.1 ALGORITHM:

CONVOLUTIONAL NEURAL NETWORKS (CNN)

Convolutional Neural Networks (CNN) is one of the variants of neural networks used heavily in the field of Computer Vision. It derives its name from the type of hidden layers it consists of. The hidden layers of a CNN typically consist of convolutional layers, pooling layers, fully connected layers, and normalization layers. Here it simply means that instead of using the normal activation functions defined above, convolution and pooling functions are used as activation functions .To understand it in detail one needs to understand what convolution and pooling are. Both of these concepts are borrowed from the field of Computer Vision

REGION-BASED CONVOLUTIONAL NEURAL NETWORKS(R-CNN)

R-CNN is a state-of-the-art visual object detection system that combines bottom-up region proposals with rich features computed by a convolutional neural network. At the time of its release, R-CNN improved the previous best detection performance on PASCAL VOC 2012 by 30% relative, going from 40.9% to 53.3% mean average precision. Unlike the previous best results, R-CNN achieves this performance without using contextual rescoring or an ensemble of feature types. To bypass the problem of selecting a huge number of regions, RossGirshicket al.Proposed a method where we use selective search to extract just 2000 regions from the image and he called them region proposals. Therefore, now, instead of trying to classify a huge number of regions, you can just work with 2000 regions.

R-CNN algorithms have truly been a game-changer for object detection tasks. There has suddenly been a spike in recent years in the amount of computer vision applications being created, and R-CNN is at the heart of most of them

CHAPTER -6
Testing and Result

6.1 TESTING

Introduction to Testing:

Testing is a process, which reveals errors in the program. It is the major quality measure employed during software development. During software development. During testing, the program is executed with a set of test cases and the output of the program for the test cases is evaluated to determine if the program is performing as it is expected to perform.

TESTING IN STRATEGIES

In order to make sure that the system does not have errors, the different levels of testing strategies that are applied at differing phases of software development are:

Unit Testing:

Unit Testing is done on individual modules as they are completed and become executable. It is confined only to the designer's requirements.

Each module can be tested using the following two Strategies:

Black Box Testing:

In this strategy some test cases are generated as input conditions that fully execute all functional requirements for the program. This testing has been uses to find errors in the following categories:

- Incorrect or missing functions
- Interface errors
- Errors in data structure or external database access
- Performance errors
- Initialization and termination errors.

In this testing only the output is checked for correctness. The logical flow of the data is not checked.

White Box testing:

In this the test cases are generated on the logic of each module by drawing flow graphs of that module and logical decisions are tested on all the cases. It has been uses to generate the test cases in the following cases:

- ✓ Guarantee that all independent paths have been executed.
- ✓ Execute all logical decisions on their true and false Sides.
- ✓ Execute all loops at their boundaries and within their operational bounds
- ✓ Execute internal data structures to ensure their validity.

Integrating Testing:

Integration testing ensures that software and subsystems work together a whole. It tests the interface of all the modules to make sure that the modules behave properly when integrated together.

System Testing:

Involves in-house testing of the entire system before delivery to the user. Its aim is to satisfy the user the system meets all requirements of the client's specifications.

Acceptance Testing:

It is a pre-delivery testing in which entire system is tested at client's site on real world data to find errors.

Test Approach:

Testing can be done in two ways:

- Bottom up approach
- Top down approach

Bottom up Approach:

Testing can be performed starting from smallest and lowest level modules and proceeding one at a time. For each module in bottom up testing a short program executes the module and provides the needed data so that the module is asked to perform the way it will when embedded within the larger system. When bottom level modules are tested attention turns to those on the next level that use the lower level ones they are tested individually and then linked with the previously examined lower level modules.

Top down approach:

This type of testing starts from upper level modules. Since the detailed activities usually performed in the lower level routines are not provided stubs are written. A stub is a module shell called by upper level module and that when reached properly will return a message to the calling module indicating that proper interaction occurred. No attempt is made to verify the correctness of the lower level module.

Validation:

The system has been tested and implemented successfully and thus ensured that all the requirements as listed in the software requirements specification are completely fulfilled. In case of erroneous input corresponding error messages are displayed.

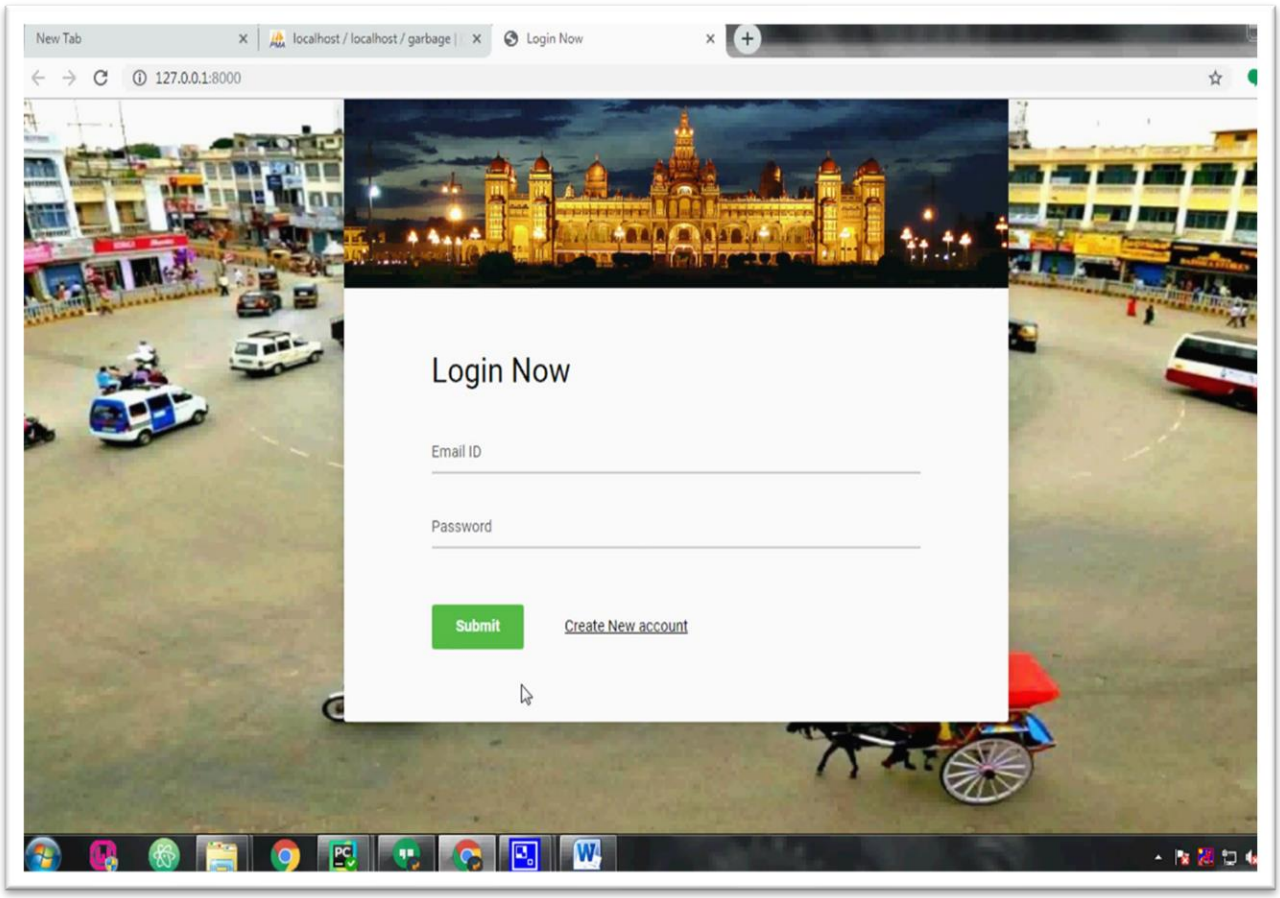
TESTING

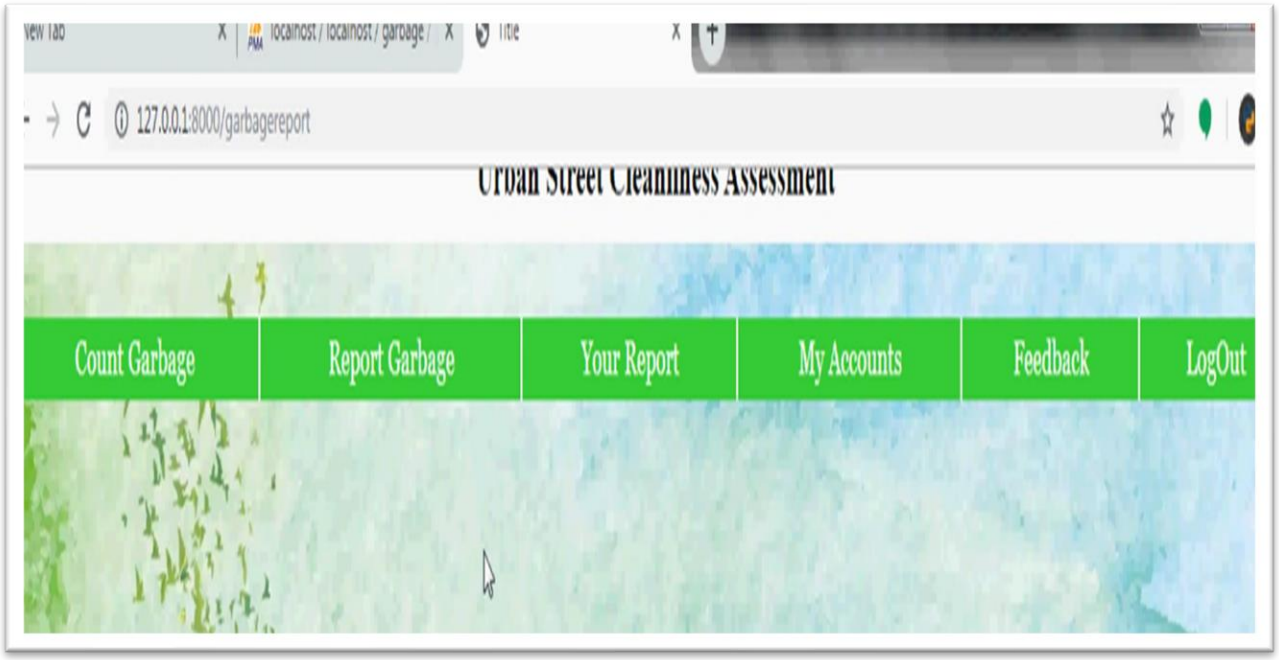
Test case:	**Login module**
Purpose:	Login module is being tested here. The Application has login module for all the three (i.e) Admin module, faculty module, and Student module.
Prereq:	The login pass contains two labels, email id and password with the corresponding text fields.
Test Data:	Providing Invalid email id for admin and testing is performed to check Admin Homepage is accessed or not.
Steps:	1.Go to login Page 2. Enter no email id and password 3. Click on Submit button and checking the validations 4. Enter correct email id and password (i.e.) admin and admin 5. Homepage is shown

6. Verifying the homepage is Admin Homepage

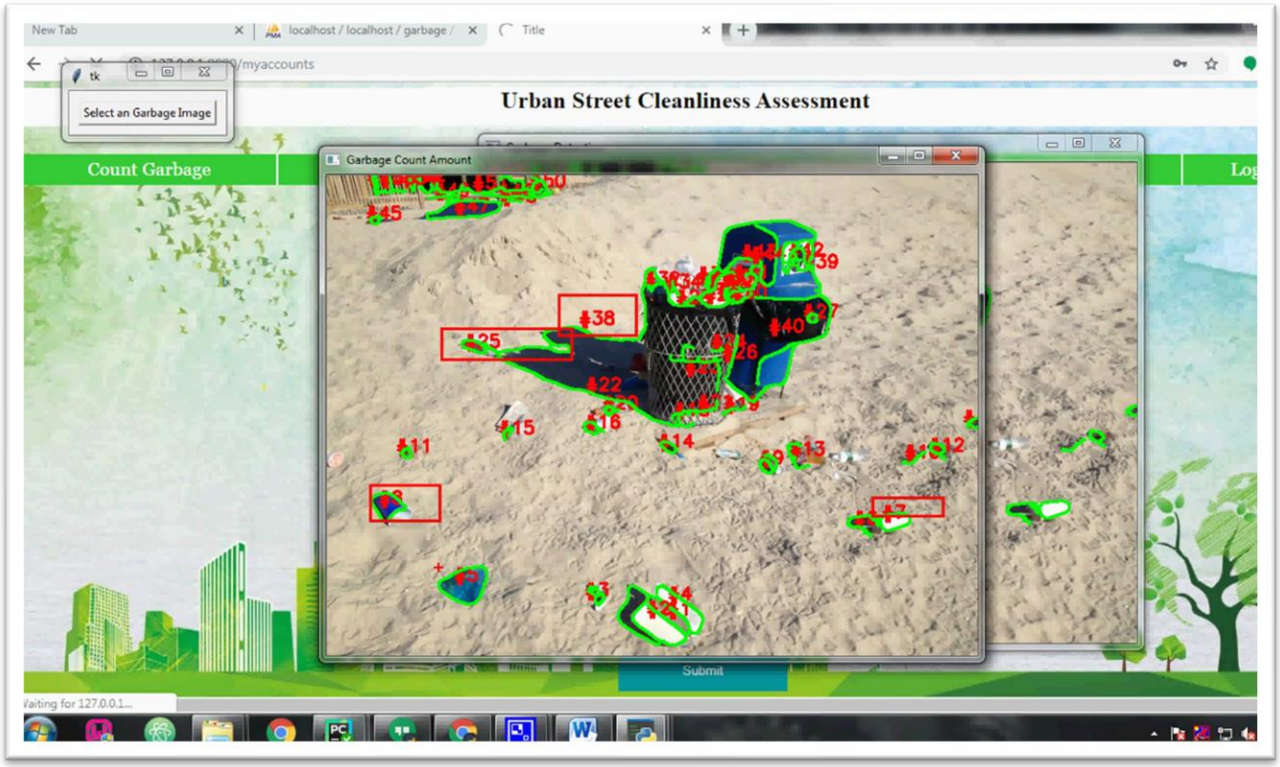
Test Screens: The following screens represent the above test case

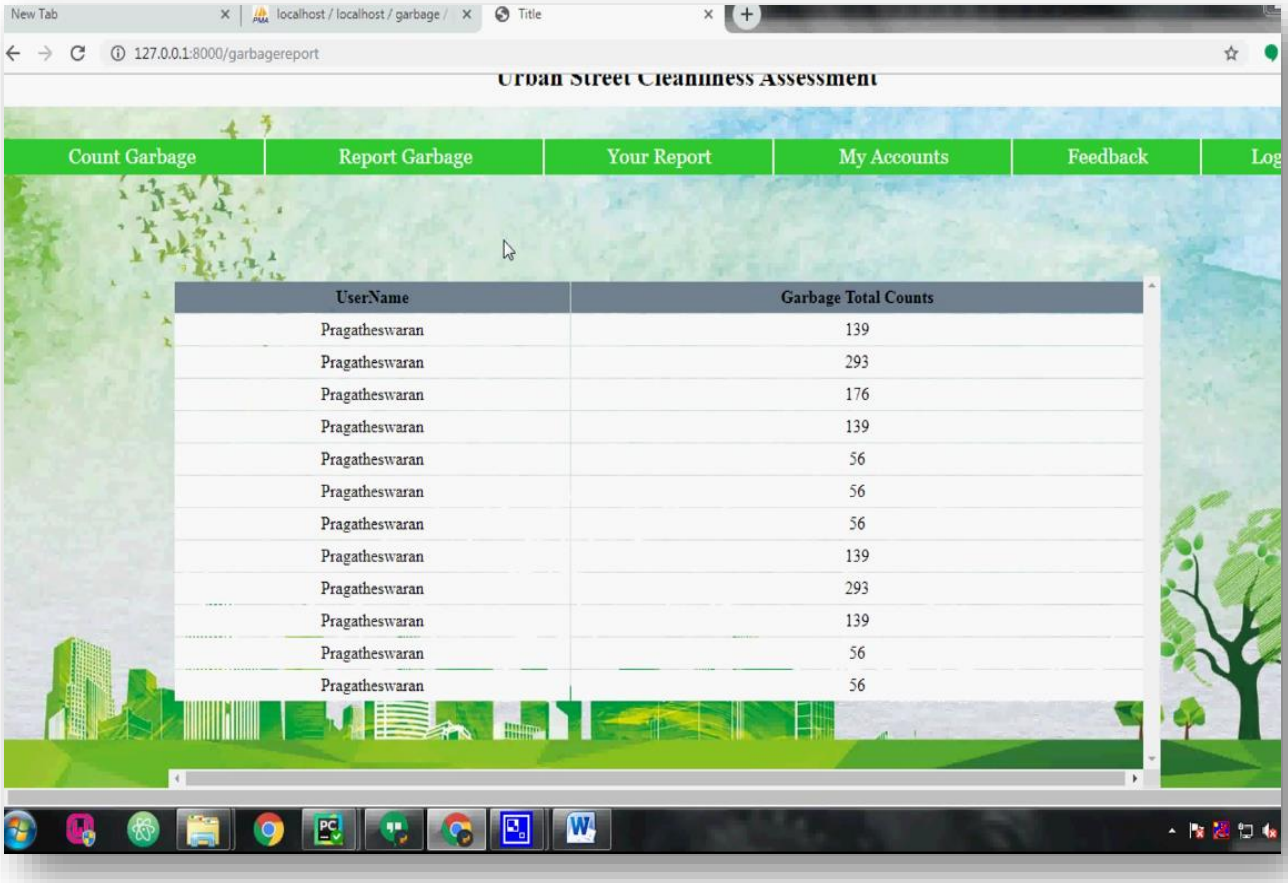
6.2 RESULT:




127.0.0.1:8000/garbagereport
Urban Street Cleanliness Assessment
Count Garbage
Report Garbage
Your Report
My Accounts
Feedback
LogOut


Urban Street Cleanliness Assessment
Select an Garbage Image
Garbage Count Amount
Garbage Detection
Submit


Urban Street Cleanliness Assessment
Select an Garbage Image
Count Garbage
Garbage Count Amount
Submit


127.0.0.1:8000/garbagereport
Urban Street Cleanliness Assessment
Count Garbage
Report Garbage
Your Report
My Accounts
Feedback
UserName
Garbage Total Counts
Pragatheswaran 139
Pragatheswaran 293
Pragatheswaran 176
Pragatheswaran 139
Pragatheswaran 56
Pragatheswaran 56
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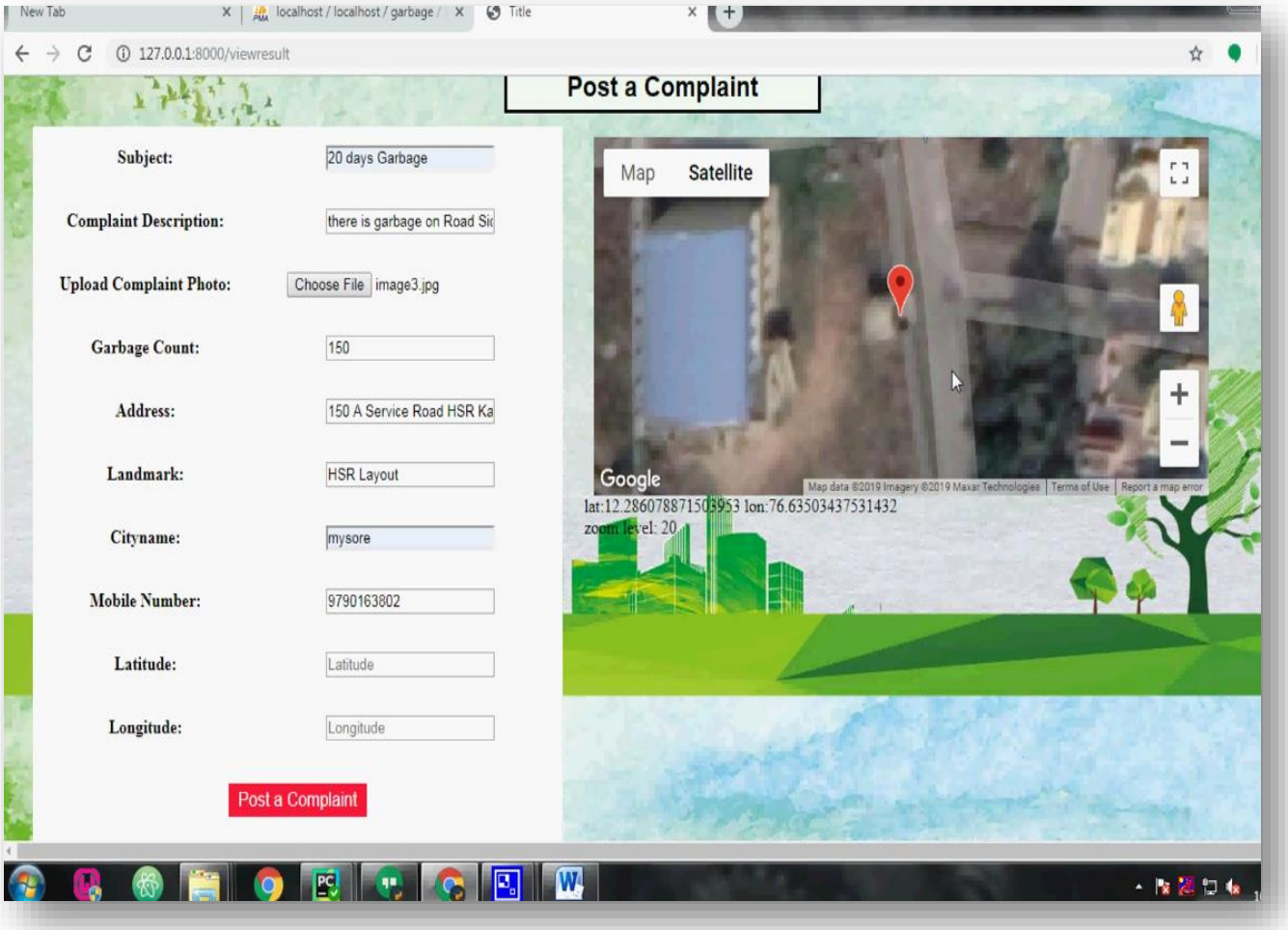
New Tab
localhost / localhost / garbage /
Title
127.0.0.1:8000/viewresult
Post a Complaint
Subject:
20 days Garbage
Complaint Description:
there is garbage on Road Sic
Upload Complaint Photo:
Choose File
image3.jpg
Garbage Count:
150
Address:
150 A Service Road HSR Ka
Landmark:
HSR Layout
Cityname:
mysore
Mobile Number:
9790163802
Latitude:
Latitude
Longitude:
Longitude
Post a Complaint
Map
Satellite
Google
Map data ©2019 Imagery ©2019 Maxar Technologies
Terms of Use
Report a map error
lat:12.286078871503953 lon:76.63503437531432
zoom level: 20


New Tab
localhost / localhost / garbage /
Title
127.0.0.1:8000/myaccounts
Urban Street Cleanliness Assessment
Count Garbage
Report Garbage
Your Report
My Accounts
Feedback
LogO
User ID:
15149102
Name:
Pragatheswaran
Email Id:
pragatheswaran@gma
Password:
Mobile Number:
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Dob:
1998-01-23
Gender:
Male
City :
Mysore
Address:
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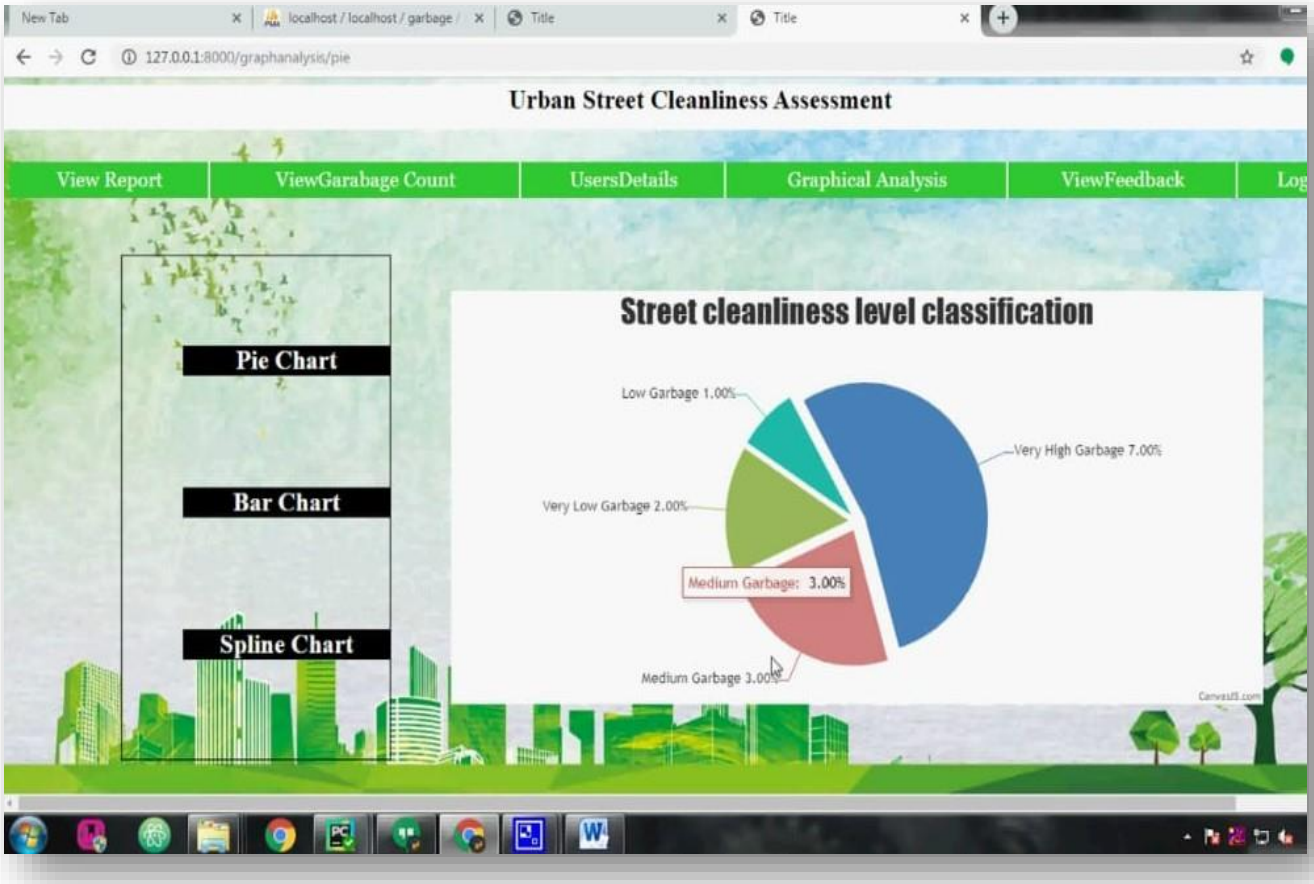
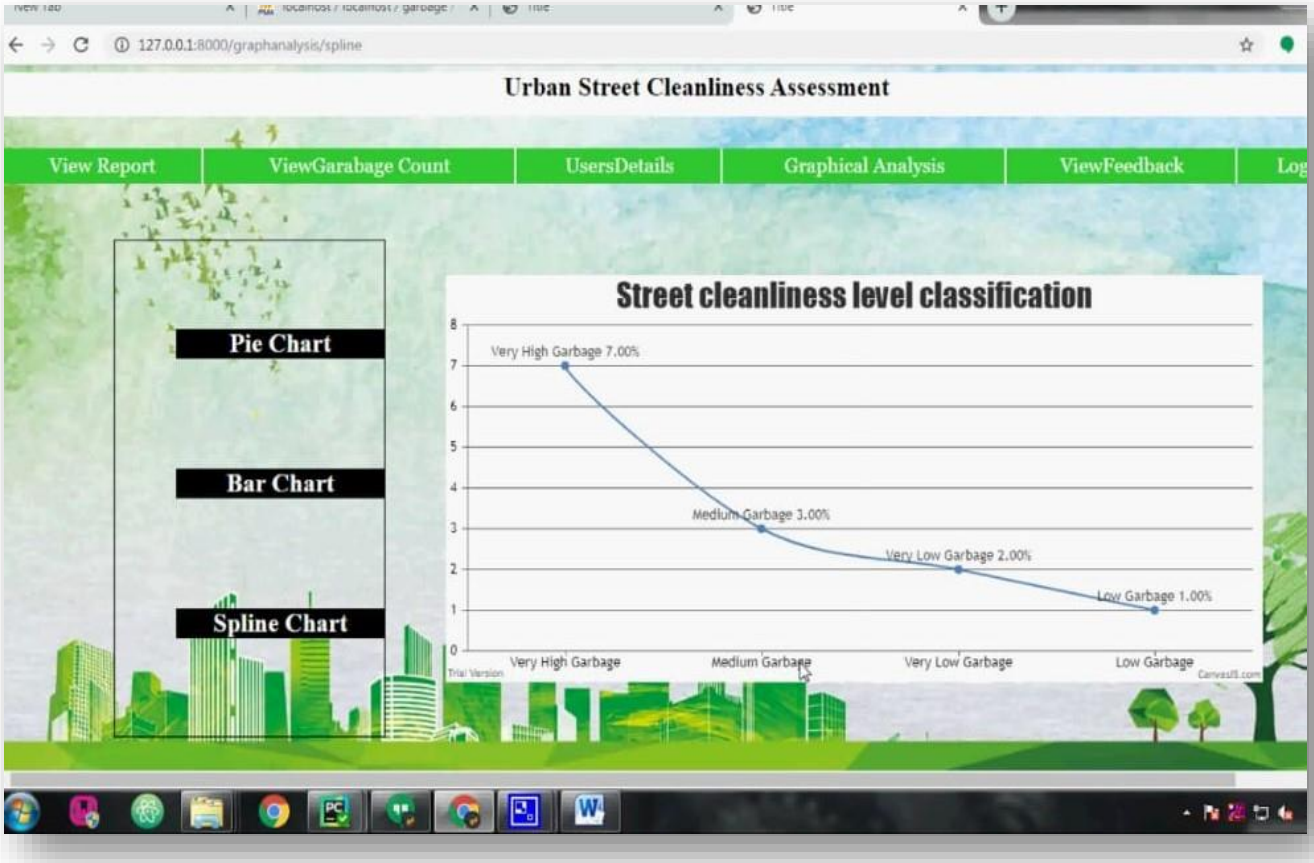
Pincode:
570010
Submit


New Tab
localhost / localhost / garbage /
Title
Title
127.0.0.1:8000/graphanalysis/pie
Urban Street Cleanliness Assessment
View Report
ViewGarabage Count
UsersDetails
Graphical Analysis
ViewFeedback
Pie Chart
Bar Chart
Spline Chart
Street cleanliness level classification
Low Garbage 1.00%
Very High Garbage 7.00%
Very Low Garbage 2.00%
Medium Garbage: 3.00%
Medium Garbage 3.00%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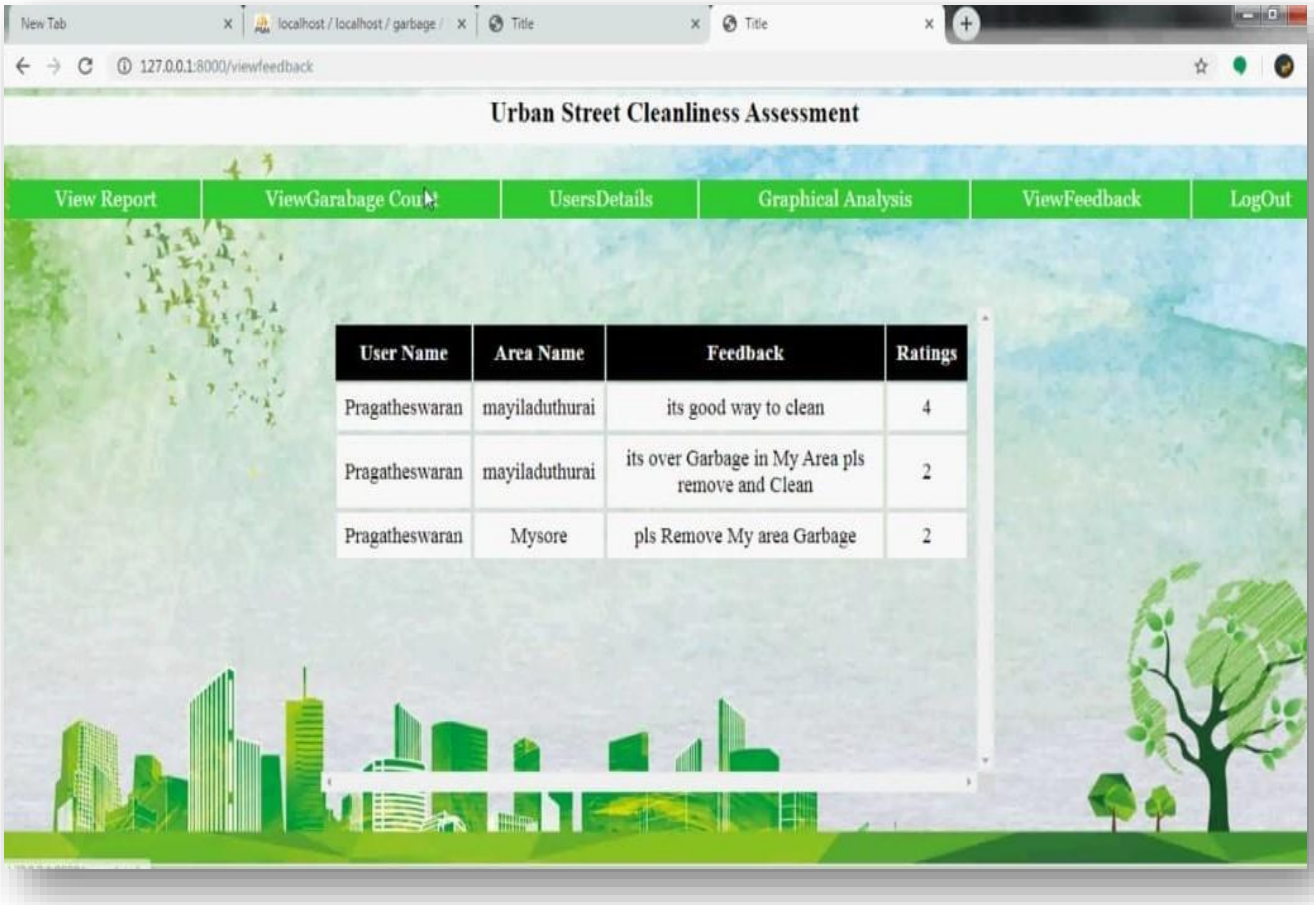
Urban Street Cleanliness Assessment
View Report
ViewGarabage Count
UsersDetails
Graphical Analysis
ViewFeedback
Pie Chart
Bar Chart
Spline Chart
Street cleanliness level classification
Very High Garbage 7.00%
Medium Garbage 3.00%
Very Low Garbage 2.00%
Low Garbage 1.00%
Very High Garbage
Medium Garbage
Very Low Garbage
Low Garbage


New Tab
localhost / localhost / garbage /
Title
Title
127.0.0.1:8000/viewfeedback
Urban Street Cleanliness Assessment
View Report
ViewGarabage Count
UsersDetails
Graphical Analysis
ViewFeedback
LogOut
User Name
Area Name
Feedback
Ratings
Pragatheswaran
mayiladuthurai
its good way to clean
4
Pragatheswaran
mayiladuthurai
its over Garbage in My Area pls remove and Clean
2
Pragatheswaran
Mysore
pls Remove My area Garbage
2

CHAPTER-7

CONCLUSION

The development of novel technologies has driven a number of cities into the way to smart cities. Street cleanliness is one of the concerns for smart cities. Consequently, this paper proposes a novel urban street cleanliness assessment approach using mobile edge computing and deep learning. A visual street cleanliness road diagram is presented; such an automated system can help city administrators to know the cleaning state of the street easily. Several directions for future work are possible.

CHAPTER-8

8.1BIBLIOGRAPHY

HTML

HTML Black Book by Holzner

JDBC

Java Database Programming with JDBC by Patel moss.
Software Engineering by Roger Pressman

1

REFERENCES

[1] U. Aguilera, O. Pe˜ na, O. Belmonte, and D. L´opez-de Ipi ˜ na, “Citizen-centric data services for smarter cities,” Future Generation Computer Systems, vol. 76, pp. 234–247, 2017.

[2] M. Armbrust, A. Fox, R. Griffith, A. D. Joseph, R. Katz, A. Konwinski,
G. Lee, D. Patterson, A. Rabkin, I. Stoica et al., “A view of cloud computing,” Communications of the ACM, vol. 53, no. 4, pp. 50–58, 2010.

[3] C. Badii, P. Bellini, D. Cenni, A. Difino, P. Nesi, and M. Paolucci, “Analysis and assessment of a knowledge based smart city architecture providing service apis,” Future Generation Computer Systems, vol. 75, pp. 14–29, 2017.

[4] C. Balchandani, R. K. Hatwar, P. Makkar, Y. Shah, P. Yelure, and M. Eirinaki, “A deep learning framework for smart street cleaning,” in IEEE Third International Conference on Big Data Computing Service and Applications, 2017, pp. 112–117.

[5] A. Borozdukhin, O. Dolinina, and V. Pechenkin, “Approach to the garbage collection in the smart clean city project,” in Information Science and Technology (CiSt), 2016 4th IEEE International Colloquium on. IEEE, 2016, pp. 918–922.

Thank you