RV COLLEGE OF ENGINEERING®,

BENGALURU-560059

(Autonomous Institution Affiliated to VTU, Belagavi)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

TITLE OF THE PROJECT:

Waste Collection and Management

Mini - Project Compilation

Submitted by

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in partial fulfillment for the requirement of 5th Semester

Software Engineering Mini Project (16CS54)

Under the Guidance of

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Academic Year 2019 - 2020

RV COLLEGE OF ENGINEERING®, BENGALURU - 560059
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CERTIFICATE

Certified that the project work titled **'Waste Collection and Management'** is carried out by **Swathi.N.R(1RV17CS171) and Tejaswini.S(1RV17CS173),** who are bonafide students of RV College of Engineering®, Bengaluru, in partial fulfillment of the curriculum requirement of 5th Semester Database Design Laboratory Mini Project during the academic year **2019-2020**. It is certified that all corrections/suggestions indicated for the internal Assessment have been incorporated in the report deposited in the departmental library. The report has been approved as it satisfies the academic requirements in all respect laboratory mini-project work prescribed by the institution.

Signature of Faculty In-charge

Head of the Department
Dept. of CSE, RVCE

External Examination

Name of Examiners	**Signature with date**
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ACKNOWLEDGEMENT

Any achievement, be it scholastic or otherwise does not depend solely on the individual efforts but on the guidance, encouragement and cooperation of intellectuals, elders and friends. A number of personalities, in their own capacities have helped me in carrying out this project work. I would like to take this opportunity to thank them all.

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Abstract

The proposed system would be able to automate the solid waste monitoring process and management of the overall collection process using IOT (Internet of Things). It helps us obtain statistical information about the generated waste.It is a new, self-contained product which can be an alternative for the traditional garbage collection system. It analyses and quantifies the different types and amount of waste produced in the college campus.

The methodology undertaken for the project can be explained briefly as follows. All the waste bins are given a unique number. Alerts are raised once the bins get full. The cleaning staff will collect from those bins. Data is collected and necessary statistical analysis is performed using an easy to understand user interface.

The product can be of benefit to college campus garbage management. This can be further extended to contain the waste scene of the city. This easily implementable system can be run a desktop based software.

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Chapter 1

Introduction

The proposed system would be able to automate the solid waste monitoring process and management of the overall collection process using IOT (Internet of Things). It helps us obtain statistical information about the generated waste.

Existing System

Existing System Traditional garbage collection involves collecting waste from bins on a daily/weekly basis. This system could lead to either overflow of bins or poor time management. No information about the type and quantity of waste generated is recorded.

Proposed System

1. All the waste bins are given a unique number
2. Alerts are raised once the bins get full
3. The cleaning staff will collect from those bins
4. Data is collected and necessary statistical analysis is performed

Societal Concern

Efficient waste management once tested in the college campus can be further extended to the city corporations. This will help in combat the ever-increasing dumping of garbage around the city, thus helping keep the city clean.

1.1 Objective

The objective of the project is to make waste collection and management more efficient. Using technology to increase the response time of each bin keep the bins available for use, thus keeping the surroundings clean. The database gives us a complete picture of all the waste generated. This helps come up with ideas to reduce the generation of different types of waste.

1.2 Scope

The product can be of benefit to college campus garbage management. This can be further extended to contain the waste scene of the city.

Chapter 2

Software Requirement Specifications

Preamble

A Software Requirement Specification (SRS) is a description of a software system to be developed. Software requirements specification (SRS) is important for developers because it minimizes the amount of time and effort developers have to expend to achieve desired software goals. Software requirements specifications establish the basis for an agreement between customers and contractors or suppliers on how the software product should function

2.1 Software Requirements

- **Operating System** - Windows, Linux, Mac OS
- **Programming language** - Python
- **Front End** - HTML, CSS, Javascript
- **Database** - MySQL, MongoDB
- **Backend** - Flask

2.2 Hardware Requirements

- **Processor -** Intel i3 and above
- **Disk -** 4 GB and above
- **RAM -** 2 GB and above

2.3 Functional Requirements

A functional requirement defines a function of a system or its component, where a function is described as a specification of behavior between outputs and inputs. The functional requirements are specified with respect to various modules of the system as follows

- Login Module

This is a common module for all the admins and cleaners of the system. The user can log in to the system using their credentials that have been already given to them.

- Admin Profile Module

The admin profile lets him perform the following functions

1. Adding new waste bins
2. Adding new cleaners
3. Assign cleaner to bins
4. Get notified on bins that are full

- Cleaner Profile Module

The cleaner can perform the following functions

1. Get notified on the bins that need to be cleaned by him
2. Input all the data about the cleaned bin along with date and time

- Statistics Module

The statistics module has the following functionalities

1. Displays the most recently cleaned bins
2. Displays the top cleaners
3. Displays the wet, dry and the total quantity of waste collected

Chapter 3

ER Diagram

Preamble

An entity–relationship model describes interrelated things of interest in a specific domain of knowledge. A basic ER model is composed of entity types and specifies relationships that can exist between entities.

Relational Database Structure

The complete architecture is divided into 4 basic entities- BIN, CLEANER, ADMINISTRATOR and WASTE as shown in the figure 1.

- The BIN table has ID_num which is the primary key along with Location, Alert_datetime
- The CLEANER table has Cleaner_ID as the primary key along with Name, DOB, Contact_no , C_password and Age as a derived attribute.
- The WASTE table has Wet_qty, Dry_qty, Collected_datetime and Total_qty as a derived attribute
- The ADMINISTRATOR table has Admin_ID as its primary key along with Name, A_Password and Contact_no
- The BIN and CLEANER share a M:N realtionship
- The ADMIN and CLEANER share a 1:N relationship
- The BIN AND WASTE share 1:N relationship

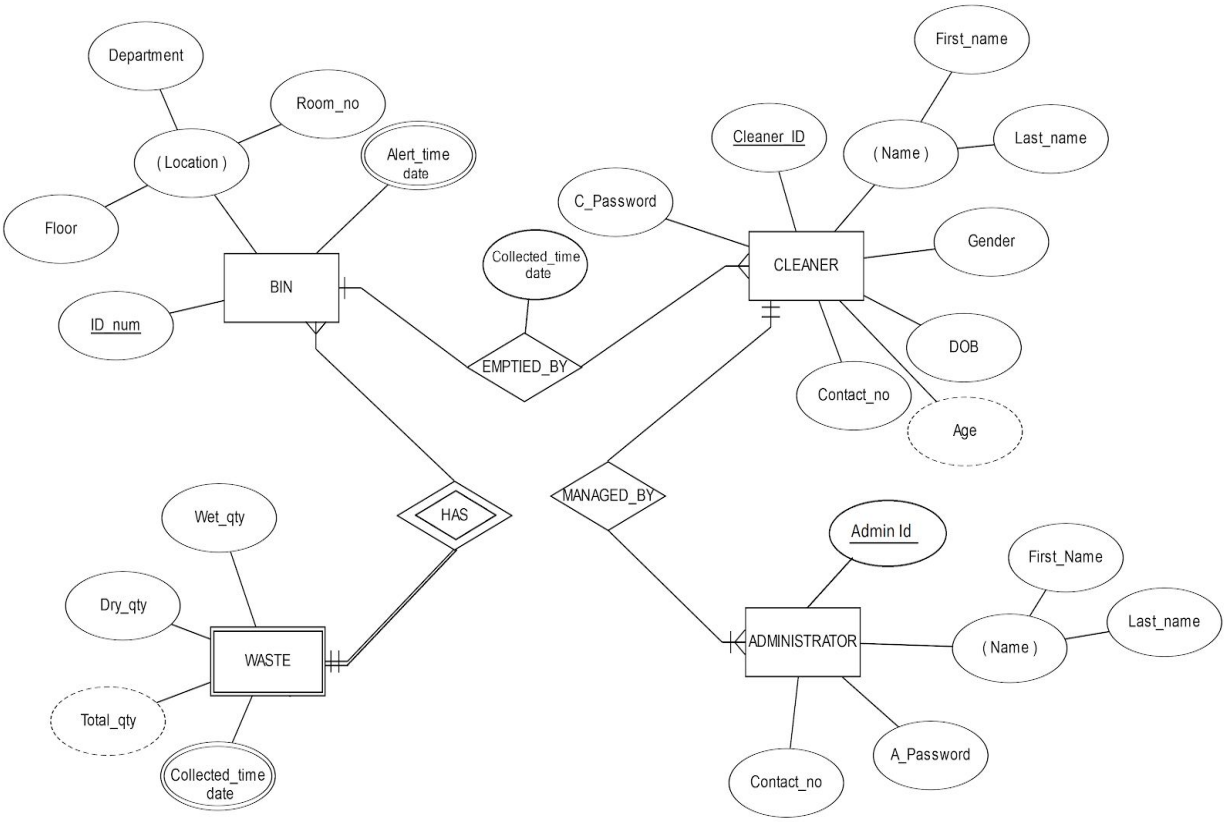


Figure 1: ER Diagram with 4 entities where WASTE is a weak entity.

Chapter 4

Detailed Design

Preamble

The detailed design of the project involves Data Flow Diagrams which show the detailed flow of data and information flow in the whole system. The DFD consists of 3 levels-

- DFD Level 0 - General Information Flow as shown in Figure 2.
- DFD Level 1 - Listing the major processes in the whole system as shown in Fig 3.
- DFD Level 2 - Detailed flow of each process in the system as shown in Figure 4.

4.1 Data Flow Designs

4.1.1 DFD Level 0

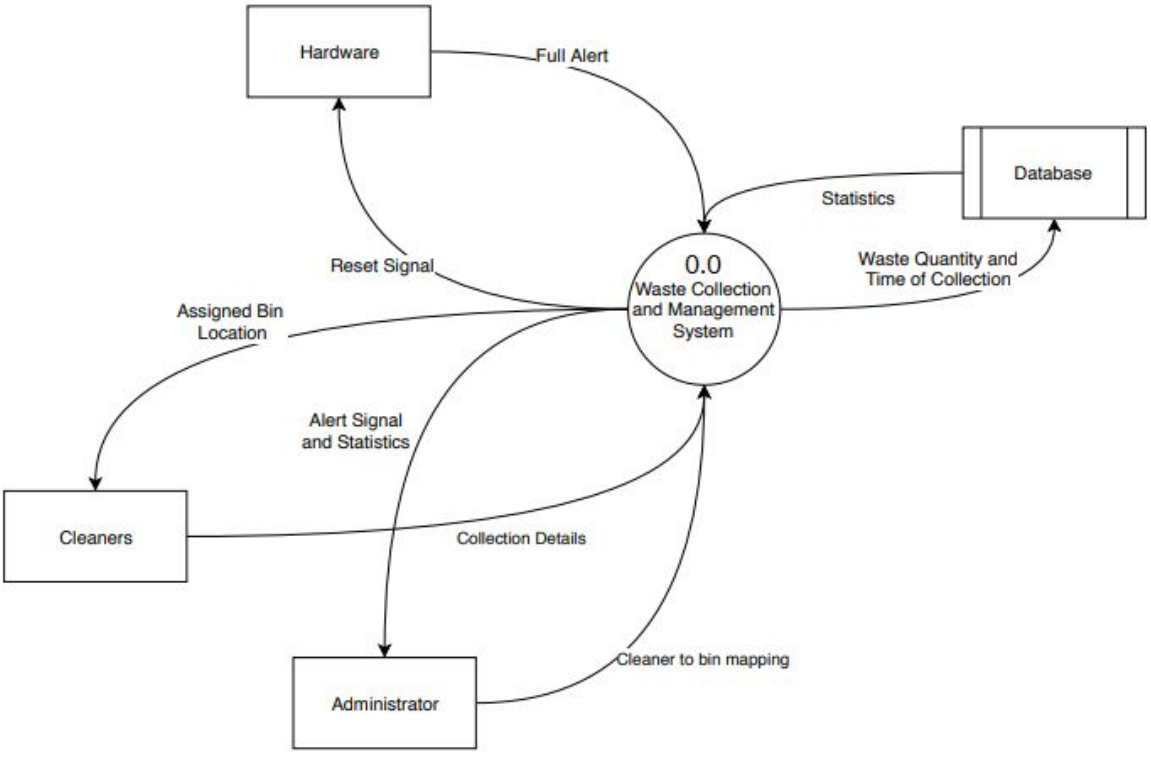


Figure 2: DFD Level 0 which is also called context diagram

4.1.2 DFD Level 1

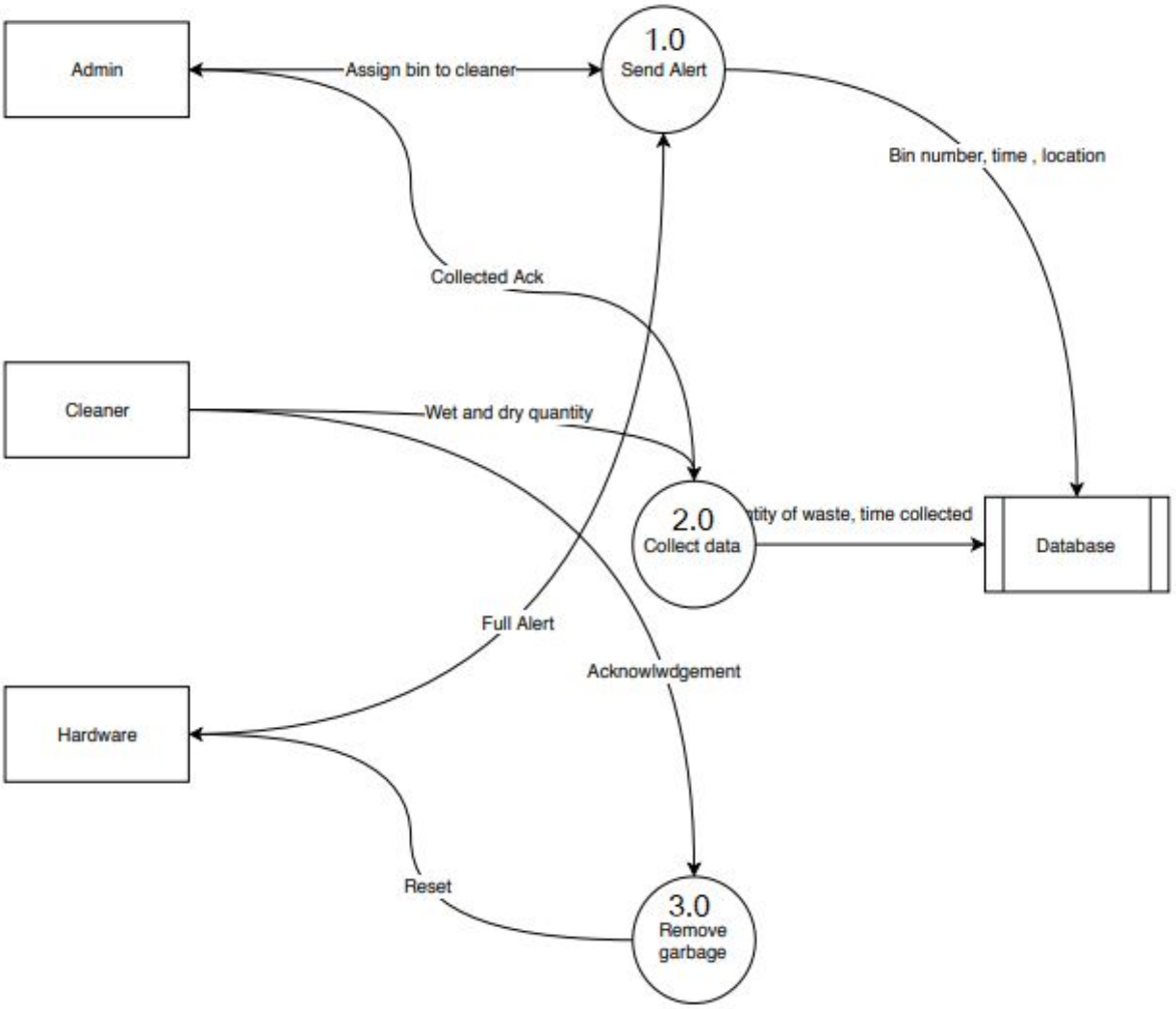


Figure 3: DFD Level 1 shows the major process.

4.1.3 DFD Level 2

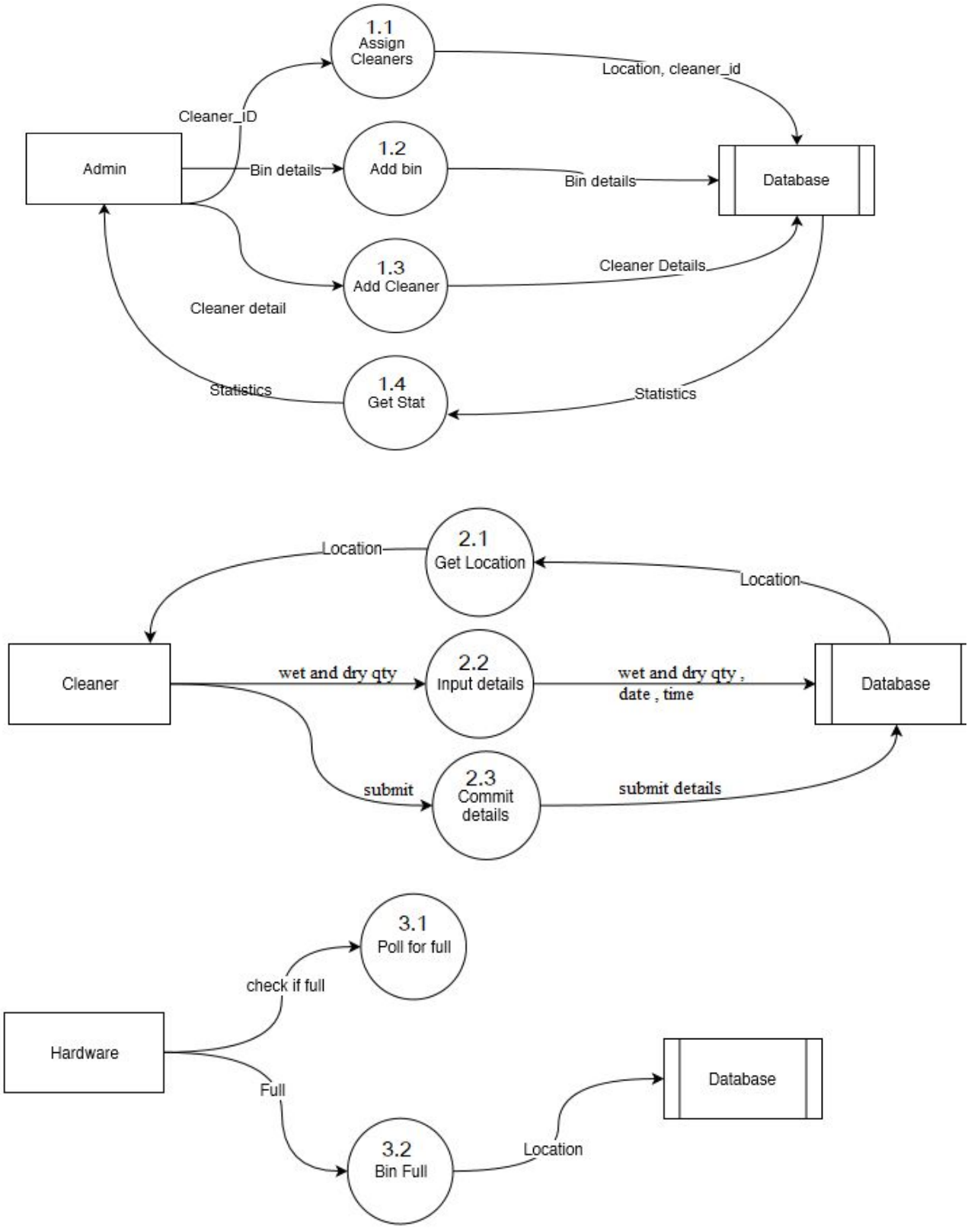


Figure 4: DFD Level 2 with all the sub processes involved is shown

Chapter 5

Relational Schema and Normalization

Preamble

Relational schema refers to the meta-data that describes the structure of data within a certain domain. It is the blueprint of a database that outlines the way its structure organizes data into tables.

Schema Diagram

The schema diagram of the project is shown in figure 5 -

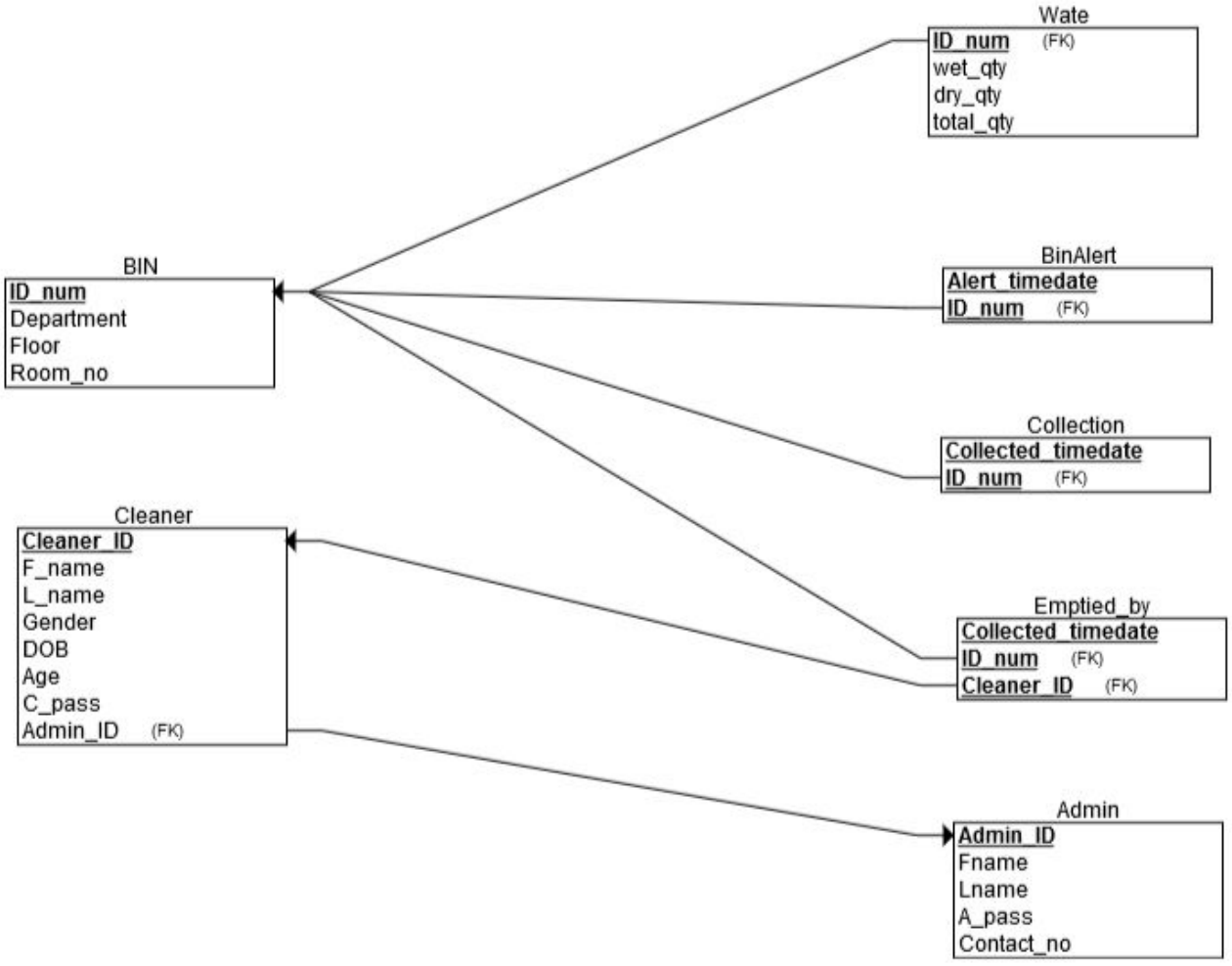


Figure 5: Schema diagram with all the primary key indications

Normalization

Normalization is a database design technique which organizes tables in a manner that reduces redundancy and dependency of data. It divides larger tables into smaller tables and links them using relationships

First Normal Form

All the tables are already in 1NF as the tables doesn't have any multivalued fields.

Second Normal Form

The tables in 2NF have no partial dependency involved in any table. So, new tables for BIN ALERT, EMPTY and COLLECTION are made as shown in figure 6.

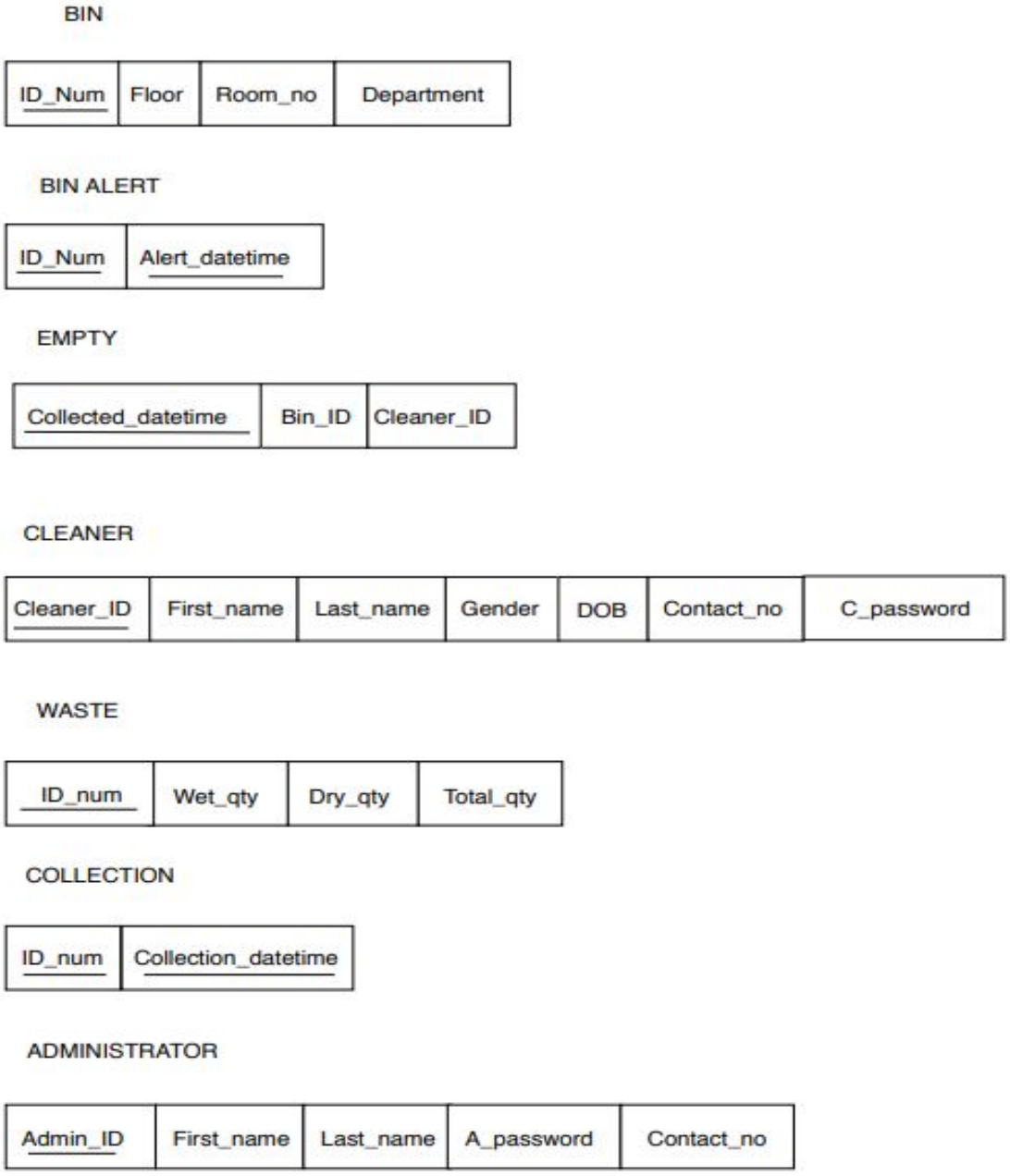


Figure 6: The 2NF form of the relational schema

Third Normal Form

The tables are said to be in 3NF form if there are no transitive dependencies between its attributes. The Room_no can tell which department and which floor the bin is at. Hence, they are removed from the BIN table and a new table called ROOMS is created with Room_no as its primary key as shown in figure 7.

ROOMS

Room_no	Department	Floor

BIN

ID_Num	Room_no

BIN ALERT

ID_Num	Alert_datetime

EMPTY

Collected_datetime	Bin_ID	Cleaner_ID

CLEANER

Cleaner_ID	First_name	Last_name	Gender	DOB	Contact_no	C_password

WASTE

ID_num	Wet_qty	Dry_qty	Total_qty

COLLECTION

ID_num	Collection_datetime

ADMINISTRATOR

Admin_ID	First_name	Last_name	A_password	Contact_no

Figure 7: The 3NF form of the relational schema

Chapter 6

NoSQL

Preamble

NqSQL is NoSQL, which stands for "not only SQL," is an alternative to traditional relational databases in which data is placed in tables and data schema is carefully designed before the database is built. NoSQL databases are especially useful for working with large sets of distributed data.

NoSQL Implementation

This project uses MongoDB to store all the information about the cleaners working in the system. Information includes their name, date of birth and contact numbers are stored on MongoDB for easy addition of new cleaners into the database.Administrator can modify such data and add new cleaner information.This is only a second copy of the main cleaner RDBMS table. MongoDB is used to display the Cleaner data on the ‘About Our Team’ page on the website.

Also public reviews can be added into the database. Reviews are accompanied with date and time of review.

Chapter 7

Conclusion

The Waste Collection and Management System is an easy to implement application which effectively manages the waste collected in an area with accurate details about the kind of waste and their respective quantities.

This application can easily be extended to include the city which can be managed by the city corporation. An administrator can handle the database of waste and also the details of all the employees working in the system. A detailed statistics of all the waste and their composition can be given in a monthly report.

The hardware detection unit can be made more sophisticated to include more complexities to make the application usable in larger areas. This will help in combat the ever-increasing dumping of garbage around the city, thus helping keep the city clean.

References

Text Books:

- Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Design, 6th edition, Pearson Education, ISBN-13: 978-0136086208.
- MongoDB in Action, Kyle Banker, Peter Bakkum, Shaun Verch, Douglas Garrett, Tim Hawkins, 2nd Edition, 2015, Manning, ISBN-1617291609, 9781617291609

Online resources:

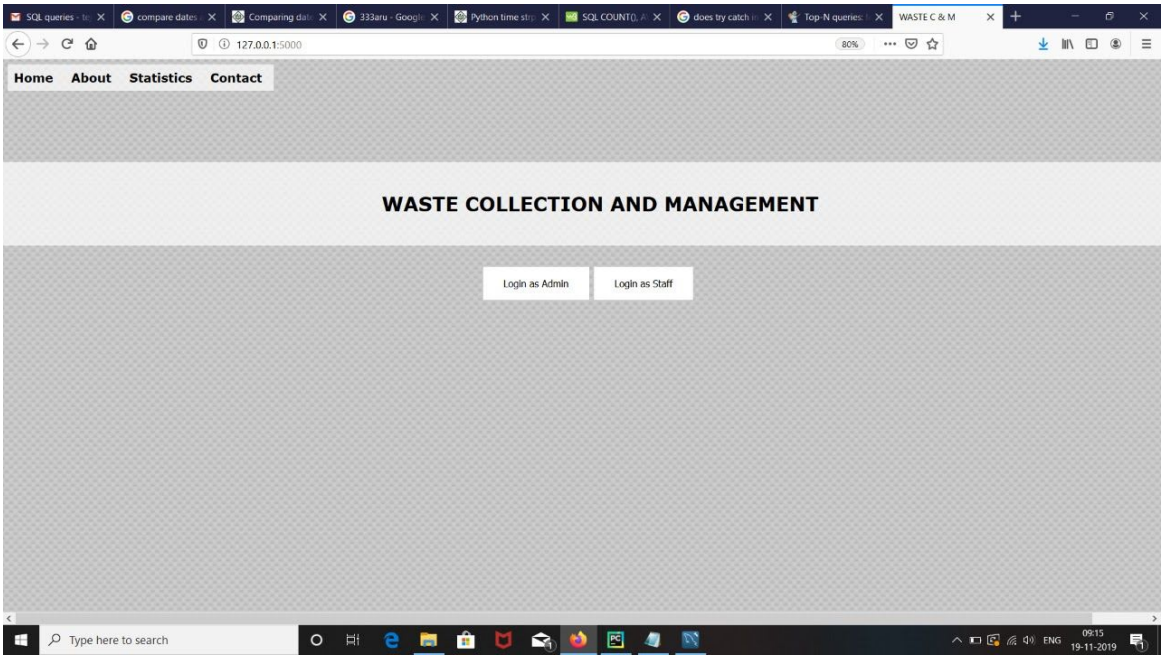
- https://www.w3schools.com/sql/
- https://www.w3schools.com/html/
- https://devdocs.io/css/
- https://www.iotforall.com/iot-applications-waste-management/
- https://realpython.com/tutorials/flask/
- https://www.w3schools.com/python/python_mysql_getstarted.asp

Tools Used:

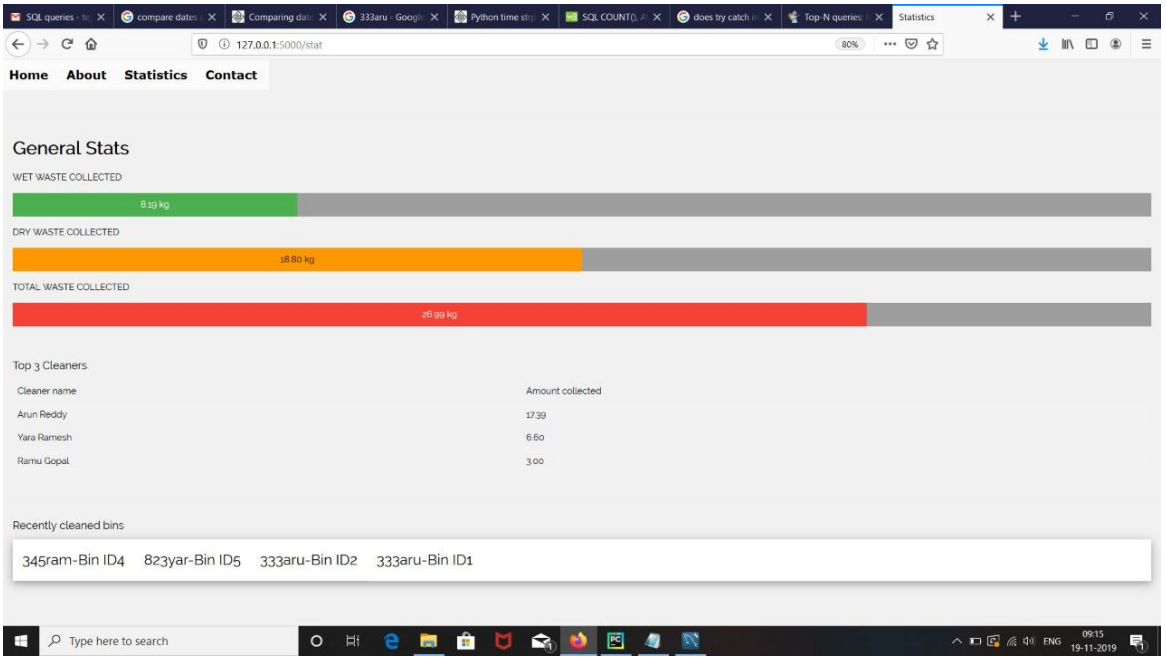
- https://draw.io/
- https://erdplus.com/

Appendix

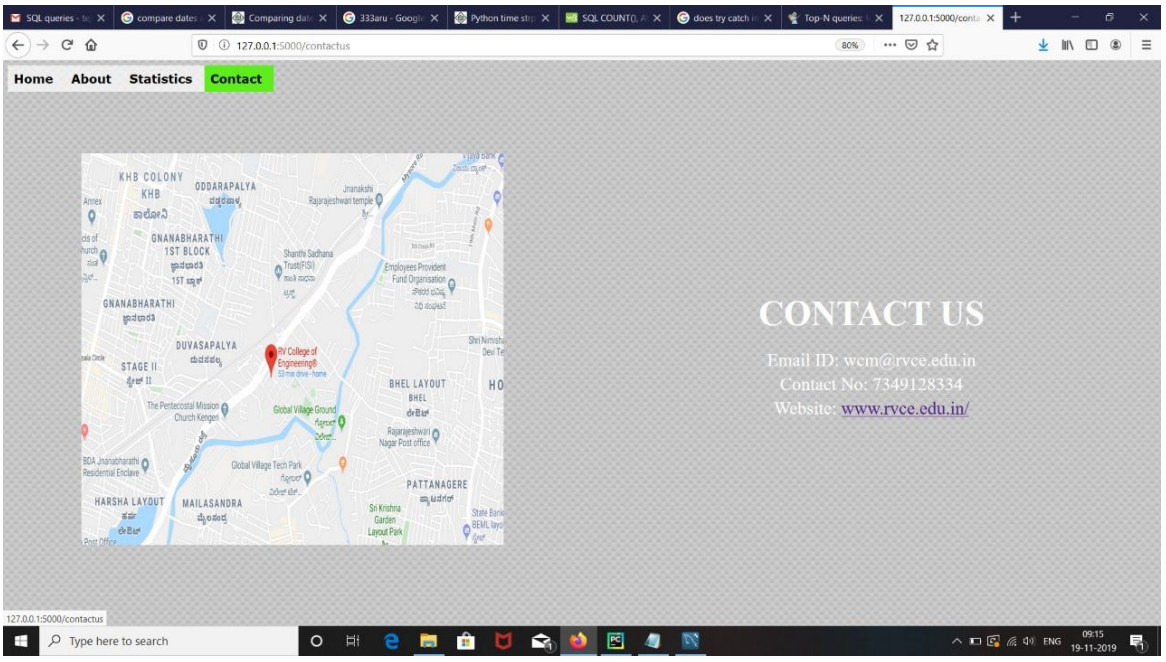
Result: Screenshots



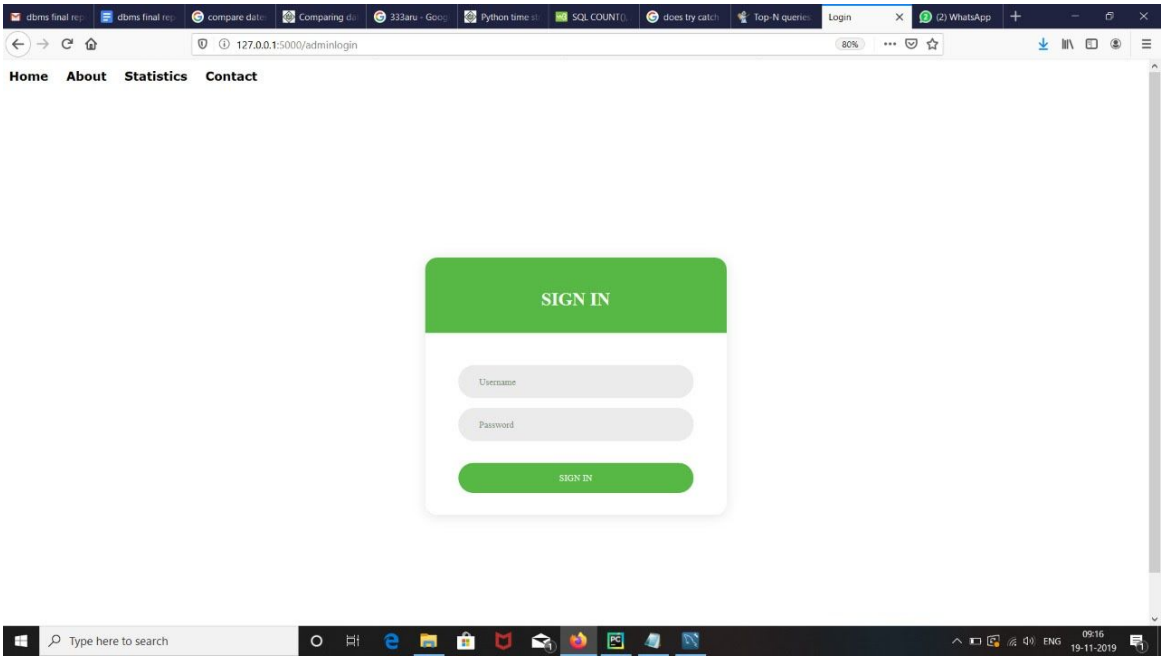
The main home page of our website



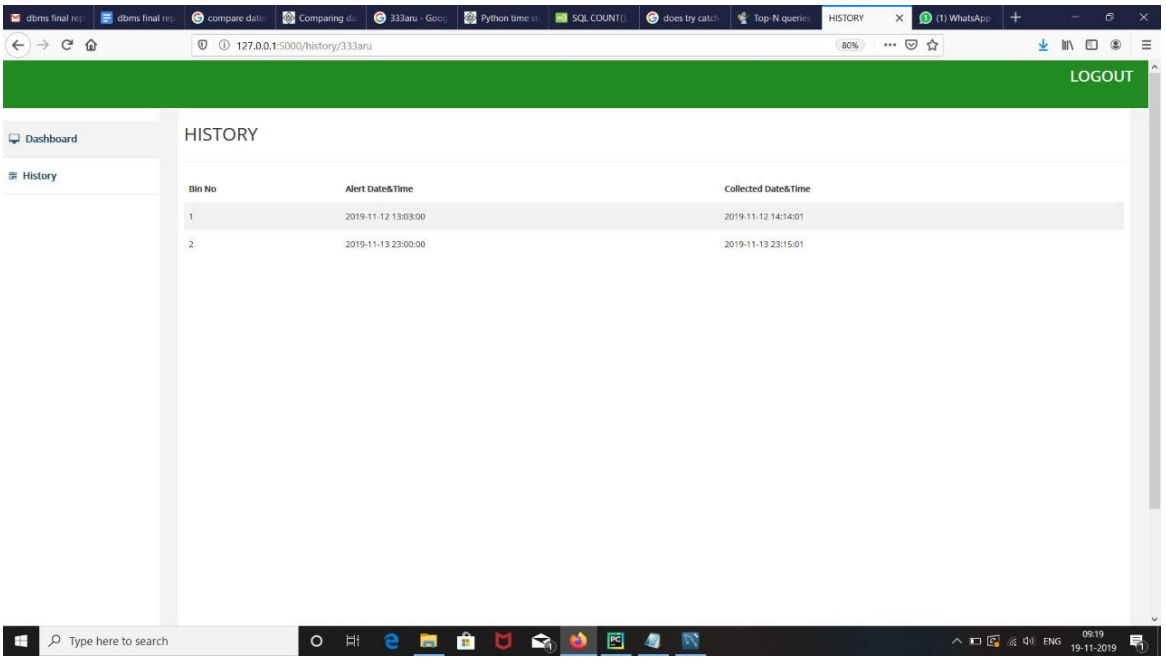
Statistics of the collected waste



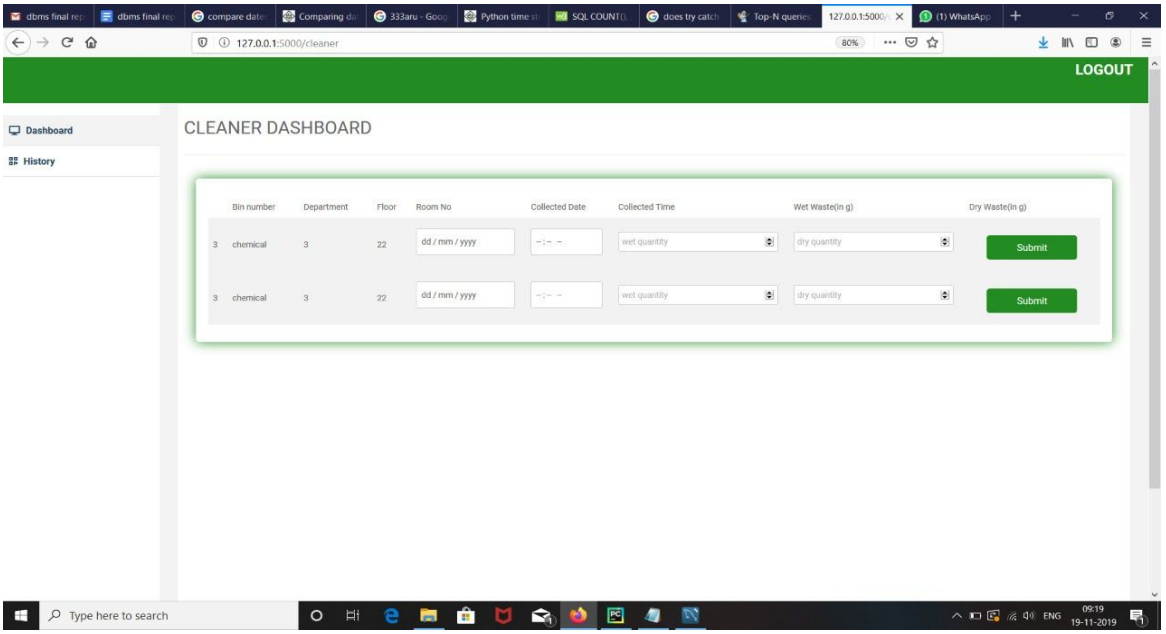
Contact us page of the website



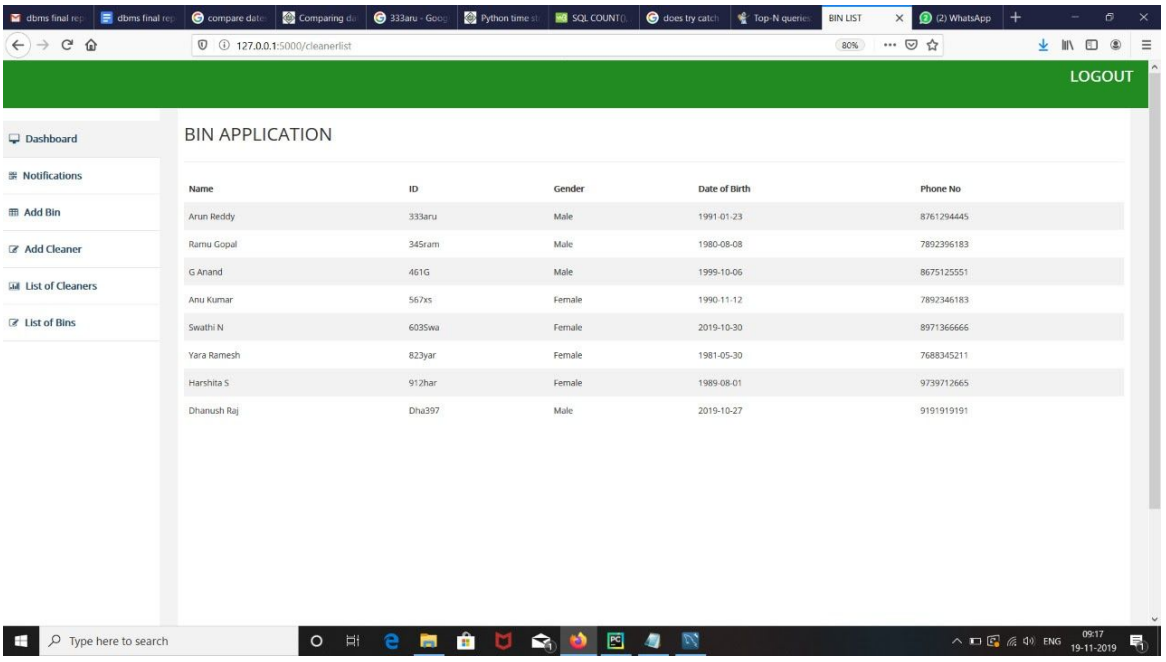
Login page



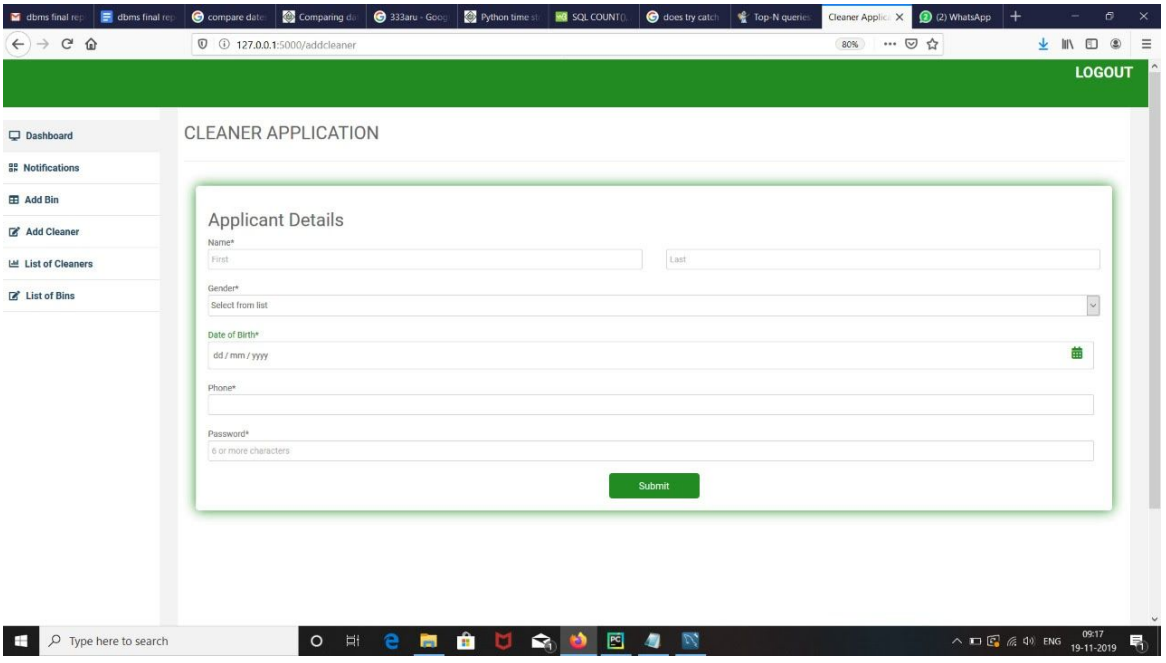
History of cleaned bins by the cleaner



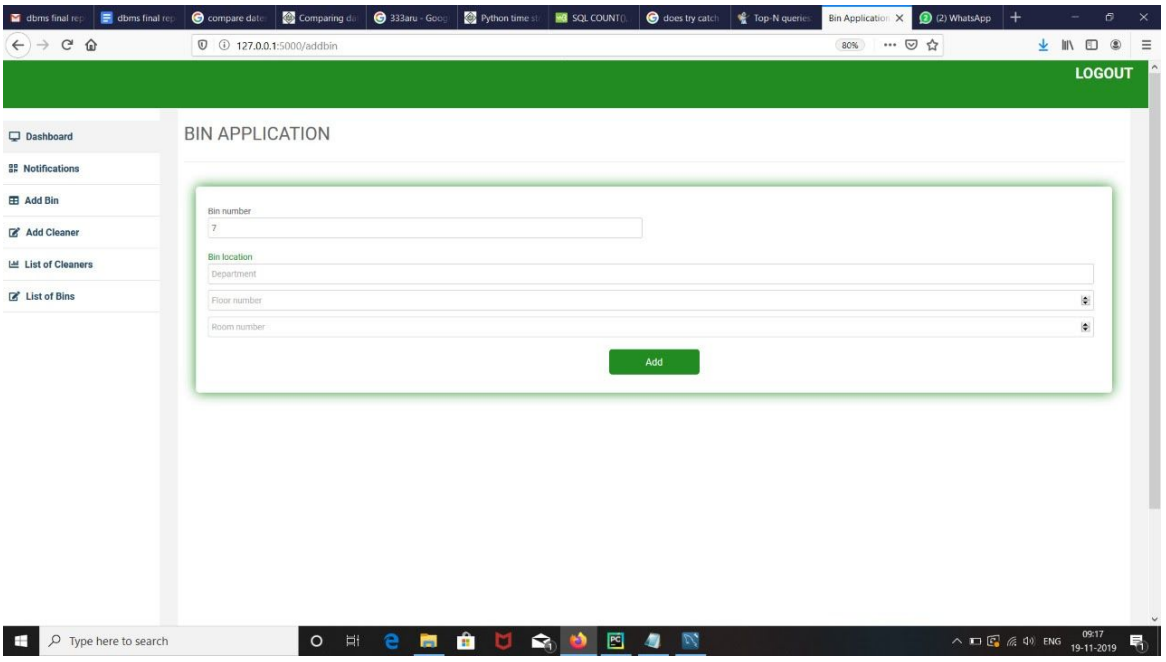
Cleaner Dashboard having the list of bins to be cleaned by him



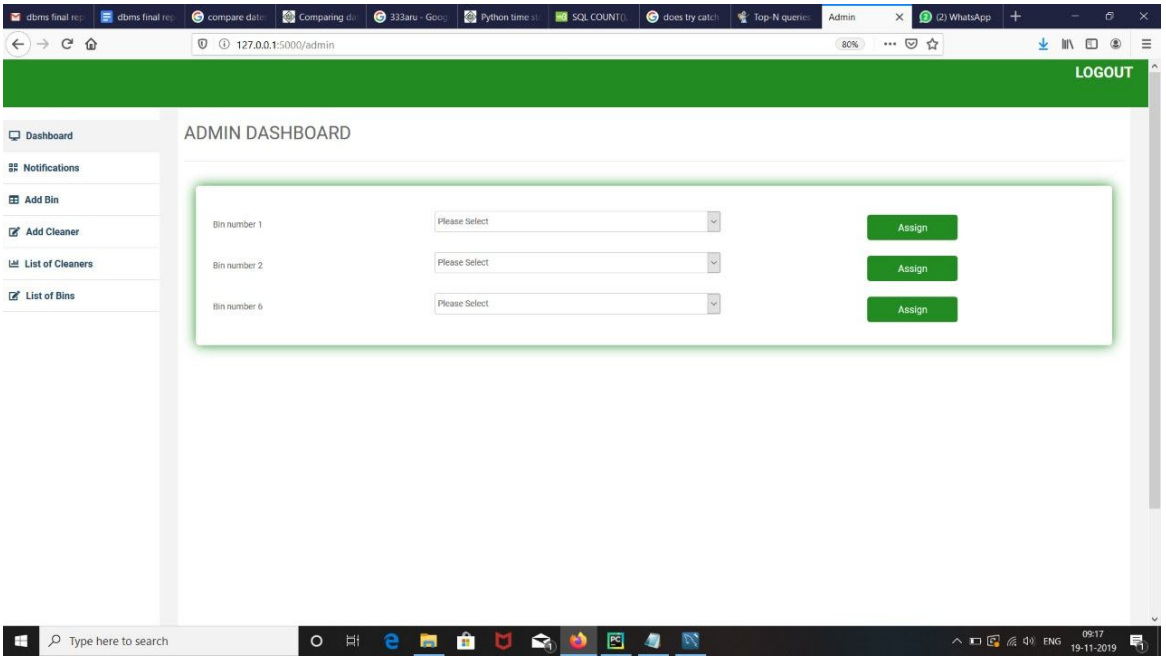
List of cleaners



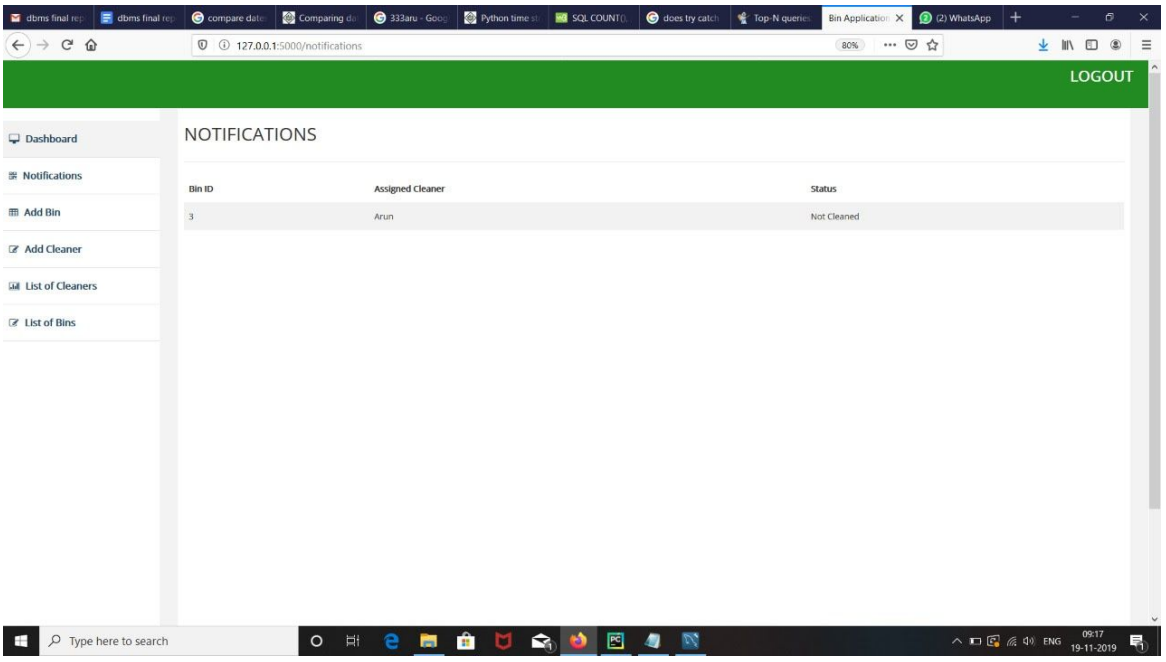
New application form for the cleaner



Application for Bin



Admin dashboard to assign cleaner to bin



Notification menu for the cleaner