

Location Based Garbage Management System with IOT for Smart City

Project ID: 17-100

Software Requirement Specification

R.K.R. Ranaweera

(IT14005718)

Supervised by: Ms.Shashika Lokuliyana

Bachelor of Science Special Honors Degree in Information Technology
(Specialized in Computer System & Networking Engineering)

Department of Information Systems
Sri Lanka Institute of Information Technology
Sri Lanka

May 2017

Location Based Garbage Management System with IOT for Smart City

Project ID: 17-100

Software Requirement Specification

(Proposal documentation submitted in partial fulfilment of the requirement
for the
Degree of Bachelor of Science Special (honors) In Information Technology)

Bachelor of Science Special Honors Degree in Information Technology
(Specialized in Computer System & Networking Engineering)
Department of Information Systems

Sri Lanka Institute of Information Technology
Sri Lanka

May 2017

Declaration

I declare that this is my own work and dissertation does not incorporate without acknowledgment of any material previously submitted for a Degree or Diploma in SLIIT or any other university or institute of higher learning. To the best of my knowledge and belief the document does not contain any material previously published or written by another person except where the acknowledgment is made in the text.

.....
R.K.R. Ranaweera
IT14006326
2nd of May, 2017

Table of Contents

1 Introduction	
1.1 Purpose-----	1
1.2 Scope-----	1
1.3 Definitions, Acronyms, and Abbreviations-----	1
1.4 Overview-----	2
2 Overall Descriptions-----	2
2.1 Product perspective-----	2
2.1.1 System interfaces-----	3
2.1.2 User interfaces-----	3
2.1.3 Hardware interfaces-----	6
2.1.4 Software interfaces-----	6
2.1.5 Communication interfaces-----	6
2.1.6 Memory constraints-----	7
2.1.7 Operations-----	7
2.1.8 Site adaptation requirements-----	7
2.2 Product functions-----	8
2.3 User characteristics-----	11
2.4 Constraints-----	11
2.5 Assumptions and dependencies-----	11
2.6 Apportioning of requirements-----	11
2.6.1 Essential requirements-----	11
2.6.2 Desirable requirements-----	12
3 Specific requirements	
3.1. External interface requirements	
3.1.1. User interfaces-----	12
3.1.2. Hardware interfaces -----	15
3.1.3. Software interfaces-----	16
3.2 Classes/Objects-----	16
3.3 Performance requirements-----	17
3.4 Design constraints-----	17
3.5 Software system attributes	
3.5.1 Reliability-----	17
3.5.2 Availability-----	17
3.5.3 Security-----	17
3.5.4 Maintainability-----	17
3.6 Other requirements-----	17
4 Supporting information-----	17

List of Figures

Figure 2.1.2.1 Login/Register-----	3
Figure 2.1.2.2 My Profile-----	4
Figure 2.1.2.3 City Map-----	4
Figure 2.1.2.4 Request Bin-----	5
Figure 2.1.2.5 Bin Management-----	5
Figure 2.1.2.6 User Feedback-----	6
Figure 2.2.1 Use Case Scenario-----	8
Figure 3.1.1.1 Login/Register-----	12
Figure 3.1.1.2 My Profile-----	13
Figure 3.1.1.3 City Map-----	13
Figure 3.1.1.4 Request Bin-----	14
Figure 3.1.1.5 Bin Management-----	14
Figure 3.1.1.6 User Feedback-----	15
Figure 3.2.1 Class Diagram-----	16

1 Introduction

1.1 Purpose

The purpose of this document is to provide a detailed description of one component of the Location Based Garbage Management System with IOT for Smart City. This will explain the purpose and the features of the system, the interfaces of the system, what the system will do and the constraints under which it must operate. This document is intended for both the end users and the developers of the system.

1.2 Scope

This document covers the requirements for the cloud based area of the system. This area contains four components which would be covered in this document. They are the Web Server, Website, Data analyzing and monitoring. These components do specific tasks for the system and the users. Cloud computing technology is used to create a web server that receives real time sensor data, stores it and uses unique algorithms to analyze and turn this data to different types of useful information, which is fed into the monitoring systems of the website. By using this technology, this project will remove the need for resource heavy systems and provide portability to developers. By incorporating these components administrators, workforce and clients will ultimately have a much efficient working environment.

1.3 Definitions, Acronyms, and Abbreviations

Admin	Administrator
Server	The main computer on a network
SRS	Software Requirement Specification
User	People who use the website
Web	The network of computers that form the internet
HTTP	Hypertext Transfer Protocol is a transaction oriented client/server protocol between a web browser & a Web Server
HTTPS	Secure Hypertext Transfer Protocol is a HTTP over SSL (secure socket layer)
Ubuntu	Linux OS used in server
CLI	Command Line Interface
FTP	File transfer Protocol

1.5 Overview

Following content describes the overview of A Location Based Garbage Management System with IOT for Smart City project and its work flow.

The section one gives the brief description about the overall project mentioning the important points and what is the expected outcome of the project. Reference materials can be found in last section which are mostly referenced to this document.

In Section 2, it gives an idea about the overview of the functionality of project. It describes the informal requirements, hardware, software and Graphical User Interfaces and other dependencies in this section. It will be context to the technical requirement specification which is addressed in the next section.

The section 3 is intended for the developers of the project and the functionalities, interfaces are further described in technical terms. Non-functional requirements are also described in the later part of section 3.

2 Overall Descriptions

This section gives background information about specific requirements of the web based integrated development environment service to be developed in brief. Although every requirement will not be described in detail, this section will describe the factors that affect the final product.

2.1 Product perspective

There are lots of researches on this topic of garbage management, but as mentioned in our literary survey this project has some unique functions that most of the other researches lack.

A website will be deployed, which the users can use to access the system. The website will be the main user interface where users can access all of the functionalities available in the system. However, this website is only a certain segment of the components mentioned in this document. There will be a webserver where all the core functions of the system will be performed. The main functions that the web server performs includes receiving sensor data, storage, perform calculations based on algorithms, feeding information to monitoring system, etc. The web server also includes some functions that would not be explained in this SRS, since they are parts of other research components which would be explained in the other 3 SRS documents.

The analyzing and monitoring system includes unique algorithms that use data that is stored in the databases to provide different useful information to different areas of the system. All of the information that is output from the algorithms will be displayed in the website, alongside a real time monitoring system for each garbage bin.

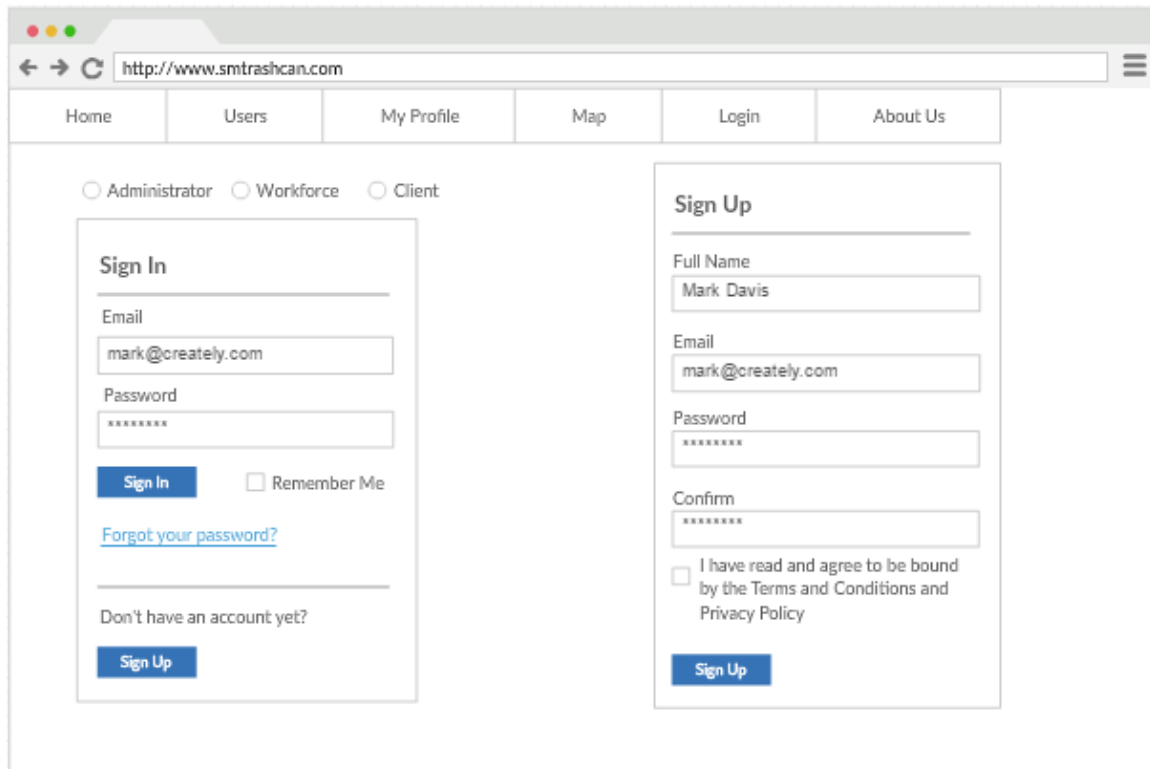
There will be three types of users, Administrators, workforce and clients. Administrators will have full access to every function of the system, which includes monitoring bins, workforce progress, receiving reports, adding new bins, receiving user feedback, etc. Workforce will be able to create profiles, receive bin notifications, receive cleaning routes,

etc. The clients will be able to create profiles, get map routes to bins, give feedback, receive news alerts, request new bins, etc.

2.1.1 System interfaces

The web server is run on Ubuntu Server 16.04. This component interfaces with two different interfaces of two other components. They are the android application for the client and workforce, and the python interface of the raspberry pie zero used in the garbage bin.

2.1.2 User interfaces



The screenshot displays the web application interface for smtrashcan.com. The browser address bar shows the URL http://www.smtrashcan.com. The navigation menu includes links for Home, Users, My Profile, Map, Login, and About Us. Below the navigation menu, there are three radio buttons for user roles: Administrator, Workforce, and Client. The main content area is divided into two sections: Sign In and Sign Up. The Sign In section includes fields for Email (marked with mark@createlly.com) and Password (masked with asterisks), a Sign In button, a Remember Me checkbox, and a link for Forgot your password?. The Sign Up section includes fields for Full Name (marked with Mark Davis), Email (marked with mark@createlly.com), Password (masked with asterisks), and a Confirm field (also masked with asterisks). It also features a checkbox for I have read and agree to be bound by the Terms and Conditions and Privacy Policy, and a Sign Up button.

Figure 2.1.2.1 Login/Register

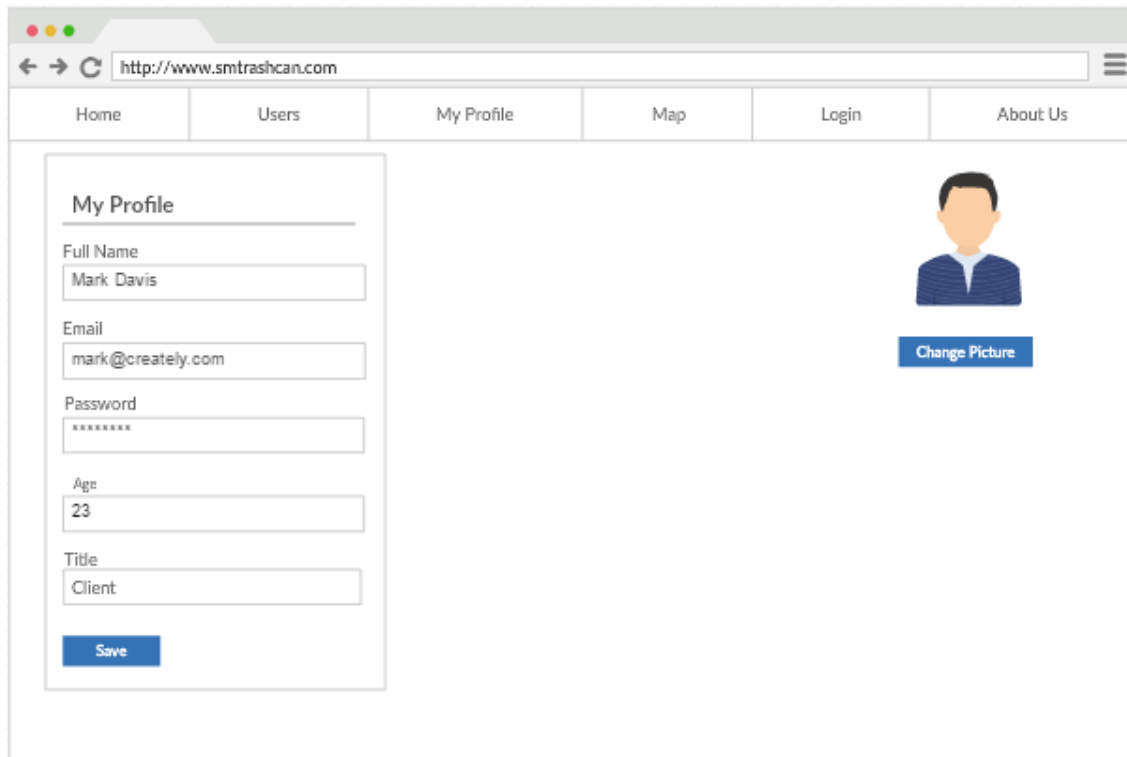


Figure 2.1.2.2 My Profile

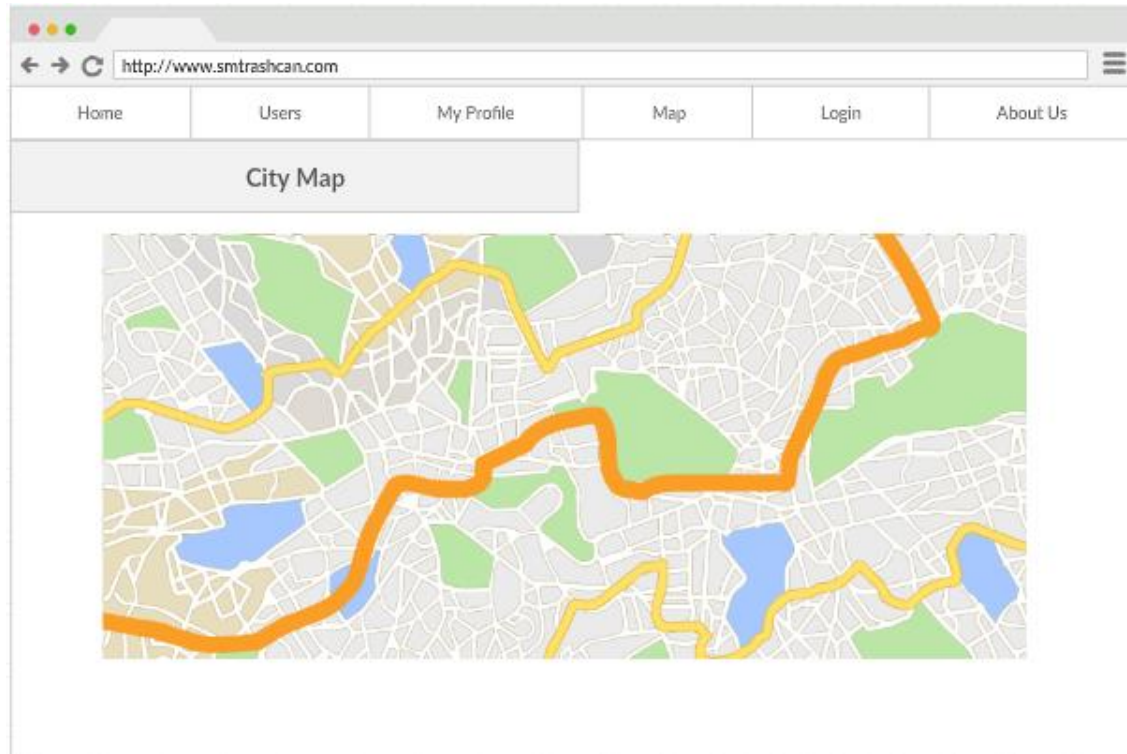


Figure 2.1.2.3 City Map

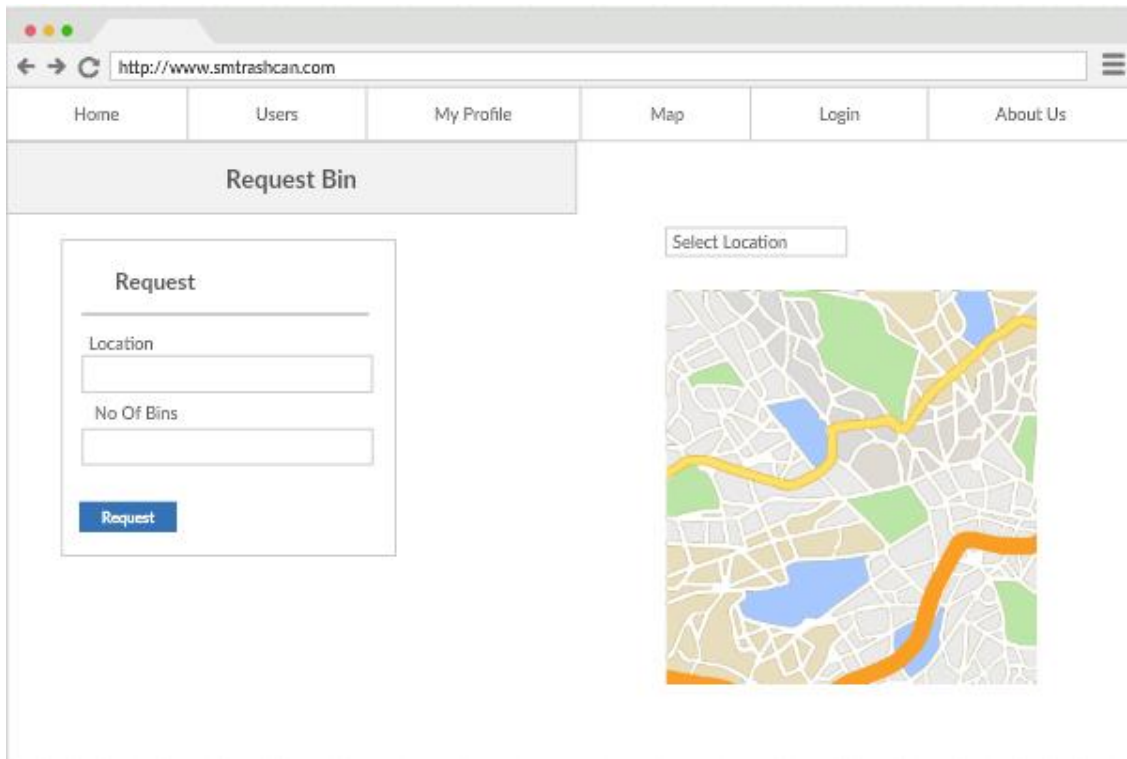


Figure 2.1.2.4 Request Bin

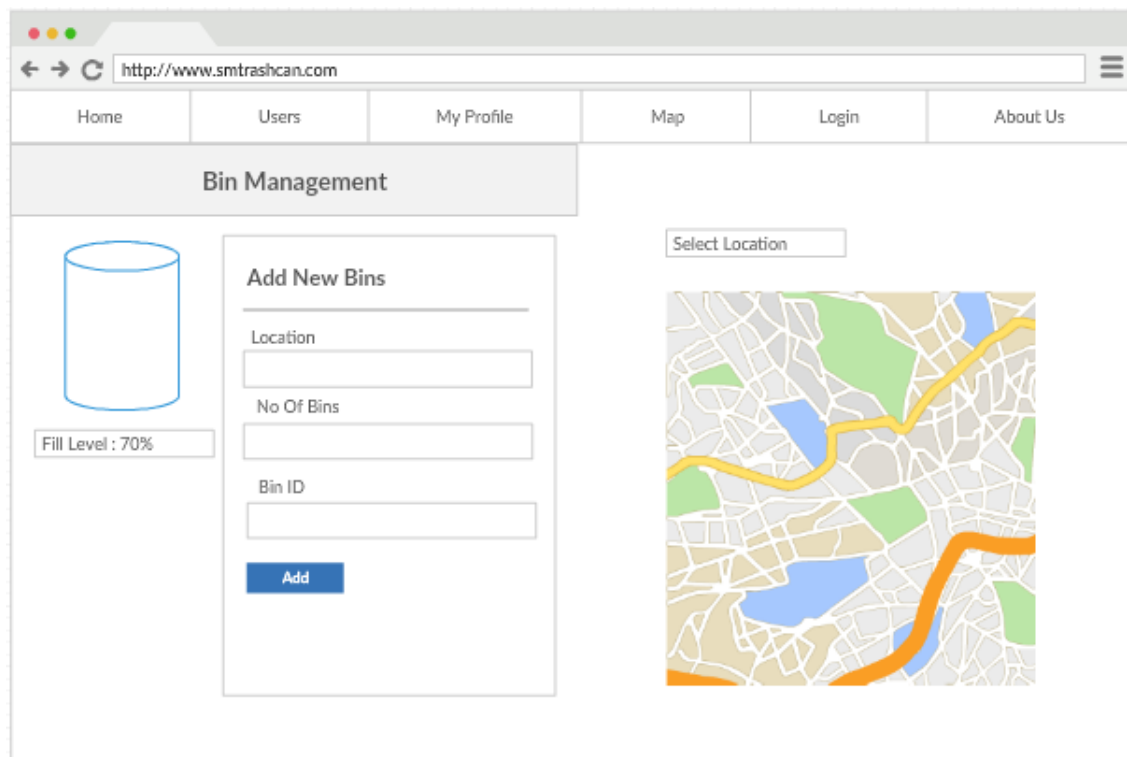


Figure 2.1.2.5 Bin Management

The screenshot shows a web browser window with the address bar displaying <http://www.smtrashcan.com>. The browser's navigation bar includes back, forward, and refresh buttons. Below the address bar is a horizontal menu with links: Home, Users, My Profile, Map, Login, and About Us. The main content area features a 'User Feedback' section. This section contains a form with the following elements:

- A heading 'Feedback'.
- A label 'Subject' above a single-line text input field.
- A label 'Your Feedback' above a multi-line text area.
- A blue 'Submit' button at the bottom of the form.

Figure 2.1.2.6 User Feedback

2.1.3 Hardware interfaces

Since all the processing will be done on the cloud server no hardware interfaces will be included.

2.1.4 Software interfaces

- Putty
- WinSCP
- LAMP Server
- Apache HTTP Server
- Google Chrome

2.1.5 Communication interfaces

The communication interface used is the internet for all the communications from the server.

2.1.6 Memory constraints

The exact memory usage is unknown at this moment, but the cloud server has 1GB of memory.

2.1.7 Operations

The main operation a workforce user or a client has to do to use the website is to register for an account. This can be done through the website for first time visitors or through the android application. The administrators will not be able to create accounts through these means, since they will be provided accounts by the management.

After registering the users can login to the website through the login page and perform the functionalities provided for each of the user groups.

2.1.8 Site adaptation requirements

Since this is cloud based system, users need have registered accounts to use the system. Administrators will be provided accounts by the management. Workforce and clients will have to register via the application or the website.

2.2 Product functions

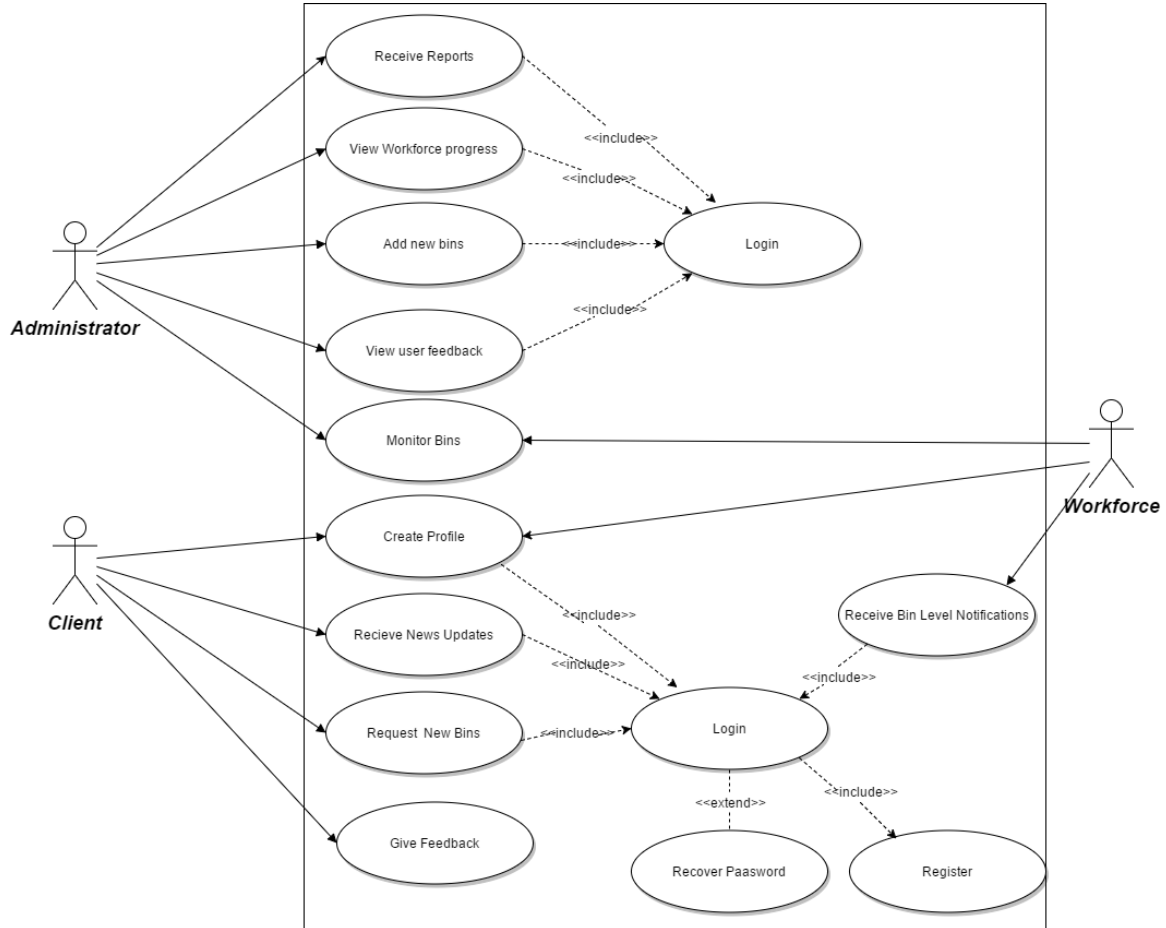


Figure 2.2.1 Use Case Scenario

Use case name	Account Registration
Description	User should be able to register on the website
Pre-condition	User must load up the website
Primary user	Workforce/client
Main flow of events	1. load the website 2. Click register

Use case name	Monitor Bin
Description	User should be able to monitor all available bin levels
Pre-condition	User must be login to system
Primary user	Administrator/Workforce
Main flow of events	1. login to system 2. Click view bin detail map

Use case name	View workforce progress
Description	Admin should be able to view work progress of all the workforce
Pre-condition	Users must be login to system
Primary user	Administrator
Main flow of events	1. login to system 2. Workforce management

Use case name	Receive reports
Description	User should be able to receive different types of progress/review reports
Pre-condition	Users must be login to system
Primary user	Administrator
Main flow of events	1. login to system 2. Click reports button

Use case name	Add new bins
Description	Admin should be able to add new bins to required location of the map
Pre-condition	Users must be login to system
Primary user	Administrator
Main flow of events	1. login to system 2. Click on the monitoring system map to check required locations 3.Add bins from the map

Use case name	View user feedback
Description	User should be able to view all the feedback the clients have given regarding the system
Pre-condition	Users must be login to system
Primary user	Administrator
Main flow of events	1. login to system 2. Click feedback button

Use case name	Create Profile
Description	User should be able to create and edit their own profiles
Pre-condition	Users must be login to system
Primary user	Workforce/client
Main flow of events	1. login to system 2. Click MyProfile

Use case name	Receive bin notifications
Description	User should be able to receive bin level updates when they are at 80% and 100%
Pre-condition	Users must be login to system
Primary user	Workforce
Main flow of events	1. login to system (notifications will appear on whatever window connected)

Use case name	Give Feedback
Description	User should be able to give feedback to the system
Pre-condition	Users must be login to system
Primary user	Client
Main flow of events	1. login to system 2. Click on feedback

Use case name	Receive news alerts
Description	User should be able to receive any updates and news about the system
Pre-condition	Users must be login to system
Primary user	Client
Main flow of events	1. login to system 2. Click on updates and news

Use case name	Request new bins
Description	User should be able to request new bins on specific locations
Pre-condition	Users must be login to system
Primary user	client
Main flow of events	1. login to system 2. Click on request bins

2.3 User characteristics

All types of users should have basic computer usability. Administrators should have a bit more knowledge of the system and its functions to get the full usage of the system.

2.4 Constraints

- Limited to HTTP/HTTPS
- No multilingual support.
- Whole system depends on the reliability of up time and backup capabilities of the cloud server provider.

2.5 Assumptions and dependencies

- The user must have a connection to the internet
- The user must have the ability to use the internet
- For the client side route calculation, all users should have GPS capabilities

2.6 Apportioning of requirements

This section describes the order of the fulfillment of the requirements of the system.

2.6.1 Essential requirements

1. Using GPS mobile can detect its exact location.
2. Bins must send fill level data at all times.
3. Server provider should have 100% uptime.

2.6.2 Desirable requirements

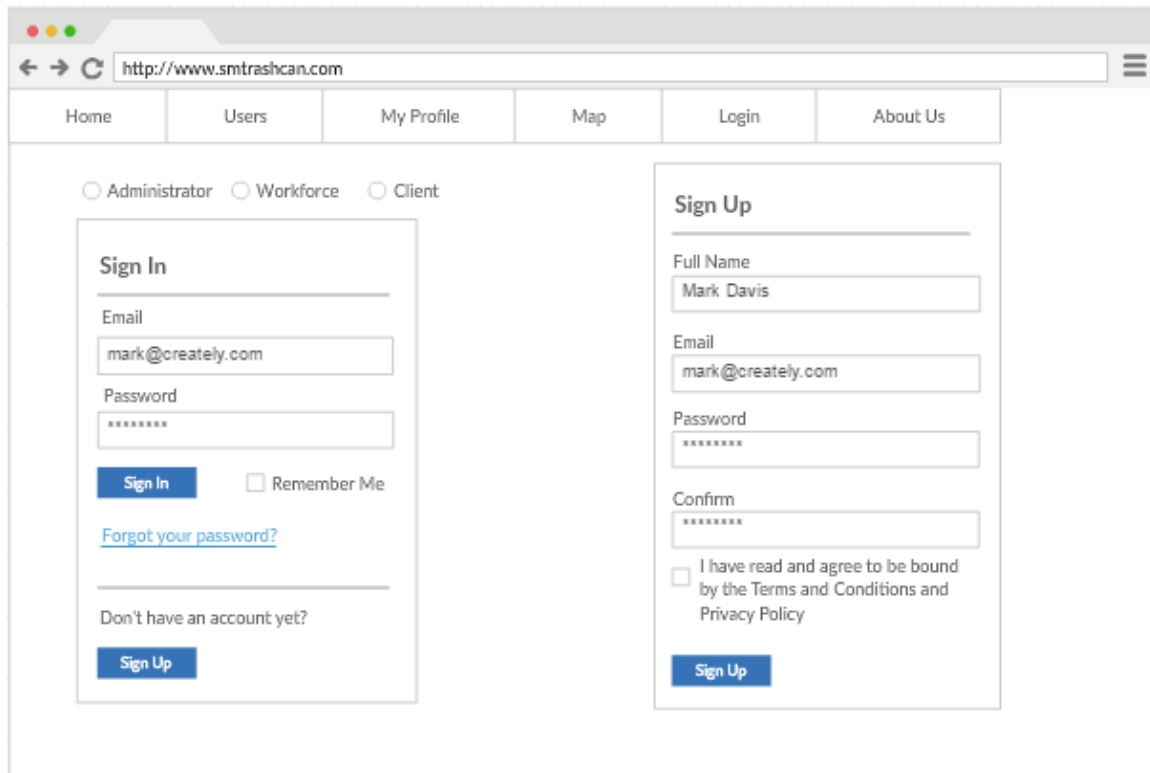
These requirements are not forced to develop but hope to develop in future releases. Push notification to unregistered users.

1. Provide tutorial and lectures about how this system will work.
2. Get feedback about our system

3 Specific requirements

3.1 External interface requirements

3.1.1 User interfaces



The screenshot shows a web browser window with the URL <http://www.smtrashcan.com>. The navigation bar includes links for Home, Users, My Profile, Map, Login, and About Us. Below the navigation bar, there are three radio buttons for user selection: Administrator, Workforce, and Client. The main content area is divided into two columns. The left column contains a 'Sign In' form with fields for Email (pre-filled with 'mark@createlly.com') and Password (masked with '*****'). It includes a 'Sign In' button, a 'Remember Me' checkbox, a 'Forgot your password?' link, and a 'Sign Up' button for users who don't have an account yet. The right column contains a 'Sign Up' form with fields for Full Name (pre-filled with 'Mark Davis'), Email (pre-filled with 'mark@createlly.com'), Password (masked with '*****'), and a Confirm field (masked with '*****'). It also includes a checkbox for 'I have read and agree to be bound by the Terms and Conditions and Privacy Policy' and a 'Sign Up' button.

Figure 3.1.1.1 Login/Register

This screen is used to login or register to the system. When doing this, the user has to select which type of user is logging in or registering. When logging in email and password has to be provided. When registering Full name, email and password has to be provided.

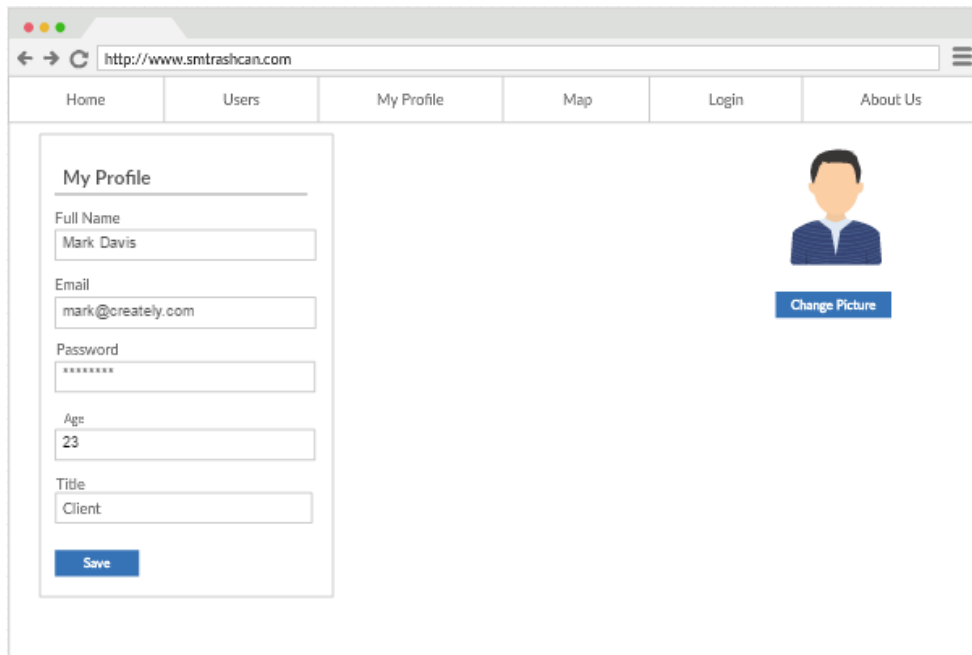


Figure 3.1.1.2 My Profile

This interface is used to edit the profile of the user. In this name, email, password or age can be edited.

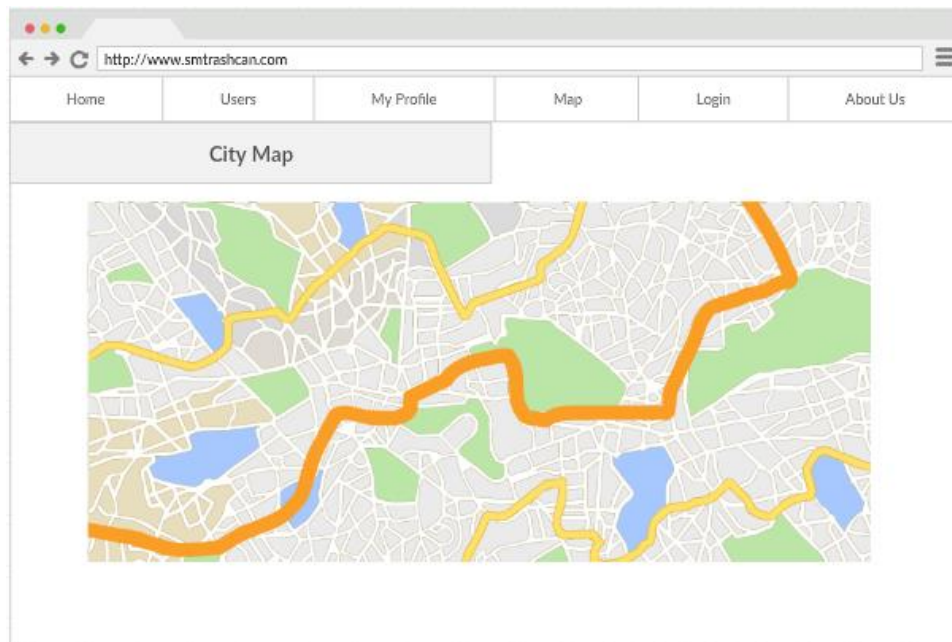


Figure 3.1.1.3 City Map

This interface is used to display the monitoring system of the bins, the routes generated by the algorithms, etc. This can be viewed by the admin or the workforce types of users.

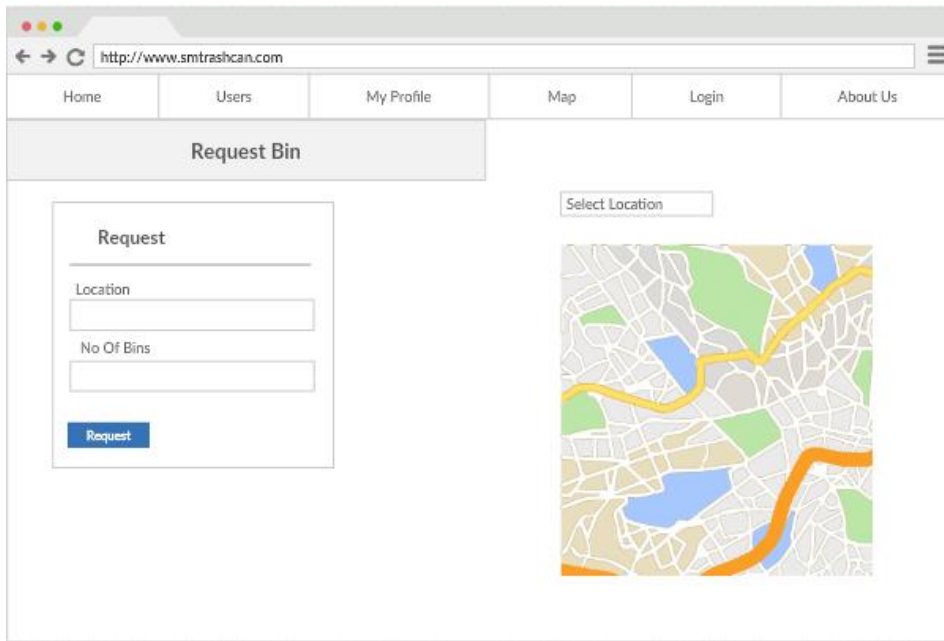


Figure 3.1.1.4 Request Bin

This interface can be client type users to request bins on specific locations. The location can be selected or typed and the no of bins can be typed in.

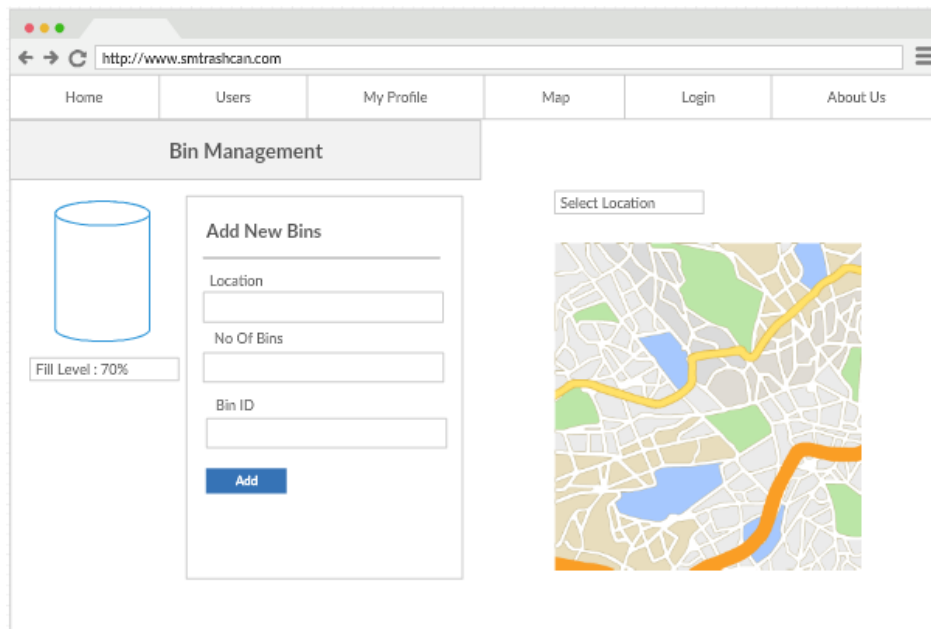


Figure 3.1.1.5 Bin Management

This interface is used to add new bins. This can be used by the admin type of users. A location can be selected or typed and the number of bins and new id numbers can be given to add new bins.

The screenshot shows a web browser window with the address bar displaying <http://www.smtrashcan.com>. The navigation menu includes links for Home, Users, My Profile, Map, Login, and About Us. A prominent 'User Feedback' header is visible. Below it, a form titled 'Feedback' contains a 'Subject' label followed by a text input field, a 'Your Feedback' label followed by a larger text area, and a blue 'Submit' button at the bottom.

Figure 3.1.1.6 User Feedback

This interface is used by clients or guests to give feedback about the system. These feedbacks can be viewed by admins.

3.1.2 Hardware interfaces

Server specifications [1]:

- OS - Ubuntu Server 16.04 LTS
- RAM - 1 GB
- Storage - 30GB SSD
- Network Bandwidth – 15GB
- CPU - 1 vCPUs, 2.5 GHz, Intel Xeon Family
- Server location – Singapore
- Service Provider - AmazonAWS

3.1.3 Software interfaces

- Putty: Used to connect to the CLI of the cloud server
- WinSCP: Used as an FTP client to upload/download files from the server
- MYSQL Server: Database used on the cloud to store data
- Apache HTTP Server: Enables server hosting
- Google Chrome: The web browser used to test the web site.

3.1.4 Communication interfaces

The communication interface used is the internet for all the communications from the server.

3.2 Classes/Objects

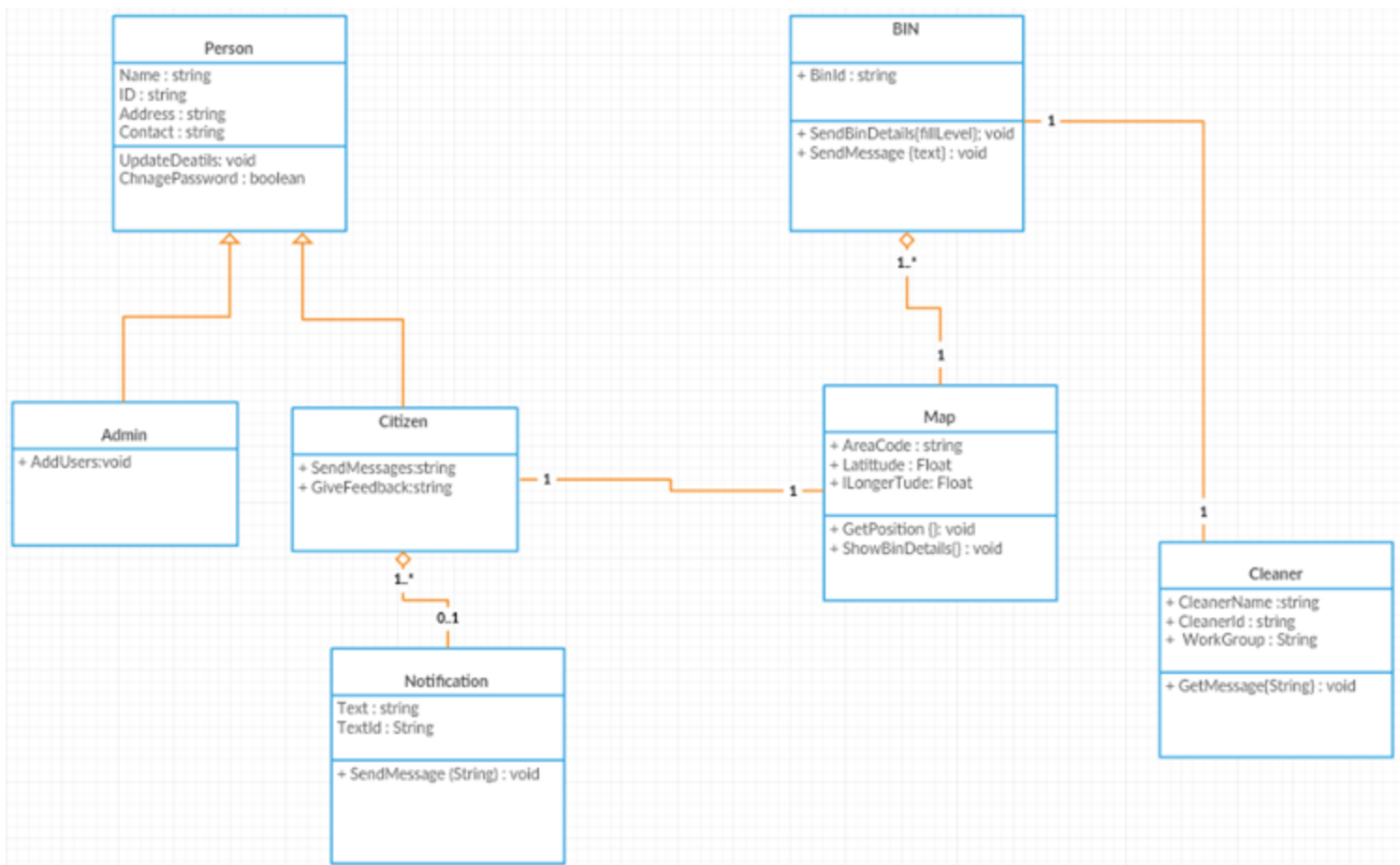


Figure 3.2.1 Class Diagram

3.3 Performance requirements

The website shall not have a load time of no more than 10s.

3.4 Design constraints

The website will adjust and display properly on any size of display.

3.5 Software system attributes

3.5.1 Reliability

Since a 100% uptime is expected from the server providers, the system should be very reliable. In case of maintenance, the clients are notified.

3.5.2 Availability

Since the server is run on a cloud based system, the system should have high availability at all times.

3.5.3 Security

Location Based Garbage Management System with IOT for Smart City will not require any sensitive data of the users, but general security should be maintained in the system such as authentication at login and registration.

3.5.4 Maintainability

Updates must be available for the user time to time. There are no maintainability requirements from the user's side but management will handle the necessary updates when required.

3.6 Other requirements

A database should be maintained by the system in order to store the knowledge base which will be used for garbage management. This database may not have a predefined structure of tables, because complex events will be the data which will be stored.

4 Supporting information

References

[1] Server specifications [online] Available:
<https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/Instances.html>