CITY GUIDE

(TRAFFIC MONITORING MADE EASY !!!)

CMPE 281 - Cloud Technologies
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1. Introduction

1.1 Project Introduction:

To develop and implement Mobile Sensor Cloud Infrastructures (IAAS). The project provides various capabilities to the users from providing the Sensor clusters for use and making it as a one system irrespective of physical deployment, Load balance and Scalable options. The project works with an on-demand sensor allocation algorithm which provides the user the capability to meet their demands dynamically. It also thrives in metering and billing the resources used by the users.

Our project thrives to solve the traffic monitoring easier which in turn reduces the number of accidents.

1.2 Objectives

This project is designed to develop, implement, and validate a mobile sensor cloud infrastructure to support and manage mobile sensor resources and infrastructure set-up with the following capabilities:

(1) Set-up, control, and management of mobile sensor cloud infrastructures as a service

• Automatic and on-demand sensor network provision and management

• Or automatic and on-demand mobile sensor network provision and management

(2) Virtualization of sensor networks (or mobile sensor networks) making it as sensor clusters.

(3) Monitoring and metering for mobile sensor cloud resources

(4) Dashboard for different types of users and their interactions

(5) Load balance and scalability management

(6) Billing components for sensing services and data services

1.3 Expected Outcomes

A Dashboard for user and admin within which the user will be able to register them in the Traffic Monitoring system, request a cluster of sensors, fetch traffic data and view analysis and charts along with the payment details. A admin will be able to manage clients, manage sensor clusters, infrastructure, client's services and virtual sensors.

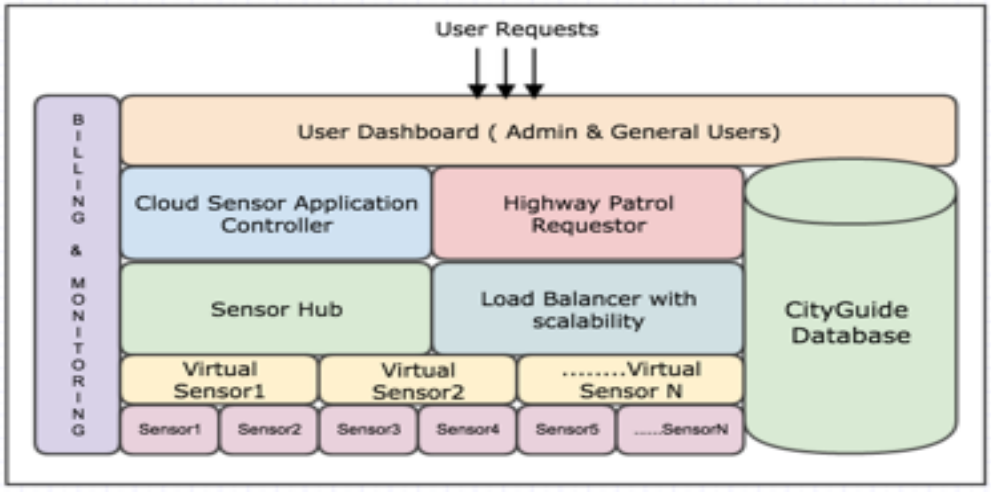

Fig 1.2 System Architechture

2. System Infrastructure and Architecture

2.1 System Architecture

The system consists of Sensor clusters and virtual sensors which are connected to the hubs and are controlled by the admins. Load Balancer will act as a proxy and uses round robin method in order to redirect the request to various servers. Database about the users and various sensors and hubs are storied in the Amazon RDS. Billing and Monitoring modules are used to generate income for the service providers. On top of everything there is a dashboard for both the users and admins in order to control the sensors, hubs and view payment details along with the charts and visualization of the sensors in map.

2.2 Database Design

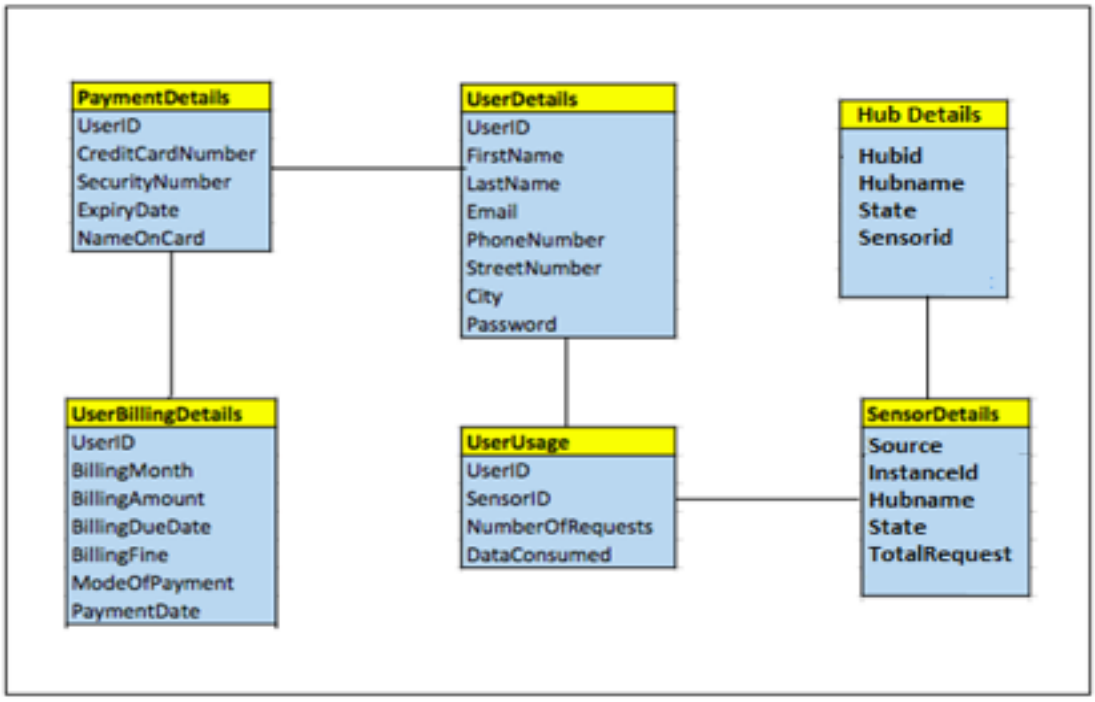

Fig 2.1 Database Design

The database design of the system consists of different tables which comprises details about users, sensors, hubs, billing and various details related to the project.

2.3 Deployment Diagram:

Deployment diagram of the project gives us a fair idea of how the system will be deployed and the communication channel between various installed components.

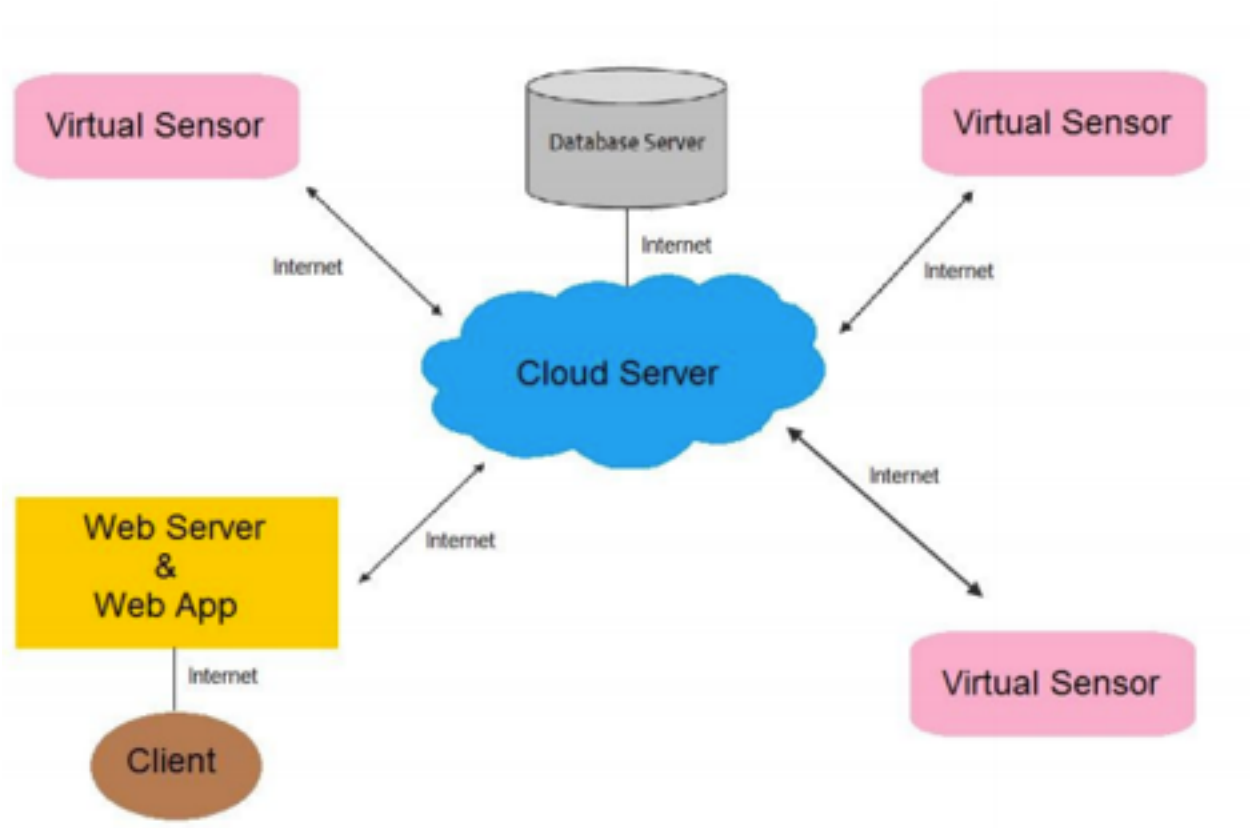

Fig: Deployment Diagram

2.4 User Flow:

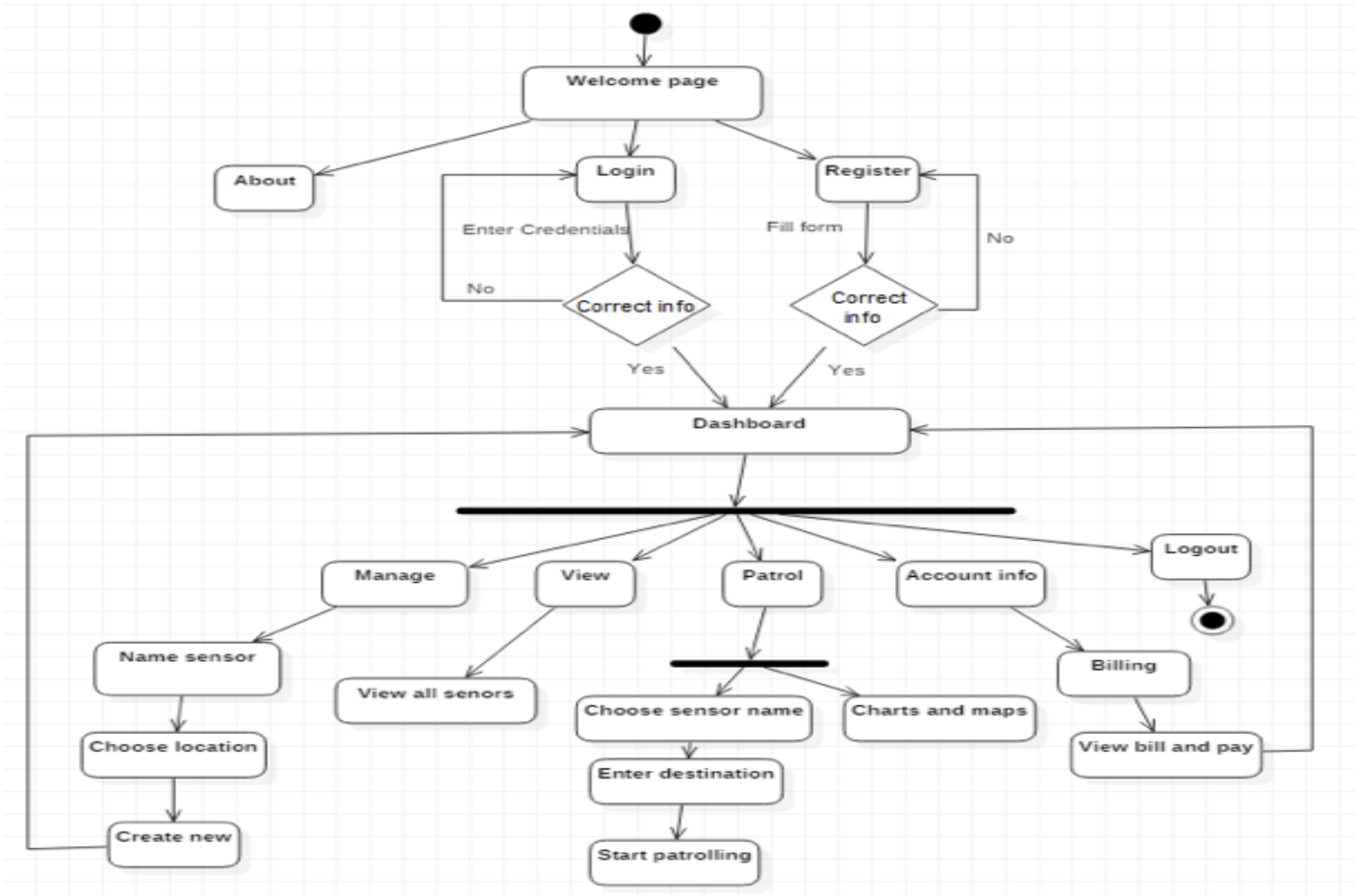

Fig 2.3 User Flow

The user flow suggests every way or operation a user can make inside the system. It also depicts the flow of the operations and the expected outcomes.

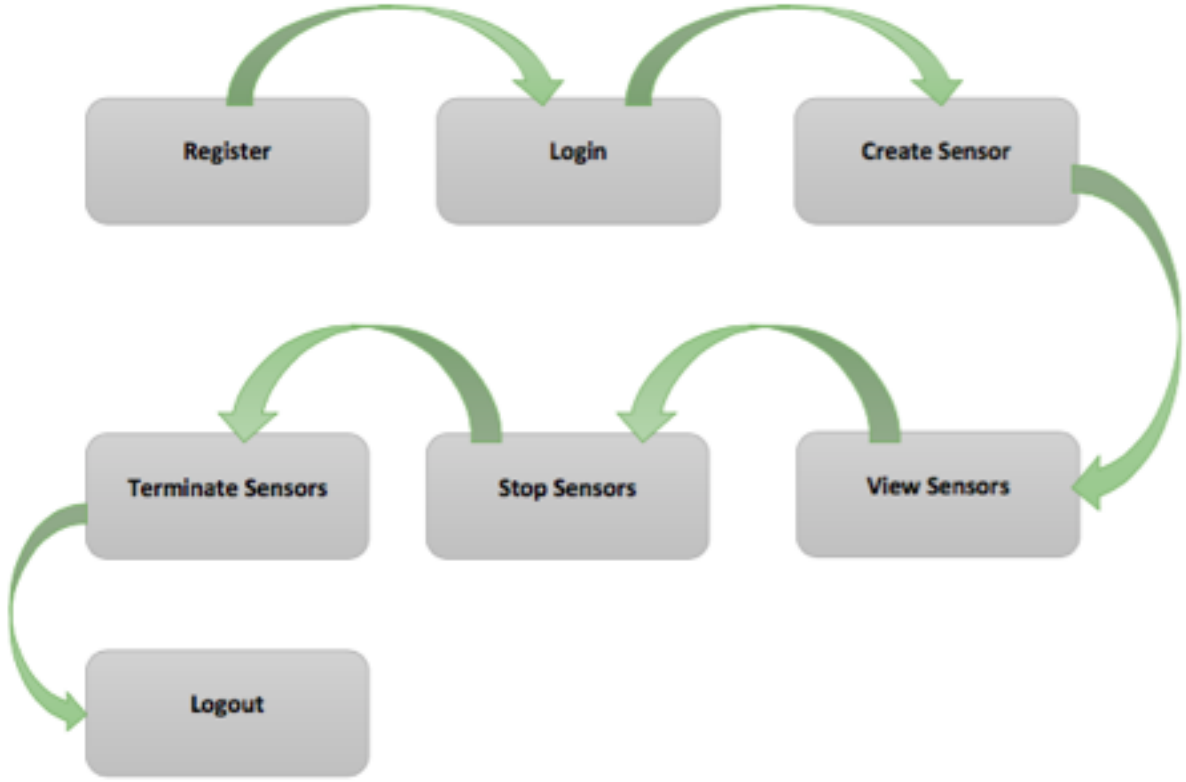

Fig 2.4 Workflow

3. Functional Component and Interaction Design

The various components present in the system are as follows with the design and details about them.

3.1 Sensor Cloud Management

Base controller which controls entire operation of system. It includes various operations such as :

1) Virtual Sensor allocation / Deallocation.
2) Monitoring Virtual Sensors / Hubs.
3) Creating new Virtual sensors on-demand.
4) Facilitate Billing part for the allocated virtual Sensors.

5) Provide various analysis related to the allocated virtual sensors.

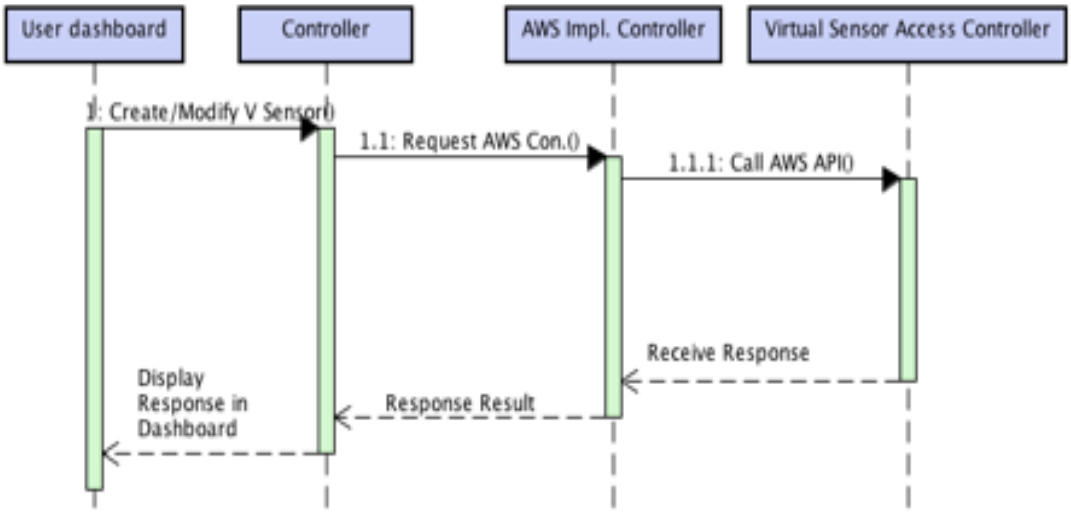

Fig 3.1 Sequence Diagram

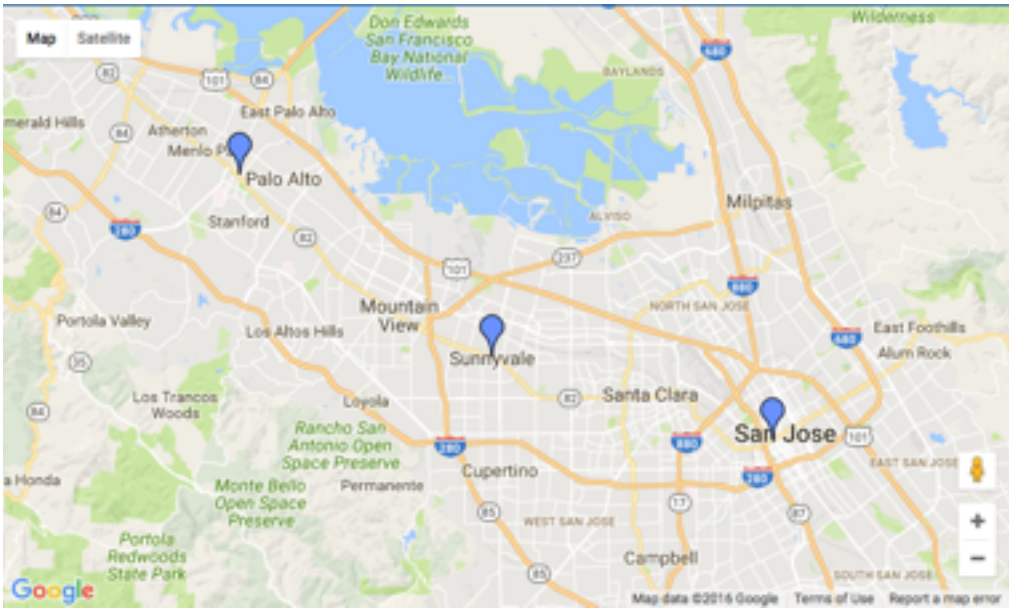

Fig 3.2 On-Demand Allocated Sensors.

3.2 DashBoard:

Dashboard allows the user and admin to carry out various operations in the system. It serves as a end point for the sensor control Management. Its user friendly and elegant and consists of various charts and maps which depicts whats going on inside the system.

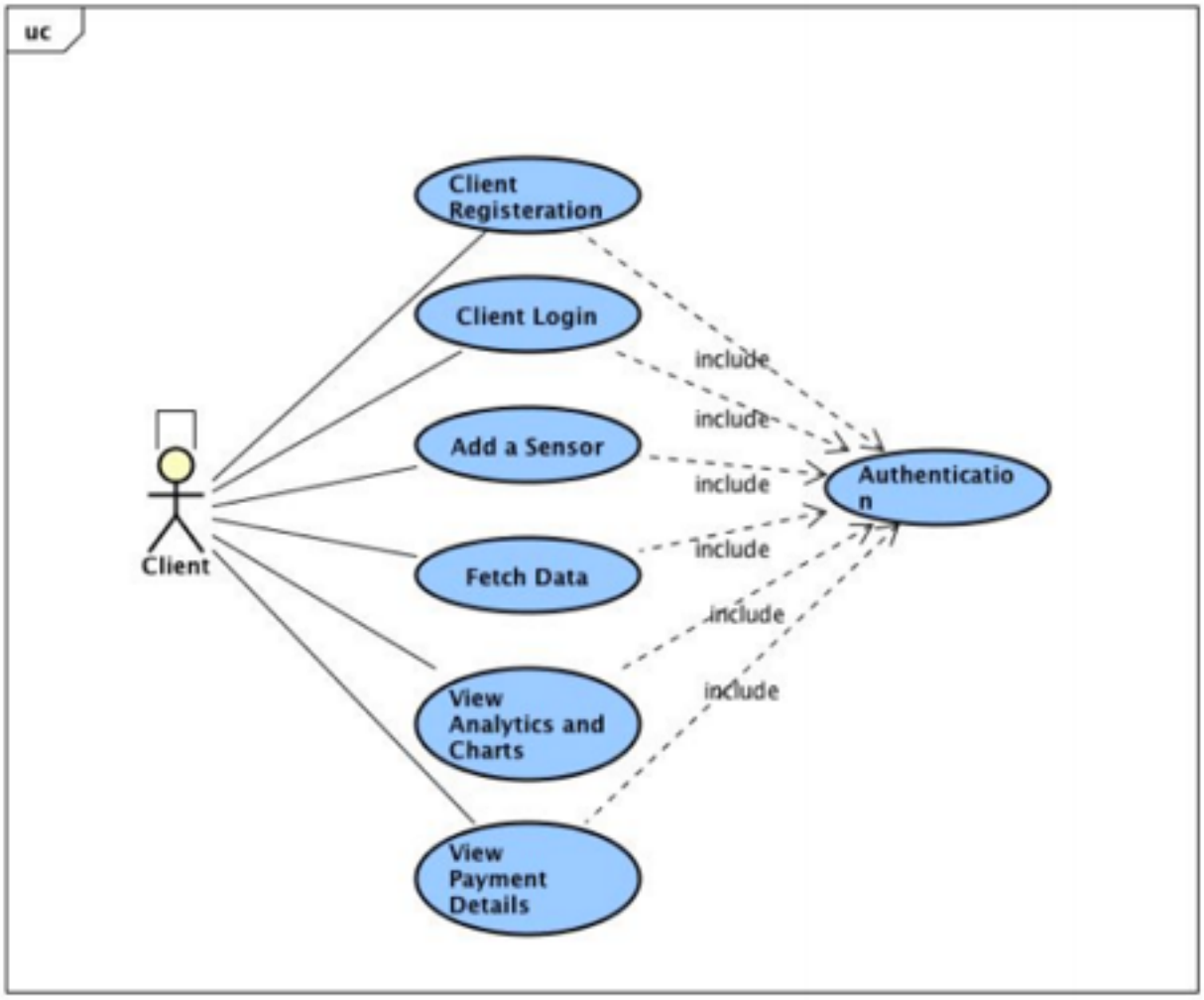

Fig 3.3 Use Case for User

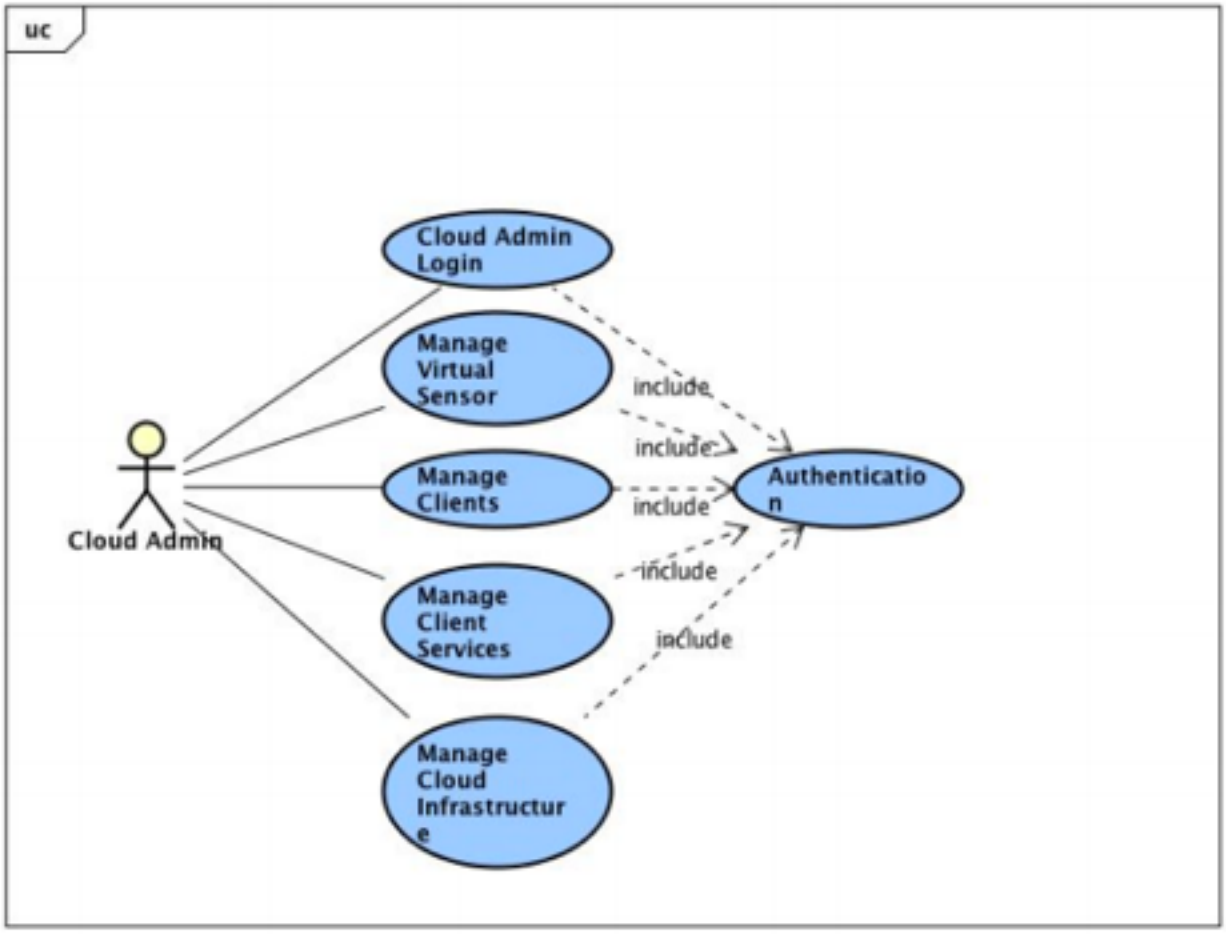

Fig 3.4 Admin Use Case

3.3 Moniotring and Billing Module :

Virtual sensors once allocated on-demand can be tracked by the user. As well as a admin can track down or monitor the mobile sensor allocated through out the system irrespective of user. A user can generate billing of his data services and sensors usage based on the consumption cost model. i.e, price as per usage (PAY AS YOU GO). The admin can generate the billing for all the users and mail them the report. Besides, the admin can allocate/deallocate various hubs to facilitate sensor clusters on new geographic locations on demand.

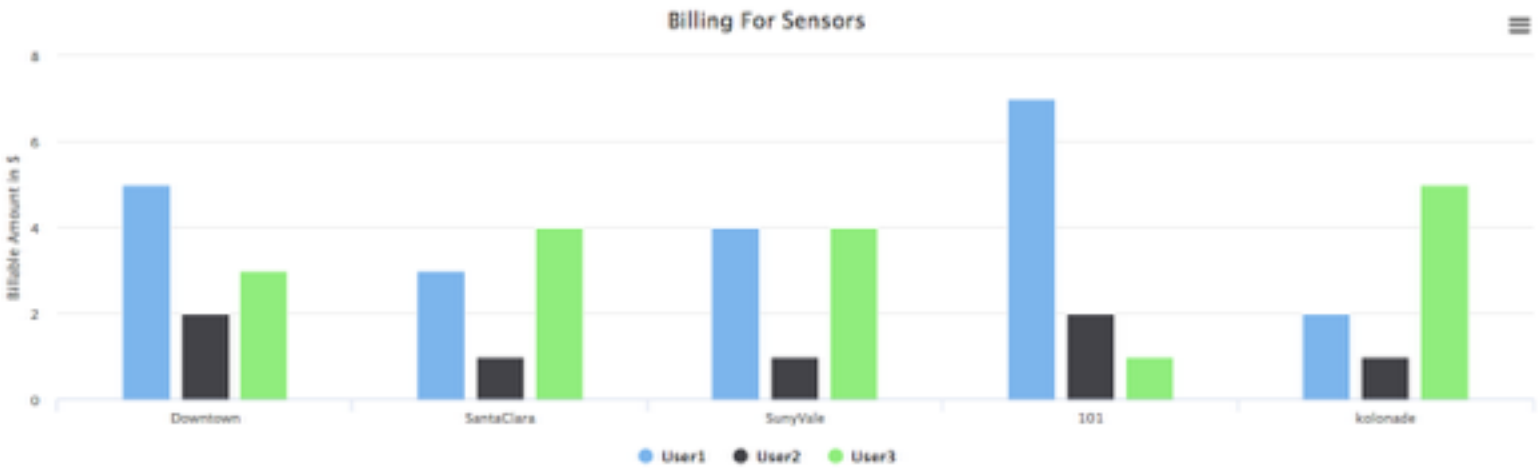

Fig : 3.5 Billing Chart

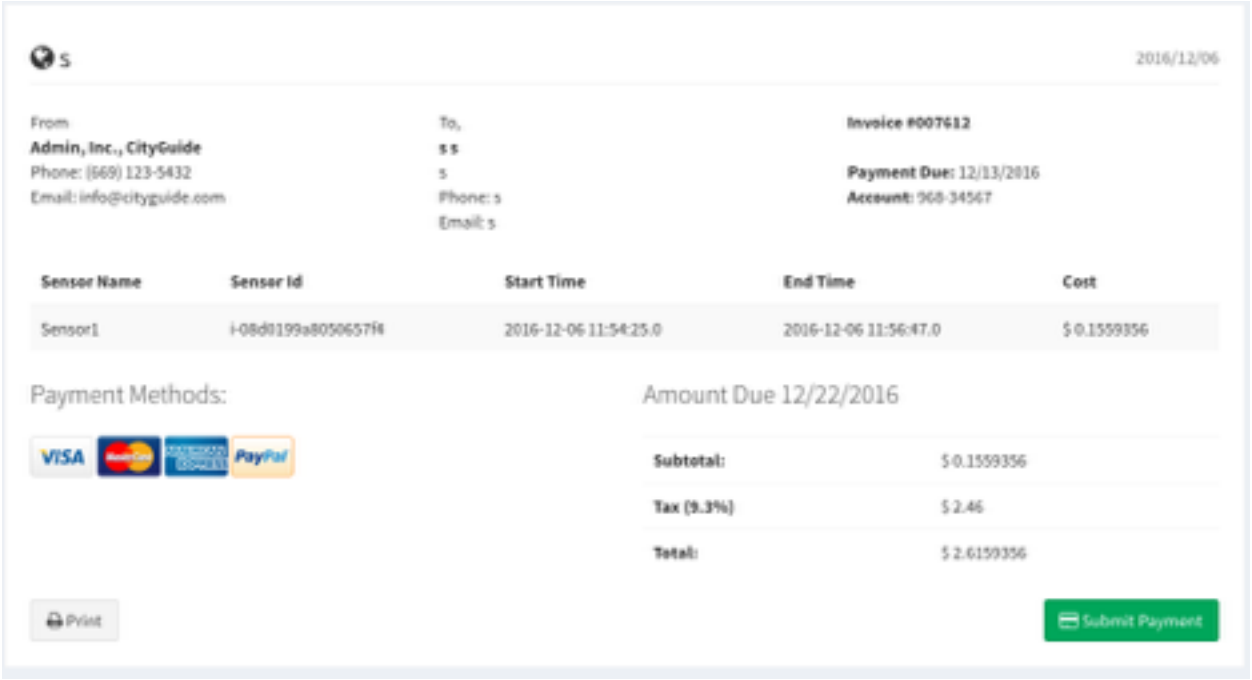

Fig 3.6 Billing Report

3.4 Load Balancing and Scalability :

Load Balancing component is used to distribute user requests or network load efficiently across multiple servers. It is achieved by having multiple servers that can work parallel. Thus it provides high availability and reliability by sending requests only to servers that are up. It also provides the flexibility to allocate and deallocate servers as per demand.

LOAD BALANCER

Various algorithms such as Round robin and Least Network Connections are used for load balancing. On Demand requests if exceed the systems are made scalable in order to handle the requests.

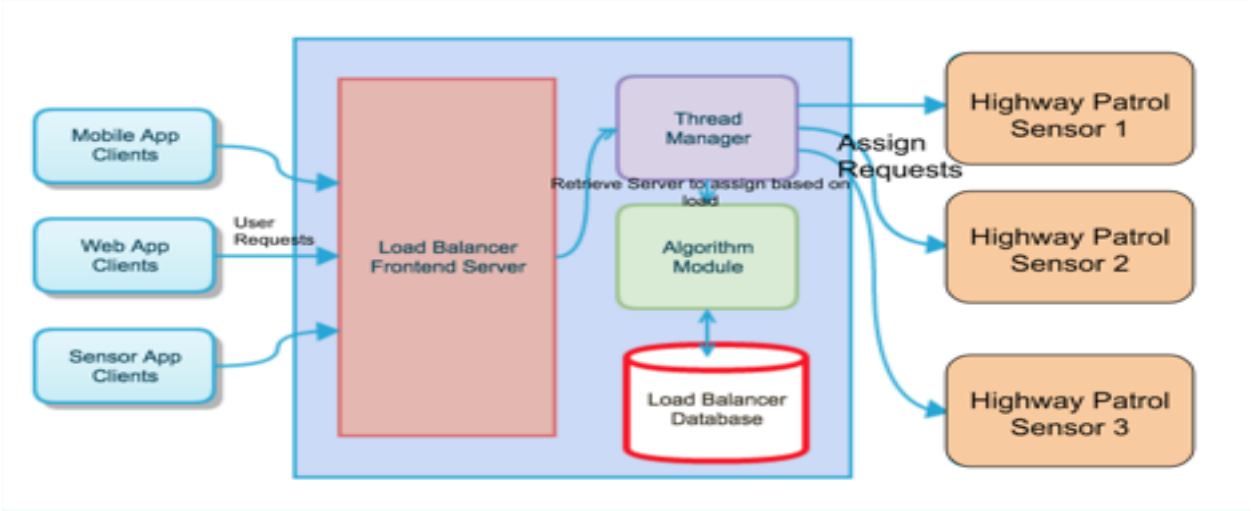

Fig 3.7 Load Balancer

Scalability has been achieved through the following tools

1) HaProxy.
2) Linux Virtual servers.
3) Nginx.

```
public RoundRobinNextServer() {
  if (currentServer >= maxServers) {
    currentServer = 0;
  }
  chosenServer = currentServer;
  currentServer++;
  return chosenServer;
}
```

4. Cloud Technology Selection and Validation Environment

- **Amazon EC2**

Amazon Elastic Cloud Compute (Amazon EC2) is a service which provides on-demand computing-infrastructure and resources on cloud. It is designed to make web-scale Cloud Computing easier for developers. In this project we are making use of Amazon EC2 for hosting the virtual sensors and providing an infrastructure for our clients. Our project requires scalability and Amazon EC2 provides us with an efficient and very scalable development environment. The virtual sensors as well as the main controller module in our project are EC2 instances. We make the use of scalable computing power provided by Amazon to configure and deploy sensors, satisfying our business needs.

- **Amazon RDS**

Amazon Relational database Service (Amazon RDS) provides easy to set up and operate database on cloud. We are making use of this to store the data sent by our virtual sensors and query the data as and when required by the user. It provides a scalable database which perfectly suits our requirements. We have used MySQL server as our database engine for storing our sensor data.

- **J2EE**

We have used Java EE as our programming language for implementing all the business logic of our project.

- **HTML,CSS,BOOTSTRAP and HighChart**

We have designed our front end using HTML, CSS, JAVASCRIPT and JQUERY. Used High chart for displaying charts.

4.2. Validation and Monitoring Environment

Validating sensor cloud environment is critical component as sensor networks in health service are critical. Sensor cloud can misbehave in number of situations such as high request load, security attack and code bugs. There must be an isolated validation and monitoring environment to ensure the health of sensor clouds. Following diagram shows a sophisticated monitoring and validation architecture that can be employed in sensor networks.

Important components in the design:

- Sensor Cloud periodic monitoring module - Sensor clouds require periodic monitoring where they check sensor cloud request load and make sure their quality of service is meeting SLA (service level agreement). Monitoring module collects the 99% latency, critical path latency, throughput and makes sure they are within limits.

- Sensor cloud health module - Sensor clouds health module collects periodic metrics that are not mission critical, but affect the service slowly. For example, it collects the sample request and responses to make sure

they are as expected. Since this verification is sophisticated, advanced machine learning algorithms are used to ensure proper functionality.

● Sensor cloud security module - Sensor clouds can be attacked and that disrupts service. Sensor cloud security module collects traces of service requests to validate them for authentication, stop DOS attacks and ensures data integrity.

5. Conclusion and Future Improvements

A Virtualized, dynamic, scalable, Pay as you Go with easy interface is the theme of the project. It makes the Traffic monitoring easy and useful in avoiding traffic and traffic accidents.
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For future improvements, its mobile app version has been planned to deployed. The sensors currently placed on VTAs can be installed in other mode of transports such as trash cars and smart cars.