

CMPE 281-01 Cloud Technologies

Project System Design Document

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**SAN JOSÉ STATE
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Submitted to:

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1. Introduction

The objective behind developing this application is to develop, implement and validate a mobile sensor cloud platform for managing and providing on demand sensor cloud service. Features of the application other than sensor controller management and provisioning are dashboard user interface, scalability management - load balancing and Sensor Monitoring.

1.1 Project Introduction

As connectivity, storage, and compute become more pervasive, The Internet of things (IoT) is becoming one of the most relevant trends in the history of the software engineering industry. In this IOT era sensors are deployed in various products and places in large number for gathering real time data. After gathering data, it is analyzed to provide insights to the clients. Research predicts that the worldwide Internet of Things market will grow to \$1.7 trillion in 2020 with a compound annual growth rate (CAGR) of 16.9%, connecting 50 billion devices. The need is felt by industries to manage these devices and making maximum use of huge amount of data generated.

The project gathers data from different sources like sensors and sensor-networks to provide access to real-time and historic data with easy user interface. It will also provide facilities like profile management, role management, monitoring and billing.

Main functionalities that the application would consist are: -

- 1. Provision and Management of Virtual Sensor**

This functionality will allow user to create, manage and delete different virtual mobile sensors.

- 2. Provision and Management of Sensor Controller**

This functionality will allow user to manage various type of sensor controllers.

- 3. Provision and Management of Scalability and Load Balancing**

This functionality will enable a feature of load balancing and make application scalable so that it can add/remove number of sensors whenever needed.

- 4. Virtualization of sensor clouds**

This functionality will simulate a virtual sensor by providing weather sensing data as virtual sensor controller will be controlling sensors.

- 5. Monitoring of Virtual Sensors**

This will help user in monitoring the sensing data gathered by a virtual sensor.

- 6. User Dashboard**

User Dashboard will provide a way to users interact with application.

7. Billing

Application follows pay as you go model. We have enabled metering service that gathers usage data of users.

8. Admin Panel

By using this functionality admin will be able to login and monitor and manage different virtual sensors.

2. Deployment Architecture Design

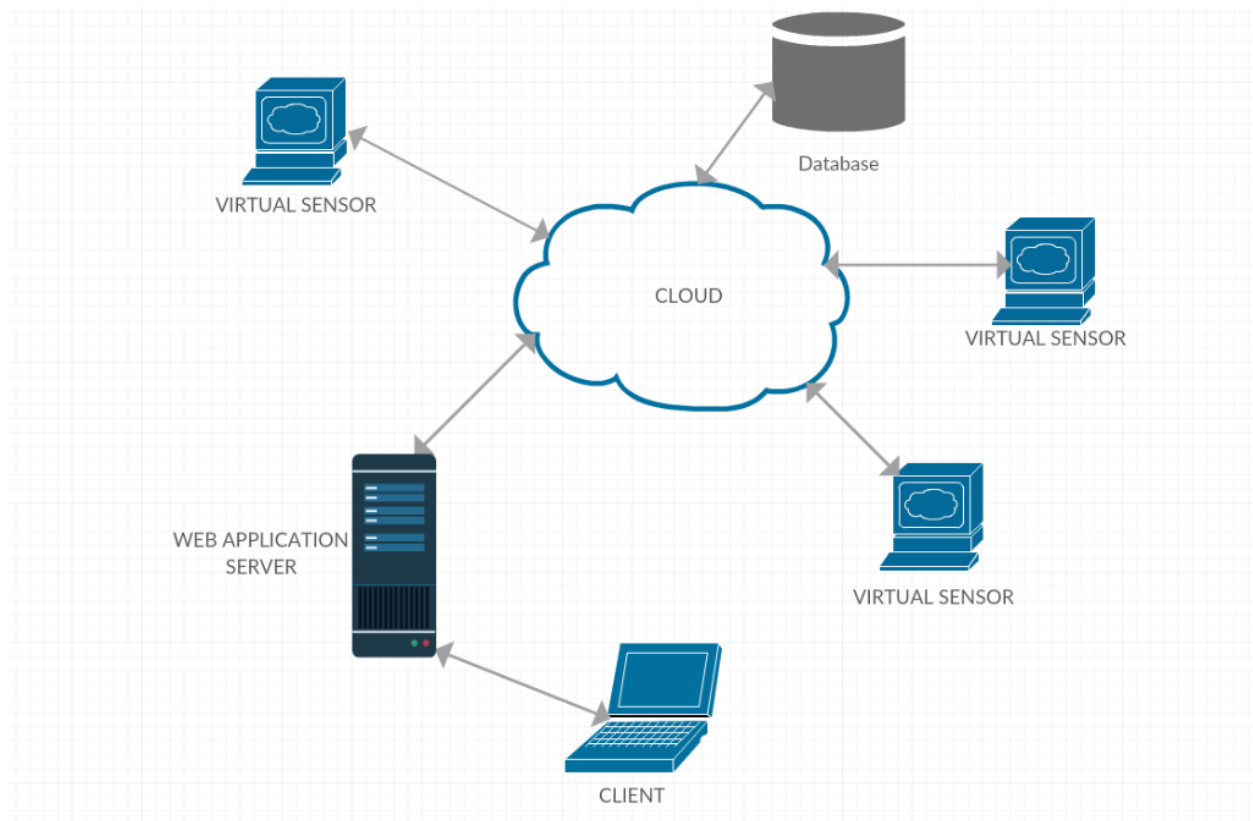
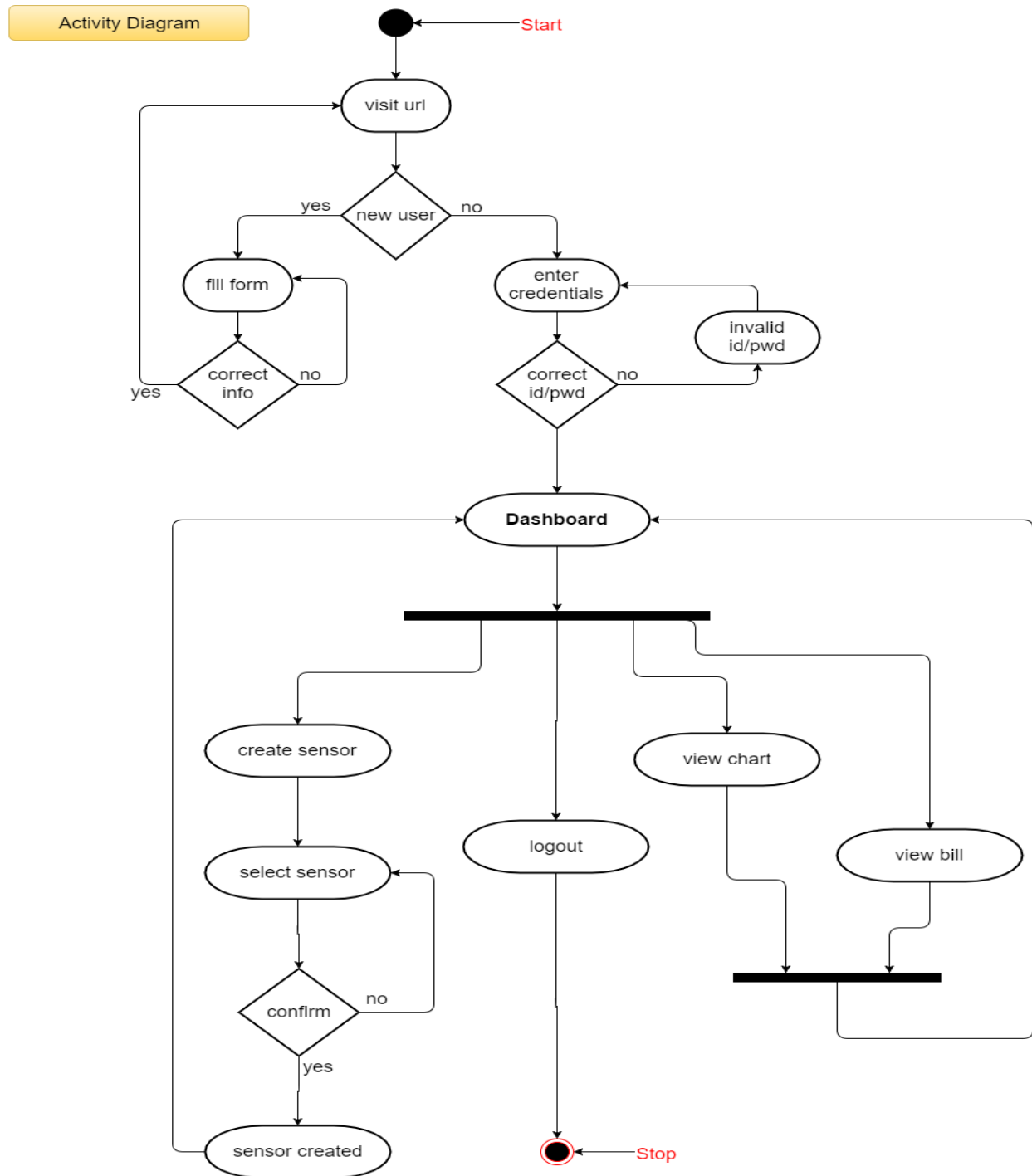
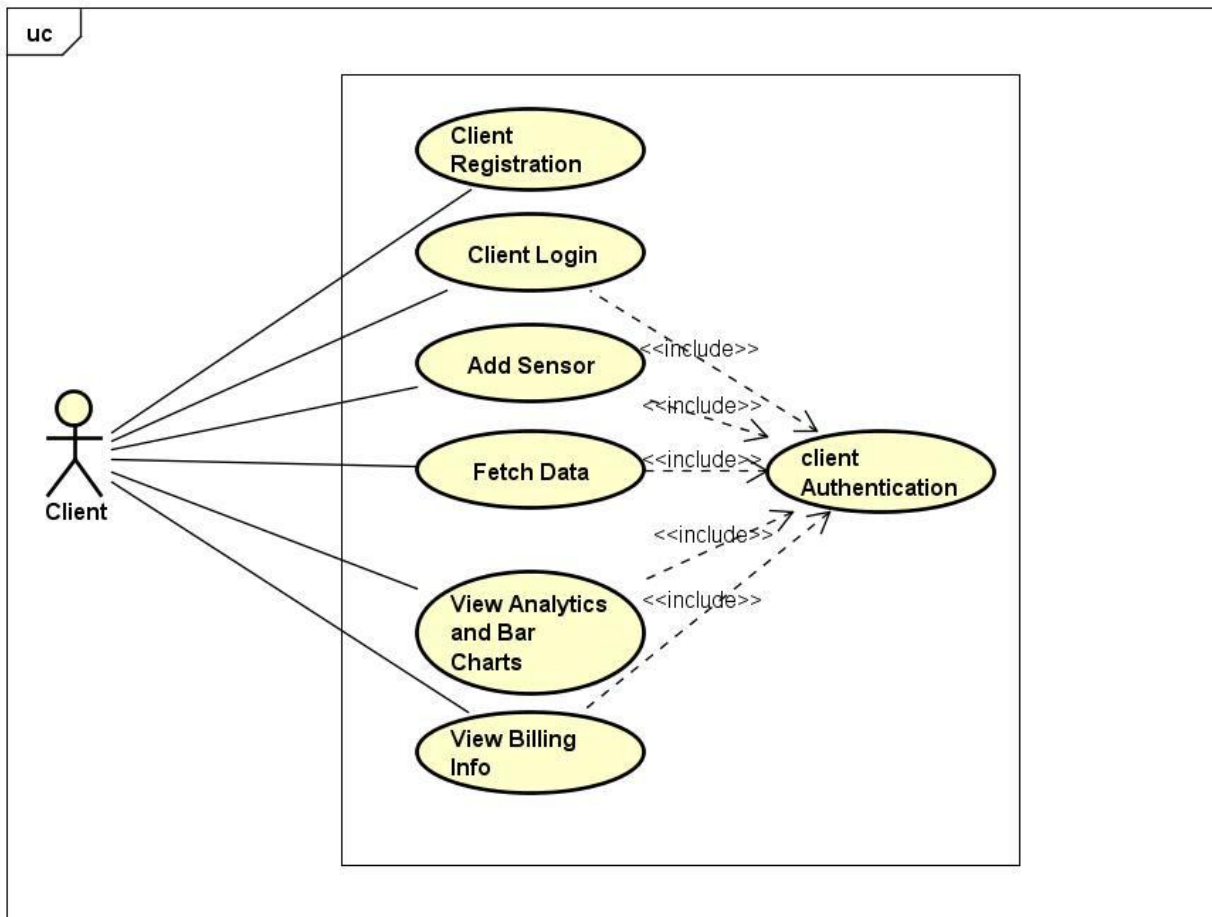


Figure 1 : Deployment Architecture

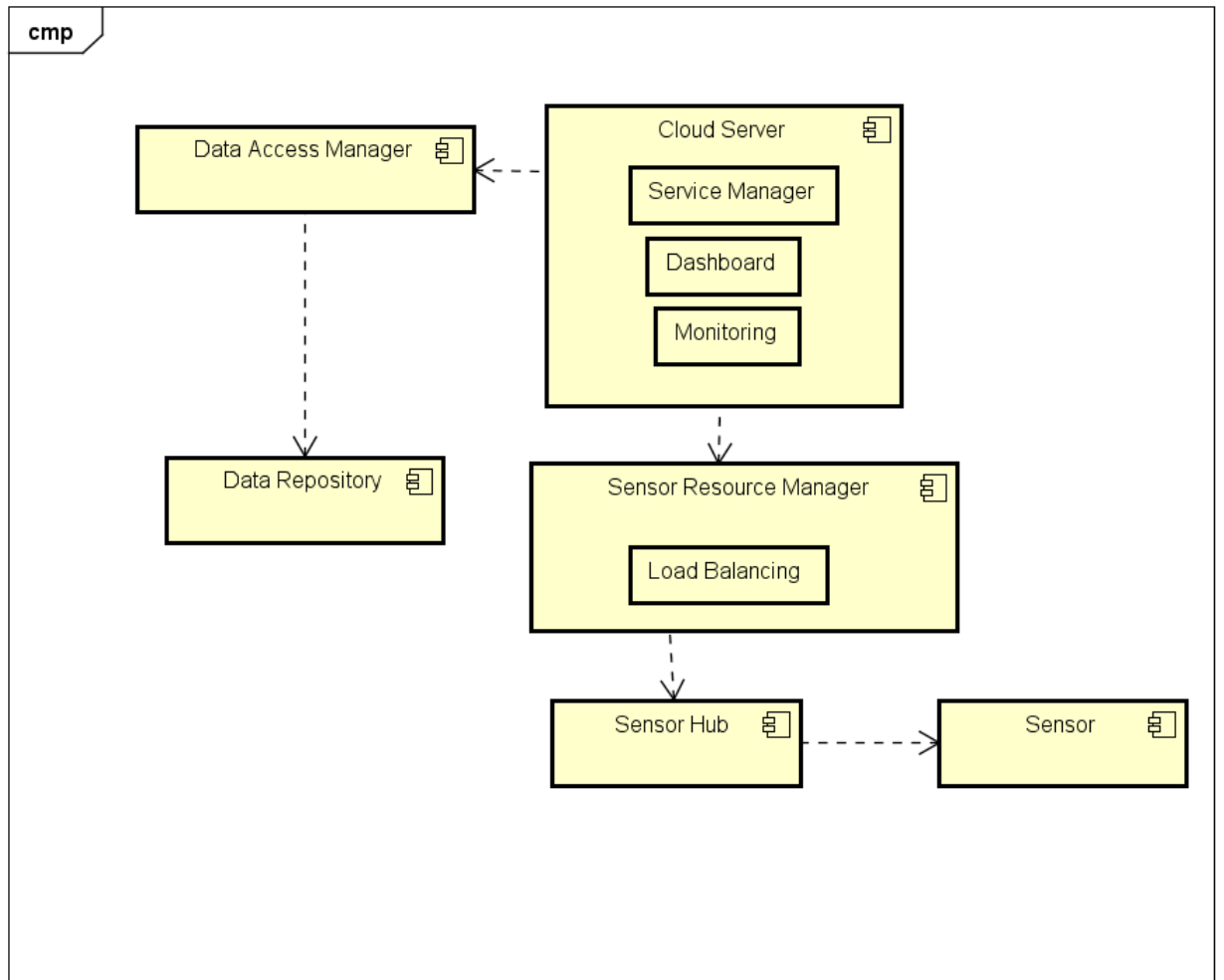
3. Activity Diagram



4. Use Case Diagram



5. Component Diagram



6. Application Architecture

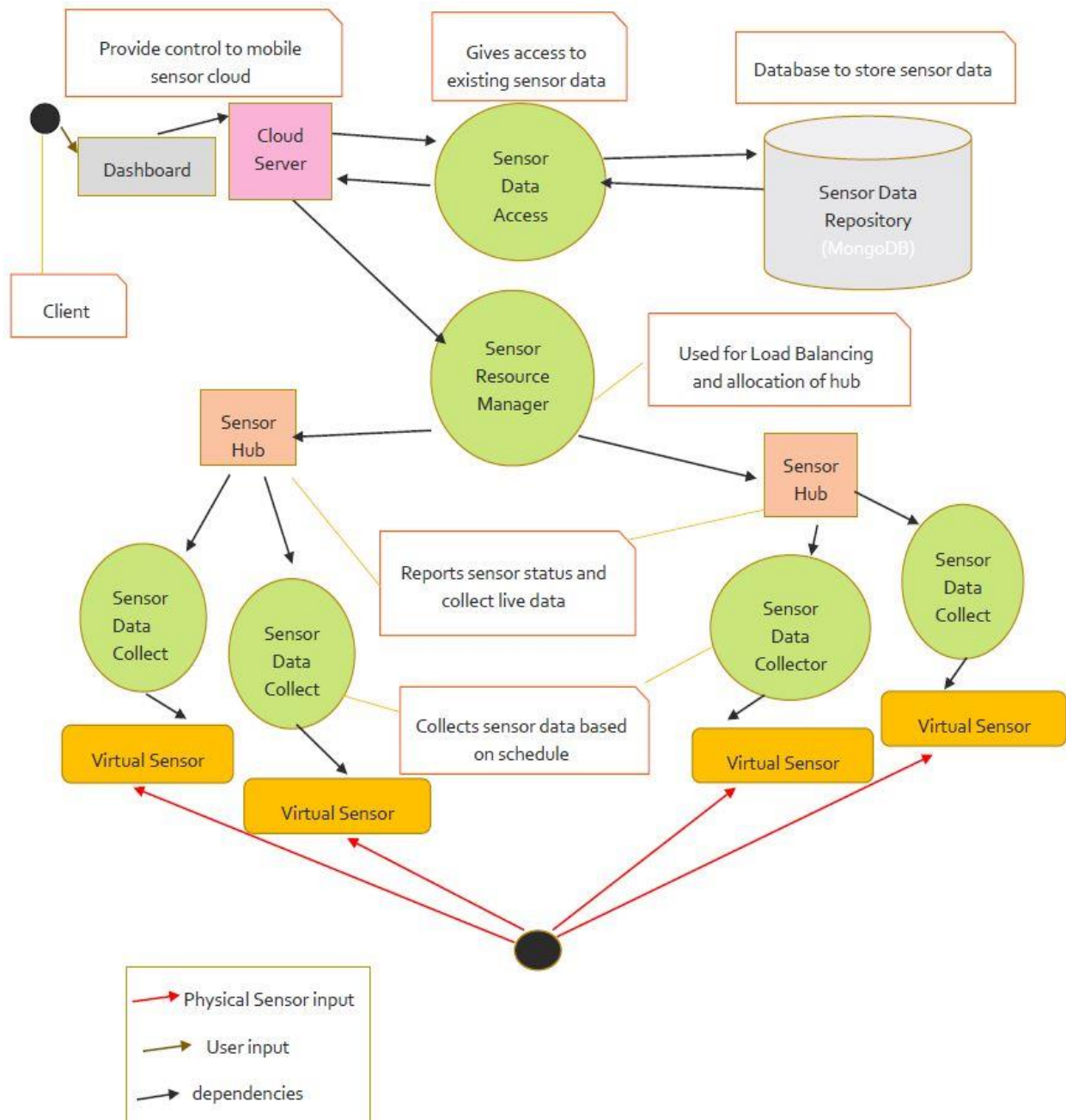


Figure 1 : Application Architecture

7. Load Balancing Algorithm

To manage the load on the server, effective load balancing is needed. The mechanism of dispersing the traffic across multiple hubs is Sensor Cloud load balancing. This mechanism lessens costs and maximizes availability of resources. Through an optimized load balancing, the resources can be better and easily be administered and can be better allocated and the scheduling can also be effective. This will help us handle the resources and will also reduce cost too.

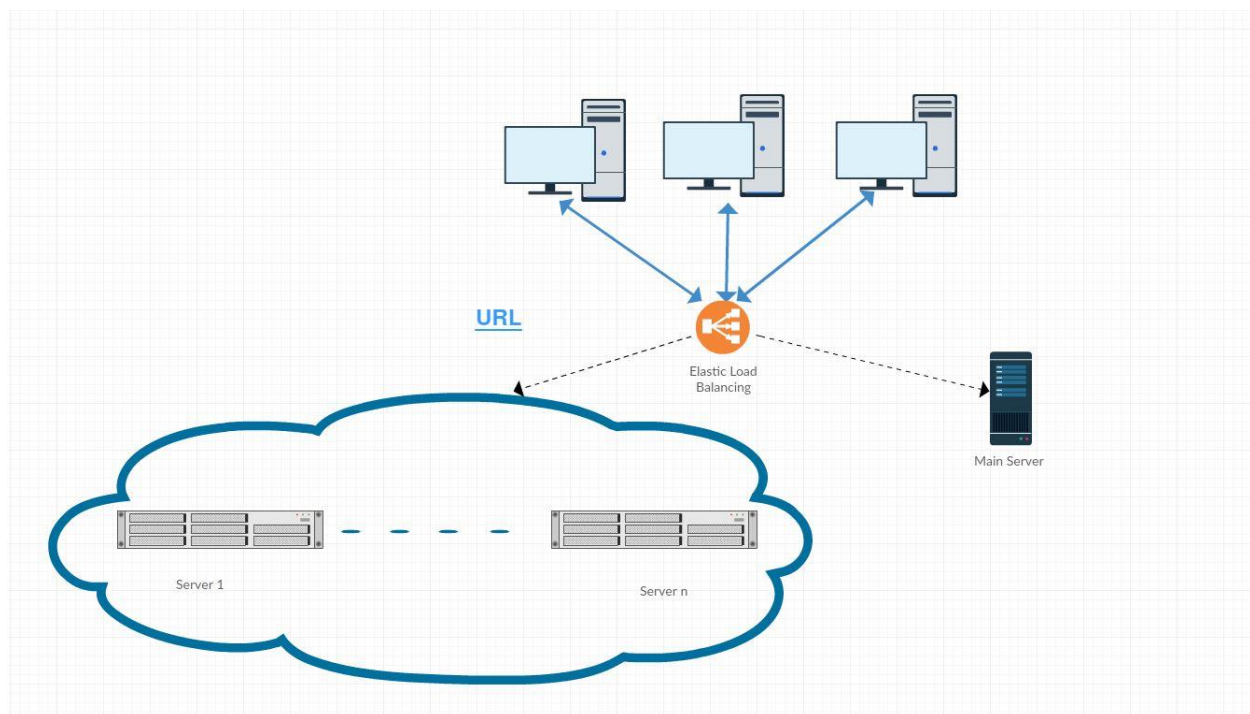


Figure 2 : Load Balancing Algorithm

8. Technology Selection



Figure 3 : Technologies Used

9. Strategy



Figure 3 : Strategy Architecture

9.1 Virtual Sensor:

This simulates a sensor and provides sensing data. This sensor takes the data from actual physical sensor and sends it to the user for the completion of the request

9.2 Billing:

User needs to pay for the sensors that he adds according to area. Utility billing is the universal concept that is used in this project.

9.3 Scalable:

Sensors can be scaled up and down as per the user need. The rescaling done is the product of itself. With this feature we can remarkably diminish the risks correlated with traffic overflow which causes server overflow.

9.4 On Demand:

User can add sensors and monitor them as he wants real-time or hourly. This service enables the provisioning of sensors, on demand whenever they are required instead of waiting for the subs.

10. Implementation Design

10.1 Signup Page

The user has to go to the sign-up page to register the account and enter all the locations. The fields are marked as required for all the mandatory information

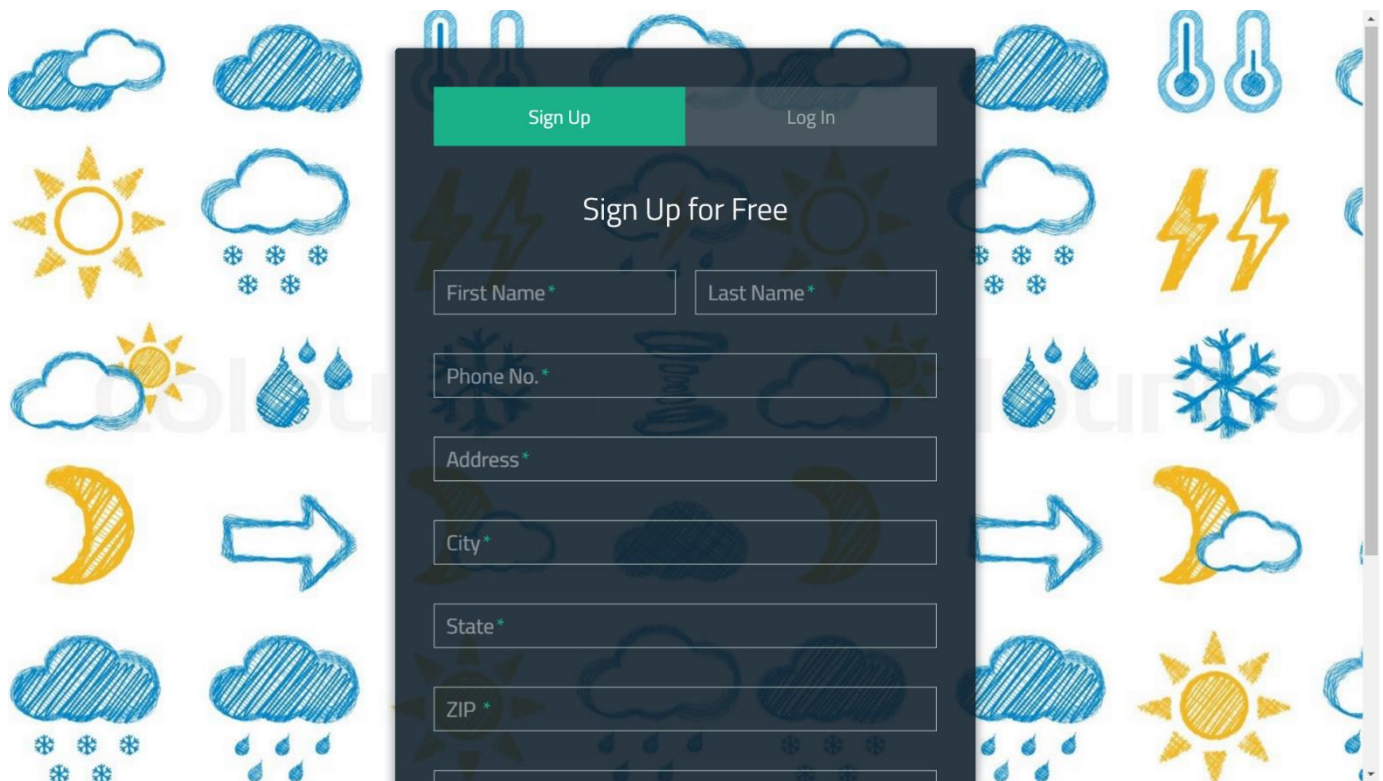
A screenshot of a web application's signup page. The page has a dark blue background with a pattern of white and yellow weather icons (clouds, sun, rain, snow, lightning, moon, arrow, thermometer). At the top, there are two buttons: 'Sign Up' in green and 'Log In' in grey. Below these is the text 'Sign Up for Free'. The form contains several input fields, each with an asterisk indicating it is required: 'First Name*', 'Last Name*', 'Phone No.*', 'Address*', 'City*', 'State*', and 'ZIP*'. A large, faint watermark 'molurbox' is visible across the center of the page.

Figure 5 : Signup Page Screenshot

10.2 Login Page

The returning user must provide the email address and the password which was input at the time of signup.

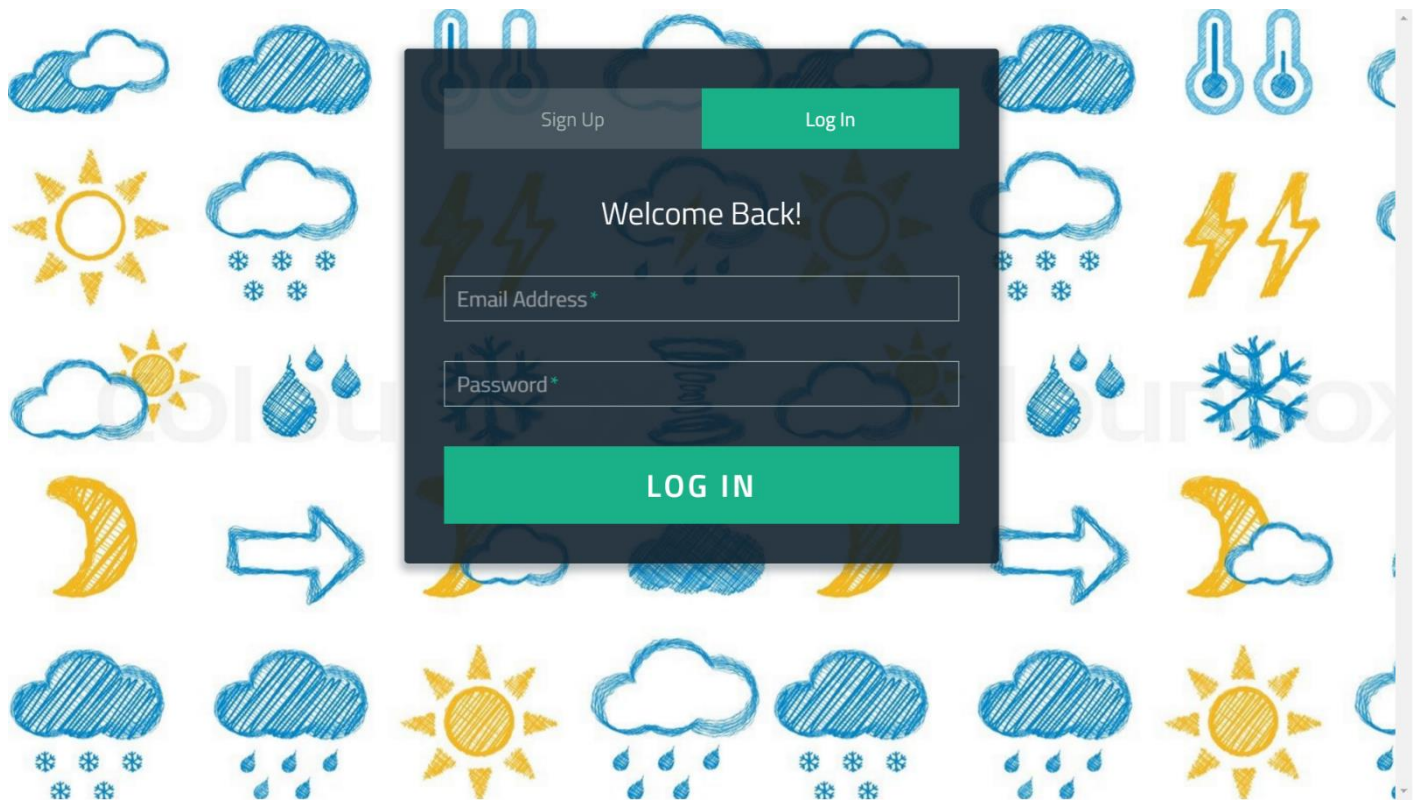


Figure 6 : Login Page Screenshot

10.3 Dashboard

The user has to login first. After the user is authenticated the user can add the sensors that he/she wants to see in his/her dashboard. The sensors he wants can be selected from the dashboard. The user can even view all the sensors that he has added and all that are deactivated and needs to be added.

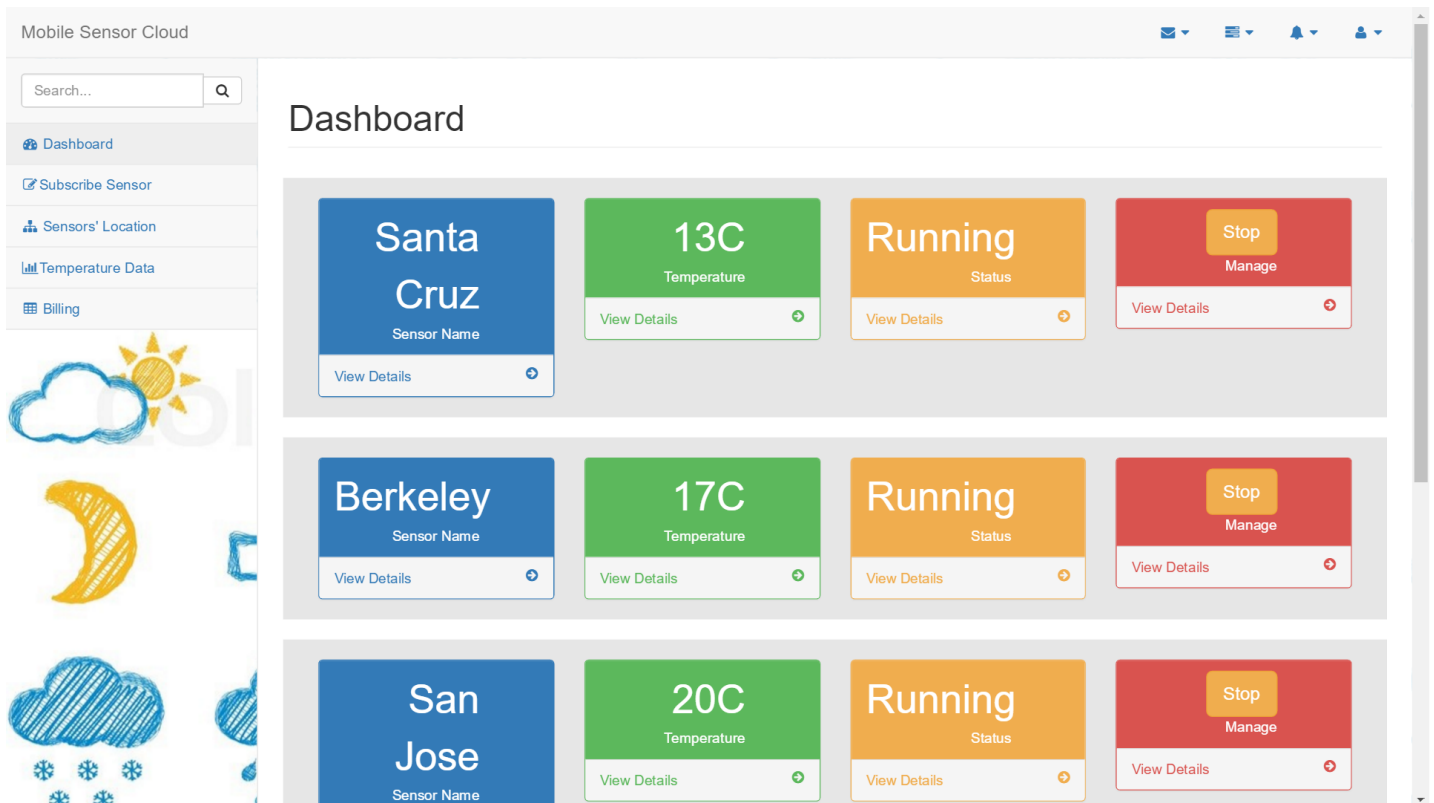


Figure 7 : Dashboard Screenshot

10.4 Temperature Data

User can view temperature graphs in this page. User can group graphs according to area and city also. User can also choose the cities that he wants to be displayed.

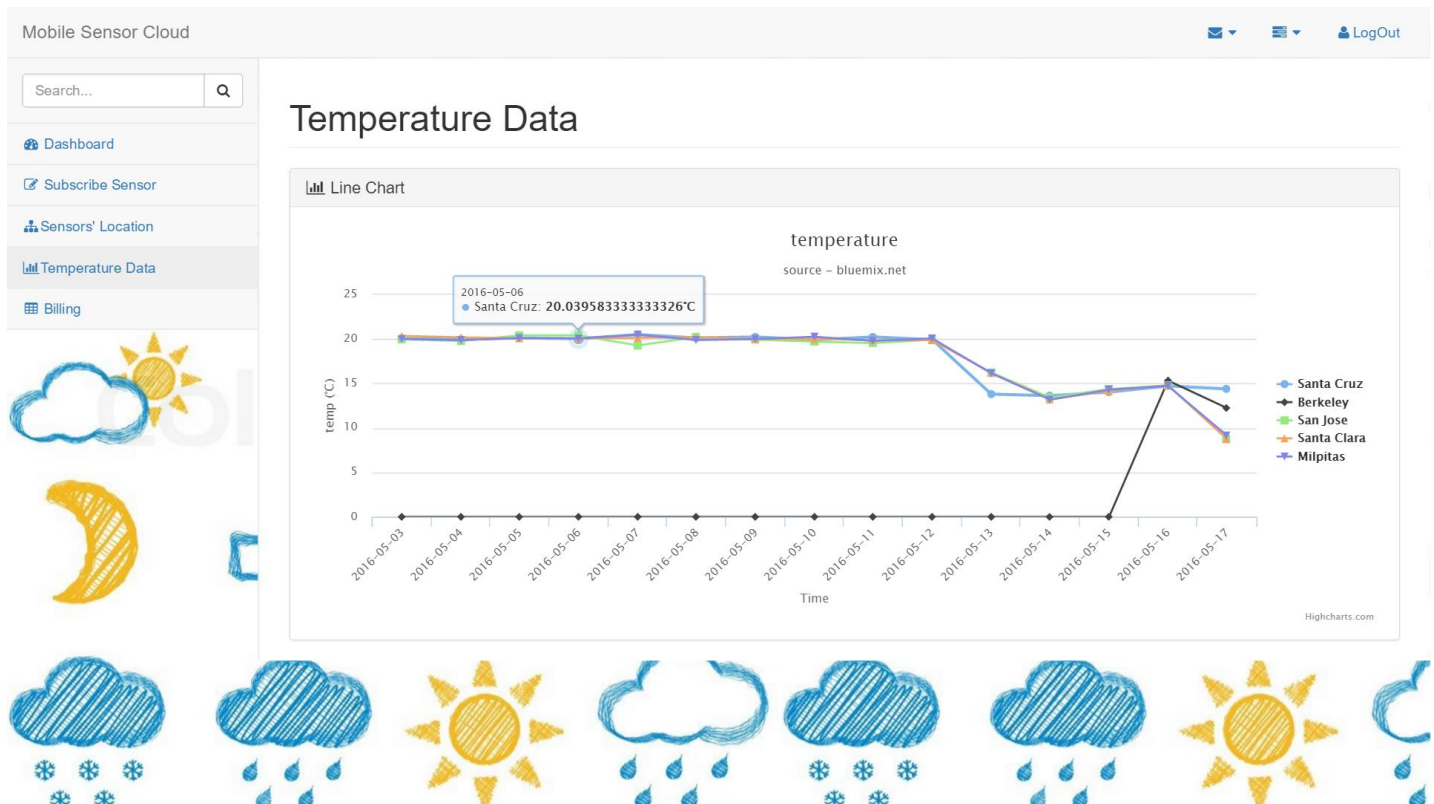


Figure 8 : Graphs Screenshot

10.5 Billing

In this the user can see all the payment data and estimate the cost of the sensor as well as the total cost.

Mobile Sensor Cloud

Search...

Dashboard

Subscribe Sensor

Sensors' Location

Temperature Data

Billing

Billing

Sensor Name	UP Time	Cost
Santa Cruz	3 days 5 hours 42 minutes 12 seconds 289 ms	\$ 40.29
Berkeley	-197710 ms	\$ -0.02
San Jose	3 days 5 hours 43 minutes 56 seconds 291 ms	\$ 40.3
Santa Clara	3 days 5 hours 44 minutes 4 seconds 292 ms	\$ 40.3
Milpitas	3 days 5 hours 41 minutes 7 seconds 293 ms	\$ 40.28
Total cost		\$161.15

Figure 9 : Tables Screenshot

10.6 Maps

In this the user can see the sensors on the map and can create real time virtual sensor by selecting location on map. User can select the sensor and sensor with the area on maps would be visible.

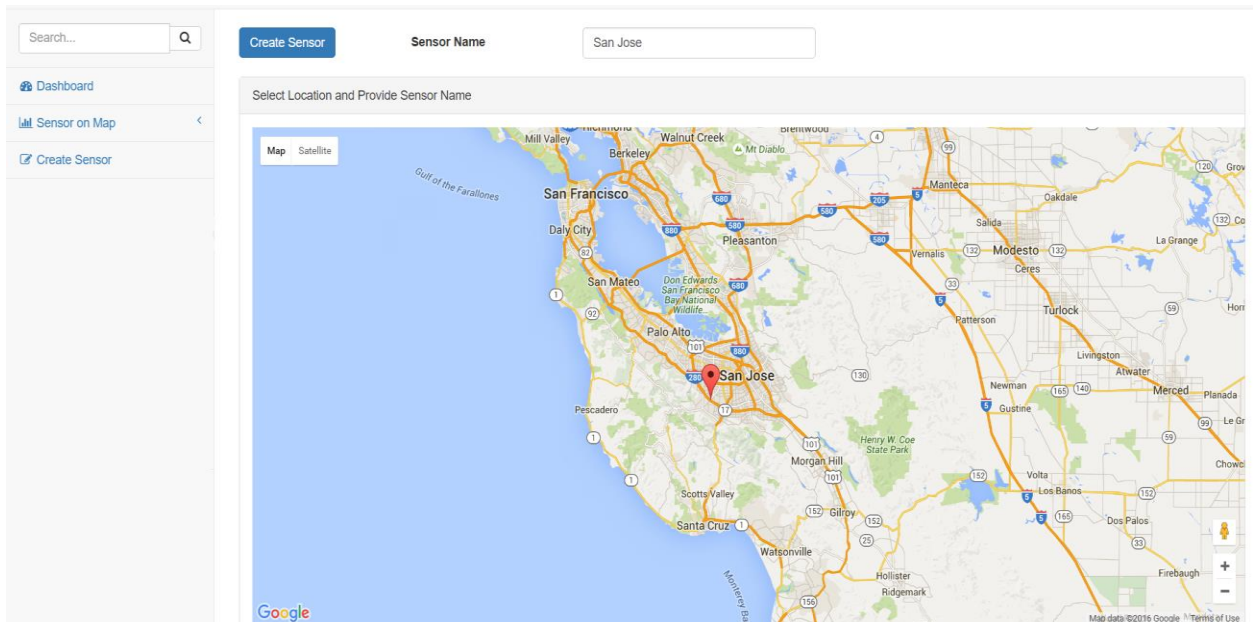


Figure10 : Maps Screenshot

10.7 Billing

User will be charged \$1.00/minute and can add as many as he wants and will have to pay per sensor only.

Mobile Sensor Cloud

Search...

Dashboard

Sensor Data

Billing

Billing

Payment Invoice

Show 10 entries

Search:

Sensor ID	Sensor Location	Sensor UP Time (hrs:mins)	Payment Due ()	Due Date (mm/dd/yy)	Sensor Status
Sensor-1	San Jose	87:06	115	05/07/16	Active
Sensor-2	Santa Clara	59:33	49	05/10/16	Active
Sensor-3	San Francisco	47:06	86	05/09/16	Active
Sensor-4	Los Angeles	51:06	64	05/09/16	Active

Showing 1 to 4 of 4 entries

Previous 1 Next

Terms and Conditions

- The users will be notified of any due payment via Email.
- Failure to process any payment may lead to deallocation of resources and deactivation of account

Figure11 : Billing Screenshot

10.8 Admin Panel

The Admin can login using his User Id and Password and can keep a check on all the sensors that are being added to be monitored. The admin can view Sensor Type whether it is temperature, humidity or pressure sensor, Admin can also see the Sensor Area, City, Owner Name and Owner Id. Along with all these Admin can see the health of all the sensors also on his screen.

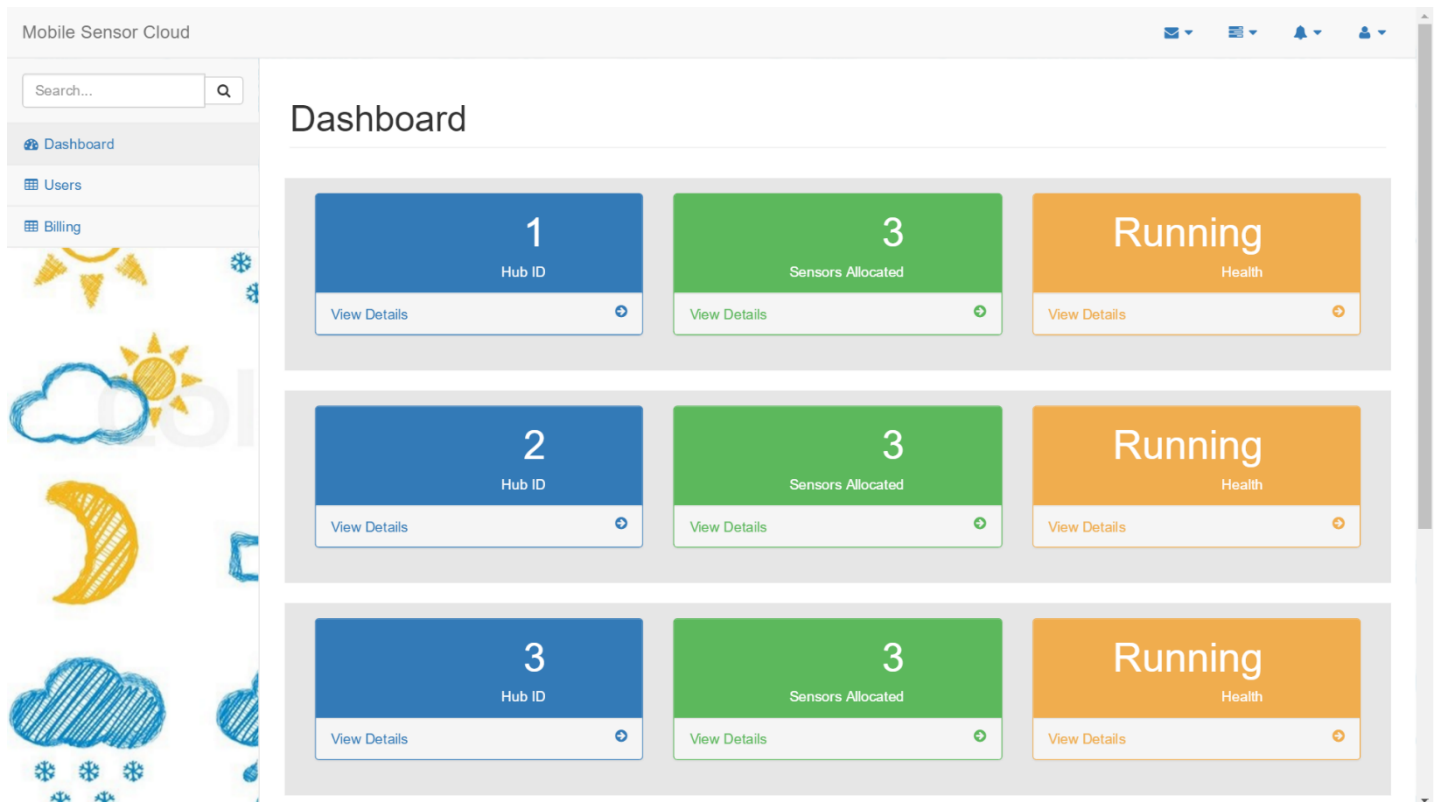


Figure12 : Admin Dashboard Screenshot

Mobile Sensor Cloud

Search...

Q

Dashboard

Users

Billing

☀️☁️🌙☔️

☁️☀️

🌙

☁️☔️☀️☁️☔️☁️☀️☁️

User Information

First Name	Last Name	Email	Status	No of sensors
Divya	Patel	2406divya@gmail.com	active	5
Aditya	Chauhan	aditya@gmail.com	active	5
Ashay	Argal	ashay@gmail.com	active	4

Figure13 : User Information Screenshot

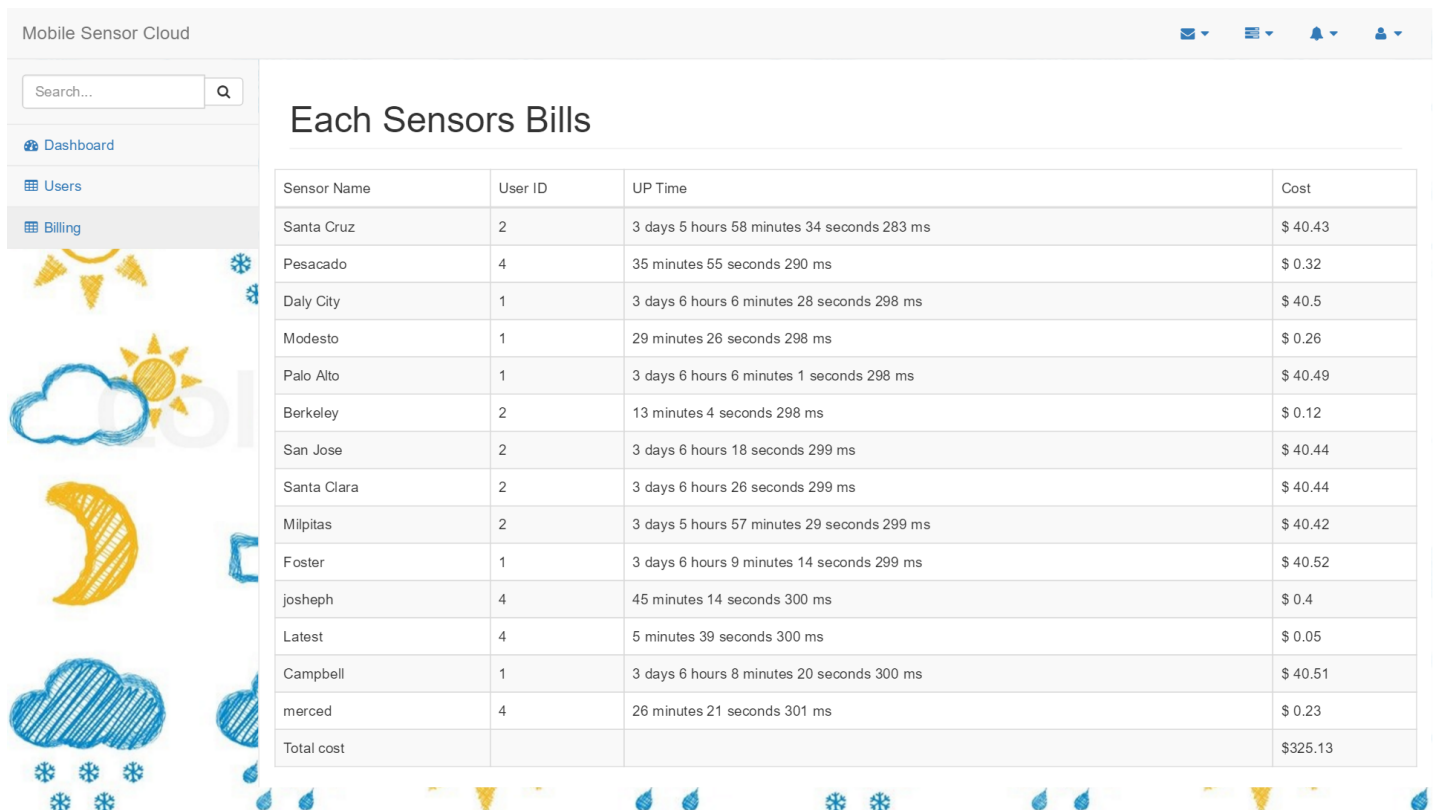


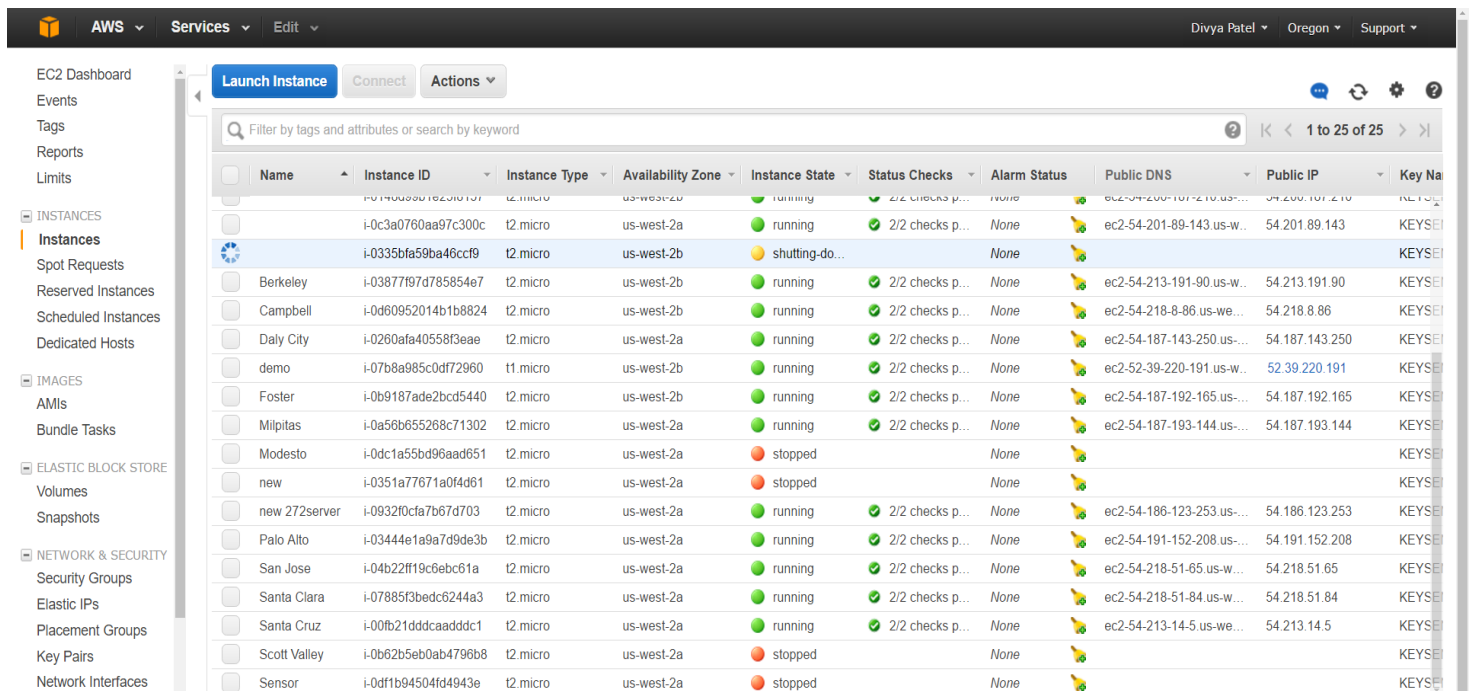
Figure14 : Sensor billing Screenshot

11. Virtual Sensors

This component works as a simulator of actual physical sensor residing on different location. This virtual sensor gets the data from actual physical sensor in appropriate format as required by the client. This component acts as a physical sensor which will provide all the sensor data, health data and status data and will be able to communicate as well with sensor hub through sensor data hub.

Input = physical sensor data.

Output = sensor data



	Name	Instance ID	Instance Type	Availability Zone	Instance State	Status Checks	Alarm Status	Public DNS	Public IP	Key Name
		i-0c3a0760aa97c300c	t2.micro	us-west-2a	running	2/2 checks p...	None	ec2-54-201-89-143.us-...	54.201.89.143	KEYSEI
		i-0335bfa59ba46ccf9	t2.micro	us-west-2b	shutting-do...		None			KEYSEI
	Berkeley	i-03877f97d785854e7	t2.micro	us-west-2b	running	2/2 checks p...	None	ec2-54-213-191-90.us-w...	54.213.191.90	KEYSEI
	Campbell	i-d60952014b1b8824	t2.micro	us-west-2b	running	2/2 checks p...	None	ec2-54-218-8-86.us-we...	54.218.8.86	KEYSEI
	Daly City	i-0260afa40558f3eae	t2.micro	us-west-2a	running	2/2 checks p...	None	ec2-54-187-143-250.us-...	54.187.143.250	KEYSEI
	demo	i-07b8a985c0df72960	t1.micro	us-west-2b	running	2/2 checks p...	None	ec2-52-39-220-191.us-w...	52.39.220.191	KEYSEI
	Foster	i-0b9187ade2bcd5440	t2.micro	us-west-2b	running	2/2 checks p...	None	ec2-54-187-192-165.us-...	54.187.192.165	KEYSEI
	Milpitas	i-0a56b655268c71302	t2.micro	us-west-2a	running	2/2 checks p...	None	ec2-54-187-193-144.us-...	54.187.193.144	KEYSEI
	Modesto	i-0dc1a55bd96aad651	t2.micro	us-west-2a	stopped		None			KEYSEI
	new	i-0351a77671a0f4d61	t2.micro	us-west-2a	stopped		None			KEYSEI
	new 272server	i-0932f0cfa7b67d703	t2.micro	us-west-2a	running	2/2 checks p...	None	ec2-54-186-123-253.us-...	54.186.123.253	KEYSEI
	Palo Alto	i-03444e1a9a7d9de3b	t2.micro	us-west-2a	running	2/2 checks p...	None	ec2-54-191-152-208.us-...	54.191.152.208	KEYSEI
	San Jose	i-04b22ff19c6ebc61a	t2.micro	us-west-2a	running	2/2 checks p...	None	ec2-54-218-51-65.us-w...	54.218.51.65	KEYSEI
	Santa Clara	i-07885f3bedc6244a3	t2.micro	us-west-2a	running	2/2 checks p...	None	ec2-54-218-51-84.us-w...	54.218.51.84	KEYSEI
	Santa Cruz	i-00fb21dddcaaddc1	t2.micro	us-west-2a	running	2/2 checks p...	None	ec2-54-213-14-5.us-we...	54.213.14.5	KEYSEI
	Scott Valley	i-0b62b5eb0ab4796b8	t2.micro	us-west-2a	stopped		None			KEYSEI
	Sensor	i-0df1b94504fd4943e	t2.micro	us-west-2a	stopped		None			KEYSEI

Figure 15 : Virtual Sensors website screenshot

12. Conclusion

User can use this web application to remain updated about weather data of any area across the world, which is done by providing virtual sensors to users which collects sensor data. In addition to that user will be able to see historical data to know the change in temperature, atmospheric pressure and humidity. Users are provided with functionality to add sensor that they want to monitor and remove sensor that they don't want to. Application is highly scalable and follows, pay as you go model.

13. References

- ❖ CmpE-281 lecture slides
- ❖ <https://sjsu.instructure.com/courses/1162965/files/?preview=40037457>
- ❖ <http://en.wikipedia.org/>
- ❖ <https://aws.amazon.com/documentation/ec2/>
- ❖ Big Data Sensing and Service: A Tutorial