



SMARTaxi Services



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Introduction

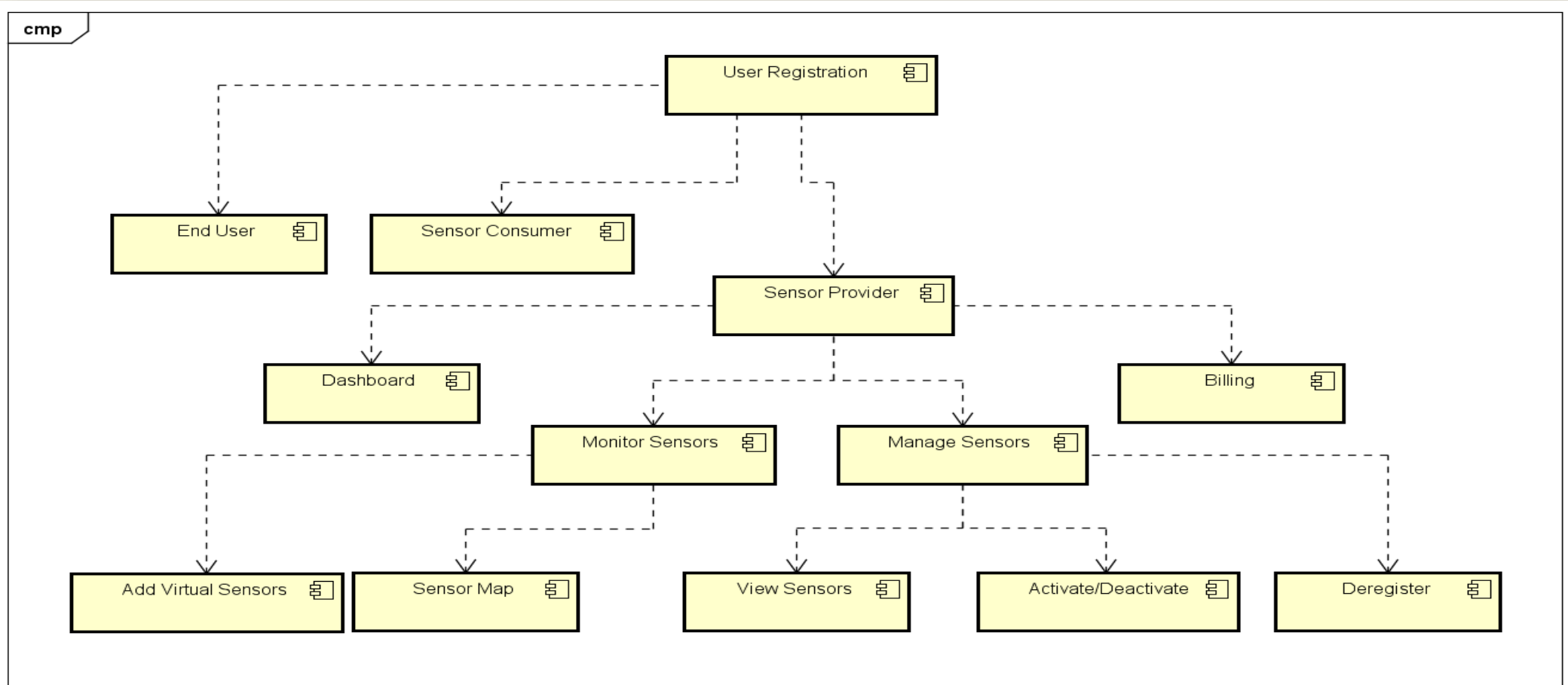
- Traffic incidents in United States happen on annual basis of upwards of 33000 incidents .
- Leading cause of these accidents are driver distractions.
- Human driven cars come at a very high cost in terms of danger.
- The U.S. Department of Transportation actually assigns a value to each human life: \$9.2 million.
- Self Driving Cars ?

Continued

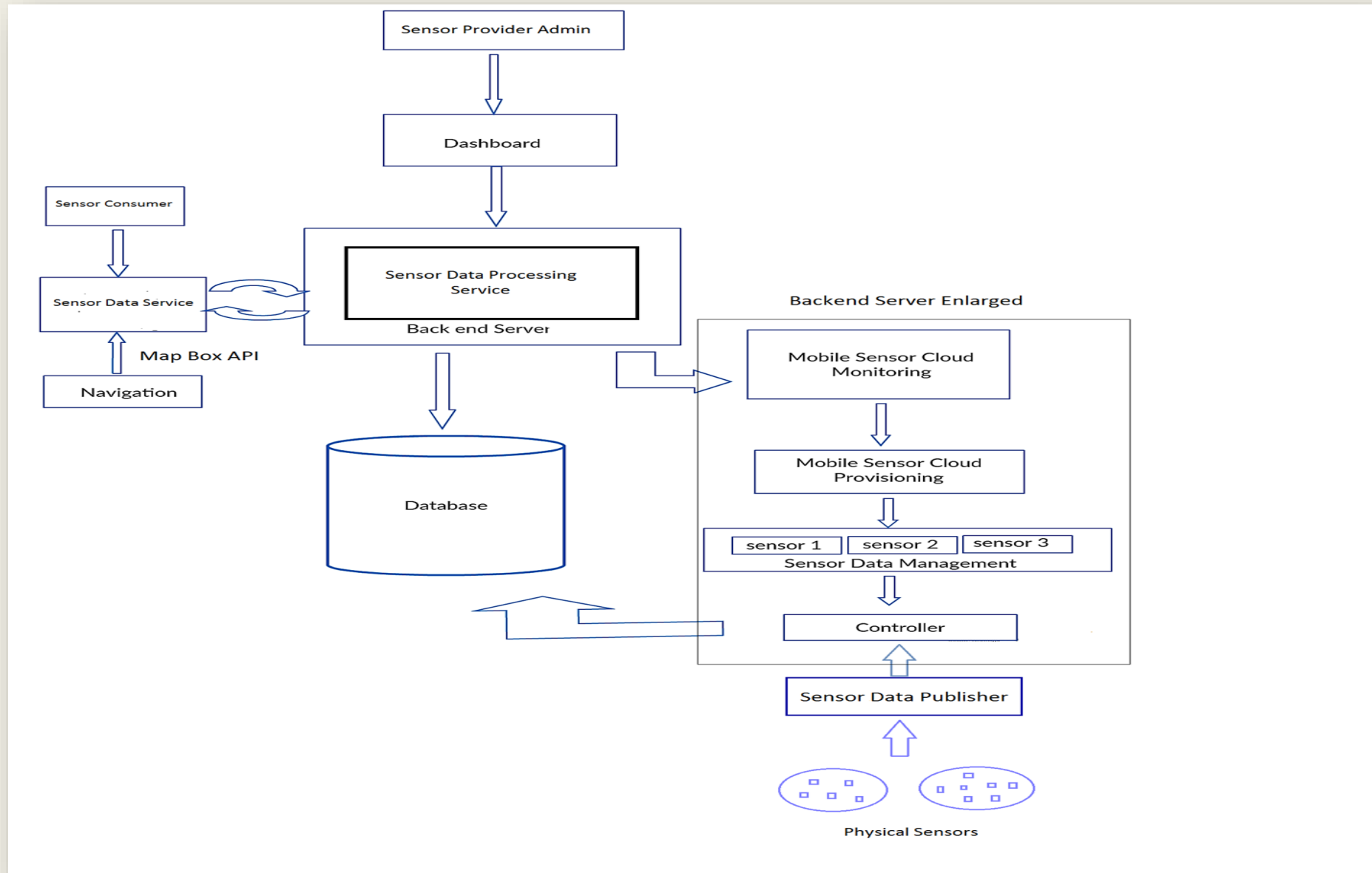
- In order for the cars to operate most efficiently, they'd need to communicate with one another, helping to identify traffic problems or road risks early on.
- Driverless cars sense their surroundings using technology such as temperature sensors, speed sensors, lidar sensors, GPS, and computer vision.
- Using sensors we can monitor various aspects of the vehicle.

Component Overview

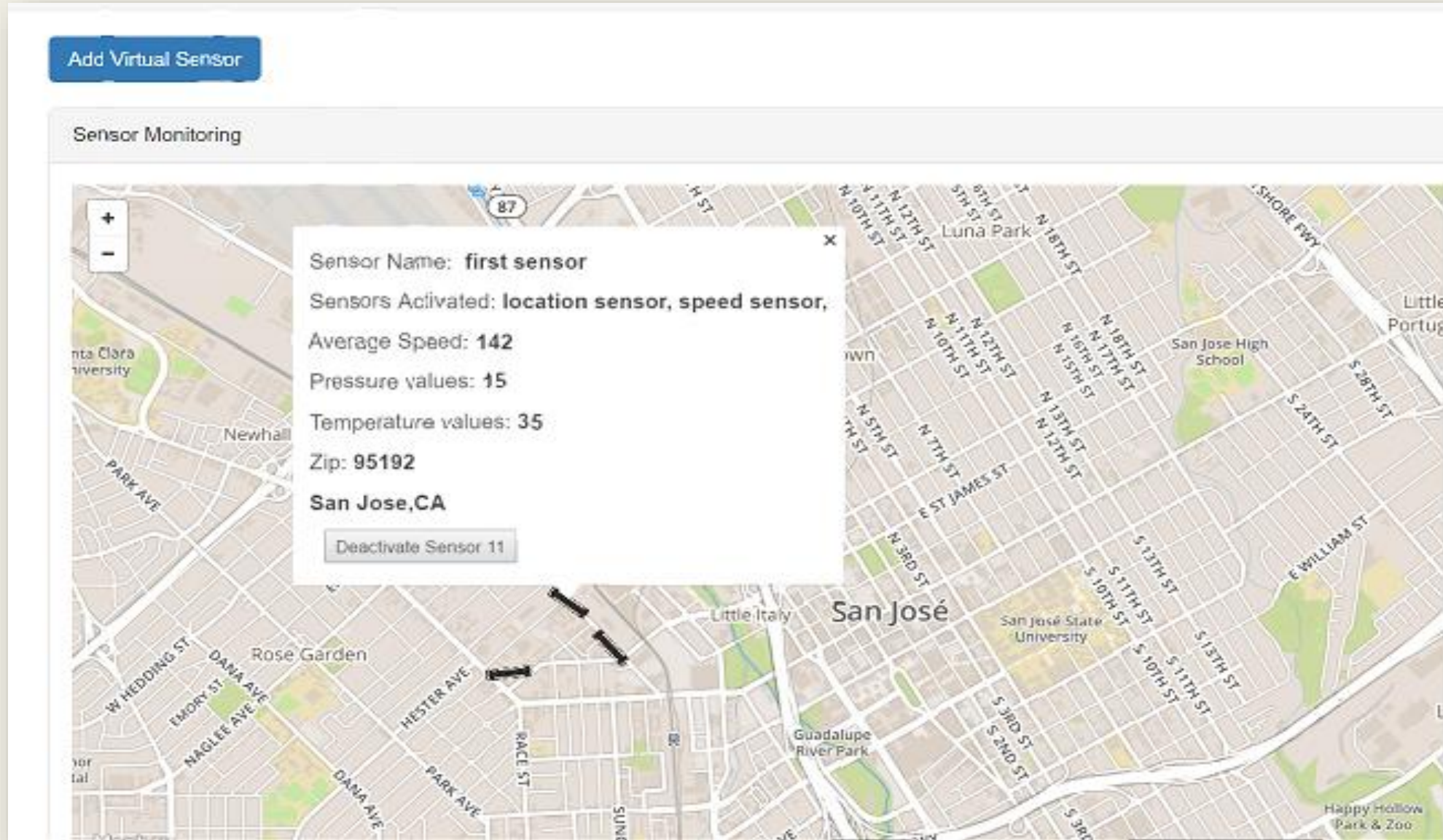
- The registered users can be end user , a sensor consumer or sensor provider



Mobile Sensor Cloud Infrastructure



Monitoring Sensors



Add Virtual Sensors

Add Virtual Sensor

[Back to Monitor Sensors](#)

Sensor Name	<input type="text" value="Sensor Name"/>
Sensor Description	<input type="text" value="Sensor Description"/>
Select Sensor Type	<div>location sensor speed sensor Temperature Sensor Pressure Sensor</div>
Select Virtual Sensor	<div>383 Stockton Avenue, SJ, CA</div>
Latitude	<input type="text" value="Latitude"/>
Longitude	<input type="text" value="Longitude"/>
Zip Code	<input type="text" value="ZipCode"/>
Address Line1	<input type="text" value="Address Line1"/>
Address Line2	<input type="text" value="Address Line2"/>
City	<input type="text" value="City"/>
State	<input type="text" value="State"/>
Country	<input type="text" value="Country"/>

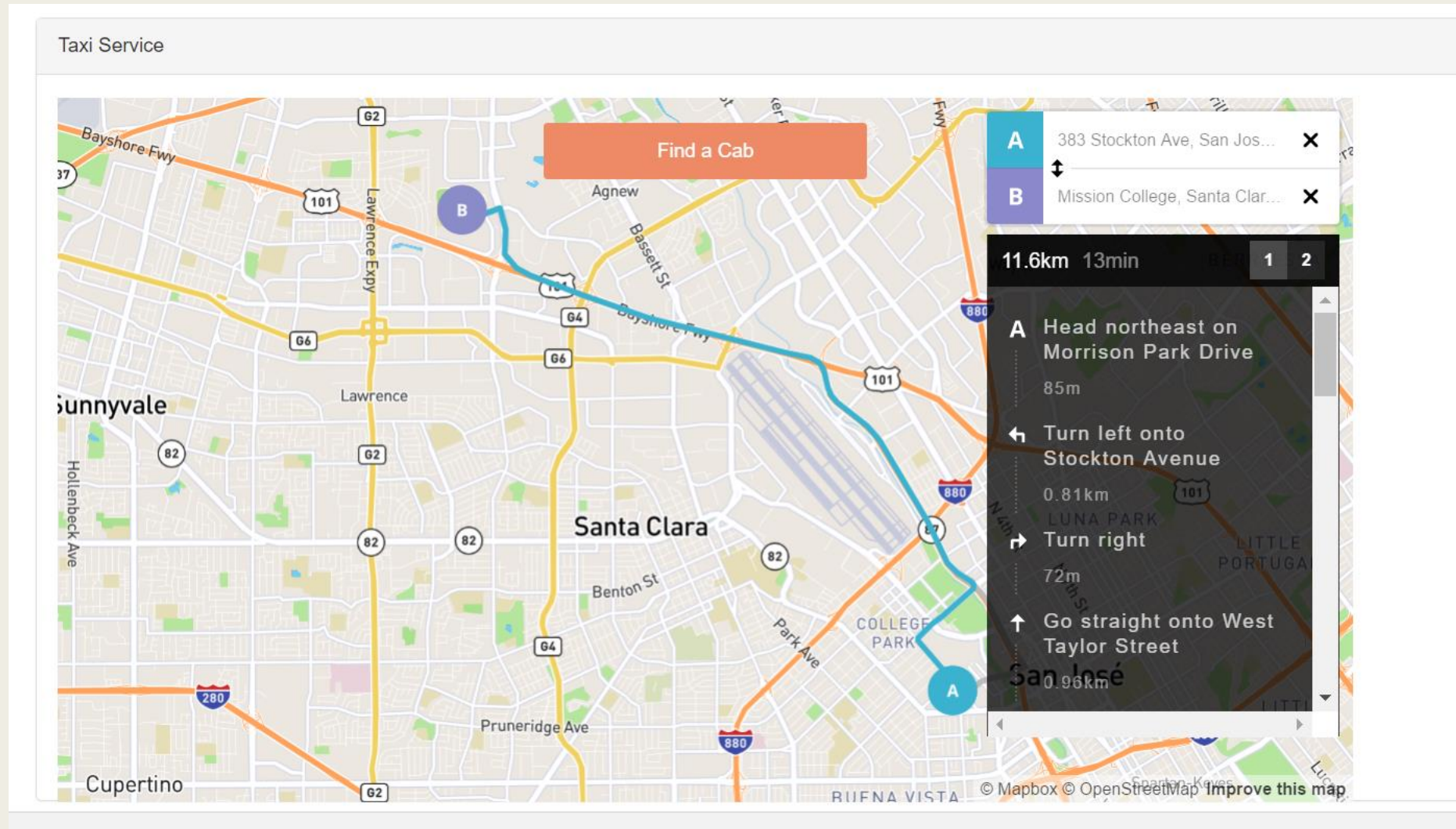
Sensor Management

Manage Sensors

Sensor ID	Sensor Name	Sensor Type	Sensor Cluster	Sensor Status	Actions
11	first sensor	location sensor, speed sensor,	101	Active	<button>Deactivate</button> <button>Deregister</button>
12	second sensor	location sensor, Temperature sensor,	102	Active	<button>Deactivate</button> <button>Deregister</button>
13	third sensor	location sensor, Temperature sensor	103	Active	<button>Deactivate</button> <button>Deregister</button>
15	wda	speed sensor,	101	Deactive	<button>Activate</button> <button>Deregister</button>
16	tahoe	speed sensor, Temperature sensor	101	Deactive	<button>Activate</button> <button>Deregister</button>
17	yosemite	speed sensor, Temperature sensor	103	Active	<button>Deactivate</button> <button>Deregister</button>

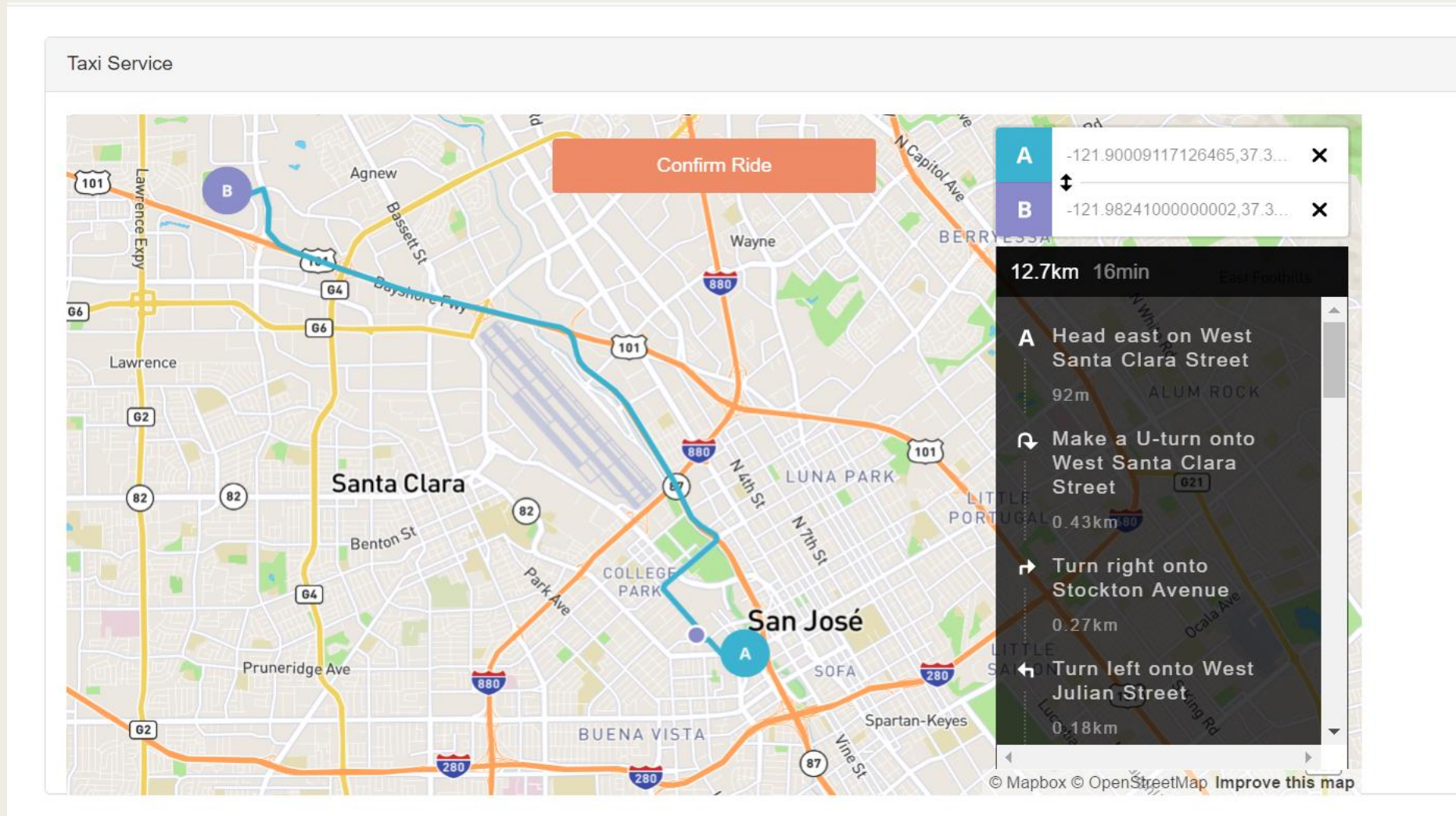
End User Service

- End user mentions his source and destination



Continued..

- End user then finds a cab based on sensor data where A is Cab Location , purple marker is the customer location and B is the destination



Service Use Cases: Sensor Provider

- Sensor provider owns the sensor services
- Bill generated based on the active time of sensors
- Sensor Provider can add, activate/deactivate and deregister sensors.

Service Use Cases: Sensor Consumer

- Sensor consumer use the sensor data provided by the sensor provider.
- Sensor consumer can monitor his vehicles.
- Sensor consumer can deactivate his vehicles but cannot add a sensor

Service Use cases: End User

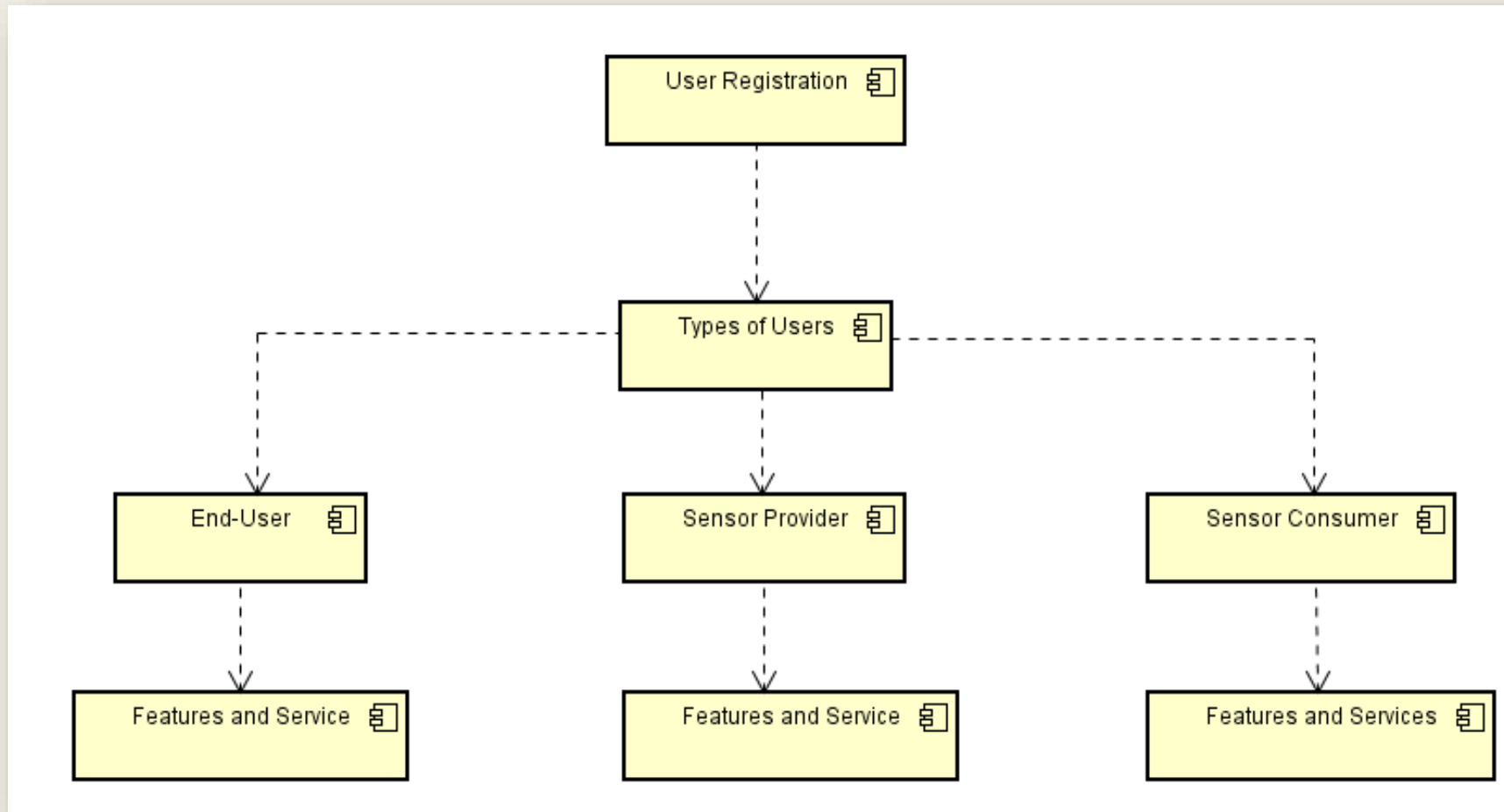
- End user is provided with the service to find nearby taxis based on the realtime sensor data
- End user can check his Trip History along with the Billing
- End user can check his Driving Safety Score

Mobile Cloud Infrastructure Data Repository

- Amazon Relational Database Service.
- MySQL DB instance.
- Why Amazon RDS?
 - *Ease of use.*
 - *Scalability.*
 - *Available and Durable.*

Multitenancy

- Multi-tenant application: It isolates different users on the same platform.



- Registration of different tenants with the aid of user type in Sign Up screen.



Create an Account

Enter FirstName

Enter LastName

Enter Phone No

Enter Address

Enter City

Enter State

Enter ZIP

Email address

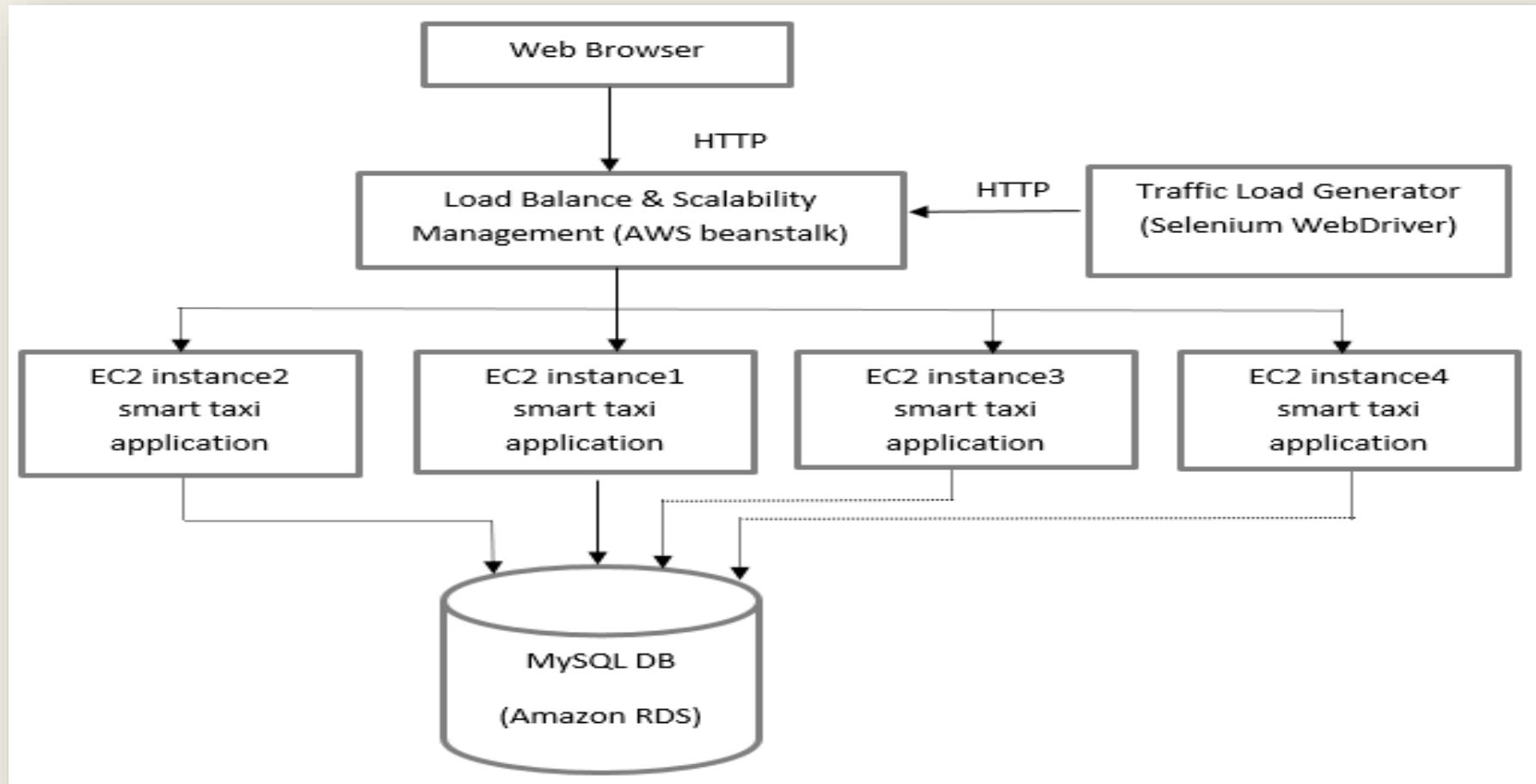
Choose a password

admin

admin
client
enduser

Sign Up

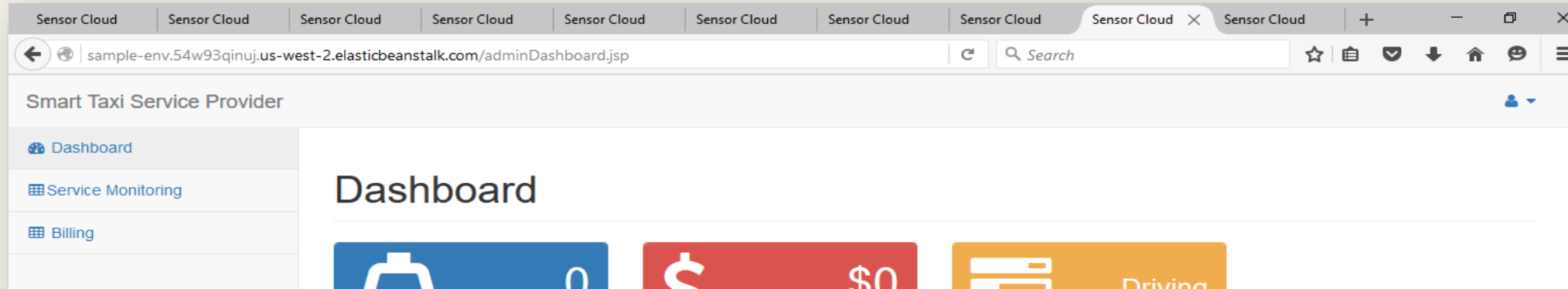
Load Balance, Scalability Management and Traffic Load Generation



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- Elastic Beanstalk is a service offered from Amazon Web Services for deploying applications.
- Auto Scaling deals with traffic changes by automatically increasing or decreasing the EC2 instances.
- Load Balancer balances the network load by distributing traffic which increases resource utilization.

- Traffic Load Generation is achieved using Selenium-WebDriver.

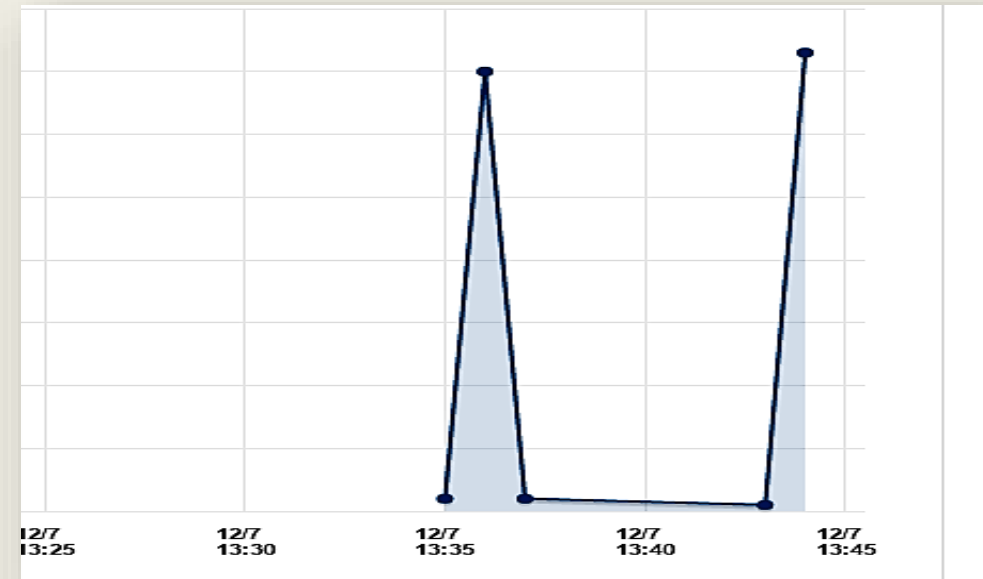


- Auto Scaling of instances when the request count reaches threshold value.

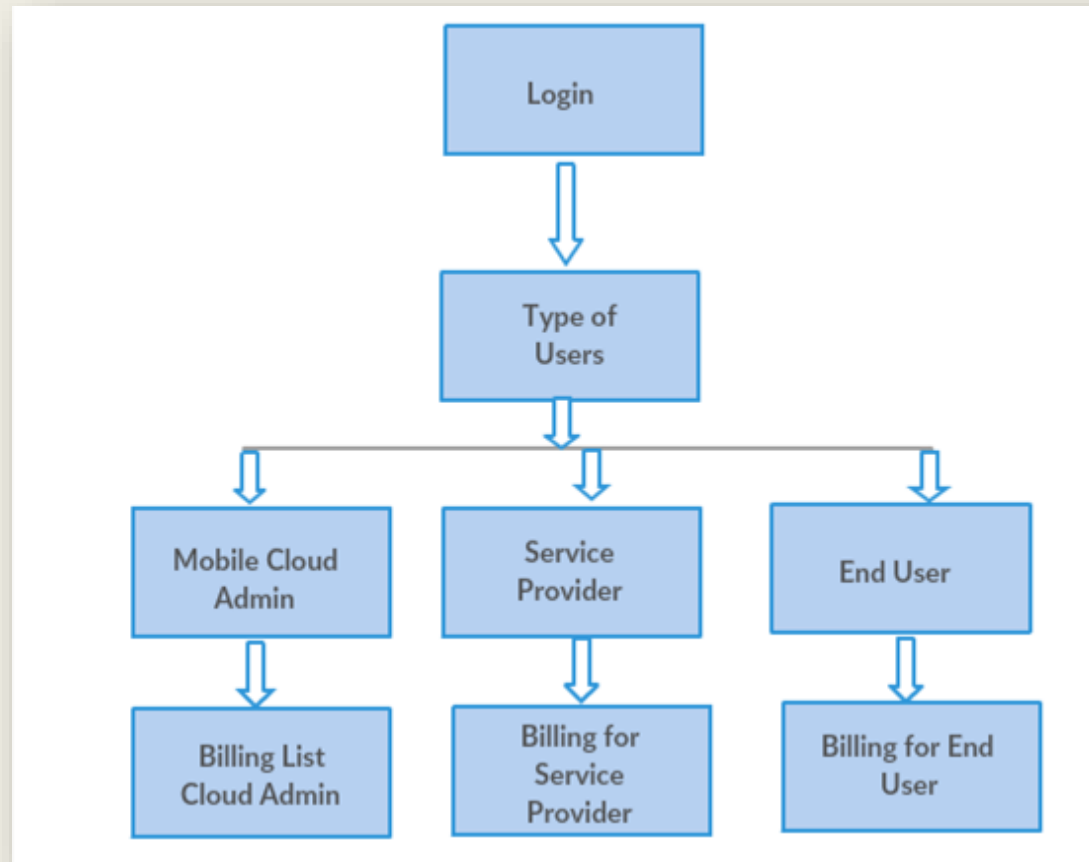
Launch Instance Connect Actions

Filter by tags and attributes or search by keyword

	Name	Instance ID	Instance Type	Availability Zone	Instance State	Status Checks	Alarm Status
<input checked="" type="checkbox"/>	Sample-env	i-03ad86d9b975d3a21	t1.micro	us-west-2a	running	2/2 checks...	None
<input type="checkbox"/>	Sample-env	i-07298af96f18b0d18	t1.micro	us-west-2a	running	Initializing	None



Billing for Sensing and Data Services



Billing - Mobile Sensor Cloud Admin

- Mobile Sensor Cloud Admin provides and allocates the sensors to the Service Provider.
- Cloud Admin, monitor the sensors and can also activate, deactivate or de-register the sensors.
- Mobile Sensor Cloud Admin has the billing list of all the sensors allocated to all the Sensor Service Provider.
- Billing calculation: (Sensor de-activated time-Sensor creation time)* cost.

Billing - Mobile Sensor Cloud Admin

Mobile Sensor Cloud Admin

Dashboard

Monitor Sensors

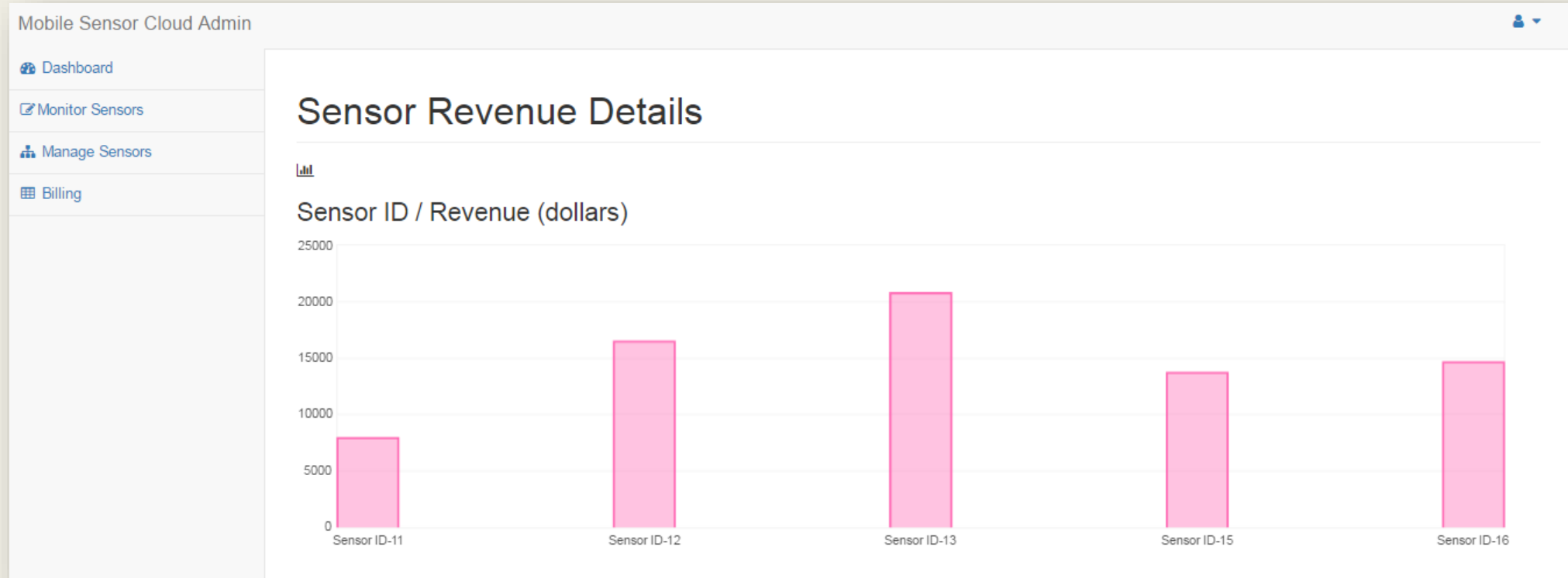
Manage Sensors

Billing

Billing List of all Consumers

Sensor ID	Sensor Name	Sensor Description	Sensor Type	Revenue (dollars)
11	first sensor	first virtual sensor	location sensor, speed sensor,	7920
12	second sensor	second sensor	location sensor, radar sensor,	16470
13	third sensor	third sensor	location sensor, torque sensor	20760
15	wda	asdasd	speed sensor,	13710
16	sensor 3	zdzdfd	location sensor, radar sensor,	14640
Total Cost				73500

Analytics For Mobile Sensor Cloud Admin



Billing - Service Provider

- The billing for the sensor service provider is calculated based on the number of sensors allocated to the particular provider.
- Timestamp of the sensor activation and deactivation is noted.
- Billing is calculated based on the uptime of the sensor based on the activation and deactivation of the sensors.

Billing - Service Provider

Smart Taxi Service Provider

Dashboard

Sensor Monitoring

Billing for Sensor Consumer

Sensor ID	Sensor Name	Sensor Description	Sensor Type	Revenue (dollars)
11	first sensor	first virtual sensor	location sensor, speed sensor,	7920
12	second sensor	second sensor	location sensor, radar sensor,	16470
13	third sensor	third sensor	location sensor, torque sensor	20760
15	wda	asdasd	speed sensor,	13710
16	sensor 3	zdzdfd	location sensor, radar sensor,	14640
Total Cost				73500

Analytics For Service Provider

Trip Details

Trip ID	Distance (miles)	Cost (dollars)
1	301	603
2	301	603
3	301	603
4	301	603
5	724	1448



Number of Trips (last 7 days)





Billing - End User

- End user is the one who receives the service from the service provider.
- End user provides the pick-up and drop-off location.
- The billing for the end user is calculated based on the distance between the pick-up and drop-off location.
- The billing is also provided with the trip history of his previous rides.


Billing - End User

Smart Taxi

 Dashboard

 Driver Safety Score

ML Stanford univerty
openclassroom.stanford.edu/MainFolder/CoursePage.php?course=MachineLearning



Billing and Trip History of End User

Trip ID	Date of Travel	Source	Destination	Distance	Cost
1	2016-11-29 00:00:00.0	37.331962	37.329887	301.782	603.564
2	2016-11-29 20:42:40.000457	37.331962	37.329887	301.782	603.564
3	2016-11-29 20:46:43.000403	37.331962	37.329887	301.782	603.564
4	2016-11-29 20:49:06.000691	37.331962	37.329887	301.782	603.564
5	2016-11-29 22:21:12.000175	37.331962	37.335282	724.204	1448.41

Technologies Used in our project:

Database:

- Amazon Relational Database Service
- MySQL

Cloud Technology:

Amazon EC2, AWS BeanStalk

Real Time Data Mapping:

- Mapbox for customized map
- PubNub for realtime data streaming

Front-end Technologies Used:

- JavaScript
- jQuery
- Bootstrap for simple styling

Driving Quality Analysis

To quantify the Driving Quality, driver safety score is computed using the following 4 parameters. Percentage signifies how each of the parameters impact the final score.

- Overspeed (40%)
- Distraction instants when driving (40%)
- Sudden Acceleration (10%)
- Sudden Braking (10%)

Driving Quality Analysis Algorithm

- Overspeed (40%)

Avg Overspeed < 5 mph => 40 points

5 mph < Avg Overspeed < 8mph => 30 points

8 mph < Avg Overspeed < 12 mph => 15 points

12mph < Avg Overspeed => 0 points

- Distraction instants when driving (40%)

- Sudden Acceleration (10%)

- Sudden Braking (10%)

Ideally, the standard values for this computation need to be derived from a large dataset of safe driving behavior.

Driving Quality Analysis

The screenshot below shows driver safety score calculated for each user making a trip.

Driver Safety Score

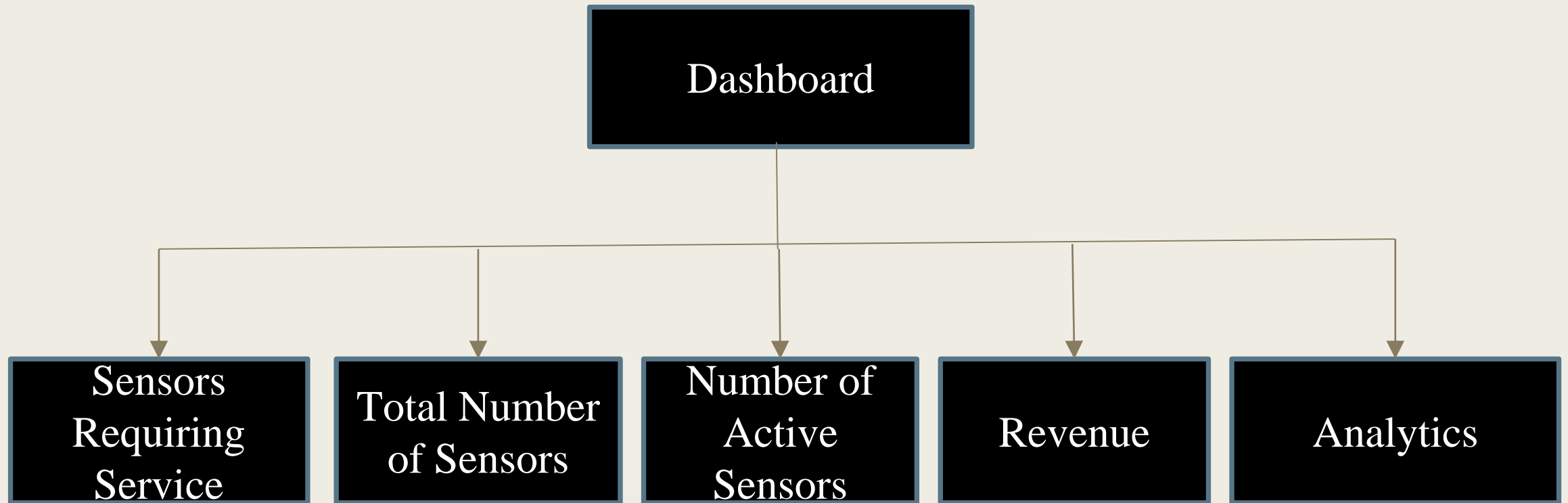
Name	Miles Travelled	Average Over speed	Sudden Acceleration Times	Sudden Brake Times	Distracted Driving Times	Driver Safety Score
Jack	75	30	10	10	20	30
John	10	15	20	0	10	60
Sam	30	20	15	10	5	40
Smith	5	25	5	5	20	38
Tim	45	25	15	25	15	30

Dashboard & Analytics

- Dashboard for each type of user in our application
 1. Sensor Provider
 2. Sensor Consumer
 3. End User
- Dashboard fetches critical data from the Database, and displays it in an user friendly manner for analysis.
- We have data analytics and graphs to quickly understand and observe the trends.

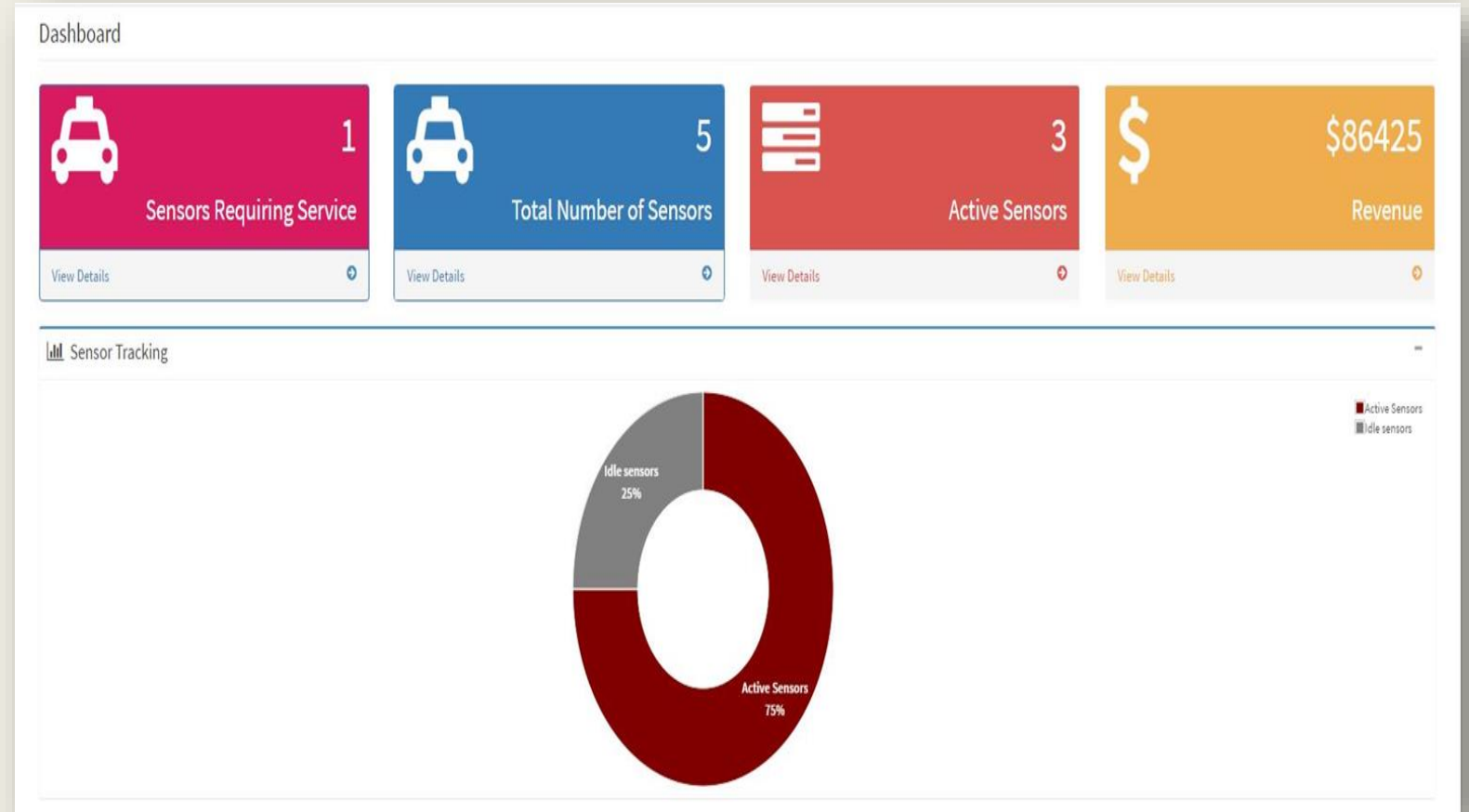
Sensor Provider

Admin is the one who can add and manage sensor.



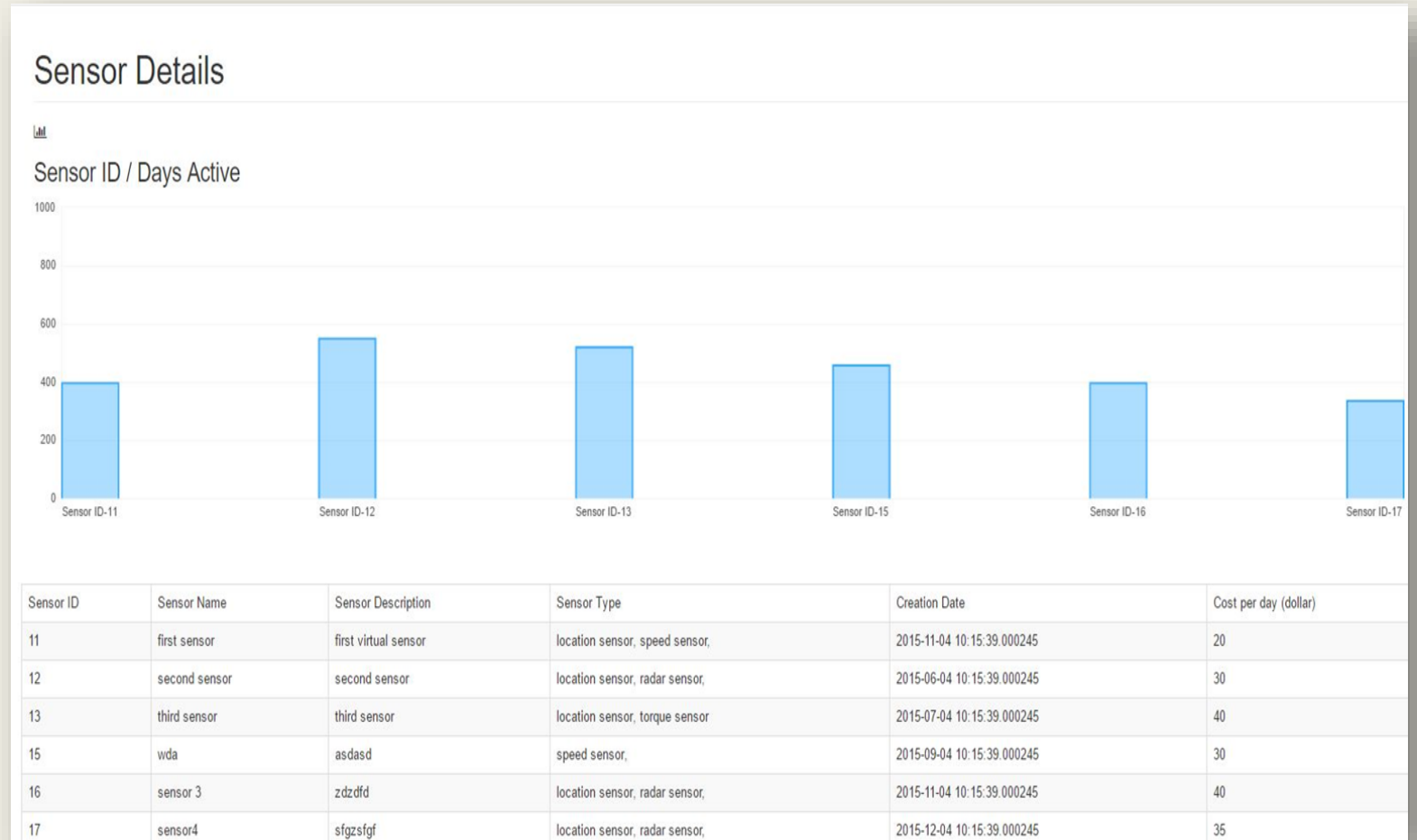
Sensor Provider Dashboard

- This is a screenshot of the admin dashboard which shows analytics for sensor details, sensor activity tracking and revenue.



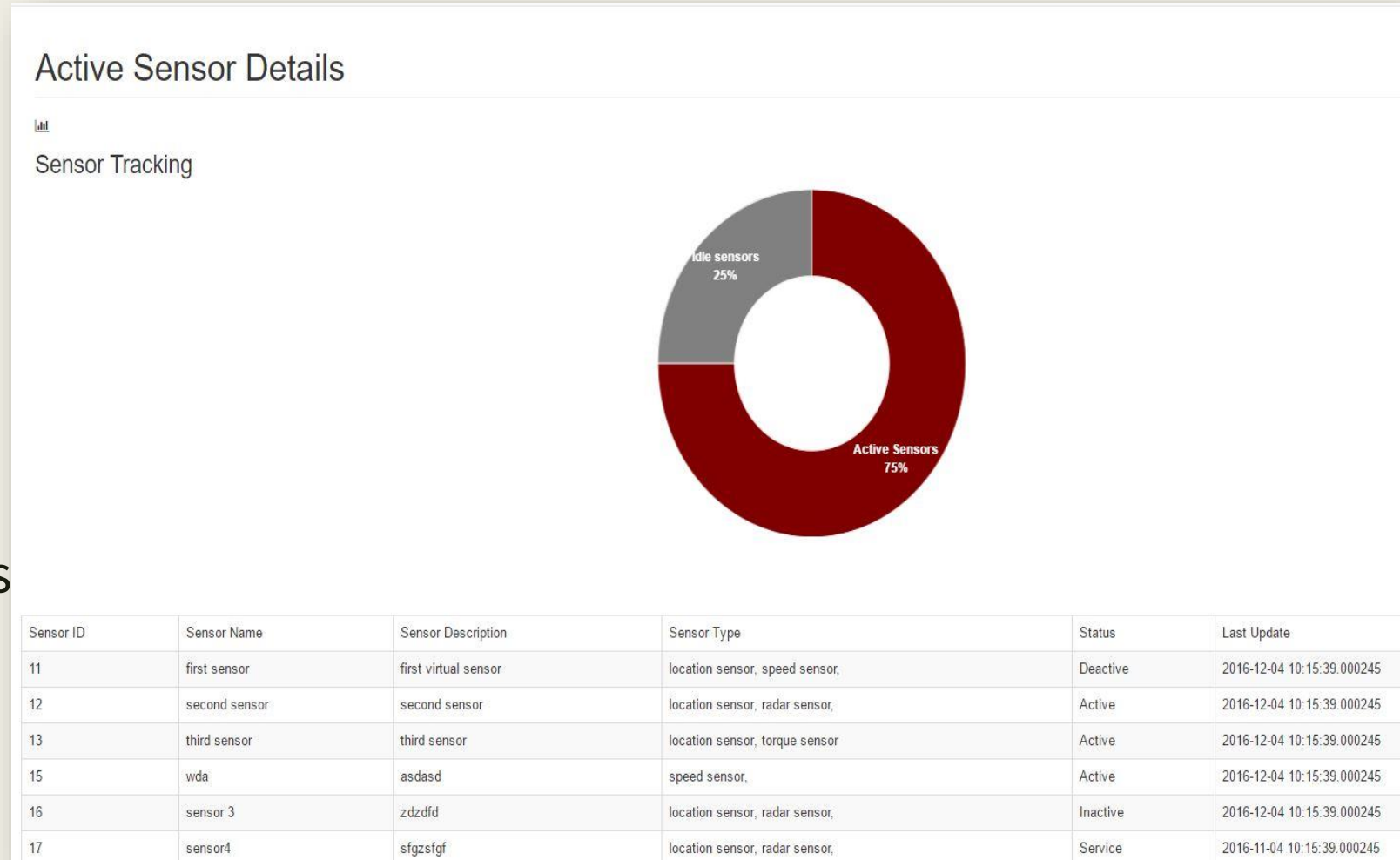
Sensor Provider – Analytics for Sensor details

- This screenshot shows the number of active sensors and the number of days each sensor was active.
- $\text{Active Sensor Time} = \text{Last Updated TimeStamp} - \text{Creation date TimeStamp}$



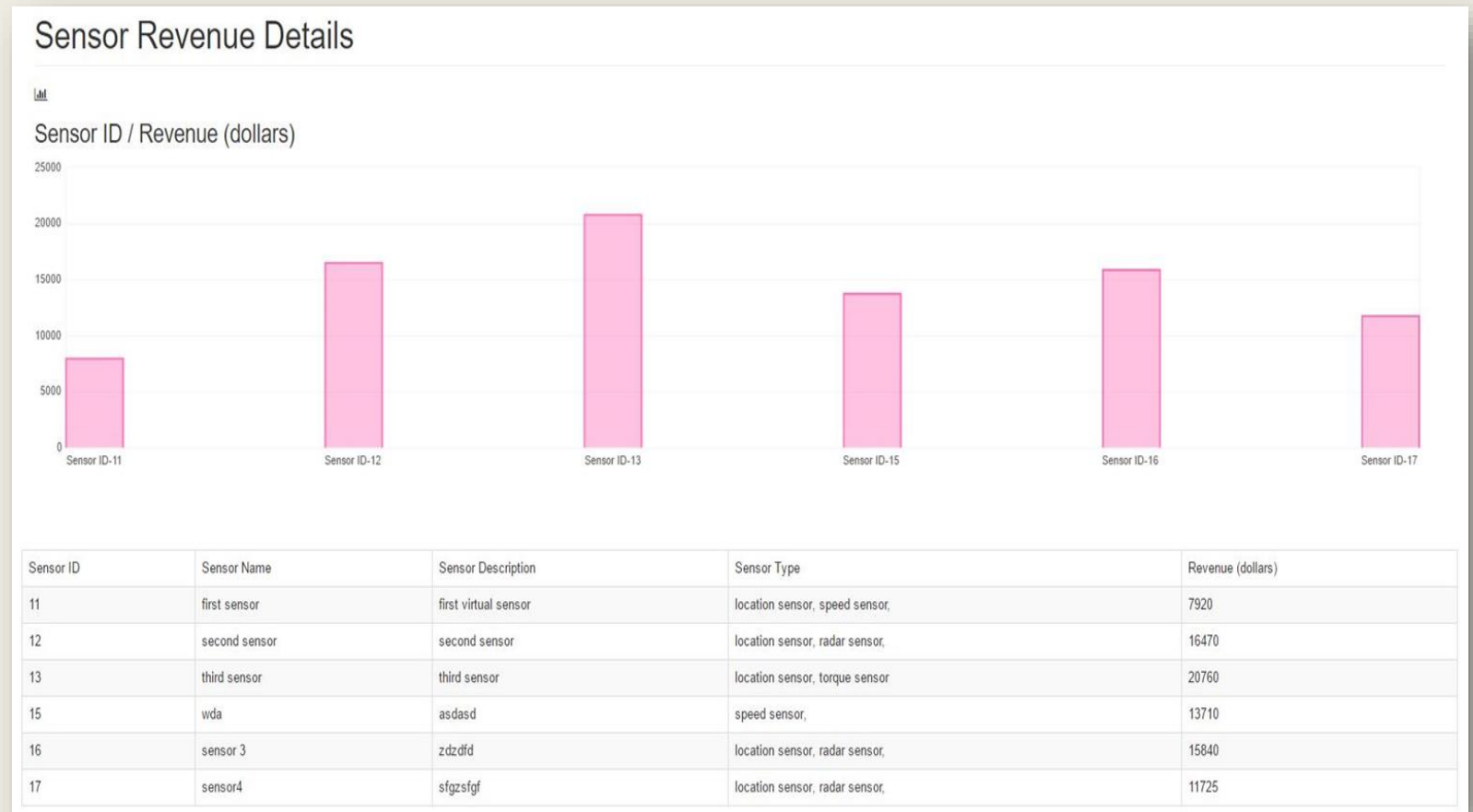
Sensor Provider –Analytics for Active sensors

- Admin can track the sensor activity as shown in the screenshot.
- The screenshot shows details of registered mobile sensors such as sensor id , name , status type and last updated timestamp.

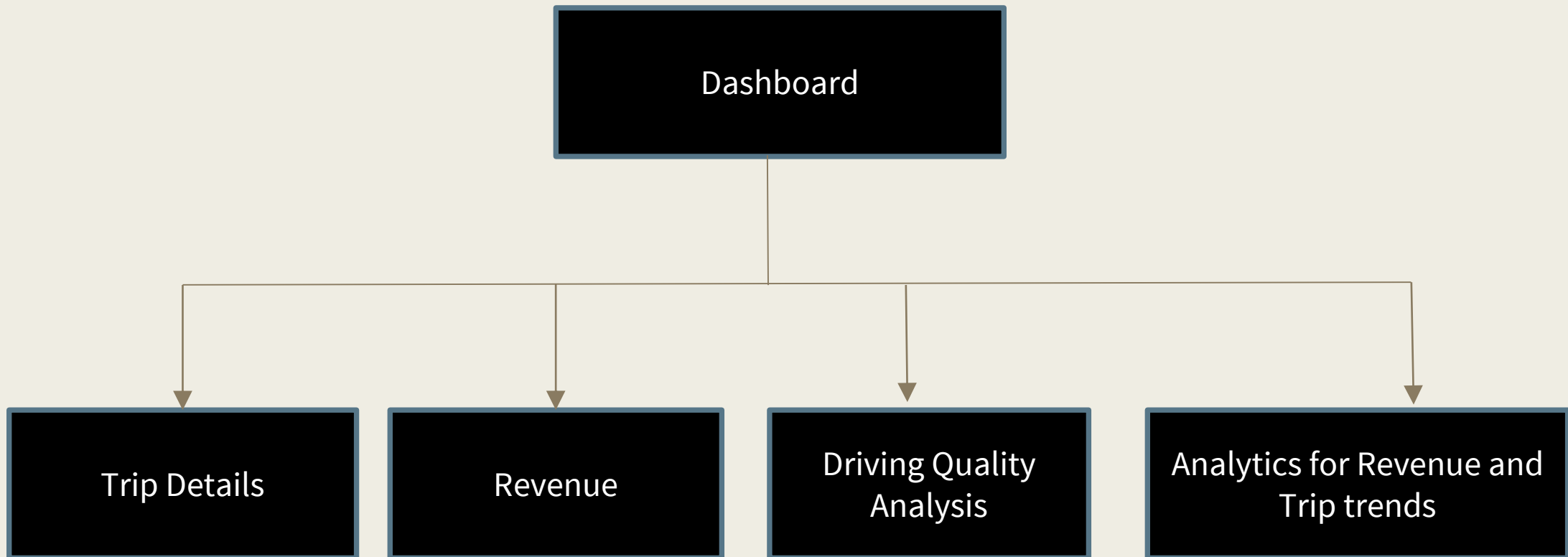


Sensor Provider -Analytics for Revenue

- The graph fetches sensor revenue details for each sensor in real time.
- This table has details on the revenue generated by each sensor type

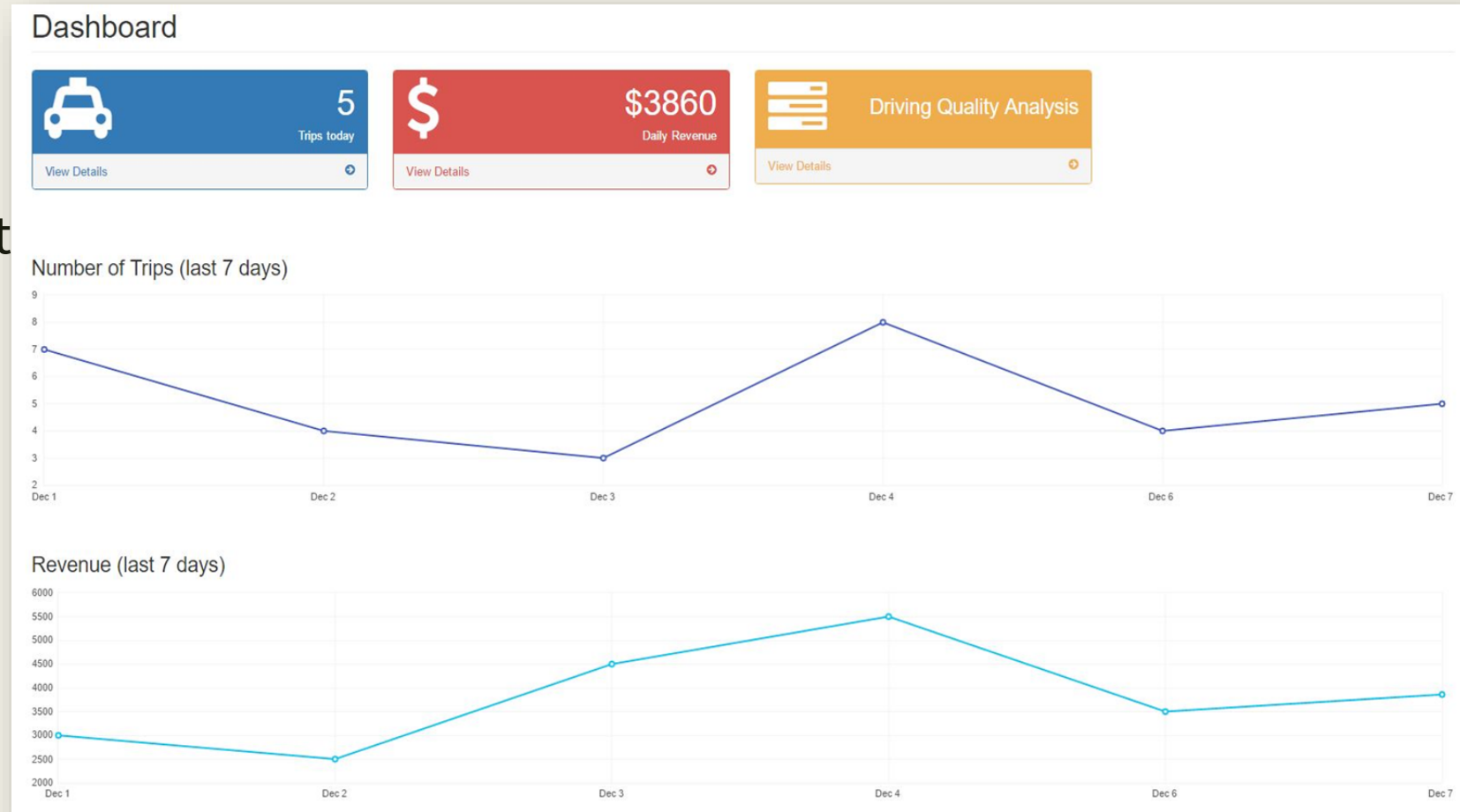


Sensor Consumer – (Client who can monitor and de-register sensors added by admin)



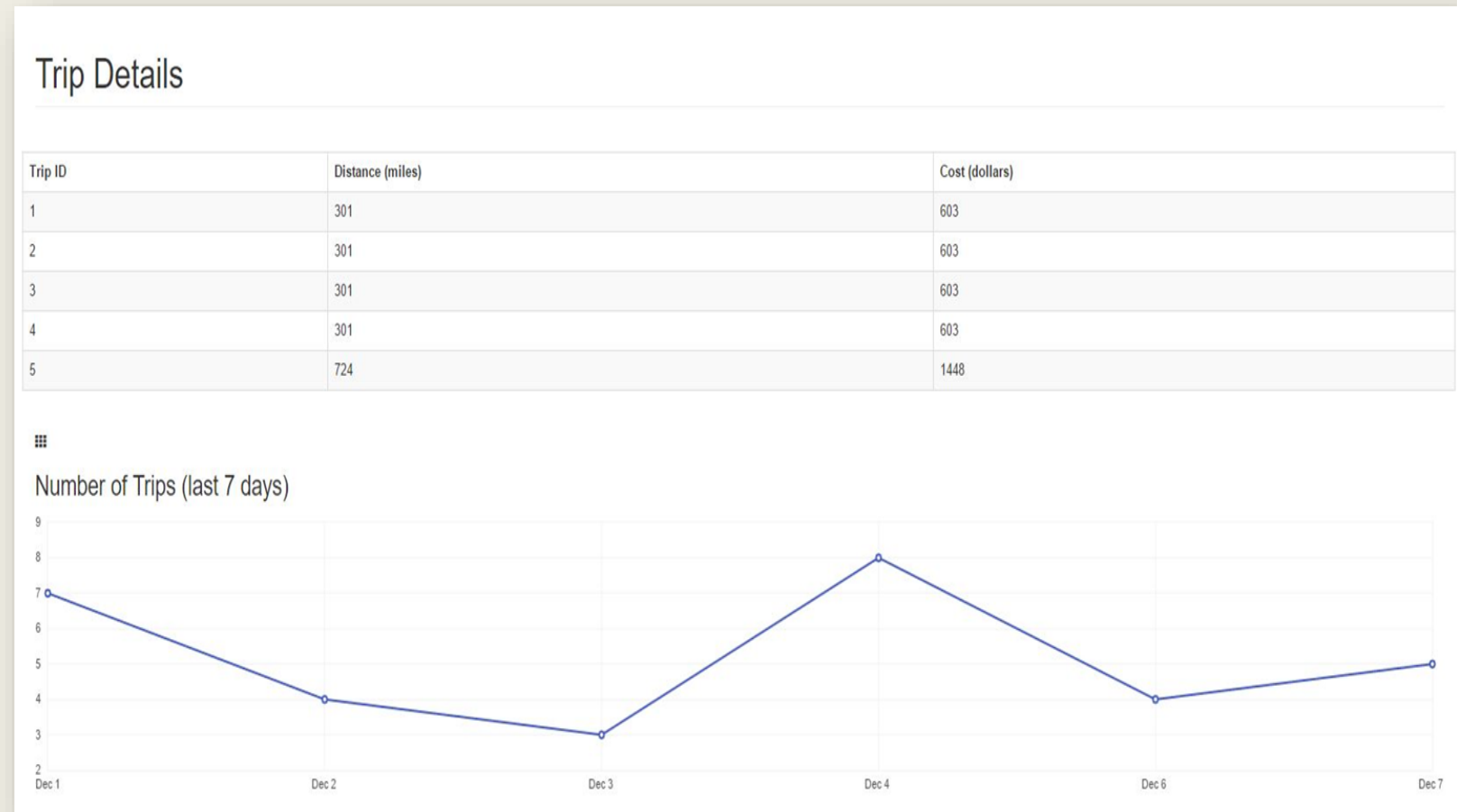
Sensor Consumer

- Sensor consumer or client gets sensor as a service from the admin and also provides smart taxi service to the end user.
- The screenshot shows the dashboard for sensor consumer.



Sensor Consumer-Analytics for Trip details

- The screenshot shows the total number of trips and the distance travelled for each trip along with the trip id .



Thank You