International Journal of Electrical Engineering and Technology (IJEET)
Volume 11, Issue 4, June 2020, pp. 191-203, Article ID: IJEET_11_04_022
Available online at https://iaeme.com/Home/issue/IJEET?Volume=11&Issue=4
ISSN Print: 0976-6545 and ISSN Online: 0976-6553
DOI: https://doi.org/10.34218/IJEET.11.4.2020.022

VISUALIZING ROAD DAMAGE BY MONITORING SYSTEM IN CLOUD

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ABSTRACT

Cloud computing gives many beneficial services to share large scale of information, storage resources, computing resources, and provide knowledge for research. In this paper, I have proposed the methodology for visualizing the road damage condition by monitoring and detecting the road damage and specifying the location of the damage by which others can prevent from accident response. In the proposed system is about the visualizing road damages using cloud database. That is we need some prevention by monitoring 'road damage' using mobiles. To find the road damage, the roads are monitored and the snapshots are taken. The snapshot images are then processed in the application developed without internet. The information details about the road damage will be sent to the cloud. Then the cloud stores that information in the database. This information is very helpful in visualizing road damage locations to the users. Different maps are developed for different kinds of users based on the above gathered information. There are three types of users involved. They are Vehicle Users, Corporation Users and Administration Users. The Vehicle user gets the visualized map of the specified road damage on the path between the source and destination. The Corporation user visualizes the road map for damaged locations in a specified area. The Administration user visualizes the map of the Client broker locations in a specified area.

Key words: Cloud database, Client Broker, Visualizing, Cloud Computing, Road Damage

Cite this Article: Deepa D, R. Vignesh, Sivasangari A, Suja Cherukullapurath Mana, B. Keerthi Samhitha and Jithina Jose, Visualizing Road Damage by Monitoring System in Cloud. *International Journal of Electrical Engineering and Technology*, 11(4), 2020, pp. 191-203.
https://iaeme.com/Home/issue/IJEET?Volume=11&Issue=4

1. INTRODUCTION

Cloud computing can provide resource as services via virtualization technology which provides software environment in the form of virtual machine VM. In cloud computing, applications with operating system, specific hardware, software, and libraries requirements can be executed in a larger amount of resources by instantiating VMs from a repository so that requirements can be supported. The detection of road damages and their correct locations contributes to the improvement of driver safety and ensures safe driving by visualizing the map for the road damage specification. Road damage assessment has been identified as a critical issue related to the possibility of making the transportation system more safe, efficient and comfortable. This would enable them to take preventive measures before further damage occurs. It is worth noting damaged roads with several damages which can lead to traffic choking and cause accidents.

In such a scenario, we need some prevention by monitoring „road damage" using mobiles. To find the road damage, the roads are monitored and the snapshots are taken. The snapshot images are then processed in the application developed without internet usage. The information such as the latitude, longitude and amount of the damage of the road damage are gathered from the images. The information gathered will be sent to the appropriate client broker who in turn sends the gathered information to the cloud. Then the cloud stores that information in the database.

This information is very helpful in visualizing road damage locations to the users. Different maps are developed for different kinds of users based on the above gathered information. There are three types of users involved. They are Vehicle Users, Corporation Users and Administration Users. The Vehicle user gets the visualized map of the specified road damage on the path between the source and destination. The Corporation user visualizes the road map for damaged locations in a specified area. The Administration user visualizes the map of the Client broker locations in a specified area. Visualization is the creation of a virtual version of something such as an operating system, a server, a storage device or network resources. Scheduling the basic processing units on a computing environment has always been an important issue. In cloud computing, a user may require a set of virtual machine co-operating with each other to accomplish one task. [3]

2. RELATED WORK

This section lists out the various research works related to the problem that we have considered and the features and the drawbacks of such approaches.

[9] Described how each road surface is obtained and used for rough discrimination between road and road points. Road points are grouped based on vicinity and false areas are rejected. Each road area is classified into obstacles or traffic road patches for path planning by using criteria related to the density of the 3D points. The proposed real-time algorithm was evaluated in an urban scenario and can be used in complex applications, from ego-pose estimation to path planning. Further work to be done includes how using the tracking can greatly improve the robustness of the method, MMXSSE processor features can reduce the processing time to half, and enhancing the algorithm to cope better with various types of noise in the 3D dataset.

[8] Proposed approach removes the need for global matching performance by the vision front-end and instead it must only pick the best match within any short sequence of images. This approach is applicable over environment changes that render traditional feature-based techniques ineffective. Using two car-mounted camera datasets they demonstrate the effectiveness of the algorithm and compare it to one of the most successful feature-based SLAM algorithms, FAB-MAP.

[10] Discussed the key features of the road shape is a key element for driver assistance systems which support the driver in complex scenarios like construction sites. The paper presents an approach to estimate road boundaries based on static objects bounding the road. A map based environment description and an interpretation algorithm identifying the road

boundaries in the map are used. Two approaches are presented for estimating the map, one based on a radar sensor, one on a mono video camera. The estimated boundaries are independent of road markings and as such can be used as orthogonal information with respect to detected markings. Results of practical tests using the estimated road boundaries for a lane keeping system are presented.

[5] Ensure that each mobile device consumes the same proportion of its energy to its energy capacity while meeting its user SLA requirement; an energy cost model is used to model the cost of executing a task in different computing facilities including mobile devices, the local cloudlet, and the remote cloud. They then devise an efficient online algorithm for fairly offloading location-aware tasks among mobile users. Even though they finally conduct experiments by simulations to evaluate the performance of the proposed algorithm, the issues are that mobile users do not have the knowledge about offload in without use of internet, when they have tasks to be offloaded in the future.

3. PROPOSED MONITORING SYSTEM FOR VISUALIZING THE ROAD DAMAGE

The proposed frame work consists of the following modules as follows:

Step 1: Vehicle User Module: The vehicle user requests the cloud for a specific route about road damage information. The route name is decoded using Polyline decode algorithm in the Google map API. This will convert the string name into corresponding latitude and longitude. Each request is processed in the cloud and the requested routes are returned as plotted in the Map.

Input : Source and Destination

Output: Map of specified path plotted with road damages

Methodology: Polyline decode

Procedure:

- Request Google Map API data
- Source and Destination address is entered as string.
- The polyline decode converts the string into latitude and longitude values and plotted the multiple path in Google Map with source and destination.
- Between the source and destination address, polyline is plotted in blue color.
- Get the source and destination data stored in cloud.

Step 2: Corporation User Module: The corporation user requests the road damage information for a specific distance to the cloud. The cloud responds to the user by returning the road damage points stored for the requested distance. The damage points are plotted in the map to facilitate the corporation users.

Input : Distance specification

Output: Road map for damaged location in an area specified

Methodology: Haversine Method

Procedure:

- Request Google Map API data.
- Corporation user enters the specific distance to know the damage.
- Using Geolocation marker point, the distance specified is covered from the current location point and the road damaged points are retrieved.

- Using Haversine Formula, Compute distances between source and destination on the surface of a sphere using the latitude and longitude of the two points and retrieve the damaged data from the cloud.
- Plot the damages in the corporation map.

Step 3: Administration User Module: The Administration user requests the cloud for a specific area, the cloud processes the request and returns the requested area as plotted map using client broker location markers in the map. The administration user grants the permission to remove damage points.

Input : Source and Destination

Output: Map of specified route plotted with client broker and road damages.

Procedure:

- Request Google Map API data.
- Get the source and the destination address and decode string to latitude and longitude values.
- Set the client brokers from source to destination in such a way that the gateways do not intersect each other.
- Retrieve the damage points from cloud between source and destination point.
- Administration user can update the damage points by removing the points which are repaired.

Step 4: Client Broker To Cloud Module: The client broker updates the cloud twice or thrice a day so that the updated information is placed in the cloud database.

Input : CSV file which contains the damage information

Output: Visualized Map of plotted damage

Procedure:

- Client broker sends the information about the damage point to cloud.
- The information contains latitude, longitude and amount of damage.
- The damage points are plotted in red color in the map.

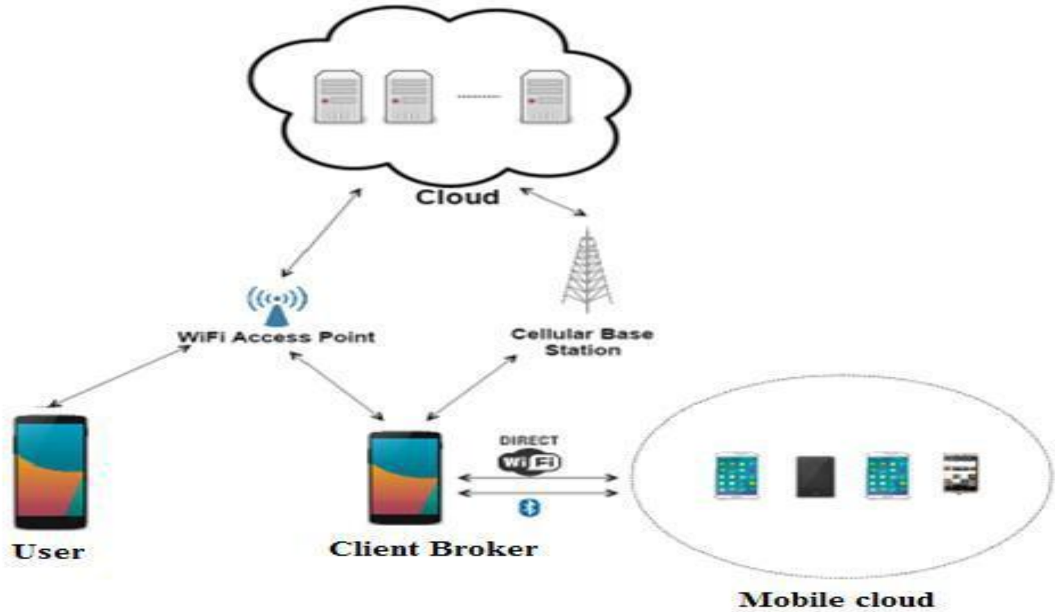

Figure 1 Overview of the proposed Vehicle Monitoring System

The figure 1 shows the overall architecture of the proposed project. The architecture is divided into cloud service establishment and client broker process. Last phase work was done on the client broker process while this phase concentrates on the cloud service establishment. The cloud service establishment deals with the different kinds of users requesting different kinds of information to the cloud and getting the different types of visualized maps about the road damage.

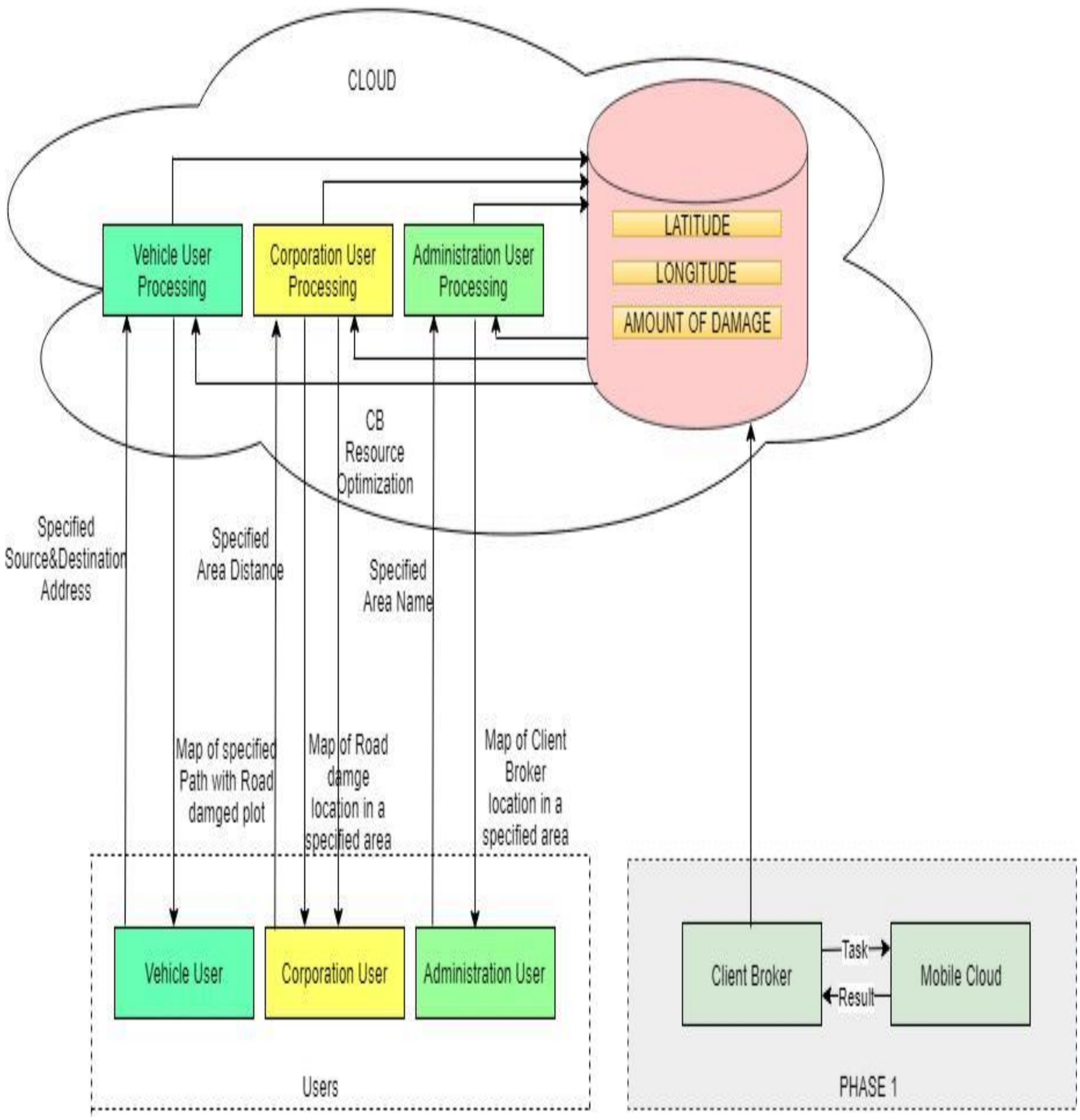

Figure 2 Detailed design of the Vehicle Monitoring System

Each and every mobile node sends the information about each road damaged area as latitude and longitude and the amount of the damage to a client broker. Client broker sends those results to the Cloud. The vehicle user sends a request to the cloud for a specific route. That route name is decoded by using Polyline decode algorithm in the Google map API. That will convert the string name into corresponding latitude and longitude. Then each request is processed in the cloud which returns the requested route as plotted in the Map. The Corporation user sends a request to the cloud for a specific area then it retrieves damaged points stored in the cloud which then returns the requested area as plotted damage points in the map. The Administration user sends a request to the cloud for a specific path name, which is processed and then returns the requested route as plotted client broker location markers and updates the damage in the map.

4. EXPERIMENTS AND RESULTS

4.1. Dataset Description

This dataset contains the data obtained from client broker processed information. The dataset is about the damage location details which include fields like LATITUDE, LONGITUDE, and AMOUNT_OF_DAMAGE. This information going to store in the cloud. After that based on the user requirements the details are extract from cloud.

Table 1 Road_damage dataset

LATITUDE	LONGITUDE	AMOUNT_OF_DAMAGE
13.010236	80.215651	45
13.015177	80.224846	60
13.012459	80.226992	40
13.010808	80.224288	50
13.007902	80.233491	35
12.931809	80.123201	44
12.941011	80.133157	80
12.949836	80.139016	40
12.953195	80.141601	55
12.965812	80.148436	45
12.961233	80.145904	30
12.956674	80.143457	55
13.045447	80.113774	50
13.043767	80.120824	55
13.042407	80.124731	70
13.041818	80.125889	50
13.041519	80.126542	45
13.038461	80.267249	45
13.042475	80.267674	55
13.043931	80.266397	35
13.053622	80.263915	40
13.054291	80.264151	60
13.048433	80.265509	60
13.033889	80.277394	30

4.2. Implementation Results

This section explains the experimental results obtained on executing the proposed system.

4.2.1. Vehicle User Module

The vehicle user gets the visualized map of the specified road damage path between the source and destination.

The vehicle user requests the cloud for a specific route about road damage information. The route name is decoded using Polyline decode and it converts the string name into corresponding latitude and longitude. Each request is processed in the cloud and the requested routes are returned as plotted in the Map.

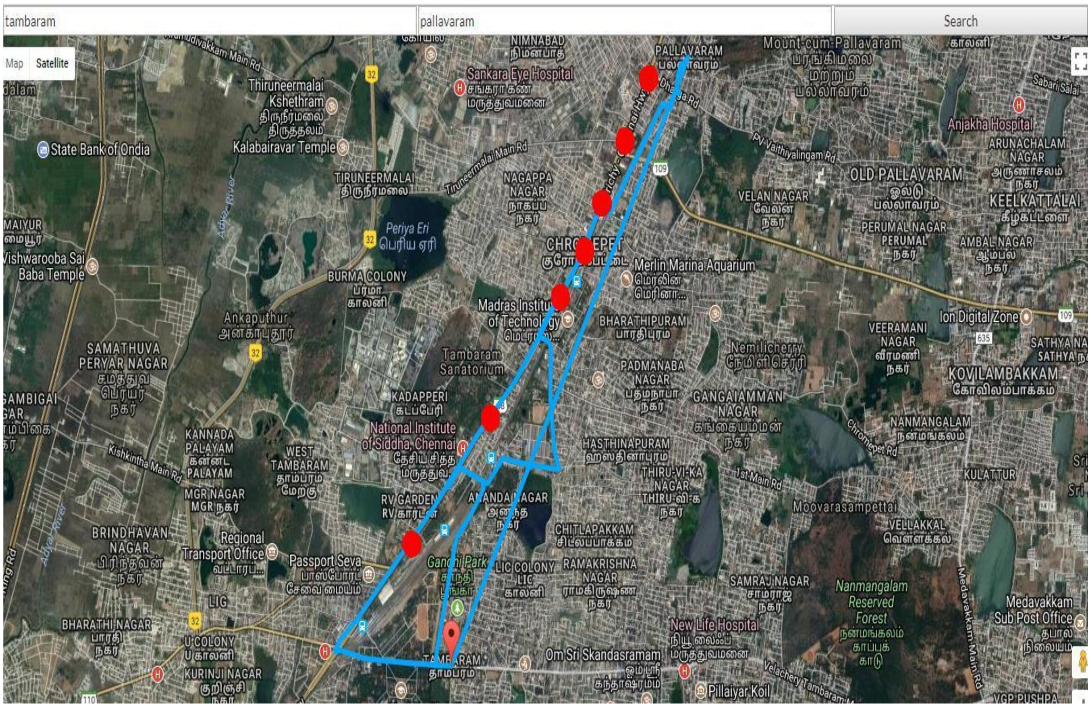

Figure 3 Map for a Vehicle User

4.2.2. Administration User Module

The administration user gets the visualized map of the specified road damage path and the client brokers are plotted along with the damages.

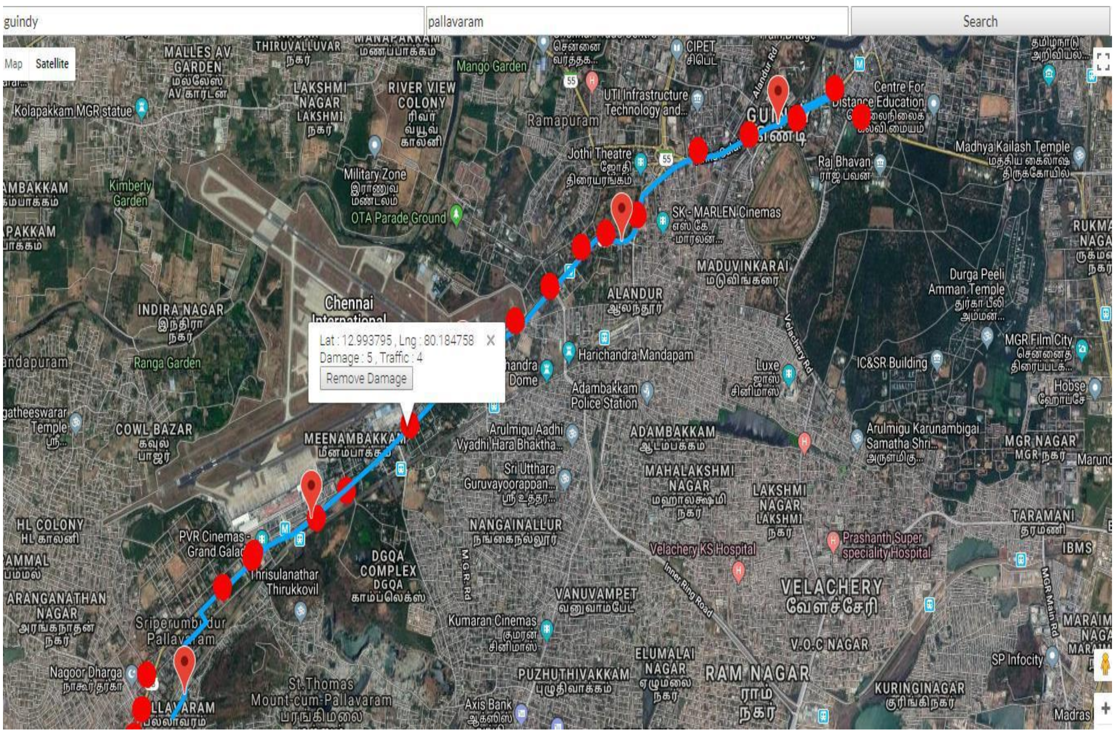

Figure 4 Map for Administration User

The Administration user requests the cloud for a specific area; the cloud processes the requests and returns the requested area as plotted map using client broker location markers in the map. The administration user only has the permission to remove the damage points.

4.2.3. Corporation User Module

The corporation user gets the visualized map of the specific distance of road damage locations.

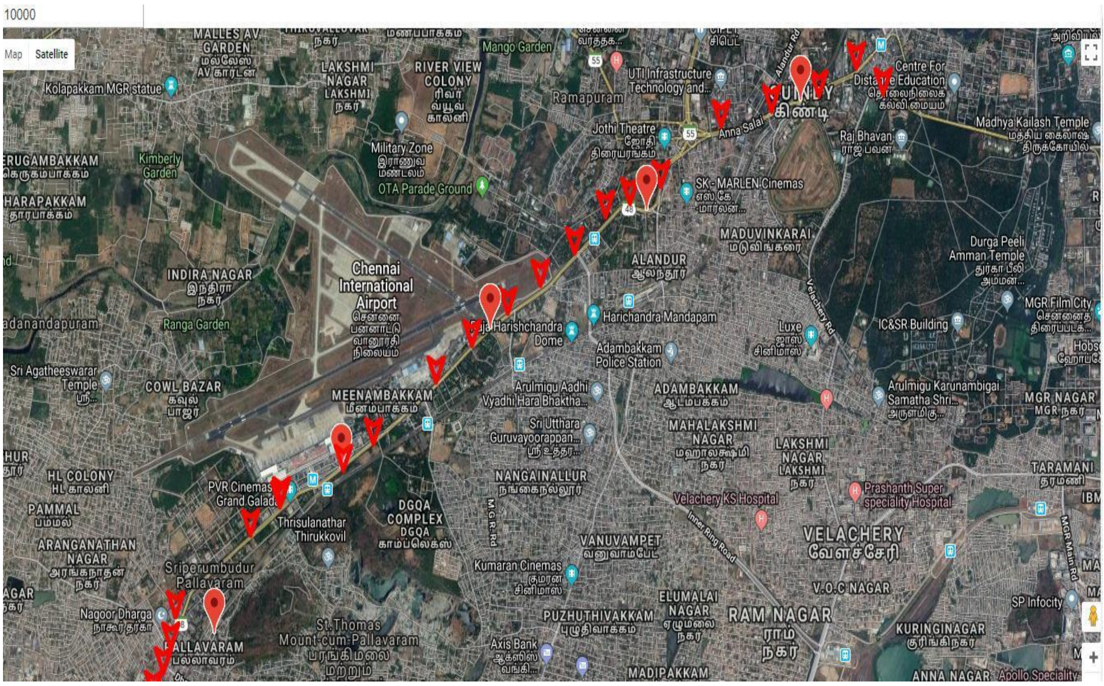

Figure 5 Map for Corporation User

The corporation user requests the road damage information for a specific distance to the cloud. The cloud responds to the user by returning the road damage points stored for the requested distance. The damage points are plotted in the map to facilitate the corporation users.

4.2.4. Client Broker to Cloud Processing Input

The client broker has the gathered information about the road damage, and It uploads this information to the cloud.

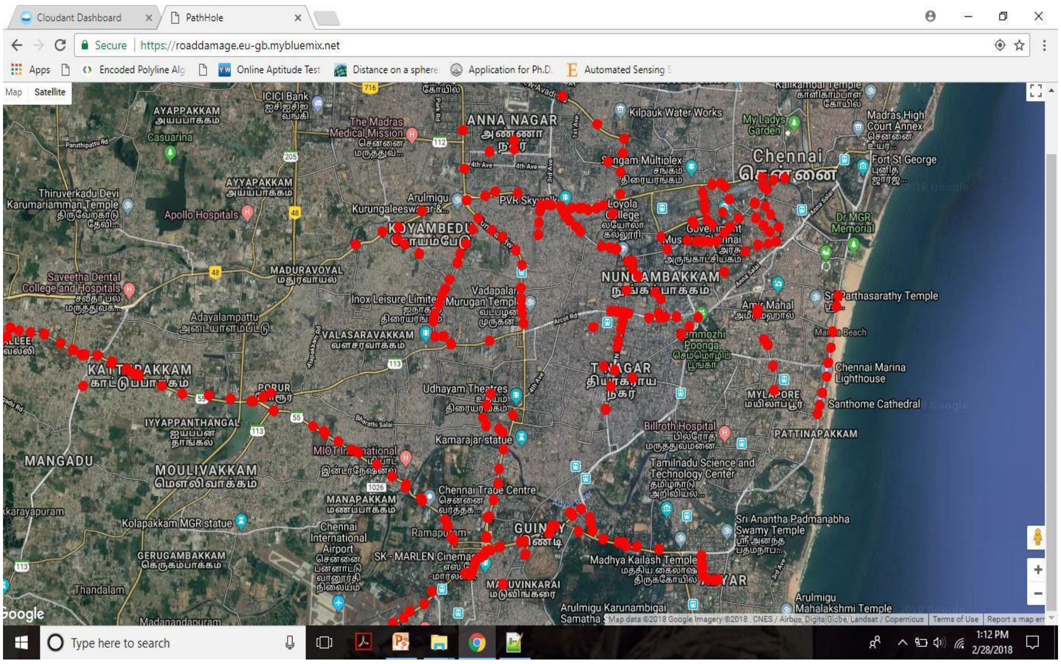

Figure 6 Map for Entire Damages

4.3. Evaluation Metrics

In this section, the proposed system is evaluated based on Client Broker
And the Resource Count allocated for each client broker.

Table 2 Resource Allocation Count

Client Broker Number	Resource Allocation Count
CB0	3
CB1	3
CB2	3
CB3	25
CB4	16
CB5	11
CB6	19
CB7	3
CB8	3
CB9	12
CB10	3
CB11	3
CB12	21
CB13	19
CB14	3
CB15	4
CB16	26
CB17	26
CB18	26
CB19	26
CB20	11

The evaluation is based on the Resource Allocation Count to each client broker. This is achieved by using PSO (Particle Swarm Optimization) technique. This is the best cloud resource optimization technique because this technique is useful for Small size data and also applicable for big size data.

The below graph is generate for the 20 client brokers in x-axis and in y-axis for Resource Allocation Count to their corresponding client broker.

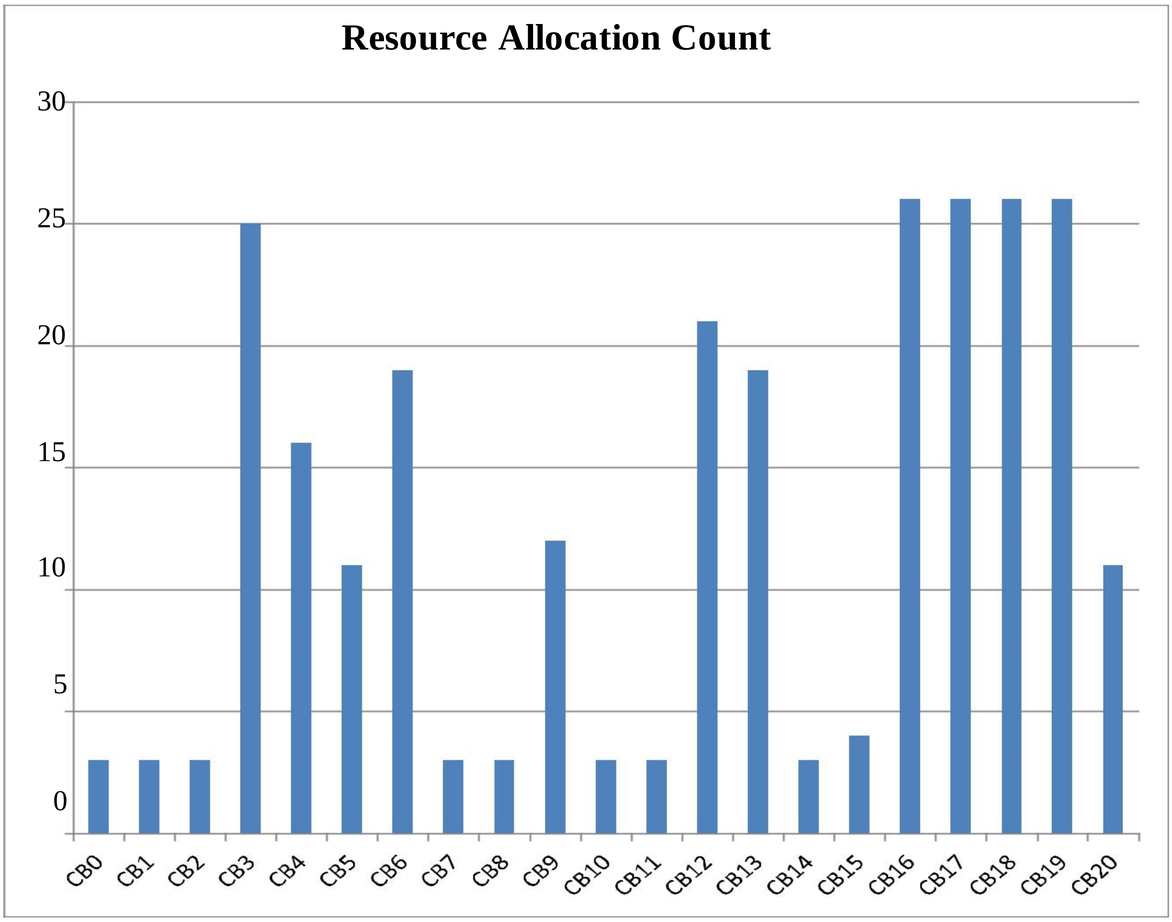

Figure 7 Graphs for Client Broker Resource Allocation Count

4.4. Test Cases

Table 3 Test Cases for the Proposed Vehicle Monitoring System

Module Name	Test No	Test Name	Expected Outcome	Actual Outcome
CLIENT BROKER TO CLOUD MODULE	1(a)	If input dataset contains three fields	It will accept and proceed with the cloud access.	It will accept and proceed with the cloud access.
	1(b)	If input dataset contains more than three fields	It will not accept to access the cloud process.	It will not accept to access the cloud process.
	1(c)	If input dataset contains less than three fields	It will not accept to access the cloud process.	It will not accept to access the cloud process.
	1(d)	If input dataset contains	It will not accept to access the	It will not accept to access the

		missing fields	cloud process.	cloud process.
VEHICLE USER MODULE,CORPO RATION USER MODULE,ADMIN ISTRATIO USER MODULE	2(a)	If the dataset contains the in between points of the source and destination	It allows retrieving points from cloud and plotting the points on the polyline from source and destination.	It allows retrieving points from cloud and plotting the points on the polyline from source and destination.
	2(b)	If the dataset	It will not allow	It will not allow
		does not contains the in between points of the source and destination	retrieving points from cloud.	retrieving points from cloud.
CLOUD DATABASE	3(a)	If database created and connect with the application	The application run correctly and data are stored and retrieve properly	The application run correctly and data are stored and retrieve properly
	3(b)	If database not created	The application cannot retrieve data.	The application cannot retrieve data.

5. CONCLUSION AND FUTURE WORK

In the proposed system I used the cloud for Detecting and visualizing road damage monitoring. The proposed vehicle monitoring system was developed as an android application for detecting the road damage is developed. This application does image processing to detect damage in the road and specifies location. The client broker receives the damage information like latitude, longitude and amount of damage.

That is the data are stored in the cloud. Then the three users like Vehicle user can able to request to cloud to retrieve specific route road damage details and plotted in Google Map with the Polyline along plotted the damages in the specific route. Then the Corporation user request to cloud to retrieve specific distance of damage details and plotted damages in Google Map. Then the Administration user requests the cloud for a specific area, the cloud processes the request and returns the requested area as plotted map using client broker location markers in the map. The administration user grants the permission to remove damage points.

Though the accuracy is based on the road image intensity it may be exact accuracy using advance machine learning method used in the evaluation of damage to roads in Indonesia is PCI (Pavement Condition Index) method. PCI method is a method of road pavement condition assessment based on the type of damage, severity level and density of damages compare to the wide of road surfacing. Application of PCI method tend to be less desirable because of the classification of the type of damage and the level of severity measurements and density calculation are performed by manual observations at each segment and further calculation are still needed to get the index value.

LIST OF ABBREVIATIONS

The following are the list of abbreviations used in this paper:

QOS — Quality Of Service

VM — Virtual Machine

VMM — Virtual Machine Monitor

VMP — Virtual Machine Placement

SLA — Service Level Agreement

ACKNOWLEDGMENTS

We are highly indebted to our respectable Chancellor, Dr. Mariazeena Johnson, B.E., MBA, M.Phil., Ph.D., Sathyabama Institute of Science and Technology for providing us with sufficient facilities.

We would like to express our sincere thanks and deep sense of gratitude to my supervisor Dr. A. Sivasangari, Associate Professor, School of Computing, Sathyabama Institute of Science and Technology for her valuable guidance, suggestions and constant encouragement which paved way for the successful completion of this project work.

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