Firebase Implementation - "Swachh Saarthi"- An initiative for cleaner Mumbai

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Abstract: In this paper, the authors design and present an application which is a proposed system, an initiative for the "Swachh Bharat Abhiyan" to help MCGM with their daily routine. Managing the complete waste management is always challenging and difficult for the various sectors of industry and society, with the growing technological advancements, there is a desperate need to enhance the existing system. The application is divided into two parts as web based application and an android application. This paper highlights the android based application designed for MCGM. The application uses firebase to implement the strategic notifications for the application. The application highlights on reducing communication time between garbage spots using the Dijikstra algorithm and Google's Distance Matrix API. The Firebase is used to send notification to the nearest vehicle, using the FMC architecture in a scenario when the current route vehicle gets full before its finishing its complete route.

Keywords: GPS, GIS, firebase, Dijkstra algorithm, MCGM.

I. INTRODUCTION

Change is the need of nature and so the change is required in every phase of life for better development. Similarly with this small effort to enhance the M.C.G.M, we have strived to give a digital platform to maintain and manage the data in real-time with the use of firebase cloud messaging. The vehicles leave the M.C.G.M. office with the complete map of the routes and the pickup spots. The wastes are collected and if the vehicle gets full before reaching the end location then the message notification is sent to the nearby vehicle. The garbage full vehicle moves towards the dumping ground to empty its load. The calculation of garbage is done on weights for analysis [1].

II. SYSTEM ARCHITECTURE

The basic idea has 4 users of the system as follows:

1. M.C.G.M.
2. Ward Office
3. Motor Loader Chowki
4. Mukkadam

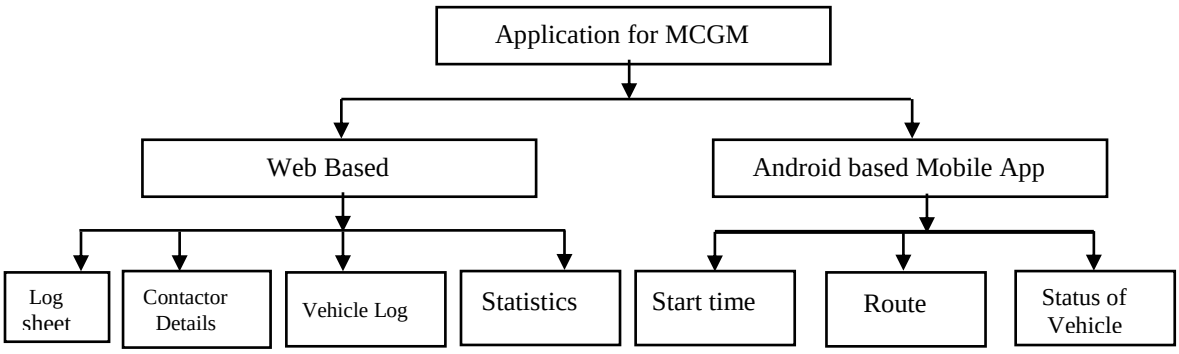

Figure 1: Flow Graph [1]

The M.C.G.M., being the super admin has the complete control of the web and the android application. The details and the log sheets of all the ward offices, contractors, and vehicles log are administered by M.C.G.M.

The Ward Offices are the ward level administrators who get the data via a browser based application which gives reports and analysis on parameters like type and weight of waste, penalties on a contractor, locations covered, etc.

The Motor Loader Chowki is the office from where the vehicle starts daily carrying out process like deployment of area and workers, type of vehicle, route, etc. Every duty chart is designed for 8 hours, hence 3 shifts of 8 hours each completing a complete 24 hour round the clock cycle across the city. It deploys different types of vehicles with respect to the area and garbage collection. The manual form filling will be replaced by an online web form and data will be managed and maintained digitally. The Swachh Saarthi vehicle follows the complete route path to collect the garbage, if the vehicle gets full on the way, then the alert message is sent to the M.C.G.M., along with to the nearest vehicle. The shortest path algorithm searches for the nearby another Swachh Saarthi vehicle to collect the garbage.

Mukkadam is the person in-charge with the vehicle to ensure that the complete route is covered and the vehicle is utilized to its optimum for collecting garbage. The Mukkadam will have a hand-held device which will replace the 3 - copy manual form which needs to be carried up to the dumping station, thus improving accuracy. The device will have the complete route and after completion of every spot the Mukkadam will authorize its approval by entering its password. Hence, efficiency and guarantee that an area has been covered will be marked. The Mukkadam will be allowed to penalize the workers based on the penalties entitled to him. During a complete route in case of surprise checks by higher authorities of the ward office, checking can be carried out and penalties can be imposed over the contractor by entering their unique password on the hand-held device with the Mukkadam.

III. FIREBASE and ITS ARCHIETECTURE

Firebase is designed as mobile-backend-as-a-service which provides various features for building useful, and powerful mobile apps. Firebase has three major services: a real-time database, user authentication and hosting. The real-time database is used as a most unique features of Firebase. To update the Firebase database, all the connected users receive updates in real-time. This signifies app can stay up to date without any user interaction. The Firebase Real-time Database is a cloud-hosted database. The data is stored as JSON and it is synchronized in real-time to each and every connected client. When the system builds cross-platform apps with our iOS, Android, and JavaScript SDKs, all of your clients share one Real-time Database instance and automatically receive updates with the newest data.

At the heart of Firebase is Firebase Analytics, a free and unlimited analytics solution.

1. Unlimited reporting of 500 event types, each with up to 25 attributes
2. One dashboard to view user behavior and cross-network campaign performance
3. Demographic segmentation, including age, gender, and location, available out-of-the-box
4. Export raw data to BigQuery for custom querying
5. The Firebase Analytics Partner database includes leading mobile advertising technology platforms, which have been validated to measure and optimize app campaign performance.

Firebase implements 2-tier architecture

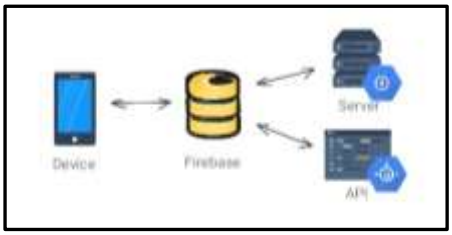

Figure 2: 2-tier Architecture

Notify users when something interesting happens

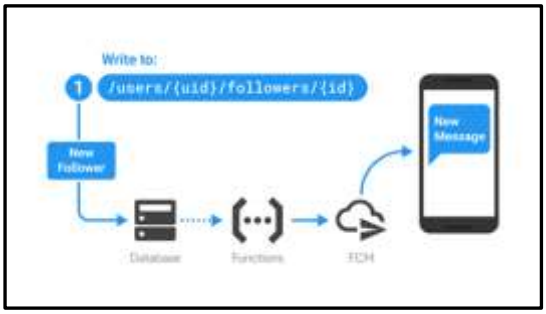

Figure 3: Notification

As developers we used Cloud Functions to keep the user engaged and up to date with relevant information about an application. A function triggered by real-time database writes to store new followers could create Firebase Cloud Messaging notifications to let the appropriate users know that they have gained new followers.

1. The function triggers on writes to the Real-time Database path where followers are stored.
2. The function sends a message via FCM.
3. FCM sends a notification message to the user's device.

The case study showcases the results of firebase implementation.

IV. IMPLEMENTING DIJKSTRA

The refuse vehicles leaves the M.C.G.M. office on the predefined routes to collect garbage. The vehicle routes are prescribed for each vehicle at the M.C.G.M. ward level and assigned to the Mukkadam with its prescribed log sheet. The refuse vehicle follows the route and if after reaching few spots if the vehicle gets loaded, a notification is sent to the nearest refuse vehicle to collect the garbage. The fully loaded vehicles then moves to the dumping ground and the round is completed.

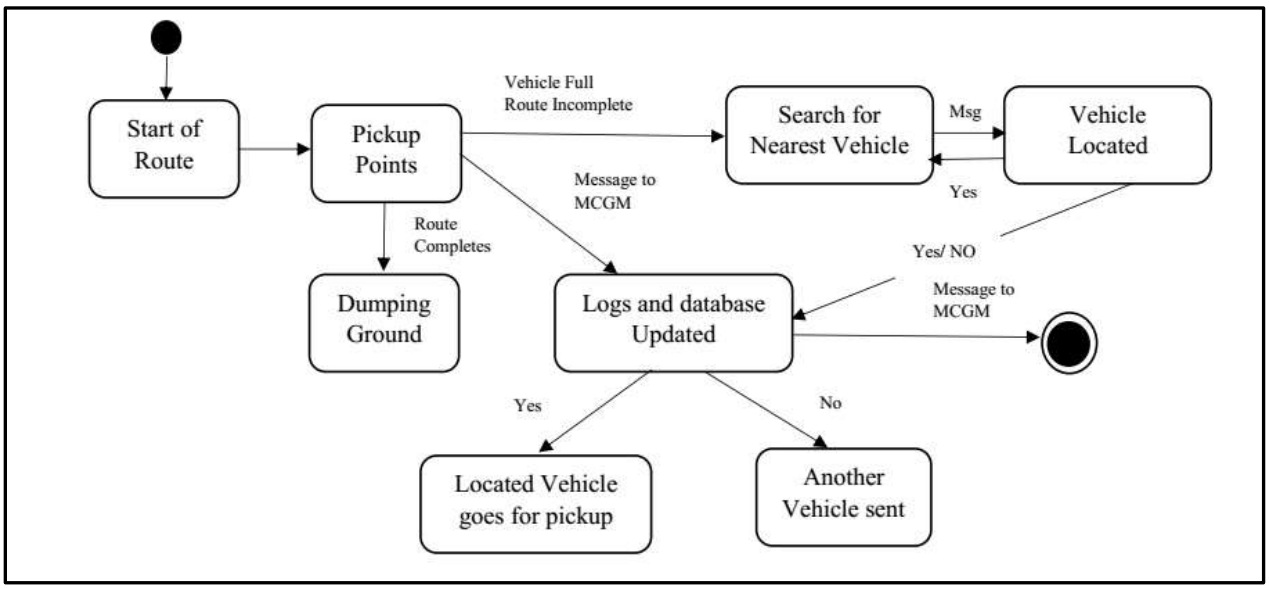

Figure 4: Implementing Dijkstra

V. WORKING PROCEDURE OF MCGM[1]

The Roll-call of the labourers in taken at 6.30 a.m. every day and After 6.30 a.m. all roads are swept through labourers and the refuse so collected is deposited in the dustbins. The surrounding area of the Refuse Collection Centers is kept clean. The debris on the roads is also removed. The roads are cleaned by means of brushing. The dust on the road dividers is also removed. The Refuse Collection Centers are disinfected by spreading over Insecticide powder.

The steps implemented during the completion of the project considers the following steps.

1. The M.C.G.M. initiates all the processes starting from the dispatch of all the Swachh Saarthi vehicles.
2. The Mukkadam's are assigned vehicles along with the mobile devices have the digital log sheet.
3. If the situation arises that the vehicle is loaded to its capacity before completing the entire route, then the status is sent to the MCGM office and to the GPS server to locate another vehicle in the nearby vicinity.
4. The shortest path algorithm is implemented to locate the nearby Swachh Saarthi vehicle.
5. The complete message update is communicated to the administrator and the log details are updated.

6. The vehicle which completes its route or the vehicle is full goes to the dumping ground for emptying the vehicle.

VI. CASE STUDY

The android application is developed with the ease of navigation between the main screen, dashboard and the various activities of the application. The login screen to log into the application as shown below:

Figure 5: Login Screen

After logging in, the various activities those are provided are shown below in Figure 7.

Figure 6: Main Screen

Figure 7: Dashboard Details

The dashboard in Figure 8, shows the complete details about the trip number, the ID of the Mukkadam who is assigned the duty, and the complete route refuse vehicle needs to follow.

If any of the contractors fail to do their duties on time, then the penalties are charged for the same. The types of penalties are as shown below in Figure 9.

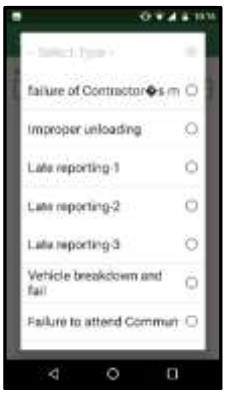

Figure 8: Types of penalties

The notification is sent to the nearest vehicle when the refuse vehicle gets full.

Figure 9: Notification Panel

VII. CONCLUSION

The case study shows its implementation as an android application, an initiative for the Swachh Baharat Abhiyan titled as "Swachh Saarthi" to help the M.C.G.M. to keep the city clean giving a digital helping hand. Incentives can be derived basis on additional routes completed. The dump collected helps in analyzing about the type of garbage collected and the alarming signal for the department to identify areas that require more attention. The GPS and FCM enabled system will help use the technology to make the initiative a little easier. The use of the Dijkstra algorithm helps track the nearest vehicle easily with the strategy of the shortest path first. The various value from transitional and structured data is understood analyzed to improve the overall functioning and deployment of the activities for waste management at M.C.G.M. This paper is a small initiative of the authors to implement the complete procedural steps through an application to ease work of M.C.G.M. and to use the technology.

References

[1] ICWET: 11: GPS enabled "Swachh Saarthi"-An Application for MCGM, Gaurav Vaswani, Ashwija Shetty, Urmi Jadhav and Manisha Ghariwal.

[2] SMS-Based Tracking, Navigation and Broadcasting System, Vijayalakshmi, International Journal of Advanced Research in Computer Science and Software Engineering 4(8), August - 2014, pp. 546-549.

[3] Vehicle Monitoring and Routing System, International Journal of Computer Applications (0975 – 8887).Volume 138 – No.12, March 2016.

[4] GPS Location Alert System, Saravana Kumar J, Veeramani .R, e-ISSN: 2278-0661, p- ISSN: 2278-8727Volume 16, Issue 2, Ver. IV (Mar-Apr. 2014), PP 36-42.

[5] A New Approach for Location based Tracking, JCSI International Journal of Computer Science Issues, Vol. 10, Issue 3, No 1, May 2013,ISSN (Print): 1694-0814 | ISSN (Online): 1694-0784,www.IJCSI.org.

[6] Automatic Ambulance Rescue System Using Shortest Path Finding Algorithm, International Journal of Science and Research (IJSR), ISSN (Online): 2319-7064,www.iosrjournals.org.

[7] Predicting Bus Arrival Time with GPS on Android Application, Deeksha Bhardwaj, Sandip Daphal, Anand Nerkar, International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064

[8] http://www.unep.or.jp/ietc/estdir/pub/msw/

[9] http://www.mcgm.gov.in/

[10] http://www.cpcb.nic.in

[11] Maharashtra non-biodegradable garbage (control) act 2006

[12] SOLID WASTE MANAGEMENT, P. U. Asnani.

[13] www.RevolutionAnalytics.com

