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Mobile Device Interface for Mining OpenStreetMap to Analyse User Contribution

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Abstract

OpenStreetMap (OSM) is an organised collection of geographic information which varies in quality and size of data is very large. Numerous publications concluded that mobile phones can be used for contributing geographic data. As no application was developed to present a comprehensive user statistics. This work tried to fill this gap by developing an android application for providing the contribution to OSM data and to know user contribution. OSM editing application programming interface (API) has been used to provide contribution and to fetch the user related data and then data is analysed to extract important results.

Keywords: OpenStreetMap, Ionic framework, user contribution.

INTRODUCTION

A map known for being freely available data under open content license is OpenStreetMap (OSM) [3]. Steve Coast started the OSM project in 2004 and is most popular volunteered geographic information (VGI) map over the internet [1]. OSM data can be edited or added by any registered user. GPS devices are used to collect VGI data [2]. Because of data license, OSM is widely by commercial and Government organisations. The rise of OSM is standing on the success story of Web 2.0. It provided the technological stack for contribution by volunteers. Hence, citizens are acting like a sensor for collecting geographic data about the various places [10]. Further, improvements in mobile networks and GPS chips made it easy for contributors to augment the OSM data. But, they are unprofessional and do not follow the suggested guidelines published by researchers. Thus, the quality of OSM is always been questioned for its data fitness to particular application e.g. navigation. As VGI is the labelled data, collected by volunteers for the welfare at low cost and very quickly. The researchers are devising methods to motivate the user to contribute by following the Linus Law (”More the contributors, better will be the map”).

To check for the credibility of OSM data for the fitness of data for various geographic information application areas, it is assessed based on quality indicators as suggested by [12; 15; 11; 13]. Although relevant issues about the credibility of crowdsourced data, including OSM data, were discussed by [8]. It has been pointed out that geographic data provided by non-experts is also credible. OSM data are still far being used at their real potential by mapping companies, national mapping agencies and many users due, amongst other things, to the absence of detailed information about data quality and the difficulty of assessing quality using traditional geographic informatics systems approaches [7; 8; 19].

A large number of studies from literature suggested that, that tools and techniques are required to motivate the contributors [7; 4; 22]. Fritz et al. [9] suggested that the challenges to attract masses can be done by rewarding people or “gamifcation application” [16]. Such approaches would increase the user contribution and spatial coverage [4]. Further, revealing user rankings would encourage the contributors to pay more attention to the quality of their data [18; 20; 14]. User reputation is hence the most pressing issue to address.

This study presents an intuitive framework for mapping the POIs to OSM Server and further mine into user contribution and presents the statistical information about the user. The framework is developed as an android application.

The paper has been divided into different sections. The next section discusses the work related literature review. The third section methodology and framework of application. The fourth section elaborates the results and conclusion and future work has been discussed in the last section.

RELATED WORK

The focus of this section is to discuss the studies that have focussed onto user contribution and user ranking. Coleman et al. [6] categorised volunteers into five categories “neophyte”, “interested amateur”, “expert amateur”, “expert Professional”, “expert authority” based on the quality of data. Various motivational factors also affect the contribution of the contributor. The action of contributor also helps to categorise contributors.

Neis et al. [17] identified from the OSM statistics that there is very less number of the active user. Only a few members have created only one changeset on OSM. Around 38% of the OSM members are able to create only one changeset and

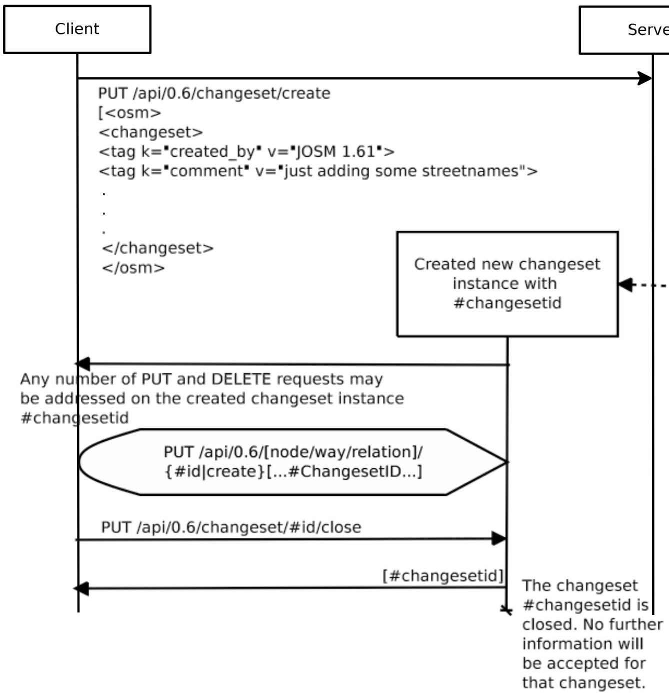


Figure 1: OSM API v0.6 in action

only 5% contributors are able to contribute most of the data to OSM. There are four categories “junior mappers”, “non-recurring mappers”, “senior mappers” and mappers with not a single edit based on the quantity of data. Nodes created by the user are used to find the category. Arsanjani et al. [5] identified that contributors can be categorized based on quality too. When categorisation is done based on the quantity, there are five mappers: “regular”,“beginner”,“expert”,“intermediate”, and “professional mappers”. Regular mappers contribute data regularly. Beginner mappers do not much about the co-ordinate system. Expert mappers provide best quality data to the user. Intermediate mappers are usual mapper which contribute when they have free time. Professional mappers are the mappers which get paid to contribute data. Conditional rules are applied to categorise the contributor.

Yasseri et al.[21] identified that temporal behaviour of contributor plays important role in contribution. The authors identified that nowadays contributor is contributing the OSM data in night time as well as day time. Hand-held devices made this possible because they are easy to use and easy to carry. Because of this reason, mobile application is in demand in the market.

METHODOLOGY

This study focusses on development of a mobile application that has two modules:

1. Mapping POIs and upload to OSM server.
2. Mine into user contribution, present statistics analysis and classify the

user. The backbone of this application are OSM APIs, i.e. editing apis. These are called

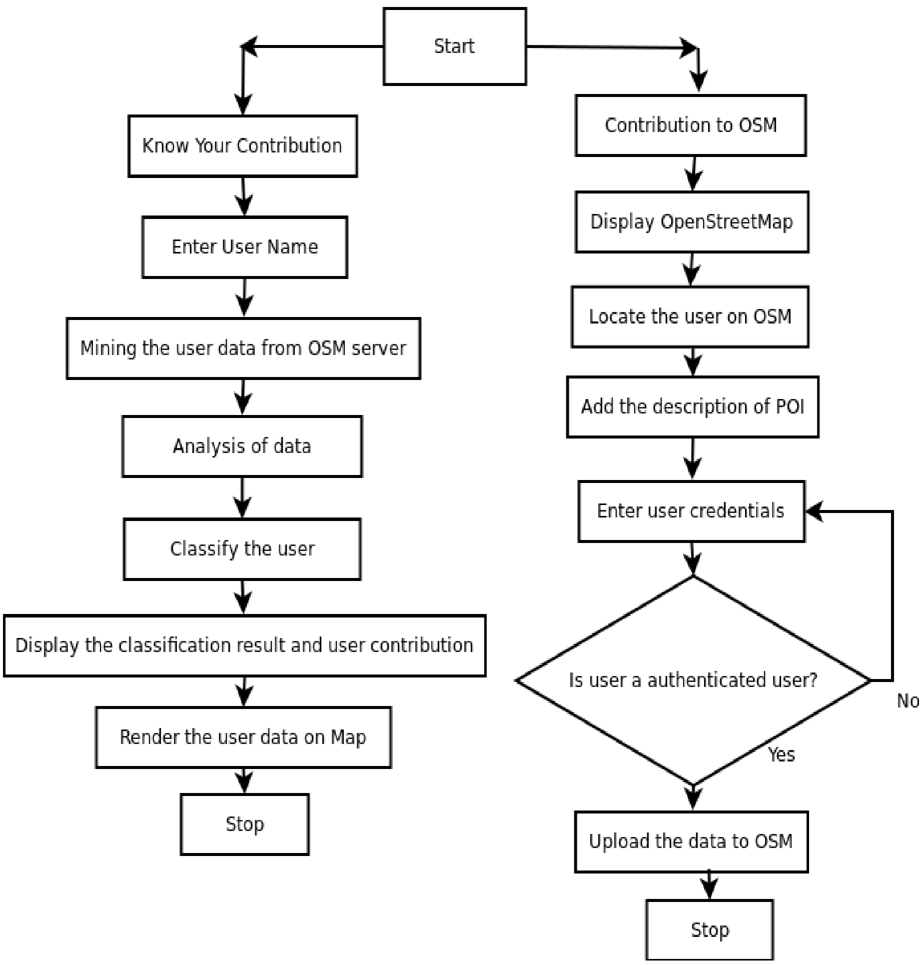


Figure 2: Flowchart of steps followed in mobile application

RESTful API's can be used for reading, writing, updating the OSM data. API version 0.6 is currently being used by developers by accessing through URL http:

//api06.dev.openstreetmap.org/ as shown in Figure 1. The Ionic framework is used to develop the application, an open-source software development kit (SDK), used for creating cross platform mobile applications. Different components for developing the mobile application were Node.js and cordova. Cordova provides a wrapper to develop an application for all types of platforms. The flowchart of application in Figure 2 depicts the steps to be followed as explained further.

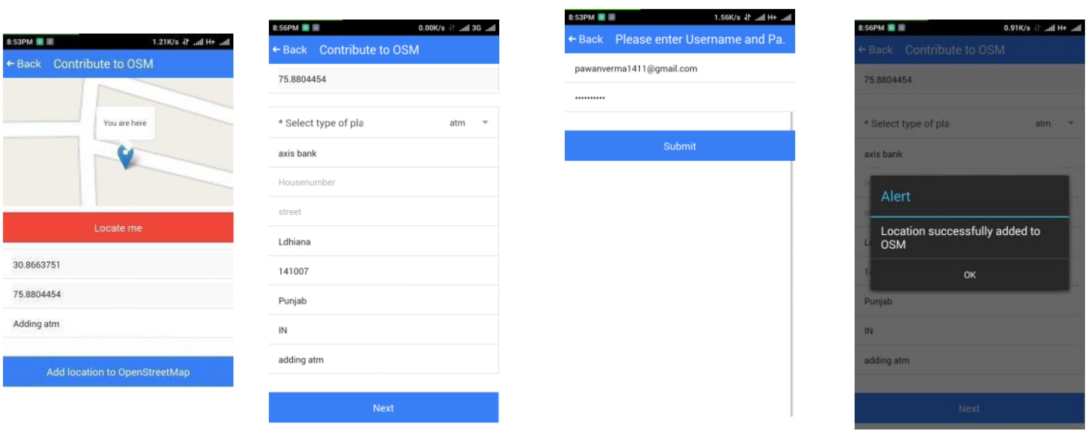
The first module used to contribute to OSM include the following components:

- **Display OSM** The leaflet API is used to display the map on user mobile screen with a "Locate Me" button.
- **Identifying user location**

User clicks "Locate Me" button, the Cordova Geolocation (development framework) module used to track the user location and display it on the map as shown in Figure 3a.

- **Description about POI**

Next, the user would be asked to fill attributes for the node to be mapped. The user fills the form data and submits the data for further process s depicted in Figure 3b. For contributing to OSM, OSM Editing API is used. For creating a data element on OSM, a changeset must be created. In this applications, when the user completes the form then submit the data. Before submission, a changeset is created then along with that changeset id whole payload is submitted to the OSM server through authentication. Form data is not directly submitted, there is need to convert data into XML file because OSM server can read XML data. Using JavaScript, form data is converted into XML data. Creation of node is shown in Figure 3.



(a) Locate user (b) Fill attributes (c) User authentication (d) Success Message

(e) Element contribution (f) Year-wise contribution (g) Week-wise contribution (h) User contribution

Figure 3: Module for contribution to OSM server (a-d) and mining user contribution (e-h)

- **Enter User Credentials**

The user will be redirected to authentication page and asked to fill in OSM username and password which is required to upload the data to OSM server s suggested in Figure 3c.

- **Is user a authenticated user?**

If the username and password are correct then data will be uploaded successfully otherwise control will return to the previous screen where the user will fill username and password again.

- **Upload data to OSM**

Form data is uploaded to OSM server using the Overpass Editing API as shown in Figure 3d.

Various steps followed in mining into user contributions and presenting statistically are:

- **User information**

The username is entered of the user whose contribution has to be analysed by clicking Go button. if the username field is empty then an alert will appear which alerts the user that username field is empty. If the username is not empty then it leads to the next screen.

- **Mining the user data from OSM Server**

Using the APIs the user information is fetched from the server. In overpass Query language it is mentioned that which data of the user to fetch.

- **Analysis of data**

The data in JSON format is fetched from the server, and on reception, it is analysed based on heuristic rules to get useful information to analyse user contribution as shown in Figure 3.

- **Classification the User**

Categorisation of user contribution is performed based on the amount of data user has contributed as per the suggestions of Neis et al. [17], which is presented in Table 1:

Table 1: Type of Mappers

Type of Mapper	Node created
Senior mappers	> 1000
Junior mappers	10 – 1000
Nonrecurring mappers	0 – 10
No Edits	0

- **Graphical representation**

The statistics are presented after analysing the information fetched from the server. The histograms in Figure 3e shows the contribution by element-wise, the count of total numbers of nodes added, the total number of ways added, the total number of relation added, the total number of edits and total contribution and count of types of places added by the user in attribute-wise.

- Figure 3f displays the graph of year-wise contribution by user and Figure 3g shows contribution made by a contributor in days of a week. Further, showing contribution in day hours represents what are favourite hours of a user to contribute. Figure 3h depicts the user contribution rendered over the map. The rendered information represents, nodes, ways, and first and the last edit along- with the changeset. Table 1 presents the classification of the user used in this current study.

CONCLUSION

This study presented the mobile application, developed to provide an intuitive interface to map and mine into user contribution. By using this application, the user can contribute to OSM from any place of the world and also can check his/her contribution and also mine into user contribution. The user information is presented in the form of graphs. The future work will be adding augmented reality engine to the application. Further, adding a module to assess completeness and data imputation in OSM data. This would lead to present an interface for indoor mapping.

REFERENCES

[1] "About OSM," (accessed on 30 April 2016). [Online]. Available: https://en.wikipedia.org/wiki/OpenStreetMap

[2] "OSM," (accessed on 30 April 2016). [Online]. Available: http: //wiki.openstreetmap.org

[3] "OSM Introduction," (accessed on 30 April 2016). [Online]. Available: http://wiki.openstreetmap.org/wiki/About\ OpenStreetMap

[4] V. Antoniou and A. Skopeliti, "Measures and indicators of vgi quality: An overview," *ISPRS Internationa Society for Photogrammetry and Remote Sensing*, vol. II-3/W5, pp. 345–351, Aug. 2015.

[5] J. J. Arsanjani, C. Barron, M. Bakillah, and M. Helbich, "Assessing the quality of openstreetmap contributors together with their contributions," in *Proceedings of the AGILE*, 2013.

[6] D. J. Coleman, Y. Georgiadou, J. Labonte *et al.*, "Volunteered geographic information: The nature and motivation of produsers," *International Journal of Spatial Data Infrastructures Research*, vol. 4, no. 1, pp. 332–358, 2009.

[7] S. Elwood, M. F. Goodchild, and D. Sui, *Prospects for VGI Research and the Emerging Fourth Paradigm*. Springer, Jan. 2013, ch. Crowdsourcing Geographic Knowledge, pp. 361–375.

[8] A. J. Flanagin and M. J. Metzger, "The credibility of volunteered geographic information," *GeoJournal*, vol. 72, no. 3-4, p. 137, Aug. 2008.

[9] S. Fritz, I. McCallum, C. Schill, C. Perger, R. Grillmayer, F. Achard, F. Kraxner, and M. Obersteiner, "Geo-wiki.org: The use of crowdsourcing to improve global land cover," *Remote Sensing*, vol. 1, no. 3, pp. 345–354, aug 2009.

[10] M. F. Goodchild, "Citizens as sensors: web 2.0 and the volunteering of geographic information," *GeoFocus*, vol. 7, pp. 8–10, 2007.

[11] S. Guptill and J. Morrison, Eds., *Elements of Spatial Data Quality*, !st edition ed. Pergamon, Nov. 1995.

[12] ISO, "ISO 19157:2013: Geographic information — data quality," International Organization for Standardization (ISO), Tech. Rep., 2013. [Online]. Available: http://www.iso.org/

[13] D. Joksi´c and B. Bajat, "Elements of spatial data quality as information technology support for sustainable development planning," *Spatium*, no. 11, pp. 77–83, 2004.

[14] C. Keßler and R. T. A. de Groot, *Geographic Information Science at the Heart of Europe*. Cham: Springer International Publishing, May 2013, ch. Trust as a Proxy Measure for the Quality of Volunteered Geographic Information in the Case of OpenStreetMap, pp. 21–37, date- 12 May 2013.

[15] P. A. Longley, M. F. Goodchild, D. J. Maguire, and D. W. Rhind, Eds., *Geographical Information Systems: Principles, Techniques, Management and Applications*, 2nd ed., ser. Abridged. Wiley, 2005.

[16] C. Muller, L. Chapman, S. Johnston, C. Kidd, S. Illingworth, G. Foody, A. Overeem, and R. Leigh, "Crowdsourcing for climate and atmospheric sciences: current status and future potential," *Internationa Journal of Climatology*, vol. 35, no. 11, pp. 3185–3203, Jan. 2015.

[17] P. Neis and A. Zipf, "Analyzing the contributor activity of a volunteered geographic information project — the case of OpenStreetMap," *ISPRS International Journal of Geo-Information*, vol. 1, no. 3, pp. 146–165, jul 2012.

[18] H. Senaratne, A. Mobasheri, A. L. Ali, C. Capineri, and M. M. Haklay, "A review of volunteered geographic information quality assessment methods," *International Journal of Geographical Information Science*, pp. 1–29, may 2016.

[19] A. Vandecasteele and R. Devillers, "Improving volunteered geographic data quality using semantic similarity measurements," *ISPRS - International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, vol. XL-2/W1, pp. 143–148, May 2013.

[20] A. Yang, H. Fan, N. Jing, Y. Sun, and A. Zipf, "Temporal analysis of contribution inequality in openstreetmap: A comparative study for four countries," *ISPRS International Journal of Geo-Information*, vol. 5, no. 1, p. 5, Jan. 2016, date- 18 January 2016.

[21] T. Yasseri, G. Quattrone, and A. Mashhadi, "Temporal analysis of activity patterns of editors in collaborative mapping project of openstreetmap," in *Proceedings of the 9th International Symposium on Open Collaboration*. ACM, 2013, p. 13.

[22] P. Zhao, T. Jia, K. Qin, J. Shan, and C. Jiao, "Statistical analysis on the evolution of openstreetmap road networks in beijing," *Physica A: Statistical Mechanics and its Applications*, vol. 420, pp. 59 – 72, Nov. 2015, date- 4 November 2014.