# Location Based Information System using OpenStreetMap

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Abstract-Faced with an increasingly difficult challenge in growing both the average revenue per user (ARPU) and the number of subscribers, wireless carriers and their partners are developing a lot of new products, services, and business models based on data services. Location based services, which provide information specific to a geographic location, are a key part of this portfolio. Our Location Based Information System is such a location based application that works as a audio road guider for both the normal and visually impaired people using OpenStreetMap. OpenStreetMap (OSM) is a world-wide campaign for developing open source maps. The prospect of such open source maps is very bright in commercial, educational and political points of views. In this paper we discuss the challenges and features of our proposed Location Based Information System as an example of the usability of OpenStreetMap. We also discuss about the problems we face while developing OSM in a developing region like Bangladesh. Finally, we present the future scope of various location based services using OpenStreetMap.

*Keywords* - OpenStreetMap, Location Based Services, Bangladesh, Audio Message, Road Guider, Blind People.

#### I. INTRODUCTION

Our Location Based Information System is one of the first few projects using OpenStreetMap in Bangladesh. Open-StreetMap is, as the name suggests, an open source map of the world [1]. It is a *Wiki-Style* project for digitally mapping all over the world. It is called *The Free Wiki World Map*, a collaborative project to create a free editable map of the world. A digital map is always handy for various purposes. It can be used in navigation, in research, in development of location based applications. Our Location Based Information System is an android platform based mobile application using OpenStreetMap that is mainly designed to help the user giving audio massage about his/her present location in a map.

Location Based Information System works as a road guider for an unknown place. This application helps people to find his/her location easily through audio message and also helps to reach his/her destination using the map. Most of the road guiders available in the market provides guidance in text format which is quite difficult to use for the people while traveling by transport or walking. But as our Location Based Information System provides audio massages, people do not have to look at their mobile and so they will be able to concentrate on the road. It will also reduce the chance of road accidents as lack of concentration is one of the main reasons for road accident. User will get a complete map at the same time so it will be much easier to find his/her destination with a perfect match of auditory (audio massage) and visual (map) guidance.

One of the main focusing points of our research is that most of the existing applications are for normal people and very few of them addresses the special requirements for the disabled people. About 15 percent of the worlds population some 785 million people has a significant physical or mental disability. According to a new report prepared jointly by the World Health Organization [2] and the World Bank [3], Geneva, 10 October, 2002 - an estimated 180 million people world-wide are visually disabled. Of those, between 40 and 45 million persons are blind. Due to growing populations and aging, these numbers are expected to double by the year 2020 making the colossal human tragedy even worse, stalling development and denying a basic human right [4].

The blind people faced tremendous challenges daily in accessing the information while moving or during communicating with the world around them. They had to depend on their sighted colleagues, friends, relatives, or the people on the road to help them for locating places. Considering this, our proposed system is design for both the normal and the blind people. For indicating current location in the map, the open source OpenStreetMap has been used instead of the *constrained* Google map. Users are able to search anything near their current location or any other location. Both textual and image results along with auditory messages are provided and a description of route to destination are shown using the OpenStreetMap.

We have organized the paper in the following sections. Section II discusses about some related projects and their facilities with corresponding drawbacks. Section III presents the platform and other methodologies we used in our project development. We discuss the system prerequisites, features and technical details in Section IV. Then we discuss the associated challenges of developing a OpenStreetMap based project in this region in Section V and some proposal to mitigate them in Section VI. Finally we conclude our discussion after presenting a guideline for the future location based projects that we are now working on in Section VII.

### **II. RELATED WORKS**

There exists some research works for helping blind people with map technology. But most of these researches have some limitations which might not be suitable for the developing countries. Some modifications of these applications are required so that people can use these easily in our regions. We tried to overcome these limitations in our project 'Location Based Information System using OpenStreetMap'.

## A. Walky-Talky

One of the mentionable existing research works is *Walky-Talky* [5]. This application has been designed to help the blind with walking directions that combine Google Maps with GPS navigation technology. The Walky-Talky application goes hand-in-hand with spoken walking directions from Google Maps to better navigate through the physical world. In addition, intersection explorer allows users to explore the layout of the streets using touch interface before venturing out with Walky-Talky. Our software differs from this software in the following way:

The main weakness of this project is it uses Google Map. Google Map has legal or technical restrictions on its use, holding back people from using it in creative, productive, or unexpected ways. Use of the Google Mapping API is subject to a query limit of 2,500 geo-location requests per day and this limit may be changed in the future without prior notice.

So, we used the free OpenStreetMap in our application instead of Google Map, which has the following advantages:

- The geo-data of OpenStreetMap is free and include no technical or illegal restrictions. The OpenStreetMap license for data is under the Creative Commons Attribution-Share Alike 2.0 license [6], which should not cause any restrictions to the users.
- 2) People from anywhere of the world can edit it. We are free to upload new geo-track of different attributes, update it, create new layers, maintain our own layer in OSM which can be used later for our mobile apps and other usage.
- 3) With the increasing growth of smart phone in our country, demands for different location based services (LBS) are rising and to avail those services, we are badly in need of a digital map. Different LBS will bring about a revolutionary change in the lifestyle and economy of our country. So for development of location based software we need an updated digital map and OpenStreetMap is the ultimate solution for this demand. We formed a team in BUET and contributing to OSM since its formation in 2010 and have already taken initiative to implement different location based services. "Location Based Information System" is one the first few software in our country using OSM.

Our software has other options like general attributes, location map, and obviously the most useful search option. This is where it differs from Walky-Talky because it is a complete solution for path-finding for the blind as well as the normal people and also provides a complete location based search and information help.



Fig. 1: Statistics of smart phone market share.

# B. Mobile Speak

Another mentionable existing project is *Mobile Speak* [7]. Mobile Speak is a talking software that converts the cell phone into a talking mobile phone, thus making the lives of the visually impaired people easier and put them at par with the sighted ones. Mobile Speak is a screen reading software for mobile phones that allows access to most of the functionalities of the mobile phone and will make it possible for the blind people for the first time to navigate through the internet using a mobile phone. Mobile Speak software is to a mobile phone what *Jaws* is to a personal computer that converts it into a talking computer.

After considering these projects, it is clear that these projects are only for the blind people. But our location based information system has taken an initiative not to differentiate normal and blind people providing them same software, and that's also using one of the fastest growing mapping technology - OpenStreetMap.

### III. METHODOLOGY

Android is a mobile operating system for cell phone devices and tablet computers developed by the Open Handset Alliance led by Google. Nowadays the demand of android phone is increasing very rapidly. If we consider the smart phone market, then we will find that the android phones share the major part of the market. Here is a statistics on the share of smartphone sales to end users worldwide by operating system, according to Canalys (Fig. 1). The price of these phones are decreasing dramatically, thus promising a even better market growth.

It has been already mentioned that our "Location Based Information System" has used OpenStreetMap. While the map is free, its usability is guaranteed for everyone. And as OpenStreetMap is open source, its development is very rapid and dynamic. OpenStreetMap (OSM) was founded in July 2004 by Steve Coast. In April 2006, the OpenStreetMap Foundation (OSMF) was established to encourage the growth, development and distribution of free geospatial data and provide geospatial data for anybody to use and share. In December



Fig. 2: Map of BUET in OpenStreetMap.

2006, Yahoo confirmed that OpenStreetMap could use its aerial photography as a backdrop for map production [8]. OpenStreetMap has helped in a number of projects conducted worldwide and drew the attention of mass people and media.

The most prominent of those are the *MapKibera* project [9] and the *Wiki Project Haiti* [10], [11]. In the MapKibera project, Kibera the largest slum of Kenya was mapped with full details. And in Wiki Project Haiti, OpenStreetMap helped to a great deal after the devastating earthquake of 2010. OSM community also actively worked for the flood victims of Brazil and Pakistan and the earth-quake victims of Japan in recent days.

In Bangladesh, the activities of OpenStreetMap started in 2010. Five GPS units were donated by the OpenStreetMap Foundation. Using those, the first mapping project was done at Bangladesh University of Engineering and Technology (BUET), the top engineering school located at the capital of the country. Our "Location Based Information System" is the first project in Bangladesh using that OpenStreetMap of BUET campus. The first OpenStreetMap created in Bangladesh is shown in Fig. 2 and our software was first developed and tested using this map.

## IV. DESCRIPTION OF THE PROJECT

## A. Prerequisite

- 1) The software is based on android 2.1 version. It will run on android 2.1 supported mobile phones and upgraded versions.
- 2) The cell phone should have GPS enabled. If the GPS unit is not enabled then this should be enabled first before starting this software. To do so, the following procedure should be followed: menu - > settings - > location (Fig. 3). Then GPS can be enabled and disabled here.

## B. Feature Overview

- 1) It provides a complete map of the location around under the 'map' option (Fig. 4).
- 2) A collective list of special attributes of an area is created. As this software is first designed thinking about the



Fig. 3: Main menu of the apps.



Fig. 4: Showing location map.

BUET campus, there is an option named "Building" containing all the buildings of BUET as people coming from outside of BUET find it difficult to locate departments, labs, research centres etc (Fig. 5). It is a complete solution to these people. The content of these options can be changed with the change of location. For example, if this software is developed for a zoo then this option will display information about the relevant animals, like information about animals, their life span, residence, food habit, availability in the country etc. So, this type of system can bring about a revolutionary change in different applications.

 One of the main features of this software is the Audio Help feature. For road guidance, a textual message with



Fig. 5: A list of point of interests around the location.

location detection is enough for the normal people but not for the visually impaired ones. So it is featured specially to reduce difficulties of finding path for blinds. Users get location based audio description of his/her current location and important details of that location which helps them to find their path to the destination easily. With this feature, user's current location is marked on OpenStreetMap. Another important point can be stated here that normal people can also be benefitted using this feature as they don't have to look at their mobile screen to know the information. They just have to click and hear the audio and pay attention to their surroundings (Fig. 6).

4) Another powerful feature of the application is searching, which helps the user to find any location easily and discover what is located nearby. In this application, when the user searches for any place (Fig. 7), then s/he is provided with both audio and textual message as the result (Fig. 8). In textual message details of that location is provided. For example, if an user searches for the EME building in BUET, s/he will find a picture of the EME building which will help him/her to locate it easily. In addition to the textual message, it will help the user to discover which departments, labs, institutes are located in EME. All these information will also be presented in audible format.

# C. Technical Details of the System

- 1) The software is based on android 2.1 operating system. Android 2.1 corresponded to the "Eclair" milestone branch, and has an API level of 7.
- 2) For location detection 'GPS provider' has been used. It should be mentioned that if GPS is enabled then the battery charge is reduced quickly. On other hand if



Fig. 6: Audio help feature.



Fig. 7: Search input screen.

location update is requested very frequently then battery consumption process accelerate noticeably. To reduce battery consumption, an 'optimal time' has been set to update the location data. When the software is started for the first time, it takes some time to get signals from the satellite. When it finds the satellite signal, it starts updating the current location. Users should wait until it finds GPS signal which is easily verifiable in android phones.

3) In the map attribute, OpenStreepMap has been used to show the map of the current location. It has built in zoom control as well as two finger zoom to make



Fig. 8: Search result screen.

easier view of the map. Internet connection is needed for these options. Users can navigate to anywhere using touch functionality. Experimentally it shows a very clear and quick map though we tested with only 2G network to access the internet. The great news is that the local government is taking initiative to launch 3G network in our country very soon. We hope to have the deployment of a great amount of location based services in our country after its launch.

- 4) In the software, for the general attribute like the 'BUILDING' option, information is stored in a central database (not in mobile SQLite database). When the user click on that button then it sends a request for information of corresponding location. Both image and textual information is provided here. After database query is performed, the information is sent to the mobile phone and displayed on screen. So, if any information of a location is changed then it is updated in the central server. As data is provided from the central database, the user always get updated data of any location.
- 5) For audio help option, at first users' current location (longitude and latitude) is detected using the GPS and sent to the central server. In the central server, locations are pre-defined on accordance with their longitudelatitude range and an unique code is given for every location. After receiving the users' longitude-latitude of the current position, a query on the database is performed and the corresponding geo-position's code and info are sent to the requested mobile phone. Then the position of the user is shown in the OpenStreetMap and the corresponding text is converted to speech using 'Text To Speech API' to deliver the audio help for the current location.
- 6) On the search option, the user has to give input about what s/he wants to search. This is done using 'Edit

Text' feature of android. Then user's keyword is sent to the central database and after query, the graphical and textual information is provided to user.

# V. CHALLENGES

Our Location Based Information System is designed to provide mapping facility to the user using OpenStreetMap to eliminate the legal or technical restrictions in other commercial mapping utilities. But in undeveloped countries like Bangladesh, the activities of OpenStreetMap has just started. There are several strong reasons behind this, some of which are listed below:

- 1) There are very few GPS devices used actively in Bangladesh. Very few people have a GPS device, because people here still have not coped up with GPS.
- 2) There is a lack of technically skilled volunteers for OpenStreetMap contribution. The lack of volunteers is causing the slow progress.
- 3) Contribution in OpenStreetMap requires a moderately high speed internet connection, which is quite costly in Bangladesh. Most of the people use low-cost internet packages which suffice for browsing, but that is not enough for viewing or editing OpenStreetMap in a short time.
- 4) People of Bangladesh are not used to consult maps for the daily needs. They do not consider a map as an important gadget. This reluctance is also making the progress of OpenStreetMap slow.
- 5) 3G mobile phone technology has not been introduced to Bangladesh till the beginning of 2011. So, the location based services are not provided by the operators.
- 6) Software firms in Bangladesh mostly use the map services from Google and Yahoo for application development rather than making their own products. Under this situation, OpenStreetMap lags behind.
- 7) The government of Bangladesh has not taken any initative to promote open source development. All the actions on OpenStreetMap have been carried out by individuals or small groups.

A comparison between Bangladesh and a neighboring country India can clearly indicate the situation. In the Open-StreetMap GPS traces database, there are only 25 entries from Bangladesh [12] where India has 531 [13]. The comparison was done using the number of search results found by using the country names as search tags.

## VI. PROPOSED IDEAS FOR ENRICHMENT OF OSM

Some initiatives should be taken for promoting Open-StreetMap in Bangladesh:

- The main initiative for rapid growth of OpenStreetMap is decentralization. Currently there are seven divisions in Bangladesh. If each division has its own mapping organizations with active volunteers, it will be much enriched in a short time.
- 2) Some map based applications may be developed. When these applications will gain popularity among the users,

the software firms and industries will show their interest in this field. This will serve two purposes: it will help the growth of OpenStreetMap, and it will open a new field with various types of useful services.

3) The thing OpenStreetMap needs most is volunteers. As the building up of OpenStreetMap is a fully voluntary process, a large group of volunteers may be trained up for this. This objective may be achieved through frequent meetings, workshops and mapping parties. The trained volunteers should spread out their knowledge to others while contributing to OpenStreetMap.

## VII. FUTURE SCOPE

Location based service can be deployed to solve our existing problems as well as can bring about a change in our daily life meeting our own demand.

## A. Fire Service and Health Service Helper:

Showing the path on the map (OpenStreetMap) and giving audio massage about the path before a transition point to reach the destination in shorter possible time.

## B. Effective Learning of Children:

Reduces the burden of books for a child. Just using the smart phone, children can learn practical things. For example, standing before a cage of an animal, if an audio message can provide informing about the animal, it will be much easier to teach a child about animals. It will be enjoyable for a child too.

## C. Smart Advertising:

Providing advertisement about restaurant, fashion house etc on user's current location. These can be used in business purpose by the restaurant and fashion house owner. Again it will help users to get information about the restaurants and fashion houses when they visit a new place. It will also provide mapping facility with OpenStreetMap so that user can find his destination easily.

## VIII. CONCLUSION

Nowadays, the world is moving towards digitalization. People want everything effective and handy. Location-based services and advertising allow people to receive services and advertisement based on their geographic location, which is actually very much effective for people. That's why demand of location based service is increasing day by day. In the modern world of sharing, collaboration is the key to progress. The open source community is being more and more enriched. That is why Wikipedia has become world's greatest knowledge-base. OpenStreetMap is emerging along the same way. Today it may be a small thing, but if its development goes on, in a few years it will become a part of people's life.

To go forward to make a revolution with location based service OpenStreetMap can be a very useful tool. Our "Location Based Information System" is an initial effort to start this journey using OpenStreetMap and aimed at providing some useful service to the blind people as well as others in the same platform.

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