# A Location Based Advertisement Scheme using OpenStreetMap

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Abstract-Location Based Advertisement (LBA) has become today's most personal and direct marketing channel that provides customers more relevant information, personalized message, targeted offer about products and allows marketers to reach a specific target audience by creating campaigns. Location-based advertising (LBA) is a new form of advertising that integrates mobile advertising with location based services (LBS) to provide location-specific advertisements on consumer's devices. With the help of LBA, it is possible to target population at the right place and the right time. By taking advantage of a consumer's real world position, location based advertising delivers relevant ads for products and services. In this paper the features and usability of the application, "Location Based Intelligent Advertisement using OpenStreetMap" are explained and how this type of OpenStreetMap (OSM) based LBS application is effective for Bangladesh is discussed. The application helps the registered shop owners to introduce the offers to a consumer who is in close proximity to make them take those final steps to enter his store and let the consumer know what is around him with audio and map support. Additional feature of this application is for visually impaired people so that they can shop easily. We also focus on the benefits of using an open source map over a commercial one in this respect.

Keywords: LBA, LBS, ÖpenStreetMap, Android, Visibly Impaired People.

## I. INTRODUCTION

As advertisement of product is one of the vital parts of commerce, business organizations spend a significant amount of their investment for advertisement. Being an integral part of the marketing media mix, the booming smartphone adoption and increasing mobile media consumption is accelerating the process. The increasing integration of location-sensitivity is one of the key developments in mobile advertising [1]. It releases the full potential of the mobile channel. Real-time location targeting uses location information while delivering an ad to a mobile user. Integration of location in advertising greatly enhances the relevance of mobile advertising. It has been demonstrated that location targeted ads generate considerably higher return than conventional mobile advertising.

On the other hand, from our local perspective, this type of application is significant considering some facts. In the developed countries, price of a product may vary in different locations. It is convenient for them to buy a product from a location where product can be bought with relatively low price. But in our country, product's price is almost same everywhere. So, location based ads bear more significance in this situation without creating any mess of the price of a product. It is also convenient for them to buy a product from their nearest shops or stores. In case of emergency, location based advertisement helps to find the desired product suggesting the nearest store.

Considering these local facts and significance, an easy, customized, and effective solution 'Location Based Intelligent Advertisement (LIBS)' application has been developed. It is an android based mobile application that is mainly designed to advertise the restaurants, fast-food shops, fashion houses, etc. by finding the current location of the user using mapping support. The software can be described as a two way communication. From user's perspective, they can find the advertisement advertised by nearby shops. This real time advertising facility helps them to save time in shopping. On the other hand, shop owners have the flexibility of updating their product information any time. So consumers can get latest information about any product through advertisement.

One of the main focusing points of our research is to facilitate the application for visually impaired people. About 15 percent of the world's population, i.e., some 785 million people have a significant physical or mental disability. According to World Health Organization (WHO), 285 million people are visually impaired worldwide [2]. Among them 39 millions are blind and 246 millions have low vision [3]. Due to growing populations and aging, the number of people who are blind is likely to increase to 75 million by 2020 [4]. The visually impaired people face tremendous challenges daily in accessing the information while shopping. Some visually impaired and blind persons do their shopping with a sighted friend, and/or ask for assistance from a store employee. Many visually impaired and blind persons will frequently visit the same stores, which increases their familiarity with the layout of the store and item availability. Considering this, our proposed system is designed such a way so that the visually impaired people can get guideline for shopping with additional facilities.

Online map services play a vital rule for any location based services and advertisements. Use of open source and free map services instead of commercial ones is becoming more notable in different applications day by day. Free, editable, and open source OpenStreetMap is used in this application to avoid the restrictions in commercial ones like Google maps. OpenStreetMap is, as the name suggests, an open source map of the world [5]. 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, research, and development of location based applications, among its other uses.

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

## II. RELATED WORKS

Location based advertisement has drawn the attention of users in past years. It has come in various forms for different platforms. Hao *et al.* introduced a request-response based advertisement system in [6]. In this system, the user first requests for information related to the location. In response s/he receives one or more advertisements related to that location. Matthew a Guido *et al.* [7] proposed a system where geographic database contains data entities that represent geographic features, such as roads, located in a geographic region, etc. Advertisers are allowed to associate advertising messages with advertising zones.

Regarding customization of LBA, Xu et al. [8] showed that multimedia LBA messages lead to more favorable attitude, increase the intention to use the LBA application, and have significant impact on purchase intention. They performed an exploratory study that empirically examines the effects of multimedia advertisements vs. text-based advertisements on consumer perceptions and behaviors in a simulated LBA environment. Aalto et al. [9] introduced a novel B-MAD system for delivering permission-based location-aware mobile advertisements to mobile phones using Bluetooth positioning and wireless application protocol (WAP) push. Another study performed by Barwise et al. [10] which specifically explored the effectiveness of SMS text messaging as an advertising medium for reaching young adults. The results suggested that, with the right execution, the mobile channel has the potential to benefit both advertisers and consumers. Rashid et al. presents a system [11] that can be used with any current mobile phone system to provide location based information/advertisements to any mobile phone equipped with Bluetooth technology without any necessity of installing client side software.

Nowadays, many of the embedded advertisement applications - both the web applications and mobile software are location sensitive. Though LBA [12], applications are available with many new features and almost all the applications are customized for the respective local demand and perspective. LBA applications can be one of the effective tools for flourishing business activities if it is customized according to our local needs. On the other hand LBA applications can be useful from the client perspective as this type of location sensed advertisements make marketing more convenient for them.

### A. POIdo:

POIdo [13] is the first and market-leading location-based advertising (LBA) platform in Russia, launched in March 2010. POIdo delivers ads of brands, local businesses, and services to the targeted audience of people who are either geographically close to the location, or are interested in the area. POIdo provides ads targeted to users precise location, context and behavior. POIdo is useful for both large companies with numerous locations such as gas station chains and small businesses serving local clients, such as restaurants, car services, and shops.

This application covers many attractive and necessary features, but there are some added facilities in our application. We have used free, editable, and open source map *OpenStreetMap*. The commercial mapping services used in these applications impose restrictions on use and limitations in features for using their map data. According to their license agreement they have also rights to stop their services any time. By using OSM all these restrictions has been avoided.

Our application provides audio support to make it usable and helpful for the visually impaired people. It is one of the significant improvements over almost all the LBA applications. There are also some ways to automatically start the application for the visually impaired people that makes the software more usable and effective for visually impaired people.

#### B. Info160:

Info160 [14] is a free information service and location based advertising system. Users create accounts either online or by SMS and subscribe to information categories of their choice. The categories include jokes, quotes, market prices, MDG facts, breaking news, and more. The users receive the information at a daily frequency at no cost whatsoever.

Each SMS received is appended with a short location based advert. Users can also choose to create adverts within their accounts and make them location sensitive if they want. Advertising starts at \$1 for 50 ad views making it one of the cheapest & effective ways to advertise.

The main limitation of this software is its SMS service. User has to spend SMS cost for getting an advertisement frequently. On the other hand, though it is a location based app, it is not a real time location based app. When a user registers with this service, he/she has to provide location information. The advertiser has the option of making the advert location sensitive. In that case they have to specify which county their adverts are intended for otherwise they are sent to any user.

As a user get an ad via SMS, so s/he gets small amount of information in Info160. But in our application when a user comes in a location, he/she gets a list of advertisement in the GPS enabled smartphone advertised by commercials. User can choose any of these advertisement and view details. Considering all the demand and making more usable for both normal and visually impaired people, 'Location Based Intelligent Advertisement' is an effective and customized solution for our country.

## III. LOCAL PERSPECTIVE OF LBS

From the statistics of mobile phone growth, it is seen that its advancement brought about a revolutionary change in different fields including major fields like finance, health, education and agriculture. But still people are deprived of most of the advance mobile based technologies due to the following constraints:

- 1) 3G network is still not easily obtainable.
- 2) Number of smartphone users are about to count in hand.

Now let's have a glimpse at the current situation. The free digital mapping interface are being made and the Open-StreetMap of Dhaka is almost updated just in 6 months. The OSM group of different universities has made it possible and targeting to update the whole Bangladesh in 1 year. Voluntary OSM teams have been formed in different universities and contributing to OSM since formation. The interface have been created and initiative has already been taken to implement different location based services considering local constrains and facts. Some mobile operators have already launched 3G.

Again the number of smartphone users, especially android based phone users is increasing rapidly which has started from just few month back and it is accelerating. As a consequence some companies has brought their android phone in market at a reasonable price. It is no longer confined only in style rather for daily necessities. With the increasing number of smartphone users, the demand of LBS application will increase. So there is huge scope for LBS application to gain popularity in this region.

# IV. METHODOLOGY

Android is an open source operating system for mobile devices such as mobile phones and tablet computers developed by the Open Handset Alliance led by Google. Nowadays demand of android phone is increasing. If smartphone's market is considered then demand of android phone can easily be found out. Here is the share of worldwide 2010 smartphone sales to end users by operating system, according to Canalys. [Fig. 1]

Android phones are now at only \$80 [15]. Leading mobile phone companies are stepping forward to bring smartphones to the users at lower prices . Cheaper phone from different Chinese brands are also available starting from BDT 7000 only [16].

It has been already mentioned that "Location Based Intelligent Advertisement using OpenStreetMap" has used Open-StreetMap. OpenStreetMap is free, so its usability is guaranteed for everyone. And as OpenStreetMap is open source, its development is 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



Fig. 1. Smartphone market share.



Fig. 2. Baily road map.

geospatial data and provide geospatial data for anybody to use and share. In December 2006, Yahoo confirmed that OpenStreetMap could use its aerial photography as a backdrop for map production. OpenStreetMap has helped in a number of projects conducted worldwide. The most prominent of those are the Map Kibera Project and Wiki Project Haiti [17]. In the Map Kibera project the largest slum of Kenya was mapped with full details [18]. 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. The first mapping project was done at Bangladesh University of Engineering and Technology, the top engineering school located at the capital of the country. In this application we have used OpenStreetMap. The tested areas are also updated by our OSM team in OpenStreetMap.

#### V. DESCRIPTION

For testing purpose "Location Based Intelligent Advertisement" is implemented first for New Baily Road in Dhaka. As the New Baily Road is well recognized for its numerous boutiques, shops, schools, fast foods, restaurants, and various hangout places, this place has been chosen for testing purpose.

# A. Prerequisite

- 1) The software is based on android version-2.2. It will run on android 2.2 supported mobile phones and upgraded versions.
- The cell phone should have GPS enabled. To enable the GPS unit, the following procedure should be followed: menu->settings->location. GPS can be enabled and disabled here.

# B. Software Overview

After activation, this application searches for satellite signal. When signal is found it is ready to track user location. Its general features are:

- 1) The main feature of this software is *ADVERTISEMENT* option. Depending on user's current location s/he can get all the available name of restaurants, fast-food shops, fashion houses, etc. Selecting their desired restaurant, fast-food shop, or fashion house they can get detail information like menu for restaurant and fast-food shop and address of other showrooms of fashion houses.
- 2) Provides a complete map under 'map' option with the indication of a user's current location on the Open-StreetMap.
- 3) Another most powerful feature of the app is the search option that helps the user to find any information easily. For example, if an user wants to have Chinese food, all he has to do is type *Chinese* in the search option then he will get all the names of restaurant on that location where Chinese food is available. Selecting his/her desired restaurant he/she can get the price menu. Here both image and textual help is provided.



Fig. 3. Advertising boutiques shop.

4) And the Save option is to be contributed by both users and shop authority to notify the central server if any information have been changed. If the location or any product's information is changed, the authorized person



Fig. 4. Advertisement.



Fig. 5. Showing location map.

of the respective shop provides changed or new information through this option that is updated in the central database.

5) There is an option for adding friend's phone number who can start the application by sending a SMS. As blind people can't see mobile phone's menu, it is difficult for them to find out the application from menu. As starting the application from the menu is difficult for a blind person, so the software can be started if an added friend sends an SMS writing <start>.

# C. Technical Reviews

- 1) The software is based on android 2.2 which support the API level 8 or above.
- 2) For location detection 'GPS Provider' and 'Wireless



Fig. 6. Search option.

A II C 1:17 PM advertise PLEASE GIVE INPUT AND SEND MESSAGE	
SHOP	
ITEM	
PRICE	
	SEND MESSAGE

Fig. 7. Updating Information.

Provider' has been used. It should be mentioned that if GPS is enabled then battery charge is reduced quickly. On other hand if location update is requested more frequently then battery consumption process accelerates. To reduce battery consumption we set an 'optimal time' empirically to update location. Some criteria has been defined and based on these criteria the app selects the suitable provider.

- 3) In 'map' attribute a marker has drawn to show user's current position on OpenStreetMap. It has built in zoom control as well as two finger zoom to make easier view of the map. Experimentally it shows a very clearer and quick map in spite of our 2G network of internet.
- 4) A central database has been maintained containing just textual information of restaurants, fast foods, boutiques,

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Fig. 8. Adding new friends (special feature for visually impaired people).

etc. Both image and textual information about shops and products are provided here. For blind people the app has an option to get audio information help using *Text to Speech*.

5) Search is done using *EDIT TEXT* of android. User's keyword is sent to database and after query the graphical and textual information will be provided to user.

# VI. CHALLENGES

Location based advertising gives control on what, when, how, and where customers receive ads. Unlike traditional media, LBA can be used for advertising as well as an effective medium of research. Companies can conduct mobile surveys along with their marketing campaign. Marketers can also use customers' past purchasing patterns and predict their future patterns and can send special offers to them. In spite of having these facilities in the LBA application like "Location Based Intelligent Advertisement using OpenStreetMap" there are some challenges to overcome. Some of our specific challenges:

- 1) Most mobile aggregators and networks are just now launching or will launch their location based advertising initiatives. It is easy to count all ad inventories but drilling down to location and any associated metadata is very difficult, particularly within free form text of user-generated content.
- 2) Early local advertising networks could match an advertiser to a pre-screened/pre-approved site; however, we were distributed across the web on about 500,000 sites per month and millions of blogs, profiles and websites. There were no APIs for controlling a sub network within their network.
- 3) Location based applications like ours use OpenStreetMap. But in undeveloped countries like Bangladesh, the activities of OpenStreetMap have just started. 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.

- 4) People of underdeveloped or developing countries 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) There is a lack of technically skilled volunteers for OpenStreetMap contribution. The lack of volunteers is causing the slow progress.
- 6) Local government has not taken any initiative to promote open source development. All the actions on Open-StreetMap have been carried out by individuals or small groups.

#### VII. PROPOSED IDEAS FOR ENRICHMENT OF OSM

Some initiatives should be taken for promoting update and use OpenStreetMap.

- 1) The main initiative for rapid growth of OpenStreetMap is decentralization. Currently there are seven divisions in Bangladesh. It will be enriched in short time if each division has its own mapping organizations with active volunteers.
- OpenStreetMap needs volunteers so that the trained volunteers can spread their knowledge to others to build up OSM by arranging different workshops.
- Every renowned university can contribute to develop OSM by establishing OpenStreetMap group by their own and arranging mapping party every week to cover different area of their city.
- Developers should show interest to develop OSM API so that more and more LBS application can be introduced using OpenStreetMap.

### VIII. FUTURE SCOPE

Now a days very few map based applications like the one we discussed is developed and used customized for local demands. 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. Focusing on that, there are few proposed ideas for future implementation:

- 1) Fire Service helper Showing the path on map and giving audio massage about the path before a transition point to reach the destination in shorter possible time.
- Health Services Audio massaging system for the location of nearest hospital and also showing the shorter and convenient way on map to reach there from any place.
- 3) 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 can be provides informing about the animal it will be much easier to teach a child about animals. It will be enjoyable for a child.

## IX. CONCLUSION

The application described in this paper is an attempt to aware people of our country about LBA applications and OpenStreetMap so that they can realize the importance of using map and location based service to keep moving with the advanced world. Considering the three main potentials of LBA, i.e., reach, relevant, and result, 'Location Based Intelligent Advertisement' is helpful for our region. The chance for updating product information easily has made the application more flexible for the advertisers. Using this greatly accountable medium of advertisements, the shop owners can better understand their customers with real time market research resulting in a higher advertising impact. In addition user will get a purpose to use OpenStreetMap through this application and it will help them to build up the habit of using open source map instead of commercial one. In future we would like to add an option for selecting local language to make our application more convenient for the native users.

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