# BlueAd: A Location based Service using Bluetooth

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## ABSTRACT

Location based services are information and entertainment utility using specific controls for location and time available through mobile devices. One type of location-based service is near location-based service, in which local-range technologies such as Bluetooth, WLAN, and infrared technologies are used to match devices to nearby services. This application allows a person to access information based on his/her surroundings. According to the definition of near location-based service, we have approached a new application, which has strongly reflected the sensible execution of this topic, and we have developed a complete system, which has invented a pioneering vision in advertising media.

## General Terms

Information System, Mobile Commerce

## Keywords

Bluetooth, LBS, Client/Server, LAN, Device Bounded Range

## 1. INTRODUCTION

The computing industry has been swept by wireless technology in recent years and at the present. Computer users now expect the most freedom and flexibilities with their devices, beginning with portable computers, wireless devices and wireless networks. The consequence of this shift in demand is the creation of several different standards for wireless communication. Wi-Fi, Infrared and Bluetooth represent some of the more dominant technologies now a day [1]. The nice combination of affordability, portability and an appealing name suggest a bright future for Bluetooth despite its low bandwidth compared to other protocols. In the recent past a lot of intelligent services and applications have been implemented by using Bluetooth.

### 1.1 Location Based Services

Context-aware computing describes applications, generally implemented for mobile devices, that adapt to environmental sensor information and often involves tracking peoples' location. Many of these applications rely solely on location information as their context [2]. It was predicted that location-based services would be the most common form of context-aware computing in this decade [3]. So Location Based Services (LBS) is a general and mostly used class of context-aware computing. We include a nice formal definition of LBS here: Location based services are information services accessible with mobile devices through the mobile network and utilizing the ability to make use of the location of the mobile device [4]. LBS services include services to identify a location of a person or object, such as discovering the nearest banking cash machine or the whereabouts of a friend or employee. LBS services include parcel tracking and vehicle tracking services. LBS can include mobile commerce when taking the form of coupons or advertising directed at customers, based on their current location. LBS also include

personalized weather services and even location-based games. These are an example of telecommunication convergence [5].

Location-based services (LBS) provide mobile device users personalized services, customized to their current location determined by one of several technologies. A good example is the wireless 911 emergency services, which determines the caller's location automatically. Other common location based services are traffic advisories; navigation helps including maps and directions, and roadside assistances. For finding the location of the subscriber there are several categories of methods [6], [7]. The GPS-based LBS is the simplest and standard solution. It is used to maintain knowledge of the exact location, however can be expensive for the end-user, as they would have to invest for a GPS-equipped handset. GPS is based on the concept of trilateration, a basic geometric principle that allows finding ones location if one knows its distance from other already known locations. GSM localization is the second option. Finding the location of a mobile device in relation to its cell site is another way to find out the location of an object or a person. It relies on various means of multilateration of the signal from cell sites serving a mobile phone. The geographical position of the device is found out through various techniques like time difference of arrival (TDOA) or Enhanced Observed Time Difference (E-OTD). Another example is Near LBS (NLBS), in which local-range technologies such as Bluetooth, WLAN, infrared and/or RFID technologies are used to match devices to nearby services. This application allows a person to access information based on their surroundings, especially suitable for using inside closed premises, restricted or regional areas.

### 1.2 Bluetooth

Bluetooth is a wireless communication protocol [8]. Since it is a communication protocol like any other protocols that we use every day, such as HTTP, FTP, SMTP, or IMAP, we can use Bluetooth to communicate to other Bluetooth-enabled devices. Bluetooth has client-server architecture; the one that initiates the connection is the client, and the other who receives the connection is the server. Bluetooth is a great protocol for wireless communication because it's capable of transmitting data at nearly 1 Mbps, while consuming one percent of the power used by Wi-Fi [9]. The Bluetooth special interest group (Bluetooth SIG), pioneered by Erricson, having well over 15,000 members, promotes and improves the Bluetooth standard [10], [11]. Bluetooth technology uses radio signals. Bluetooth, cordless phones, 802.11b, and 802.11g falls in the 2.3 GHz ranges. The Bluetooth specification defines the standard that a Bluetooth device should adhere to, as well as rules that need to be enforced during communication. The Bluetooth specification comprises of the Bluetooth protocol stack and Bluetooth profiles. The Bluetooth stack is the software or firmware component that has direct access to the Bluetooth device. It has control over things such as device settings, communication parameters,

and power levels for the Bluetooth device. The stack itself consists of layers, and each layer of the stack has a specific task in the overall functionality of the Bluetooth device. For application developers, the Bluetooth protocol can be broken up into two main items: layers and profiles. All the layers of the Bluetooth protocol form the protocol stack.

A profile is a description of a particular functionality, and Bluetooth device manufacturers use these profiles as a guide. With this approach, vendors can be sure that their devices will work with current and future Bluetooth products. The profiles are heavily dependent upon each other, and every profile depends upon the Generic Access Profile. The Bluetooth profiles were designed to be building blocks, where a higher-level profile is dependent upon the functionality of the lower profiles to exist.

Bluetooth devices can be classified as their connection capabilities. If a Bluetooth device can only support point-to-point communication, then it can only communicate to a single Bluetooth device at a time. On the other hand, a multipoint device is able to communicate with up to seven other devices at the same time. Bluetooth hardware devices are broken up into three power classes [12]. Power rating and coverage range for Class 1 is 100 mW and 100 meters respectively, for Class 2 is 2.5 mW and 20 meters respectively and Class 3 is 1 mW and 10 meters respectively. When two or more Bluetooth-enabled devices come within range of each other and establish a connection, a personal area network is formed.

## 2. Related work

Mobile messaging plays an essential role in LBS. Messaging, especially SMS (Short Message Service) has been used in combination with various LBS applications, such as location-based mobile advertising. Barwise and Strong explored the effectiveness of SMS advertising in the United Kingdom [4]. SMS is still the main technology carrying mobile advertising or marketing campaigns to mobile phones.

A classical example of LBS applications using SMS is the delivery of mobile coupons or discounts to mobile subscribers who are near to advertising restaurants, cafes, and movie theatres. The Singaporean mobile operator MobileOne has carried out such an initiative in 2007 that involved many local marketers, what was reported to be a huge success in terms of subscriber acceptance [13].

Lauri Aalto, Nicklas Göthlin, Jani Korhonen and Timo Ojala introduced a B-MAD system for delivering permission-based location-aware mobile advertisements to mobile phones using Bluetooth positioning and Wireless Application Protocol (WAP) Push. Some characteristics of this system are similar with our presented application [14].

Randell and Muller presented the Shopping Jacket infrastructure, which used GPS and local pingers in stores for positioning and customers were alerted when passing an interesting shop [15]. The system could also be used to guide the user around a shopping mall.

WideRay's Jack Service Point is a product for delivering local content, such as advertisements, using Bluetooth or infrared [16].

Location Segmentation Push Messaging Service offers developers using Urban Airship premium push messaging service the ability to geo-target and geo-segment opt-in users based on their location and the context of this location [17].

## 3. BlueAd

We have developed an innovative application named BlueAd, which is capable of establishing communication of two or more other Bluetooth-capable devices sequentially in the device bounded range and offering location based services for Bluetooth enabled devices by using Bluetooth data transfer method. We have expanded the application boundary range by developing a Client/Server system in a LAN (Local Area Network) environment. So the application has two portions. At the first portion the application run in the system continuously and searching for a Bluetooth device. Whenever it finds a device, it creates a connection with that device and sends data. This application also tracks the devices information and sent file information in its database. To expand the range, we developed an application that has a client portion and a server portion. The server portion opens the connection and waits for requests from clients. It sends the received messages to all the clients. In the client section, each client has an application of its own that contains text area for message writing and a send button. The client writes the message and sends it to the server. Then the server propagates the messages to the clients including all other messages. Clients integrate all the messages in to a file. Then the first application propagates the messages to the Bluetooth enable devices by the Bluetooth technology. All of the technical things are not newer in the wireless phenomenon but the idea of using the application for advertisement is new. The application was designed for a shopping center having lots of shops. They are connected into a local area network (LAN). A customer enters the shopping center with a Bluetooth enabled device, and then the foremost shop propagates the message to the customer including all the advertising information on the message. The developed application can send text message as advertisement as well as web file including picture and dynamic text, which construct the real life advertisements. The shop owner can update the information daily and send the latest arrival goods information and also the location of the shop in the shopping center. Fig-1 represents the flowchart of the developed system.

Java Standard Edition was used to develop the searching device program and send file to finding devices. Bluetooth device and bluecove-2.1.0 jar was also used to develop the searching device and send file to finding devices .In addition to these MySql was used as the data storage for finding device information and service information. The LocalDevice class defines the basic functions of the Bluetooth manager. The Bluetooth manager provides the lowest level of interface possible into the Bluetooth stack [18]. It provides access to and control of the local Bluetooth device. The getLocalDevice() method retrieves the LocalDevice object for the local Bluetooth device [19]. Multiple calls to this method will return the same object. This method will never return null.

If Bluetooth device is found then the software starts to search for remote devices. Searching for remote device is continuously running. The deviceDiscovered() method discovers remote devices.
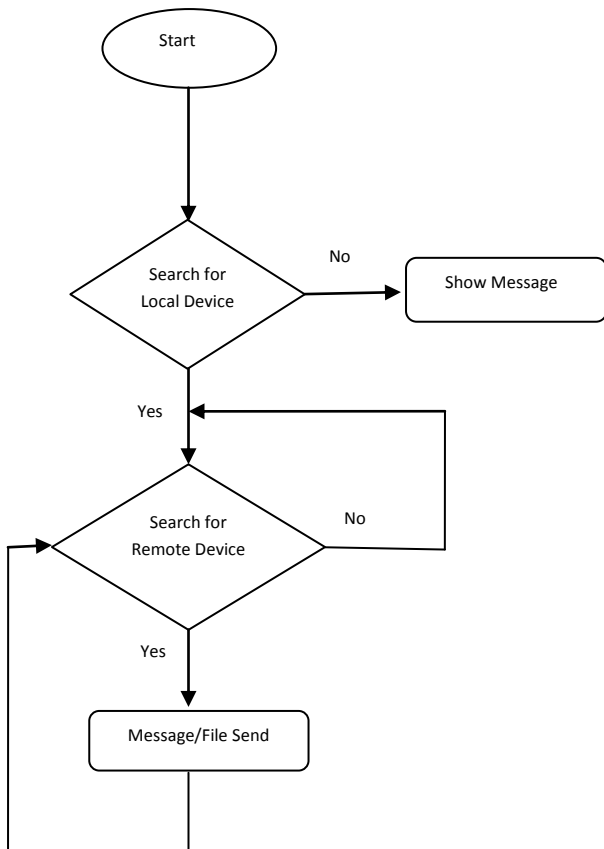
**Fig-1: Flowchart of the BlueAd application**

It is called when a device is found during an inquiry. An inquiry searches for devices that are discoverable. The same device may be returned multiple times.

The RemoteDevice() method creates a Bluetooth device instance based upon its address. The Bluetooth address must be 12 hex characters long [20]. Valid characters are 0-9, a-f, and A-F. There is no preceding "0x" in the string. For example, valid Bluetooth addresses include but are not limited to:

008037144297

00af8300cd0b

014bd91DA8FC

The getBluetoothAddress() method retrieves the Bluetooth address of this device. The getFriendlyName() returns the name of this device.

If remote devices are found then a connection is established with the remote device and the advertisement file is sent to the remote device.

For the purpose of sending all market place information to the customer at a time, we used the Client/ Server program in the LAN (Local Area Network) based system. In the Client Server System all the Client hosts or computers send message to the server then the server propagates the message to all clients. All the clients integrate the entire message into a message file and send it to the customers Bluetooth enabled devices with the help of the BlueAd software. In the Client Server System the server also can forward the integrated message to those clients, which contain the BlueAd Software. Then the clients having the BlueAd Software propagate the

message to the customers. Fig-2 represents the developed system with Client/Server relationship and connectivity.

Our application also provides the information of the finding devices. It contains the information of the devices, which it sends the message or file. We use java as our language for deploying this software, because java is platform independent and contains rich collection of APIs, which was useful for work. To work with this language we have used netbeans-6.1, also we work in JBuilder2006, With Java development kit JDK 1.6.0_01-windows-i586-p. This application also can be developed by .net or C sharp language by which mobile operating application can be built. Followings are a precise list of used APIs used in the developed LBS software BlueAd.

## 3.1 Software requirement:
We required the following software components for our application.

*i) bluecove-2.1.0.jar:* BlueCove is a JSR-82 Java Standard Edition (J2SE) implementation that currently interfaces with the Mac OS X, WIDCOMM, BlueSoleil and Microsoft Bluetooth stack found in Windows XP SP2 and newers [21]. Originally developed by Intel Research and currently maintained by volunteers. BlueCove provides Java API for Bluetooth JSR 82 [22].

*ii) MySQL-connector.jar:* MySQL Connector/J is a native Java driver that converts JDBC (Java Database Connectivity) calls into the network protocol used by the MySQL database. It lets developers working with the Java programming language easily build programs and applets that interact with MySQL and connect all corporate data, even in a heterogeneous environment [11]. MySQL Connector/J is a Type IV JDBC driver and has a complete JDBC feature set that supports the capabilities of MySQL.
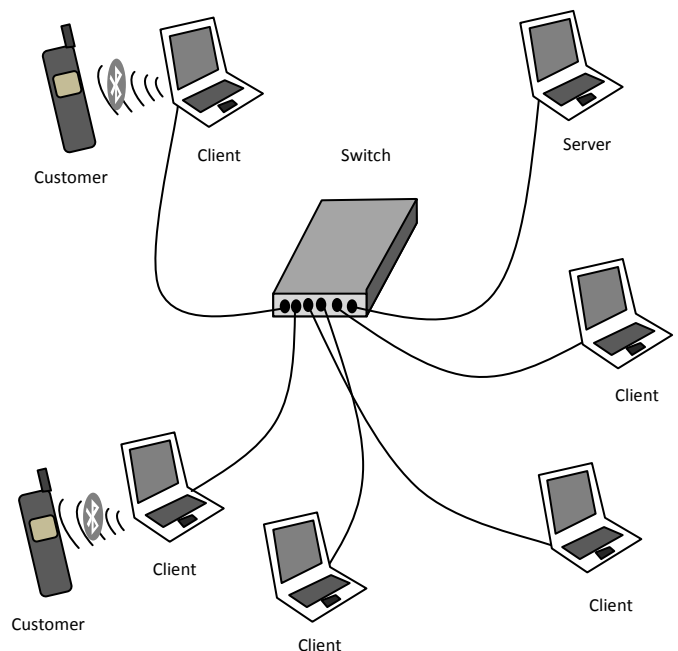


**Fig-2: Client propagates Client/Server System**

## 3.2 Hardware Requirements:

For our application we required i) any Bluetooth-enabled Mobile phone ii) Bluetooth device iii) PCs, iv) Switch and v) cables (for Local Area Network). Some mobile handsets don't support all type of sending files except text message. So we used Nokia 3110 mobile phone, which is Bluetooth enabled and also supports flash files.

## 4. CONCLUSION

BlueAd exposes a novel advertising media and it is commercially very adaptable to implement. It is very effective for advertising because it can easily bring the concentration of the customer and it can force the customer to pay their attention. The customer now grasps this type of new technological adaptation in advertising. As we also know that the Bluetooth technology has the popularity because it is easier and cheaper. The physical nature of the instrument allows it to be embedded in very small devices. Now a day, we can buy a Bluetooth device just for around 3 USD or 240 BDT. Its transmissions are omni-directional and standard coverage range is about 10 meters (30 feet) and class 1 Bluetooth device coverage area is up to 100 meters. It is capable of transmitting data at nearly 1 Mbps. The mobile technology is updating and upgrading every day and now a day all the standard mobile contains Bluetooth option. The Bluetooth communication with the other devices in the arena is very easier. Recently constructed shopping complexes and super markets have all the latest technical facilities. So it is not a big deal to find LAN based system in supermarkets in perspective of Bangladesh. Considering all these things, we have developed such an application, which brings innovative vision in commercial advertising and also helps us to gather knowledge on this platform.

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