A System Implementation of Pushing Advertisement to Handheld Devices via Bluetooth

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Abstract

Almost everyone today has his or her mobile phone and Bluetooth has already become a standard inclusion on most mobile phones, laptops and PDAs. Data transfer through Bluetooth among the handheld devices is common and popular. Bluetooth establishes links in a more convenient manner to facilitate sharing data between devices. It motivates us to apply this technology to hypermarket advertising. In this paper, we present a framework that pushes advertisements to hypermarket customers with handheld devices via Bluetooth

We have implemented the system and completed the field test in a local superstore. The result was satisfied. Hypermarket can reduce the cost of distributing handbills by using this proactive advertising system which also provides dynamic delivering of advertisement. In other words, hypermarket can make and deliver advertisement on the fly without resort to printing it.

1. Introduction

Handheld devices are so prevalent in recent years and this phenomenon inspires many researches on the application of mobile devices with Bluetooth wireless communication [1-2][5]. Mobile devices such as cellular phones, Personal Digital Assistants (PDAs), and laptops have been with Bluetooth as a basic function providing short distance file transfer without using proprietary cables; it makes Bluetooth the best tool for exchanging messages among versatile mobile devices. Bluetooth establishes links in a more convenient manner to facilitate sharing data between devices. It motivates us to apply this technology to hypermarket advertising.

Hypermarket usually distributes handbills manually on-site or mails DM (Direct Mail) to members' mailbox. Although the latter costs only postage with comparing to the former which costs manpower and flier expenses, mailing DM can only reach the members rather than those potential consumers of the hypermarket.

Seeing the shortcoming of conventional advertising, we built a proactive advertising system which pushes advertisements to on-site customers with handheld devices via Bluetooth. By using the system, hypermarket needs only to convert its major advertisements into pictures or video clips which are stored in the servers deployed around the site, then pushes the converted files to on-site customers who have handheld devices.

The remainder of the paper is organized as follows. Bluetooth technique and its file transfer protocol OBEX (Object Exchange) employed by our system are discussed in the next section. Section 3 describes the complete system architecture and the functional modules. We represent the flow chart of push mechanism and program logics in Section 4. Finally, section 5 concludes the paper.

2. Bluetooth and OBEX Protocol

Bluetooth is a short-distance wireless data transfer technology, operating in the frequency range of 2.4 ~ 2.485 GHZ, the so-called ISM (Industrial, Scientific and Medical) band, using a spread spectrum, frequency hopping, full-duplex signal at a rate of 1600 hops/sec. With hopping rate of 1600 hops per second, Bluetooth is difficult to be intercepted and less interrupted by

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electromagnetic wave. The key features of Bluetooth technology are robustness, low power, and low cost. It is designed for compact devices, such as cellular phone, PDA, to provide point to point wireless data transfer. Bluetooth devices are classified [4] by output power which determines the transmission range. Most handheld devices fall in the class 2 that outputs a 2.5 mW power having an approximate range of up to 10 meters or 33 feet.

OBEX is a communication protocol, which supports GET and PUT operations like those in the well-know FTP (File Transfer Protocol), facilitates the exchange of binary objects between devices. It is maintained by the IrDA (Infrared Data Association) but has also been adopted by the Bluetooth SIG (Bluetooth Special Interest Group). Therefore, most data transfer between Bluetooth devices is based on OBEX protocol by which a sender can send a file along with its filename, file size, and file description so that a receiver can better know about the received data. The Community Development of Java Technology Specifications also published JSR-82 API [3] that provides classes and interfaces for OBEX from which programmers can be more easily to develop file transfer programs on handheld devices.

3. System Architecture and Software Modules

This section describes system architecture, and software modules.

3.1. System Architecture

The proactive advertising system architecture is shown in Figure1.

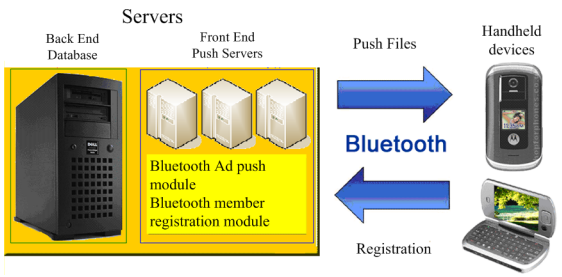

Figure 1. **System architecture**

The system requires users to register a set of username and password to become members online or at the service counter of hypermarket so that they can use the information to validate their handheld devices when coming to the hypermarket. The front end push servers, which are interconnected to the back end database for synchronizing member and mobile device information, are deployed around within hypermarket. These servers will push a registration program or advertisement to on-site customers. The member customers who have not registered their handheld devices will receive the registration program in order to complete the registration of the devices. Those who have done the registration for their handheld devices can decide to accept the advertisement or not. The back end database contains user registration information along with the Bluetooth address of the mobile device. Ad push module and member registration module are run in the front end push servers, the former module pushes either registration program or advertisement while user login information associated with the Bluetooth device address is processed by the latter module. The handheld device will receive the registration program if its Bluetooth device address is not registered otherwise it will receive advertisements. There are four software modules in our system:

1. Bluetooth Ad push module.
2. Server side Bluetooth member registration module.
3. Client side member registration module.
4. Dynamic URL advertisement generator.

Bluetooth Ad push module and server side Bluetooth member registration module, which handles data transfer and processes registration respectively, are located in the front end servers. Client side member registration module is pushed by Bluetooth Ad push module and runs in customer's handheld device. Dynamic URL advertisement generator, placed in the front end servers, produces a Jar file containing a URL pointing to an advertisement webpage. Figure 2 shows the interactivity of these four modules.

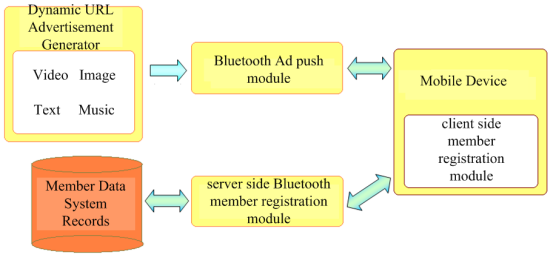

Figure 2. **Interactivity of software modules**

Functions of the four modules are described as follows.

3.2. Bluetooth Ad Push Module

This module will periodically push files to around handheld devices with Bluetooth turned on. If the push succeeds, it will store the successful information in database for later inquiry. If the push is rejected by some handheld device, the Bluetooth address of the

device is logged and set with a reset timer in a denial device list which will be referred for the next push. Therefore, the device will not receive files pushed from the module for some period of time. If the timer is up the associated device will be removed from the list.

When Bluetooth Ad Push Module is running, it will receive Bluetooth device addresses which are discovered by front end servers. This module will check the addresses with database to see if they are registered, that is, whether the addresses have associated with members' username and password. If the addresses have not registered then this module will push client side member registration module to these devices.

3.3. Server Side Bluetooth Member Registration Module

As counterpart of client side member registration module, this module will receive the registration information sent from users and check it with database to see whether they are members or not. This module will notify handheld devices of the registration status.

3.4. Client Side Member Registration Module

This module can be automatically installed and running in a Java-enable device. Customers use this module to register their handheld devices by input their username and password. The username/password and the associated Bluetooth device address are sent to server side Bluetooth member registration module to complete the one-time registration of the handheld device. After the handheld device has been registered, Bluetooth Ad push module will use its Bluetooth device address to identify the customer.

3.5. Dynamic URL Advertisement Generator

This module provides an alternative to lead the customer to access the advertisements. Hypermarket prepares its advertisements on a website rather than pushes them to the customer; and then uses this module to create a Jar file containing the URL of the website. The Jar file will be pushed to customer's handheld device on which the jar file can be executed and bring the URL to the browser of the handheld device. Thus, customers can browse the advertisements on their handheld devices. The functions of these modules are summarized in Table 1.

Table 1. Software module function

Module Name	Function	Location
Bluetooth Ad push module	Push registration program, URL jar file or advertisements to handheld devices which are discovered by front end servers.	Front End Servers
Server side Bluetooth member registration module	Gather user login information and associated Bluetooth device address then check if the device is registered or not.	Front End Servers
Client side member registration module	This module sent from Bluetooth Ad push module is used to register handheld devices.	Handheld Devices
Dynamic URL advertisement generator	Prepare a jar file containing a URL that points to an advertisement webpage which will be shown on the handheld device.	Front End Servers

4. Flow Chart of Push Mechanism and Program Logics

Let us consider the following scenario: Hypermarket might only want to send special offers to its members without bothering non-member customers; and some customers do not want to get any advertisement no matter whether they are members or not. A customer might have received the advertisement that was just pushed off. How Bluetooth Ad push module deals with these situations?

In this section, we describe the push mechanism and its logic. Figure 3 displays the flow chart of push mechanism; and the program logic within Bluetooth Ad push module is expounded as follows.

(1) There are two pushing modes in Bluetooth Ad push module. One is automatic push, the other is manual push. Hypermarket can select either automatic push or manual push depending on requirements.

a. Automatic Push: Program continuously pushes files according to a predefined sequence within a period of time that is adjustable.

b. Manual Push: Manually push a specific file.

We define the file being pushed as F (File).

(2) Search Bluetooth devices around the front end servers; put the Bluetooth devices being found in a device list. From the list choose consecutively one device which will go through the processes (3) ~ (6) described below.

We define the chosen device as D (Device).

(3) If device D is shown in the denial device list, that means the device has rejected receiving file. If the reset timer is expired then remove the device D from the denial device list.

(4) If device D is not in the denial device list, then check whether it is registered or not.

a. Is registered: Check with database to see if device D has received file F.

b. Is not registered: Transmit "Client Side Member Registration Module" to device D.

(5) If the registered device D has received file F, then stop pushing file F to device D.

(6) If the registered device D rejects receiving file F, then system will not push any file to device D within a period of time which is adjustable.

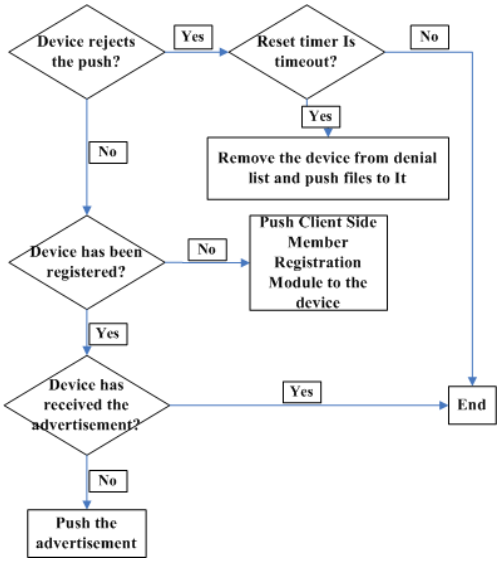

Figure 3. **Flow chart of push mechanism**

No matter whether a device rejects receiving files or it is not registered, the above mechanism can response a correct action to the device either stops pushing files or pushes registration program. In other words, customers can interact with the system so that hypermarket can not force them to receive advertisements.

5. Conclusion

Hypermarket and superstore usually distribute their fliers manually or by mail, which is inefficiency as well as consuming workforce and material. We proposed a proactive advertising system to cope with this problem. Hypermarket can reduce the cost of distributing handbills by using this system which also provides dynamic delivering of advertisement. In other words, hypermarket can make and deliver advertisement on the fly depending on real time sales data without resort to printing it. We have completed the field test in a local superstore and the result was satisfied. The proactive advertising system can also apply to similar places such as food court, amusement park and cinema. It can be used as an alternative advertising method for these places.

6. References

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