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## **Enhancing mobile advertising via Bluetooth technology**

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**Abstract:** This paper presents a Multimedia Message Transmitter Tool (MMTT) that provides businesses with the opportunity to use Bluetooth wireless connectivity delivering the relevant information to relevant people in the right places and time. MMTT empowers any business to market their services or products for unlimited time with a one-time fee. It provides the ability to deliver customised content on a permission-based manner to all devices in the range of 100 m to 1 km. MMTT supports user's right of privacy and ensures spam-free delivery of content to interested users. Experimental results show that MMTT provides a viable solution for realising mobile advertising for the advertisers as well as the consumers.

**Keywords:** Application Programming Interface; API; Bluetooth; mobile advertising; mobile communications; mobile technology; Multimedia Message Transmitter Tool; MMTT; multimedia.

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## 1 Introduction

The increasing demand of mobile advertising is due to the growth of wireless network (Hairong and Ki-Young, 2006). Bluetooth (Hopkins and Antony, 2003; Leppäniemi and Karjaluo, 2007) is an industrial specification for wireless Personal Area Networks that provides a way to connect and exchange information between devices, such as mobile phones, laptops, PCs, printers and digital cameras via a secure, low-cost and globally unlicensed short-range radio frequency. It is a radio standard and communications protocol primarily designed for low-power consumption, with a short range (power class dependent: 1, 10 and 100 m) based around low-cost transceiver microchips in each device. A Bluetooth-enabled device uses a radio communication system, so they do not have to be in line of sight of each other, and can even be in other rooms depending on the power class of the product.

There is no doubt that mobile technology made new opportunities for public and private sectors. This study intended to enhance the marketing in Jordan by using the Bluetooth technology. Multimedia Message Transmitter Tool (MMTT) is a proximity

marketing platform, which allows one-way (one-to-many) data transfer to mobile devices based on proximity of such mobile devices. The main purpose is to establish the permission-based communication through the individual's mobile phone which enables companies to reach their specific target without any expensive requirements. It depends on the new technology of Bluetooth that takes a wide place in the few last years to present a new advertisement service in the marketing world. It is a complementary application, which allows users to interact with customers in direct, wide and comprehensive way giving them the authority to send any offers without limitation on quantity, costs, type or numbers of recipients within the domain.

This paper is organised as follows. In Section 2, we briefly review the related work on proximity advertising via Bluetooth connectivity. The developed system is introduced in Section 3. The implementation of the system by using the Visual Basic and Java technology is described in Section 4. Finally, Section 5 provides the conclusion of the paper.

## **2 Related work**

A mobile marketing is a topic of growing interest and importance (Lei-da and Ravi, 2004; Varshney et al., 2004; Leppäniemi and Karjaluo, 2007). Mobile campaigns encompass acquisition, retention, customer service or Customer Relationship Management applications that use text messages (Short Message Service), picture/audio messages (Multimedia Messaging Service) and the mobile internet (Wireless Application Protocol and General Packet Radio Service; Barnes and Scornavacca, 2004; Karjaluo, 2006; Shim et al., 2006). They can support responses as varied as requests for information, sales promotion, retail football generation and direct revenue generating sales (Direct Marketing Association, 2005).

Yunos, Gao and Shim (2003) presented the opportunities and challenges of the wireless advertising.

Bluetooth Mobile Advertising system is developed by Aalto et al. (2004), which used Bluetooth for delivering permission-based location-aware advertisements to mobile phones. Their system had some difficulties related with the reliability and redundancy.

Gopal and Tripathi (2006) addressed the key issues pertaining to mobile advertising and analysis of business model for an advertising firm that delivers ads using carrier's wireless infrastructure.

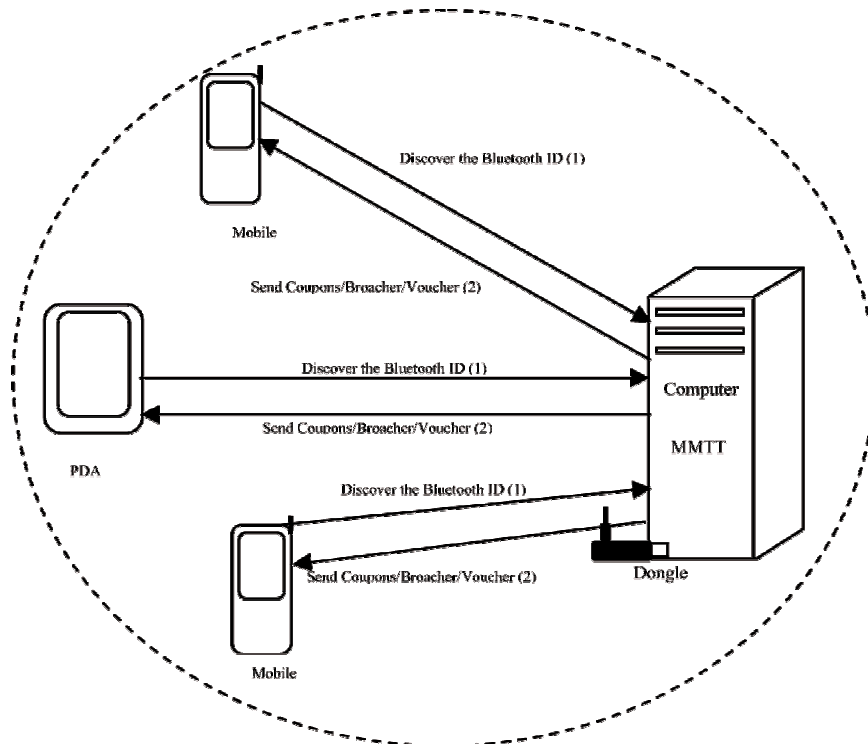
Davidrajuh (2007) described building a wireless information system by using the Bluetooth wireless technology. A Bluetooth-enabled client-server system is under development to conduct assignment during the lectures.

In our paper, we send different kinds of advertisements to mobile phones through their unique Bluetooth-ID. Based on sending the advertisements by category, such as cloths, sports and others, the users will not receive any advertisement which are not of his/her interest. Different kinds of reports are generated that list all devices according to either the date or a specific device ID. MMTT provides a redundant free service that helps the consumer to avoid repeated messages. The download of the advertisements took a short time. We adopted the multi-threading applications that enhance the performance of the MMTT.

### 3 MMTT

In the revolution of mobile technology and according to the growing radio frequency and wireless market in an unimaginable dimension, we developed MMTT, a new tool for a mobile advertising and marketing world. Figure 1 presents the architecture of the system and the sequence of the operation. The main idea of MMTT is to deploy Bluetooth devices in indoor/outdoor areas, creating a Bluetooth umbrella; therefore, we can track people through their mobile phones unique Bluetooth IDs, which enables locating consumers and sending advertisement to their mobile phones. First, the computer equipped with a Bluetooth dongle that connects into a computer's USB port and enables the computer to communicate with other Bluetooth-enabled devices. Once it discovers the new Bluetooth-enabled devices, such as cell phone, PDAs or any other devices, a branded promotional customised multimedia message is sent in different formats such as text messages, pictures and audio messages from the computer to these devices.

**Figure 1** The architecture of Multimedia Message Transmitter Tool and the sequence of the operation



MMTT is a convenient and easy-to-use programme; it has a kind of diversity and flexibility available for campaign development and enables companies or brands to reach their consumers. It also provides the opportunity to build a closer relationship to the potential consumer, where an ongoing permission-based communication is possible through the individual's mobile phone. It is considered as a successful system due to several facts: it is applicable in different environments and it can be deployed to a wide

variety of locations to achieve advertiser's purposes, such as small business, restaurants, gas stations, banks, airport lounges, malls, doctor's waiting rooms, retail locations, hospitals and university campuses. The main objectives of the MMTT are:

- 1 Building a complementary advertisement application for marketing in Jordan.
- 2 Provides a new way of marketing with interaction between users and customers.
- 3 Making the marketing in Jordan more attractive for public.

We expect the following benefits:

- 1 Delivering high bandwidth of digital data without extra network charges.
- 2 Provides an easy and a fast access to existing or new mobile multimedia services.
- 3 Sends different type of contents to handset that will motivate manufacturers to produce new models.
- 4 Offers several options for area coverage. The recommendation is that there is always a visible call-to-action which alerts target users that the system is available and that transmission range matches the visibility of the call-to-action service.
- 5 Customers have the option to accept or reject the message; therefore, it is considered as non-intrusive.
- 6 Provide a new technique which save time, money and effort for customers and users.

### *3.1 MMTT functionality*

The main functionalities of the MMTT are:

- 1 User can create or modify texts, images, recorded sounds, business cards or choose from the existing files.
- 2 User can send messages in four modes:
  - a *Automatic sending*: enabling the user to search and send message for all devices automatically.
  - b *Manual sending*: enabling the user to search for devices then send for all or selected devices.
  - c *Employee sending*: enabling the user to send messages for all or selected employees.
  - d *Category sending*: enabling the user to send a category message according to the device name.
- 3 User can show the searching and sending information.
- 4 User can get different kinds of reports.

### *3.2 Security*

In order to provide information confidentiality, the Bluetooth system provides security measures at both the application and link layer (Miller, 2001; Direct Marketing Association, 2005). These measures are appropriate for a peer environment such that in

each Bluetooth unit, the authentication and encryption routines are implemented in the same way. Four different entities are used for maintaining security at the link layer: a public address that is unique for each user, two secret keys and a random number that is different for each new transaction. Bluetooth is a highly secure system for the following reasons (Dreamtech Software Team, 2002):

- 1 Every Bluetooth device is given a 48-bit address that uniquely identifies the device. Every Bluetooth device on earth will have a unique address.
- 2 When one device wants to communicate with another device, the second device is authenticated.
- 3 Data on the channel is encrypted so that only the intended recipients can receive it.
- 4 Every Bluetooth device has a random number generator; these numbers are used for authentication.
- 5 A frequency-hopping scheme provides built-in security. Only those devices that know the hopping sequence can decode the data sent by the master.

MMTT used these technologies to send secure message that reduce the possibility of intruding the mobile with viruses.

#### **4 Implementation**

Our system was implemented by using the Visual Basic.net (VB.NET) and classes that deal with Bluetooth Application Programming Interface (API; Shelly, Cashman and Quasney, 2003). The system needs API for devices and desktop computers running the Microsoft Bluetooth stack, Microsoft Windows support an associated Object Exchange services for these medium. We used a multi-threading application that is more efficient because in a synchronous environment a new task cannot start until a previous task has been finished. If the completion of a synchronous task takes longer than expected, the application may appear unresponsive. Multi-threaded processing can simultaneously run multiple procedures. We provide two ways for sending files: the first is a manual sending which provides searching and sending operation. By multi-threading, the system can find more than one device on searching operation at the same time, and send files for a maximum of seven devices at the same time. The second one is an automatic sending that provides searching and sending operation automatically using multi-threading, the system can find many devices and send files to a maximum of seven devices at the same time. These two kinds of sending technique appear in Figure 2, where the user can perform different operations. Figure 3 shows the text files screen, where the user can create any text or choose from the existing files and then send it. The report screen in Figure 4 presents a list of all devices according to either the date or a specific device ID. It presents the number of devices and the number of successful and failed sending. Because multi-threaded applications divide programmes into independent tasks which improve the performance of MMTT in the following ways:

- multi-threaded techniques make our programme more responsive because the user interface can remain active while other work continues
- tasks that are not currently busy can yield processor time to other tasks

- tasks that use a lot of processing time can periodically yield to other tasks
- you can set the priority of individual tasks higher or lower to optimise performance.

Figure 2 Sending mode

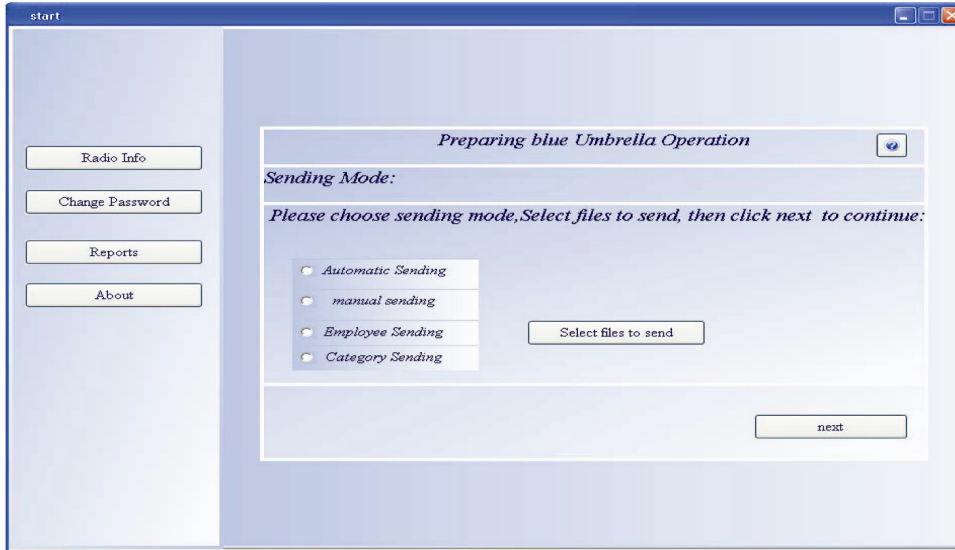
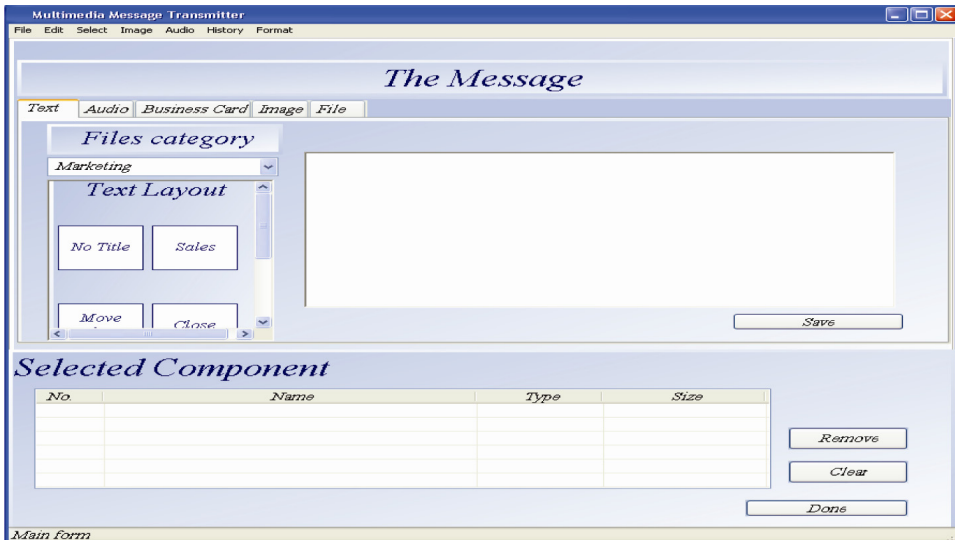


Figure 3 Text file screen



**Figure 4** Report screen

The screenshot shows a window titled 'Report' with a menu bar (File, Sending, Settings, Report). The main content area is titled 'Devices List' and contains a table with the following columns: Device Name, Send Status/percentage, Send Duration/seco..., files sent, and Date. The table is currently empty. To the right of the table are four summary statistics: Devices Count, Success Sendings, Failed Sendings, and Sending Percentage, each with a corresponding input field. Below the table is a 'Filter' section with two sub-sections: 'By Date' and 'By Device Address'. The 'By Date' section has a dropdown menu, and 'From' and 'To' date pickers, both set to 20/12/2006, with an 'ok' button below. The 'By Device Address' section has a text input field and an 'ok' button. At the bottom right of the window is a 'Back' button. The status bar at the bottom left says 'Device report'.

#### 4.1 Testing

Table 1 shows the Bluetooth dongles information that is used to test MMTT. A ‘dongle’ is a small hardware device that helps the computer to authenticate a piece of software or the identity of a user (SafeCom Technologies Limited, 2005). It connects with a computer’s USB port and enables it to communicate with the other Bluetooth-enabled devices. It is available in one of three classes: Class 1 covers up to 100 m, Class 2 covers up to 10 m, and Class 3 covers up to 1 m. In our experiments, we used Class 1 and Class 2.

**Table 1** Bluetooth dongle information

<i>Transfer rate</i>	<i>No. of sending files</i>	<i>Range</i>	<i>Class</i>	<i>Bluetooth dongle name</i>
750 kbps	1	10 m	Class 2	SAM sync
3 Mbps	5	100 m	Class 1	MSI

We tested MMTT many times in a mall in Jordan with two different Bluetooth dongle and the results are as shown in Table 2.



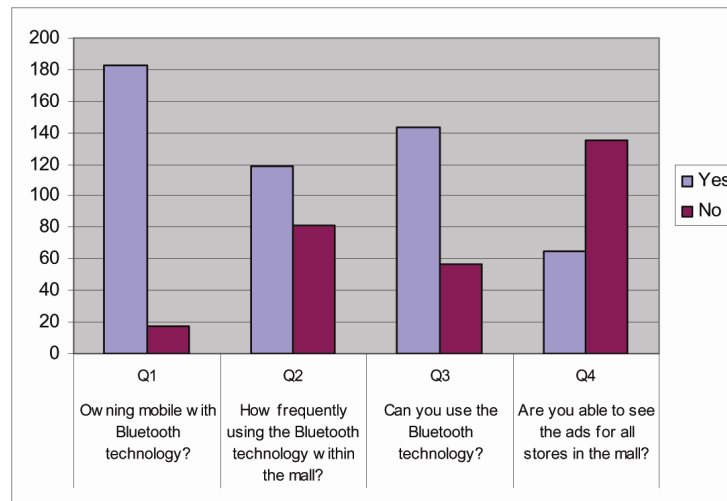
**Table 2** Testing results

<i>Bluetooth dongle name</i>	<i>Instant connections</i>	<i>Device found/30 min</i>	<i>Accepted devices</i>	<i>Rejected devices</i>
SAM sync.	Up to 7	19	11	8
MSI	Up to 7	25	18	7

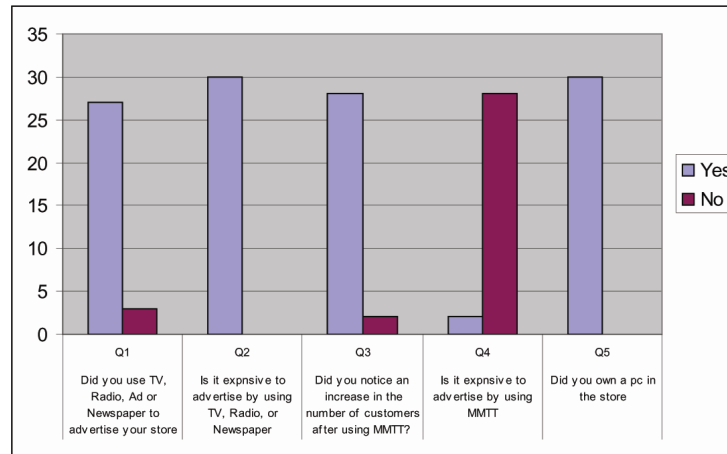
The results showed that more than 57% of people accepted the message that was sent by MMTT. While this percentage increased up to 72% of people as we used the MSI dongle that cover a large area.

Two kinds of questionnaire are presented to the customers and store owners to evaluate MMTT. The first one distributed on 200 different customers contains a variety of questions, such as age, gender, owning mobile with Bluetooth technology, how frequently using the Bluetooth technology within the mall, can you use the Bluetooth technology, and are you able to see the ads for all stores in the mall. Figure 5 shows the results to selected questions of the first questionnaire. Around 100 and 80 users own a mobile with a Bluetooth technology most of them use the Bluetooth frequently. This is expected since in Jordan more than half of the population owns a cell phone of which approximately 60% is a Bluetooth enabled device. Around 100 and 40 users were not able to see the ads for all stores in the mall.

**Figure 5** Evaluation of Multimedia Message Transmitter Tool based on customer responses (see online version for colours)



The second one distributed on 30 different store owners contains a variety of questions, such as did you use the TV, radio, ads, or newspaper to advertise your store, is it expensive to advertise via TV, radio, ads or newspaper, did you notice an increase in the number of customers after using MMTT, is it expensive to advertise by using the MMTT, and do you own a pc in your store? Figure 6 shows the results of the second questionnaire. Most of the store owners use the TV, radio or news paper to advertise their stores which is very expensive. They were excited about MMTT, because it is efficient, cheaper and it increased the number of people that visited their stores, which will affect the profit.

**Figure 6** Evaluation of Multimedia Message Transmitter Tool based on store owners responses (see online version for colours)

## 5 Conclusions

We introduced MMTT as a marketing tool for delivering permission-based mobile advertisements to mobile phones. It is the number one tool for communication achieving high targeting opportunities. The interaction between businesses and consumers is 100% cost free that has been already achieved by utilising Bluetooth technology and avoiding any network infrastructure. Our test results showed that the system provides a viable solution for realising mobile advertising as it fulfils the needs of the advertisers as well as the consumers. By using MMTT, advertisers can:

- ensure that the recipients have an enhanced retail experience
- enhance sales by offering digital delivery of discounts and promotional material
- extend the brand beyond the location
- lower the dependency on expensive advertising techniques
- reach customers where they are close to advertisers' business ready to make the decision of purchasing a service or a product.

In addition, consumers can:

- have enhanced retail experience
- gain enhanced level of personalisation
- store content on their devices for later viewing
- receive exclusive content distributed only at selected locations
- help to enhance the marketing process by transferring the received content to other mobile devices with ease.

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