Extending E-Business Applications Using Mobile Technology

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ABSTRACT
The paper outlines the application of mobile wireless technology to enhance e-business applications. The paper describes the application of mobile technology accessing web enabled databases to extend e-business competitive advantage. A number of applications using mobile technology to enhance e-business systems are outlined in relation to the evolution of mobile devices and wireless technology standards of WiMax (Worldwide Interoperability for Microwave Access) and WiBro (Wireless Broadband). An example of a restaurant wireless Personal Digital Assistance (PDA) and inventory system indicates the use of wireless technology to enhance business activity and contribute to existing e-business operation. A proposed framework is outlined to introduce the application of user mobility to mobile usage as an extension of existing Intranet, Extranet and Internet e-business application.

General Terms
Management, Performance, Reliability, Experimentation

Keywords
E-business, mobile technology, mobile business application

1 INTRODUCTION
In the last decade the purchasing of online products such as CDs, novels or even computer parts etc. has been made easier as most businesses are using online ordering system. Electronic business or e-business uses the advantage of the internet as a new platform to seek out a large global market outside the region of conventional business activity. Companies such as Amazon.com and Ebuyer.co.uk can save costs of up to 62% by eliminating the retail aspects of the business chain in targeting their sales directly to their customers [1]. Companies can also improve their competitive advantage by providing Customer Relationship Management (CRM) to gain feedback to improve customer relations and gain marketing ideas from customers. Nike, one of the world's largest sportswear companies, has implemented a system which allows customers to design their own trainers. When Nike are extracting information about their customer shoe size and footwear design they are able to interpret this information to determine the most popular footwear size, colour, style and design etc which results in improved sales revenues [2].

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The intension of e-business is to enhance business activities over the internet by achieving global sales and reaching a larger market group. In the UK, 37% of retail companies have e-business applications online and 22% of the UK population use these systems to purchase retail items [3]. It is possible to improve e-business trend by extending it over to m-commerce. The evolution of mobile devices makes it possible to enhance business activities through e-commerce transactions. E-commerce is described as a subset of e-business where e-commerce works at the back end of the e-business environment dealing with electronic transactions of the buying and selling process of e-business [1]. Mobile devices can aid in e-commerce because the majority of 79% of young adults of the UK population owns a mobile phone [4]. Most common purchase through mobile phones are mobile Ringtones and profits of up to $600 million have been generated by purchasing mobile phone Ringtones [5]. This sales concept can be applied to mobile phones, since the new 3rd generation of mobile phones have improved display screen with better colours and supports HTML text which enables purchases of CD or books on the mobile device directly. A recent survey indicated that 18% of respondents suggest that the use of mobile technology can improve CRM activity [6]. Nissan automobiles are also using wireless PDAs to improve their quality of service where staff members equipped with their PDAs can deal with customer enquiries concerning spare parts. The salesperson can check prices and equipment availability on the spot and provide direct feedback to the customer [7]. The use of mobile application software has helped insurance company Drive Assists in saving road travelling per year with the use of their mobile devices [8]. The John Hopkins Hospital saved $1,000 a day by using PDAs to relay pharmaceutical information to the pharmacists in real time [9] and Addenbrooke's Hospital in Cambridge, UK, were able to complete 176 successful kidney and liver transplants because of the up-to-date information of organ donors via their Blackberry PDAs [10]. The use of mobile devices can benefit e-business applications by improving their productivity rate. Mobile Commerce or m-Commerce is described as the "explosion" or the extensive use of mobile applications [11], or alternately may be described as making a transaction or purchase through the use of a mobile device. In the business world the importance of speed and reliability of information is crucial key of success and mobile phones can give that competitive advantage. A survey of 400 IT managers suggests that 36% of employees rely on the use of mobile devices to check their emails, 24% use mobile applications to amend documents while in transit and 50% of the companies suggests it is essential to improve mobile bandwidth in order to promote mobile business applications [6].

2 THE EVOLUTION OF MOBILE DEVICES TO E-BUSINESS APPLICATION

The evolution of mobile technology has significant benefit to e-business applications in providing extended competitive advantage. Figure 1 illustrates the progress of mobile technology since 2000 which has been quite dramatic and is evident from the types of different specification of mobile phones depicted in the diagram. In the last 6 years the bandwidth of media content has increased from 1 to 3 gigabytes of data transmission together with a variety of fashion accessories of built-in cameras, mp3 players and web browser capabilities. In the case of Personal Digital Assistance (PDA) these have evolved from organisational tools to combined GSM (Global System for Mobile Communication)/GPRS (General Packet Radio Service) services incorporating cellular coverage. This also allows the users to make phone calls, Short Messaging Service (SMS), send emails and enables access to the web. In mobile computing there are two types of mobile business that are categorised on how information is processed as illustrated in Figure 2. The first is a web-enabled database that stores and retrieves data from a centralised database system and the second is a standalone database which stores and processes the data on the held device itself. Consequently, the latter type is limited to the data operation on the handset itself and is also prone to a security problem if the mobile device is lost or stolen.

3 WIRELESS TECHNOLOGY

The advent of wireless devices such as Bluetooth enabled PDAs and Wi-fi enabled laptops has become a driver for applications to improve communication between wireless devices to improve business activities. Although, Bluetooth technology has been around since Ericsson cellular phones started, with the merge of Sony Corporation in 2000. The launch of Sony Ericsson phone, T68i, with Bluetooth technology brought popularity into the portable application to business application. The increasing popularity of Bluetooth technology has enabled Japanese restaurant Wagamama to implement a Bluetooth wireless ordering system where waiters use a Bluetooth enabled PDA to take down orders electronically [12]. A similar concept is also used in Germany

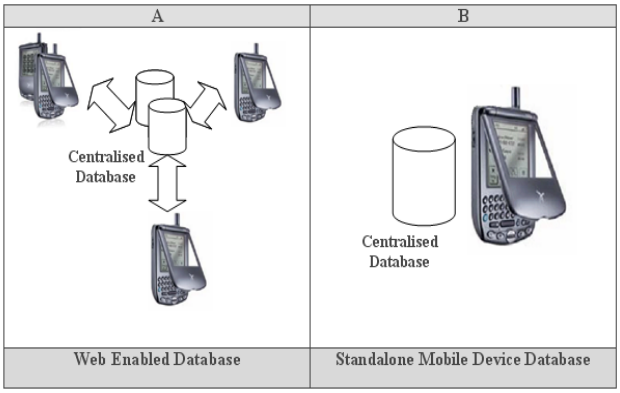

Figure 2 – Two Categories of Web Enabled Databases

for filling in registration forms on a wireless PDA which has became popular among youths when applying for insurance [13]. There are 3 ways in which the customer can register: online, Kiosk client or a wireless PDA with staff assistants. It was originally an e-business idea to register online, but because of customers having enquires they usually need a member of staff to assist before registering them for an insurance offer. Using on the spot PDA, staff members can display the price offers on their PDAs and if the customer agrees they can register them immediately which increases revenue sales for the company compared to e-business operations. The PDA is connected to a web-enabled database so the information is updated on to the server and the system is similar to an online registration form. Similar strategic advantage can be applied to help other e-businesses by using other types wireless technology such as Wi-Fi (IEEE 802.11), WiMax (IEEE 802.16) and WiBro (Korean Spectrum) where the use of mobile internet can be exploited for business opportunities.

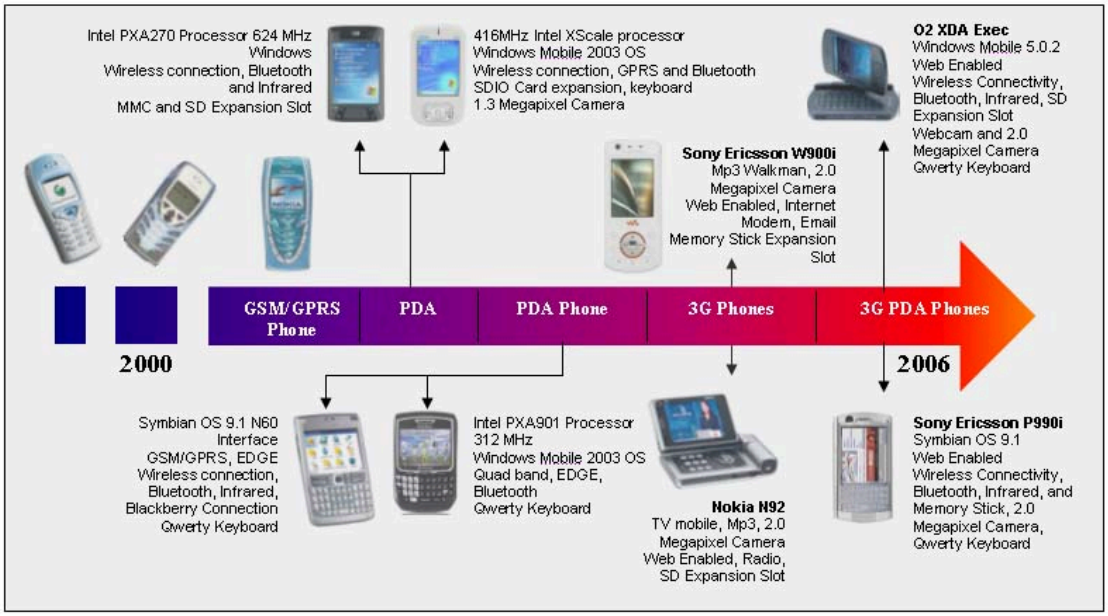

Figure 1 – Evolution of Mobile Devices from 2000 - 2006

4 RESTAURANT INVENTORY SYSTEM AND OTHER MOBILE ENHANCED APPLICATION TO E-BUSINESS

Restaurants owners can increase production and improve quality of service of their business by taking advantage of the use of wireless mobile devices. Using a PDA that has a wireless technology such as Bluetooth or Wi-Fi can save the waiter from having to take the orders directly to the kitchen for food preparations. The orders will be displayed on electronic board in the kitchen, allowing personalised customer orders to display special ingredients such as extra seasoning and allergies the customer might have. To provide the business with a competitive advantage, the electronic board could be connected to a web-enabled database which calculates the stock usage of ingredients at the restaurant allowing automated ordering. The system could be adapted to control the amount of wasted ingredients and help keep their stocks within the expiry dates. The system also offers a way of personalising orders to suit customers that frequently come to the restaurant and providing Customer Relationship Management (CRM) capabilities. As the waiter recognises the customer they can just select the name of the person on their PDA and the display of previous orders can be listed and recommendations or discounts could be offered to regular customers as shown in Figure 3. The system also allows the orders to be organised to allow groups of customers to pay for separate meals. Figure 4 illustrates other business applications of e-business extensions using mobile technology and incorporates the method of use and benefits of the applications in conjunction with the type of mobile equipment being utilised.

5 MOBILE BUSINESS APPLICATION FRAMEWORK

Figure 5 displays a framework for a mobile business application which will help guide business management in decision making on the different categories within three regions of user mobility. The x-axis of the framework shows the mobility range where it is divided in 3 different regions which are the Internet, Extranet, and Intranet. The three different regions will differentiate the types of mobile technology and how the software application can be implemented in relation to the business operations. These mobile technology and application is depicted by the y-axis. The Intranet and Extranet region of the framework will implement a fully integrated mobile device or just customised application to a normal mobile phone to help their business activity within the company itself, such as UPS PDA Signature Recognition [18] or a Wal-Mart Wireless Inventory Checking [19]. While those users, within the Internet region can just use their normal mobile device, but they will have to dial or visit a certain web-enabled e-commerce database to connect to, such as SMS vending machine [20]. Within each region of the 'rings' of mobile usage, there are colour coding that signifies 'time sensitivity' which indicates how important the data transmission is to the business applications. It is also possible for systems to migrate and be present in all three regions i.e. Intranet, Extranet and Internet respectively as depicted in Figure 6 with developing mobile technology in the future. The use of this framework will evaluate opportunities in conjunction with a SWOT (Strength, Weaknesses, Opportunity and Threats) analysis [21] and/or a Strategic Grid/Boston Matrix analysis [22, 23] as a position tool together with the application of the value chain [24, 25] to assess whether extension of mobile business application to their e-business activity is desirable in terms of competitive advantage. The framework is designed to help business managers to view what region of the business they will implement their mobile computing to aid with their strategic business operations. This strategic operation must align with the Business Strategy, IT Strategy, Organisational Infrastructure Process and Information System Infrastructure Process in order to be able to give a competitive advantage against other business rivalry [26].

6 CONCLUSIONS

The mobile business application outlined in the paper with the evolution of mobile technology can be used as a business

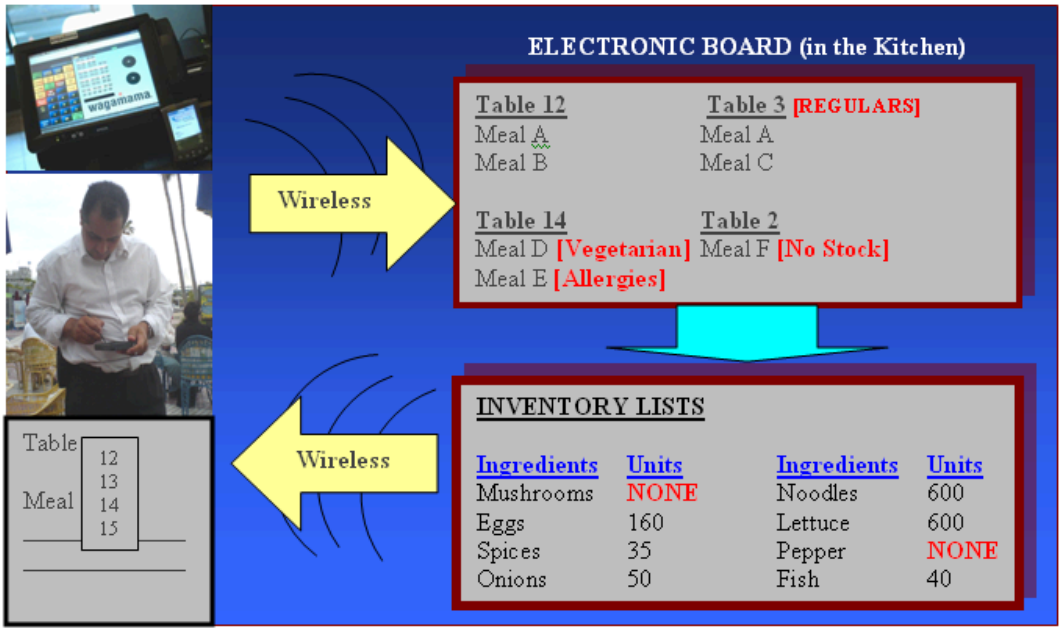

Figure 3 - Wireless PDA Ordering and Inventory System

Application	Method of use	Benefits	Equipment
Hotel Check-in cards 	• Customers that have room reservation can check in directly without having to go to reception desk. • The porter can create instant room cards on the spot with their mobile device and card reader as they direct their customers to their rooms [14].	• Fast • Improve Quality of Service • Reduce waiting in line	Wireless PDA linking to the database of the Hotels database and card reader
Insurance Quotation and registering via PDA 	• Consumers can choose and select suitable insurance offer on PDA display • Saves paperwork and travelling to different insurance companies to check offers [8] • Young adults find registering on mobile device very trendy[13]	• Trendy and fun to young adults • Fast • Saves the cost of paper work	PDA with wireless connection to Insurance quotation database
Ordering food via PDAs 	• Waiters can equip themselves with PDAs to take down orders [12]. • Orders transferred to the kitchen instantaneously. • Can make separate payment and personalise orders • Flag stock inventory and customer allergy alerts to the kitchen	• Fast and trendy • Quick ordering • Saves cost of reordering and wrong ordering • Improves Quality of Service	Bluetooth PDAs connection with an electronic board in the kitchen
Hospitals – PDAs and SMS messaging service 	• Blackberry PDAs used to help Surgeons to find suitable organ donors for their patients [10] • SMS service is to remind patients for their scheduled appointments through SMS [15].	• Improve Quality of Service • Faster surgery preparation and increase success rate • Efficient and Faster donor transfer rate	Blackberry PDAs connecting to a centralise database with all the patients details. Updated constantly.
SMS vending machines 	• SMS service can be used to pay a can of soda on the vending machine. [16] • New SMS vending machines includes snacks, chips and sandwiches in public parks and universities	• Trendy • Saves the effort looking for spare coins	SMS services connected to the vending machine
Emergency Service Risks Assessment 	• Ambulance and Police are using the camera features of mobile phones and PDAs to help them assists in crime scene or accidental situation. • Ambulances use pictures captured of the injured victims which can help surgeons to prepare rooms or assists the ambulance how to stabilise the victims[16]. • Police authorities with more than 2,500 accesses of information on criminals via PDA and phone features where it can help them scan license plates and facial checks on suspicious suspects [17].	• Police can get reliable ID on suspicious suspects • On the spot ID check • Assists ambulance on the spot to aid seriously injured victim • Prioritise injuries for effective hospital preparation and surgical operations	PDA or mobile device connected to centralise database
e-Society 	• University or school campuses are suited for this use because of the intense use of mobile application to allow students to access emails, timetables, lecture notes and submit assignments digitally across a wireless electronic environment.	• Fast and easy communication • Fun and trendy • Savings	A specialised software and/or hardware where the university and students have the same operating system for communications.

Figure 4 – Application of Mobile Technology and Devices to Improve Business Activity

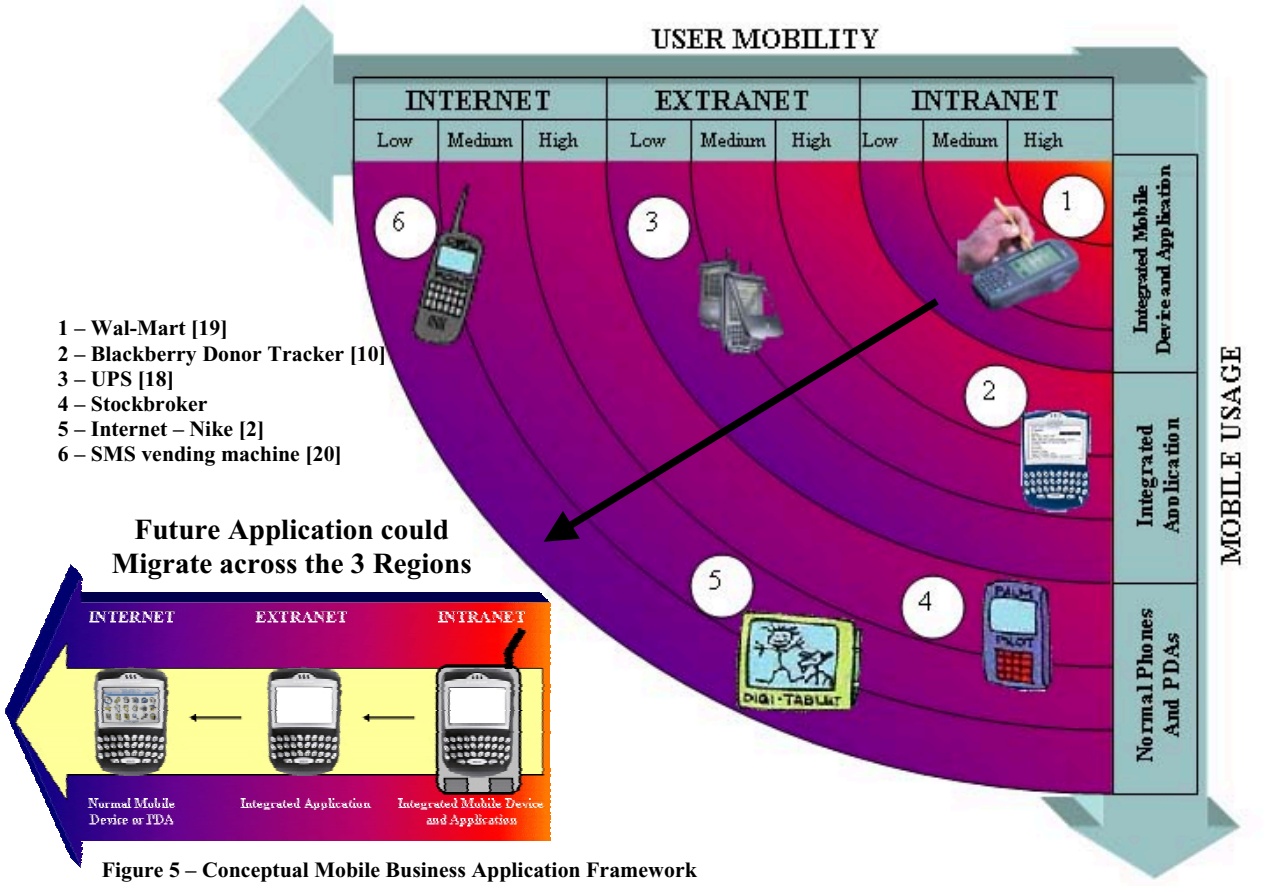

Figure 5 – Conceptual Mobile Business Application Framework

opportunity in enhancing e-business activities. In most cases the mobile phones connect to a centralised web enabled database similar to an e-commerce website where it is possible to extend the e-commerce transaction to a mobile region. This mobile technology can be effective in the use of Customer Relationship Management (CRM) activities where the response time of feedback to the customer is crucial. The proposed framework outlined assists in the decision making process of assessing the adoption of mobile commerce to enhance e-business application with evolving mobile technology. However, not all businesses can mimic specific application to their own system, but need to evaluate these opportunities in a strategic way to assess whether mobile extensions of e-business will give the company a competitive advantage rather than using mobile devices as a business trend. Although in some cases the use of mobile devices may not necessarily enhance competitive opportunities but gives the employee improved status and can contribute to staff self esteem.

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