

# Cellphone Shopper: Literature Synthesis

Tshifhiwa Ramuhaheli  
Department of Computer Science  
University of Cape Town  
tramuhah@cs.uct.ac.za

## ABSTRACT

This paper discusses the use of a cell phone application in arrangement of shopping lists and looks at the development background needed before creating such an application. The different methods of creating mobile device applications are investigated and a comparison between the different mobile development environments is included. The development environments discussed are J2ME, Symbian and BREW. The paper compares similar projects conducted in the same field and focuses on other researchers' work in the field of mobile device application development. In the end J2ME was chosen as the best environment for developing these applications as it provides the greatest portability across most mobile devices since there are more Java enabled mobile devices on the market.

**Keywords:** J2ME, Symbian, BREW, cell phones, Mobile Devices.

## 1. INTRODUCTION

The use of cell phones has increased significantly over the past few years. As a result of these developments, the need for cell phone applications has increased. In this paper we discuss work related to the 'Cellphone Shopper' which is a project that involves the use of a cell phone application to manage shopping lists. The shopping lists stored on a central server can be manipulated using two user interfaces, which are the cell phone interface and the Web interface. The Web interface will be developed using modern Web-development

techniques and technologies, such as AJAX, and the cellular phone interface will be developed in the Micro Edition of the Java Platform (J2ME) [5, 13]. Sun Microsystems has changed the J2ME name to just Java Micro Edition (JME) but for the purpose of this paper it will still be referred to as J2ME [5]. The two interfaces will allow the creation and modification of a user's shopping list. The back end Web application will handle the related database changes and synchronization between the interfaces. This paper will focus mainly on the cell phone user interface.

## 2. SHOPPING LISTS

Different people arrange and also make up their shopping lists in different ways. Generally most people have a way of grouping their shopping lists according to certain criteria like type of product or grouping items based on where the product can be purchased from. Ludford, et al. in [6] discuss how people create pre-planned information resources like lists. These pre-planned information resources can then be used at a later time and they also refer to the place where the task is performed. The paper also introduces the idea that mobile devices can be used to provide these information resources. This makes it much easier to access and manipulate these information resources since we are more likely to go everywhere with our mobile devices like cell phones and PDAs rather than walk around with a PC.

Pick 'n Pay [5] and Woolworths [6] each have an online shopping system which manages your shopping list when you select your products from their Web interface. These interfaces are very complex and do not offer much functionality. The representation of these lists on the small screen of a cell phone will prove to be much more challenging. The way these shopping lists are designed works well if you have a pointing device like a mouse and most cell phones do not offer the luxury of a pointing device except in the case of smart phones that have a touch screen. Therefore presentation of lists like these will have to be modified or redesigned since navigation through the list will be much more challenging.

### 3. SIMILAR SYSTEMS

There have been a lot of commercial applications developed in J2ME that use GPRS to transfer data over the network. The following are examples of some mobile applications that use GPRS.

**MXit** – This is one of South Africa's most popular mobile phone instant messaging applications. This application allows users to chat with other mobile phone users who have the MXit application. By using this application, users can also chat with users from other online networks like Google Talk, Jabber, MSN messenger and ICQ. A user can send text up to 2000 characters at the cost of a fraction of that for an SMS. This application is developed in J2ME and can also send multimedia files such as music, pictures and videos [15].

**Google Mail** – This is a mobile phone application that connects to any valid Google mail account. This application can retrieve all emails in the account and can be used to compose new emails. It provides various email functions like search, archive and delete. This application basically provides the same functionality as the Web interface but for mobile devices [16].

**Go Talk Mobile** – This application works in a similar way to MXit or Google Talk as it provides a way of chatting with other users. This is a J2ME application that can be used to connect to Google mail to check for new emails. This application just checks if they are any new emails. Users can chat with their online contacts from Google mail but can not compose and read emails [17].

All these applications were developed for mobile devices using the J2ME development environment. They all use GPRS or 3G for data transfer which minimises the costs as compared to using SMS.

### 4. DEVELOPMENT ENVIRONMENT

Cellphone manufactures are now developing environments which make it possible to develop cell phone applications for a wide range of phone models as compared to developing for just one particular model. This is all done by deploying cell phone applications on standard operating systems. The two most common operating systems are Symbian and Binary Runtime Environment of Wireless (BREW) [7]. Cross platform application are possible by using a small version of Java called Java 2 Micro Edition (J2ME) [5, 7].

To successfully compare applications developed in BREW, J2ME and Symbian we have to also look at the limitations of these environments. Figure 1 provides an overview of the features that are discussed below.

**Memory Size:** Symbian and BREW applications can use a couple of Megabytes whereas J2ME applications are typically 30 to 64 Kilobytes. The limits are typically 128K or 256K for over the air installation for both Symbian and BREW [7].

**Access to Phone Features:** In J2ME, MIDP 2.0 provides support for SMS, MMS, calendars, contacts and Bluetooth in the form of JSR-82 but access to SMS can be obtained also from vendor

specific APIs [5]. Symbian and BREW applications can access Bluetooth, SMS, MMS, calendars, contacts, and can sometimes dial the phone [7].

**Application Speed:** J2ME applications are slower than applications developed for Symbian and BREW since Java applications run on the Kilobyte Virtual Machine (KVM) whereas Symbian and BREW applications are compiled to machine code which runs faster [7].

**Data Storage:** J2ME applications achieve data storage through a record management system (RMS). The data is stored as individual entries and has to be contained in allotted memory. BREW and Symbian have a built in database system and also support Java database connectivity (JDBC) as an optional package [7].

**Multitasking:** BREW OS supports cooperative multitasking where an application has to be developed with this in mind Symbian is a multitasking Operating System and fully supports multitasking [7].

**Cross-Platform Portability:** J2ME applications can run on Java enabled phones and on both Symbian and BREW phones. BREW and Symbian applications can only run on phones with the same environment. Symbian applications are further limited to a certain series of Nokia smart phones and have to be rewritten to cater for another series of smart phones.

Although J2ME does not support as many features as Symbian and BREW, it is platform independent and can therefore determine the success of an application. There are more J2ME compatible phones and it therefore provides a wider coverage of handheld devices. As result of this J2ME was chosen as the development environment of the cell phone interface for the Cellphone Shopper Project. To show how easy it is to develop platform independent applications in J2ME, Davis, et. al in [4] demonstrate the possibilities of application tailoring which helps in porting software to a specific mobile device without manually rewriting the code in J2ME.

	<b>J2ME</b>	<b>Symbian</b>	<b>BREW</b>
<b>Memory Size</b>	30-64 K.	Few Megabytes.	Few Megabytes.
<b>Access to Phone Features</b>	Bluetooth, SMS, MMS, calendars and contacts.	Bluetooth, SMS, MMS, calendars and contacts.	Bluetooth, SMS, MMS, calendars and contacts.
<b>Application Speed</b>	Slower than Symbian and BREW.	Faster than J2ME.	Faster than J2ME.
<b>Data Storage</b>	Record Management System (RMS).	Has a simple built-in Database System.	Has a simple built-in Database System.
<b>Multitasking</b>	-	Fully supports multitasking.	Supports cooperative multitasking.
<b>Cross-Platform Portability</b>	Runs over Java enabled phones, Symbian and BREW phones.	Runs on Symbian Operating System only.	Runs on BREW Operating System only.

**Figure 1: Comparisons of Development Environments.**

## 5. NETWORK CONNECTIVITY

J2ME applications can use GPRS for sending data across a network and it is relatively cheaper compared to using normal SMS. Therefore applications using GPRS can benefit by minimizing the amount of network traffic generated by the application. This approach was used in topic map queries from mobile devices in [9]. The speed of data transfer is an important issue and optimizations will have to be made to deal with transfer speeds. This is a common problem and choosing the right protocol will help in minimizing the amount of network traffic between an application and the server.

Bennet, et al. in [1] conducted a study where a handheld device was used as a client in order to interact with a message board located on a server. The communication between the J2ME client and the server was through HTTP connection using POST and GET commands. The handheld device was able to connect to the JSP servlet and the response obtained from the server was in a reasonable time. Another study by Wesson, et al. in [12] also recommended using J2ME as it is suitable for mobile device applications when bandwidth is a problem or if multiple server requests would be undesirable. The paper also recommends using J2ME if a user wishes to minimize data transfer costs.

Black, et al. in [2] had conflicting results in a study of collaborative learning tasks. Handheld devices were used by students to communicate with each other either using voice or textual input. The client application was also developed using J2ME but had slow access to files from the server and this did not bode well for classroom use. Children could become frustrated with such a slow environment. The J2ME documentation caters for this problem but the recommendations made did not solve the

problem as there was no change in downloading times.

This study has different requirements from the two studies mentioned above when it comes to the response times achieved when using J2ME applications, which might have been caused by the protocol used and also the amount of data being transferred between the client and server. Choosing the right network communication protocol will be vital as it might affect the response times.

## 6. MOBILE DEVICE LIMITATIONS

Mobile devices have limited resources as compared to Personal Computers; they usually have processors that are around 100 MHz or multiples of this whereas desktop PCs have processors that in the GHz range. This eventually forces programmers to use efficient algorithms and data structures in order to produce applications with reasonable response times. This issue of limited resources is also addressed by Bowles [3] in a study conducted with undergraduate students creating a mobile phone game using efficient data structures and algorithms.

The quality of mobile device applications should also be considered when assessing limitations on mobile devices. Therefore the limitation on resources should not result in development of applications that are not robust. Umphress, et al. in [11] address this issue by developing software which conforms to industry standards. The software developed by students in this paper was assessed using the Nokia OK Certification procedures. The Nokia OK Certification procedures are basically used to test if software is robust and conforms to the industry standards for wireless software development. This certainly helps in promoting the development of robust applications for mobile devices.

## 7. CONCLUSIONS

In this paper we have discussed the different choices available for developing mobile device applications. After comparing the different environments available it was discovered that J2ME offers the best cross platform portability. There is also a greater range of mobile devices available. Therefore J2ME applications will reach a greater target group of users since it is widely supported. We also discovered that efficient algorithms and data structures can help in dealing with the limited resources available in mobile devices. As a result of this, robust applications can be developed by adhering to industry standards for wireless mobile devices and good programming practices which will clearly help in providing more functionality to mobile devices.

## 8. REFERENCES

- [1] Bennett, J. M., Armstrong, M. L., and Gupta, S. 2004. A Message Board Client for handheld devices. In *Proceedings of the 42nd Annual Southeast Regional Conference* (Huntsville, Alabama, April 02 - 03, 2004). ACM-SE 42. ACM Press, New York, NY, 17-18.
- [2] Black, J. T. and Hawkes, L. W. 2006. A prototype interface for collaborative mobile learning. In *Proceeding of the 2006 international Conference on Communications and Mobile Computing* (Vancouver, British Columbia, Canada, July 03 - 06, 2006). IWCMC '06. ACM Press, New York, NY, 1277-1282.
- [3] Bowles, J. B. 2007. Cell phone games for a CS2 data structures course. In *Proceedings of the 45th Annual Southeast Regional Conference* (Winston-Salem, North Carolina, March 23 - 24, 2007). ACM-SE 45. ACM Press, New York, NY, 300-303.
- [4] Davis, V., Gray, J., and Jones, J. 2005. Generative approaches for application tailoring of mobile devices. In *Proceedings of the 43rd Annual Southeast Regional Conference - Volume 2* (Kennesaw, Georgia, March 18 - 20, 2005). ACM-SE 43. ACM Press, New York, NY, 237-241.
- [5] J2ME. Java ME Technology. Retrieved July 05, 2007 from Sun developer Network.  
<http://java.sun.com/javame/technology/index.jsp>
- [6] Ludford, J. P., Frankowski, D., Reily, K., Wilms, K. and Terveen, L. Because I Carry My Cellphone Anyway: Functional Location-Based Reminder Applications. Proceedings of the SIGCHI conference on Human Factors in computing systems: Everyday use of mobiles. April 22-27, 2006, 889 – 898
- [7] Paul Coulton , Omer Rashid , Reuben Edwards , Robert Thompson, Creating entertainment applications for cellular phones, Computers in Entertainment (CIE), v.3 n.3, July 2005
- [8] Pick 'n Pay Home Shopping. Retrieved July 05, 2007, from Pick 'n Pay.  
<http://www.picknpay.co.za/shopping.html>
- [9] Stefan Seedorf , Axel Korthaus , Markus Aleksy, Creating a topic map query tool for mobile devices using J2ME and XML, Proceedings of the 4th international symposium on Information and communication technologies, January 03-06, 2005, Cape Town, South Africa
- [10] Tarnacha, A. and Maitland, C. F. 2006. Entrepreneurship in mobile application development. In *Proceedings of the 8th international Conference on Electronic Commerce: the New E-Commerce: innovations For Conquering Current Barriers, Obstacles and Limitations To Conducting Successful Business on the internet* (Fredericton, New Brunswick, Canada, August 13 - 16, 2006). ICEC '06, vol. 156. ACM Press, New York, NY, 589-593.

- [11] Umphress, D. A., Cross, J. H., Jain, J., Meda, N., and Barowski, L. A. 2004. Bringing J2ME industry practice into the classroom. In *Proceedings of the 35th SIGCSE Technical Symposium on Computer Science Education* (Norfolk, Virginia, USA, March 03 - 07, 2004). SIGCSE '04. ACM Press, New York, NY, 301-305.
- [12] Wesson, J. L. and van der Walt, D. F. 2005. Implementing mobile services: does the platform really make a difference? In *Proceedings of the 2005 Annual Research Conference of the South African institute of Computer Scientists and information Technologists on IT Research in Developing Countries* (White River, South Africa, September 20 - 22, 2005). ACM International Conference Proceeding Series, vol. 150. South African Institute for Computer Scientists and Information Technologists, 208-216.
- [13] White, J. 2001. An introduction to Java 2 micro edition (J2ME); Java in small things. In *Proceedings of the 23rd international Conference on Software Engineering* (Toronto, Ontario, Canada, May 12 - 19, 2001). International Conference on Software Engineering. IEEE Computer Society, Washington, DC, 724-725.
- [14] Woolworths online shop. Retrieved July 05, 2007, from Woolworths.  
<http://www.woolworths.co.za/caissa.asp>
- [15.] MXit, Retrieved July 13, 2007, from MXit  
<http://www.mxit.co.za/>
- [16.] Google Mail, Retrieved July 13, 2007, from Google Mail  
<http://www.gmail.google.com/>
- [17.] Go Talk Mobile, Retrieved July 13, 2007, from Go Talk Mobile  
<http://www.gotalkmobile.com/>