Autonomous mobile application enabling direct briefing via RSS by networks of mobile telecommunications (GPRS, 3G)

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ABSTRACT

The aim of the paper is to present an innovative educational application in mobile environment. Technology driven market has failed the needs of the user and mobile market has proven that success does not come out of estimates but out of correct analysis of needs, with the use of a new, stable and functional technology.

This paper refers to a complete educational mobile application, giving students a first acquaintance of the new wireless world and an indicative auxiliary tool with regard to their studies in an institute's faculty. Since almost every student possesses a mobile handset, it is introduced as an educational tool where one can retrieve information needed, instantly wherever, whenever, with minimum or no cost, using J2ME technology. Using customer and market analysis, starting from a technical and technological approach and finishing with sales and marketing plan, we implement a new form of what is referred to as a "killer app" in education. In this implementation, killer apps that are found in commercial use are excluded, such as games, SMS and MMS applications and focus is set on a broader strategic application development, within present and future technological environment.

This work also constitutes an easy way to get an accurate and up to date picture of global and Greek mobile telecom market, companies and technologies of the market, and generally a technology report that demonstrates ways to develop mobile applications today and in the future.

Keywords: education, data application, mobile telecom, MIDlet, mobile RSS reader.

I. INTRODUCTION

Observations in a teaching laboratory environment have indicated that although telecommunications expands its domain in everyday life, raising the interest of students in telecommunication applications is not guaranteed. Attracting the general interest of students on new technology is a difficult task and is better achieved through the understanding of how technology can be of one's best use. Mobile phones are still primarily considered a means of voice communication or more recently an entertainment device (gaming, music, ringtones, logos) and even less thought of as an educational tool [1][2].

In 2003 we begun our work towards changing the way students use their mobile phones, by introducing mobile applications in the process of the laboratory courses being taught in our department (Dept. of Electronic Computer Systems, Technological Education Institute of Piraeus). First courses planned to be included were those of Digital Image Processing and Computer Architecture. Project Electra that has been developed offered the automation such an application could have. Project Electra is a complete course management web application designed to manage user and course module information and is being used by the Microprocessors Laboratory and the department of Electronic Computer Systems at T.E.I. of Piraeus. It allows students and academic staff to communicate together in a uniform manner and access information resources at any time and from any place, and already offered stationary desktop support of RSS feeds [3] [4].

While implementing an educational service based on technological assets of mobile telephony, this project led to an application with two distinctive objectives:

1. Introduce the use of a mobile phone as an applications platform (beyond its primary role as a communications device) and
2. To allow immediate access to required information from a user's standpoint, whether of educational nature or not, over the internet.

Portability of mobile telephony and the leading role Greece has in it since the summer Olympic Games of 2004 have been our driving force of interest. Interest in mobile telephony comes due to the minimum equipment weight and portability that characterises the devices in use, the penetration in total population and the leading role Greece has in it since the Olympic Games of 2004 and all the new technologies that were tested by operators [5].

A. MOBILE MARKET

Regarding mobile technology worldwide, in August 2005 there were more than 2 billion subscribers, with 1.5 billion using GSM technology. Technology convergence on 3G systems has been technically achieved since 2003 [6]. The rapid introduction of W-CDMA (GPRS and 3G) in GSM systems used in Europe (hence in Greece) brought internet on mobile networks and the cost of access over mobile networks GPRS / 3G [7] [8] was low enough to use.

In Greece, mobile telephony corresponds to more than 4% of Greek GDP (GDP: Gross Domestic Product) (telecom has a part of 8%). The obligation to launch 3G services by July 2004 to the Greek government and the opportunities of promoting their 3G services through the Olympic Games 2004 drove investment and world innovating services by Greek mobile operators (Cosmote, Vodafone, TIM) according to analysts [5] [8] [9], and predictions are that all operators have positive economic outlook ensured up to 2010. Penetration rate of mobile subscribers in total Greek population is over 100% since 2004 (table 1).

Greek Market	2002	2003	2004	2005
Total Subscribers (m)	9,31	9,82	11,01	11,29
Nominal Penetration	85%	89,50%	100,40%	102,90%
Market Shares				
Vodafone	34,60%	31,90%	34,70%	35,40%
CosmOTE	37,60%	39,90%	37,70%	37,50%
TIM Hellas	27,00%	24,50%	21,10%	20,20%
Q Telecom	0,80%	3,70%	6,50%	7,00%

Table 1: Greek Mobile Market, Egnatia Finance 2005

Since the average personal financial status for Greek students is below the average of total population, more than 60% of students have a subscription without contract [7] [10]. This fact has led our research for mobile services offered for GPRS and 3G, for non binding subscribers. All three Greek mobile operators offer access packages without monthly fee, for prices less than 0,05 € / kb.

B. STUDENTS AND USE OF MOBILE PHONE

The examination of statistical data of students from corresponding researches in Greece has led us to the following conclusions: mobile telephone, the most advanced technological mean, constitutes the only computer system that all students use.

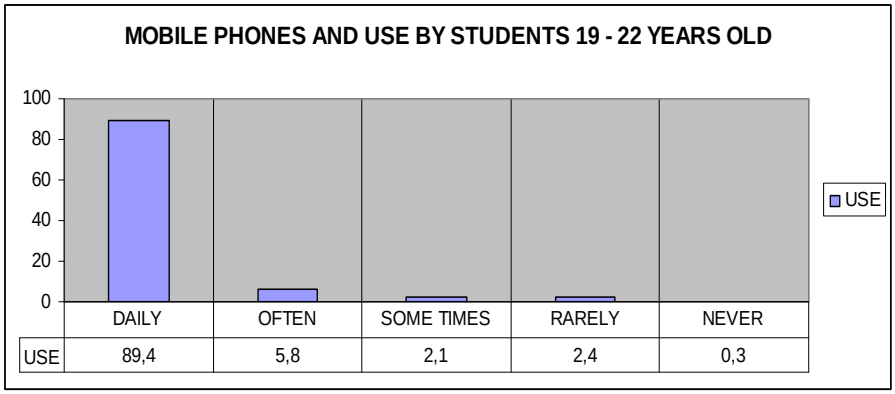

Figure 1: Students aged 19-22 and use of mobile phones in 2005, ELTRUN, 2005

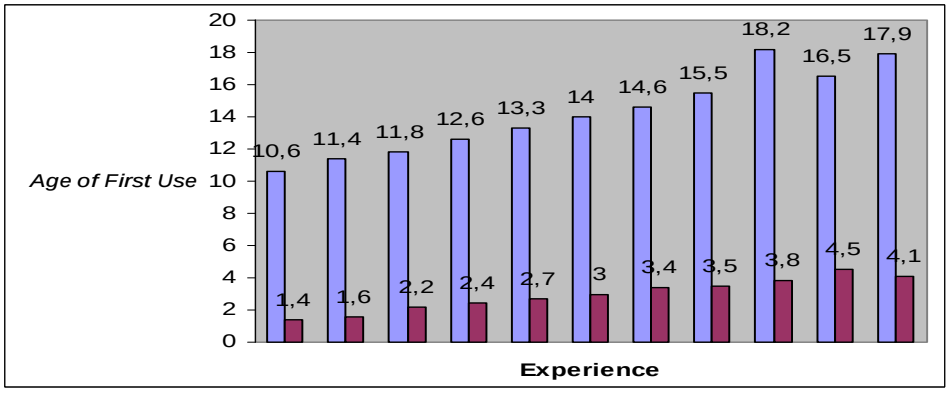

Figure 2: Age and years of possession of mobile phones in Greece, ELTRUN, 2005

Concretely, according to the last research of ELTRUN of Athens in October 2005 [10], all students possess a mobile device (89,4% as shown in figure 1), at age 21 they have an

average experience of four years (figure 2) and that use of mobile phones is irrelevant to their individual financial status. However the research notes that the use is restricted to personal needs and communication and that the oldest mobile devices in use are two years old (bought in 2003)**.**

II. METHODOLOGY

A project management approach was employed in the current project considering all the participating areas: mobile technology, general educational needs, student needs, existing wireless and mobile technologies. Initially the type of service was chosen (a personal area service-PAN) that would facilitate the introduction of a mobile application to assist in educational functions, with use of a new simple technology, faster and without cost.

Setting a number of parameters made it possible to benchmark the new application. Our aim was to create a reliable full time uninterrupted service with friendly user interface, providing a help manual, ensuring bidirectional interactivity with correct data transfers, and support mobile devices made out the last three years.

We have used a SWOT (strength, weakness, opportunities, threats) research and our basic considerations were: the cost of services, the existing laboratory network facilities, absence of financial support and the rapid technological development in telecommunications. The whole project was integrated in cooperation with the microprocessors laboratory of our department ensuring bidirectional interactivity.

III. CONTENT

Personal experience is the key for introducing any new application in real time conditions. A student mostly requires a means of accessing specific information at any time and from any place, without the need of expensive or bulky equipment (e.g. computer connected to the internet). The application must have all addresses and other information one can find in the yearbook of an educational institute (names, duties, emails, and phone numbers).

Our work fulfills student needs by giving them the capability of accessing not only embedded information, but any kind of information that might interest the user.

A page with helpful information was also created, where users can find a demonstration, answers to all their queries regarding operations, connecting costs through GPRS or 3G and finally how to add personal areas of information to the application, using any public RSS feed from the internet.

IV. DEVELOPING TECHNOLOGIES

The environment of mobile applications and the technologies involved were initially considered. Application technologies used to build wireless applications were tested and categorized, pointing to the suitable one. From the range of Operating Systems (Symbian and Windows CE) and other technologies that are used worldwide (J2ME, Brew, WAP2 and imode), the choice of Java 2 Mobile Environment emerged as the obvious choice of technology for an educational application, complying with our main objectives which are device fragmentation, network usage and cost, service capabilities, network response time and development cost (table 2). Using the chosen development tools, no development costs were introduced.

TECHNOLOGY	PROS	CONS
Symbian	No need for server.	It only concerns smartphones. Differences between x0 series, UIQ.
Windows Mobile CE	No need for server. Synergies with Windows PCs.	It only concerns smartphones. No telecom environment.
Wireless Application Protocol 2 (WAP 2)	Use of XTML.	Need of existing server side. Difficulties regarding common UI Continuous data exchange(high cost)
i-mode	Need of contact with supplier.	Only works with imode phones.
J2ME	No server. Support of imode, BREW, Symbian, blackberry. End to end telecom solution.	Differences between MIDP 1 - 2. Custom APIs by manufacturers.
BREW	Need of contract with supplier.	Not supported in Europe. Cost.

Table 2: Comparing existing development and technologies

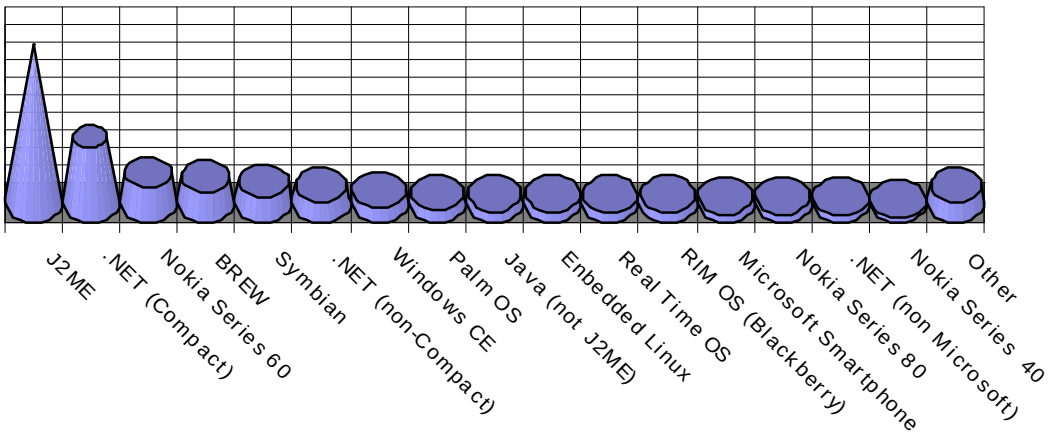

Figure 3: Primary Target platform for Mobile Phone Developers, March 2005 [11]

J2ME covered all our technological requirements:

- It is preferred by developers for mobile applications, with 36% in 2004 (figure 3),
- All development tools are distributed for free,
- It can be a stand alone application,
- It is supported in most mobile phones of the last two years (70%),
- It supports most other technologies [12] and finally
- Security is high.

The next step was finding the student's needs that would lead us to the structure of content. Processing the answers of a simple questionnaire handed to thirty students; it was obvious that cost is the primary concern. Eight out of ten students stated that they would be reluctant to use any kind of mobile application due to unknown connection fees.

V. DEVELOPING THE APPLICATION

The application was separated in two segments: one segment with local access (basic information regarding the institute, no charge what so ever) and another segment with an RSS reader, which would offer real time updates on information through the internet.

The stages for developing the application were made according to Java development (figure 4): planning, writing java code for wireless toolkit 2.2 and creating main menus, transfer source code to Sun Microsystems Net beans 4.0 IDE for simplifying all necessary steps [13] [15] due to size of menus (compilation using J2ME libraries, preverification java code, create description file JAD, executive java file JAR, debugging, emulating on Nokia and Ericsson devices, verification, obfuscation, final versions of JAR and JAD files).

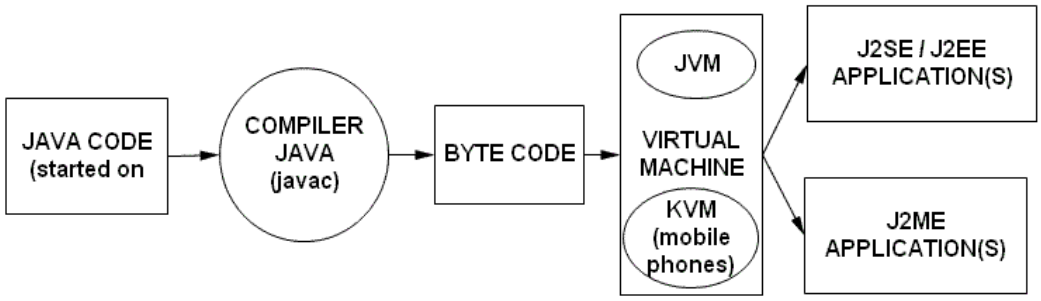

Figure 4: Java application and the way it works

We have made use of Lists, Textboxes for data, Forms for multiple data, Ticker for screen titles, commands, RSS gauges for the waiting period and use of RMS since there was use of device memory for the RSS feeds. After analyzing every RSS version, Userland Software RSS 2.0 was used, which is also used in the collaborating Electra Site [3]. The use of Greek characters in RSS pages is very important because they can be readable by any student. The pages created by the lab administrator for the RSS feeds have small size of about 3-5 kilobytes, so the download charge using public mobile networks is inexpensive and is also achieving easy representation of laboratory feed on a small mobile phones screen.

What was created is a laboratory centered RSS reader using a pull data operation, with KXML. The RSS reader remains open for adding any other RSS feed, so that the student can combine educational and personal activities in the same application, turning it to a way of life.

The result is an active java file (.jar), which can be transmitted via Bluetooth from our lab server (Room E13) or through the internet from the Electra website (http://electra.teipir.gr). The program file when launched has specific instructions how to install it like any other java application for mobile phones. We have used MIDP 2.0 [16] for development but switched back to MIDP 1.0 at the end, so we could overcome device fragmentation. The decision to limit the .JAR file to 64 KB was made to support all mobile phones introduced the last three years and support J2ME.

Our RSS reader was based on an existing simple RSS reader [14] using pull data operation with KXML, under GPL license (http://www.gnu.org/licenses/gpl.txt), making it possible for us to change it. We have inserted our own screens and changed User Interface to a different version, in Greek, with some basic characteristics:

- Pre-inserted URLs for receiving RSS feeds for department courses.
- The user can locate other channels of interesting RSS Feeds (URL addresses).
- Users can import complete address of other RSS channels that interest him.
- Last RSS feed version reside in mobile device and can be viewed at any time, without connection and with no extra cost.
- Updated RSS feeds are downloaded only when the user specifically asks for them.
- The user can control the application (navigation, reading, deletion, renewal of data), according to his needs.

VI. SECURITY

Our project planning prevented us from using messaging or email services, since they created both security and moral questions, which exceed the scope of the current application.

Security issues on mobile devices come from applications for Symbian OS (.sis files), emails (spam on mobile phones cost a lot and infected attachments are not checked). We managed to guarantee security, since public mobile networks are not user dependent (closed networks managed by mobile operators), J2ME prevents unauthorized use of any source of hardware by code manipulation, and there has been no report of a virus alert concerning .jar files. As for the RSS transmitted feeds, they are simple XML documents, preventing any misuse. The application offers 100% safety, when installed and uninstalled properly.

VII. APPLICATION CHARACTERISTICS

- Charge is optional (user choice, depending on information needed).
- Means of transmission are GPRS (40-50kbps) and UMTS (around 100 kbps).
- Compatibility with most mobile devices in the market.
- Navigation within application does not require connection to data networks.
- Ability to download the application using HTTP or Bluetooth.
- Ability to download RSS feeds using mobile networks and the internet.
- Application limit, less than 64 KB (compatible to Symbian Nokia Series 40).

The application allows the user to navigate each of the two Midlets, without any use of keyboard apart from the three required keys (accept choice, left and right buttons). The only exception is the introduction of a new URL by the user to the existing feeds of the lab.

A user can locate the way to the university and the laboratory through a map; find any email, phone number, professor or information regarding our courses, Computer Architecture and Digital Image Processing. All the capabilities of the application appear in the next two drawings that show two different applications in conjunction: the first one has all the available data that are resident in the application and the second one is a developed RSS reader.

Figure 5: Application on Nokia Emulator, using Netbeans 4.0

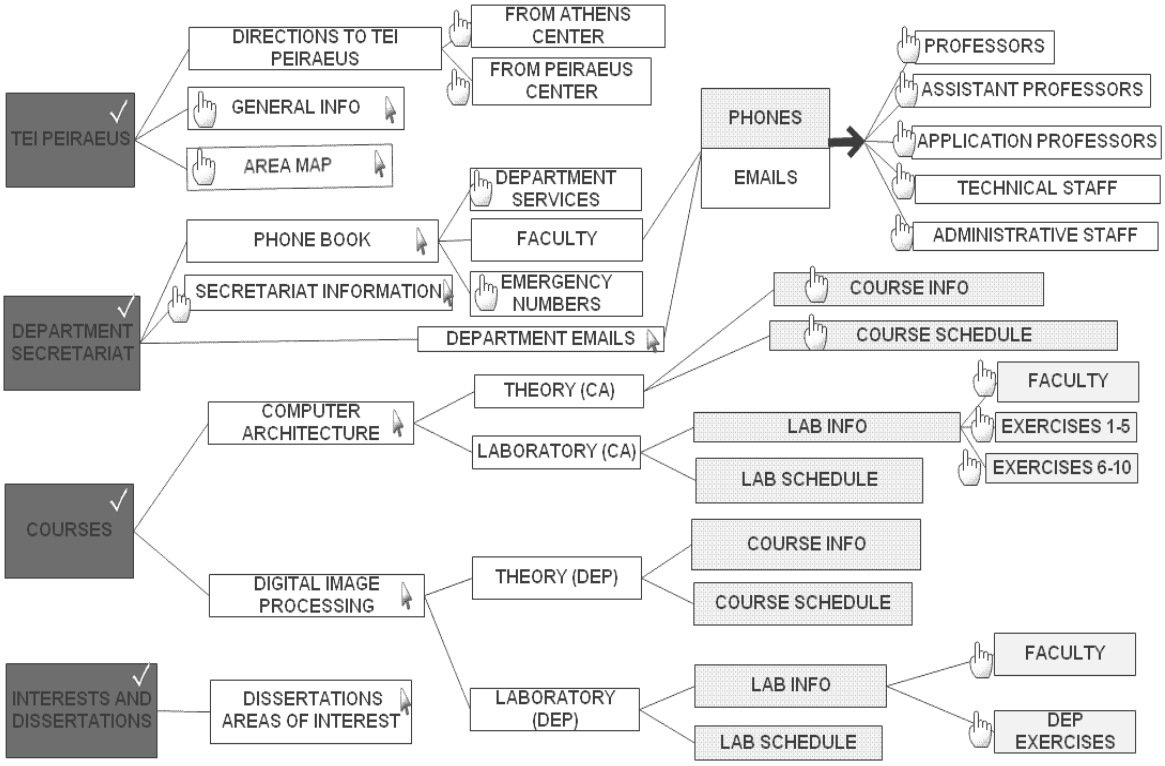

Figure 6: User choices at embedded data in the application

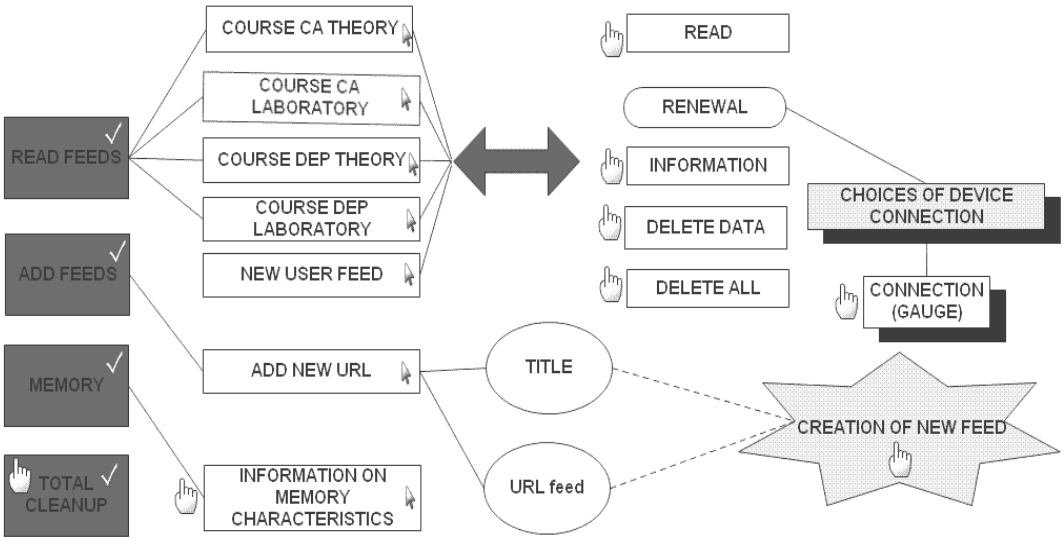

Figure 7: Choices in RSS reader of the application

Boxes with √ symbol: User's first menu, MIDlet starts.
Boxes with upper arrow: Second level of choices for the user.
Hand symbol: Final answers or maximum sectional level for user.

In all depth the application can reach a total of 20 results on the embedded data and 8 on the RSS reader, disregarding the introduction by the user of any new RSS feeds.

Maximum keyboard clicks needed to get to final stage are seven, and all tests were made using a Sony Ericsson 750i and a Siemens SX1. The lag limitation for downloading RSS feeds was 4 seconds in real life use and is easily achieved, with RSS feeds under 10 Kb.

The application demonstrates an alternative way of using a mobile phone by the students, which is as an auxiliary tool for acquiring information relative to their studies.

One can retrieve information at home, in the bus, in the car or during any other activity without any cost or with a cost of about 0.1 € per RSS feed (up to 10 Kb) to see updated information. The capabilities of the current project may be enhanced in a future work to the benefit of student's information.

Information on access to campus.	**Free of charge**
Information on access to the lab.	**Free of charge**
Information of Secretariat	**Free of charge**
Access email address of stuff.	**Free of charge**
Access phonebook of our university.	**Free of charge**
Information on courses and dates of examinations.	**Free of charge**
Update of information, news about our lab.	**GPRS use**

Table 3: Service cost for the user depending on type on information needed and access

The current project was developed for any male or female aged 18-25 that study in a Greek university. The project, after completion, was tested real time by students of the Electronic Computer Systems Department at T.E.I. Piraeus. Anyone of the administrative or the academic staff of T.E.I. Piraeus may take advantage of the provided services.

VIII. CONCLUSIONS

In this paper there has been a description of the development of an educational application that targets mobile phone as an application device. Any kind of activities and information of Piraeus educational institute or a specific department (staff, access map, telephones, emails, courses, educational materials, schedules etc.) may be accessible at a glance on the screen of a mobile device either at no cost or with minimal cost if updated information is accessed.

The application by itself is small, easy to be installed and used, thus any student can appreciate the new technology involved.What made the application more appealing to students was that it can offer a cost free experience on almost all trendy phones that most students have. The current project employed the latest advances in mobile telephony and is a guide for future work in this field.

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