Implementation of Mobile Application for the Needs of the Integrated Learning System

Zlatko Čović[1], Miodrag Ivković[2], Biljana Radulović[2]
[1]*Subotica Tech - College of Applied Sciences, Subotica, Serbia*
[2]*Technical faculty "Mihajlo Pupin", Zrenjanin, Serbia*

Abstract – *This paper describes the implementation of the native mobile application for Android operating system. Realized application is the aid for learning and testing process of the users in the integrated learning system. Components of this eco system are presented with an emphasis on mobile application. Plans for future development are given.*

1. INTRODUCTION

Recent breakthrough of handheld mobile devices, most notably smartphones and tablets, has made a way for an endless number of new applications and solutions. With mobile Internet access (Wi-Fi and 3G mobile telecommunications); these technologies create a powerful and flexible platform for building an application. Mobile technologies and services have found their implementation in education, healthcare, banking, military, and in other areas of social importance.

Mobile learning through the use of wireless mobile technology allows people to control when they want to learn and from which location they want to learn [1]. In sphere of long life learning, it is important to enable services that people could easy access, could use regardless of the location and time, make this services interactive and provide the opportunity to learn, test and share knowledge using modern Internet technologies. Education services using mobile phones are sometimes called *knowledge in pocket*.

Two major stores for mobile applications *App Store* and *Google Play* claim that all together offer customers more than 700,000 mobile applications. Most of them are free to use. This is great potential to implement projects to help learning process. The big challenge is how to do it, with the mobile web site or mobile application. In our project we connect more components in integrated learning system.

2. INTEGRATED LEARNING SYSTEM

Realization of integrated learning system was the part of research which was conducted in 2010/2011 academic year in Subotica. One of the aims of project was to show, based on theoretical and practical research and analysis of the results, a statistically significant effect of the use of mobile learning services to increase health education for young people. This system is a complex eco-system that provides multiple user access to materials for learning and testing.

System includes the following: a) Content Management System Mobko; b) Web portal access to counselling services for the PC that enables viewing and downloading of educational materials and testing; c) Mobile version of the Internet portal for access to counselling services by mobile devices, where all content is adjusted and optimized for the possibility of a user's mobile device; d) Stand-alone application for mobile phones allowing training and testing in an on-line or off-line mode and e) the SMS service used to distribute important information. [2]

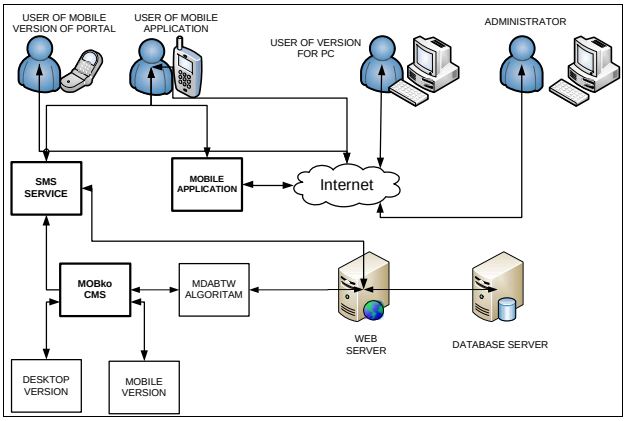

Figure 1. – Schema of integrated learning system

Component	Specification
Web server	Intel Core i7-920 8GB RAM 750GB HDD Operating system : CentOS 6.3 x86_64 Specification of software on server: Apache 2.2.16 PHP 5.3.3 MySQL 5.1.63
SMS service	*Huawei E1550* usb 3G modem Software packages: *Centos 5.7, Postfix 2.3.3, Procmail 3.22, SMSTools 3.0.10.*

Table 1. – Specification of system

3. MOBILE APPLICATIONS

Applications for mobile devices can be divided into two groups: web based applications and applications that are designed for a particular type of operating system (original or native applications). What is the right type of application to develop depends on needs and target population. With the development of new technologies and their standardization, difference between these two groups is rapidly decreasing.

3.1. WEB BASED MOBILE APPLICATIONS

Web based application is basically a web site that is specifically optimized for use on a mobile device. The basic characteristics of web applications are: user interface is built using the standard web technologies, application is available at a URL and it is optimized to the characteristics of mobile devices. Web applications are not installed on the mobile phone and they are not available through special market places, but they are accessible to a large number of phones that have a web browser, regardless of operating system. The development cycle of these applications is quick; it is possible to change the program code and usability in real time.

As they are developed for multi platforms, the first step in content delivery is detection and adaptation for the characteristics of mobile device. Different techniques are used for the adaptation, including the detection, redirection, set up of correct MIME types, the changing of links, and the removal or scaling graphics. The LCD method (*Lowest Common Denominator*) establishes a minimum set of characteristics which are expected from the mobile device. Web content is then developed by following such guidelines. The minimal set of features is also called DDC (*Default Delivery Context*) [3].

3.2. NATIVE MOBILE APPLICATIONS

In contrast, the original or native applications are installed on the phone; they have access to hardware features of mobile devices and generally are not created using web technologies. They are available from market places. The development process is, in most cases, slower than the release of web based applications. Development can be faster with the use of visual tools for generation of code. One of most used visual tools for this is *AppInventor*, which can generate standalone applications for *Android* operating system [4].

Open source project called *PhoneGap* is realized to attempts to bridge the gap that exists with web developers which has good knowledge of technology but are not adept at writing native mobile applications [5]. PhoneGap is a HTML5 application platform that allows developers to create native applications using web technologies. It allows access to most hardware features and supports several operating systems. Some projects use hybrid approach which can produce hybrid applications. Hybrid applications are development with the technologies of web based and native mobile applications.

4. DEVELOPMENT OF APPLICATION

Mobile version of web portal is developed with the use of *MDABTW* algorithm. The MDABTW is an algorithm for the detection of mobile devices based on *Tera-Wurfl* library. It allows for the detection and generation of mobile content in various technologies [2]. This version can be treated as a web based mobile application. We want to have representative of second group so we created native mobile application for Android operating system. Android is a Linux-based operating system designed primarily for mobile devices such as smartphones and tablets.

Application was realized with the use of Java programming language and SQLite database. Code was generated in *Eclipse 3.7.2* software development environment. Testing of application was made on mobile phone *Huawei U8110* and emulator of Android device.

Android applications are considered under the complete code package bundled with AAPT (*Android Asset Packaging Tool*) tool, which results in the file with *.apk* extension. Such packaged applications could be transferred and installed on various Android devices. There are three possible ways to install applications on your Android device:

1. publishing and downloading from the Android Market;
2. use of Android Debug Bridge (*adb*);
3. copying it to the memory card and using another application to install

In the development of mobile applications for the Android operating system it is possible to create a local database, which is stored on the mobile device. In this application, this is particularly useful, because in this case, it is enough to download only once data and store them in a local database on phone. This database stores much less data than on the web, as mobile applications does not use customer information and the statistics.

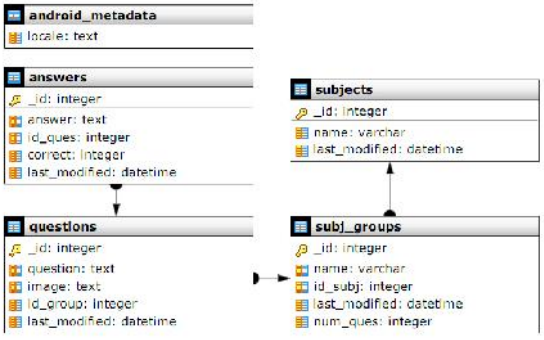

Figure 2. – Schema of SQLite database

Table *android_metadata* stores information about the application. This table is in certain cases generated automatically, but can also be created manually. Table itself is not used in the created application; it is ever used by Android operating system.

A table *answer* provides answers to questions that are put to the test.

A table *subject* contains information about categories-subjects.

A table *question* provides questions that are put to the test.

Table *subj_groups* contains information about groups within the category-subjects.

It can be noted that each table has a field *last_modified* which is very important when downloading and updating information from a web server.

5. IMPLEMENTATION OF APPLICATION

Mobile application is used as an aid in the learning process and allows users to use test. On the start screen of application two buttons are shown, *Start* and *Options*. It can be noted that there is no exit button in the application. In contrast to other programming languages, there is no command to abort execution. Instead of exit, when we no longer need a program, we can send it to the background. After that Android operating system cares about the program, or if there is a need for memory, then terminates applications that run in the background.

Figure 3. – Start screen and settings screen

Selecting the *Options* button user get options for setup application settings and the content of application. If it is the first start-up of application, it is necessary to choose the option of *adding new categories* and thus will download data (questions and answers) on selected lessons from a web server and they will be stored in the local database on the mobile phone. After that, the user does not need to use the Internet connection any more, as he can use application in offline mode. The advantage of this method is that the application is faster because it does not require additional connections when used. The disadvantage could be that the user is limited to a set of questions that he had downloaded. One component of the integrated system is SMS service. With this service users are informed about new content on the web server. If they want to expand its local database, they can easily update it with the options of *Adding new categories* or *Refresh the existing categories.*

Figure 4. – Option Update category and option Choose category

The first field contains the possibility to change address of the database server. After selection of *Confirm change of address*, application checks if there is a database on that address. If the response is negative, application uses predefined address - *http://10.0.2.2./*, which is the IP address of the local machine.

To reduce the size of data to be retrieved from the web server when updating, the application compares the information about the date of last modification of data in a local database with information about the time of last modification on the web server. In this way, application updates only data where the time of last modified is larger than value in local database. Figure 4. shows the process of updating the data related to the category.

The test is started by selecting *Start* from the *Home* screen of application. The user selects the desired category and group of questions in that category. The application randomly selects 10 questions from a selected group and displays them one by one. Questions can contain multiple choice questions and in addition can contain text and images that are related to the question.

When running the test, the user gets two buttons *Back to the menu* and *Move on to the next question* in the upper part of window application for each question. The application remembers the time that user spent from the beginning to the end of the test.

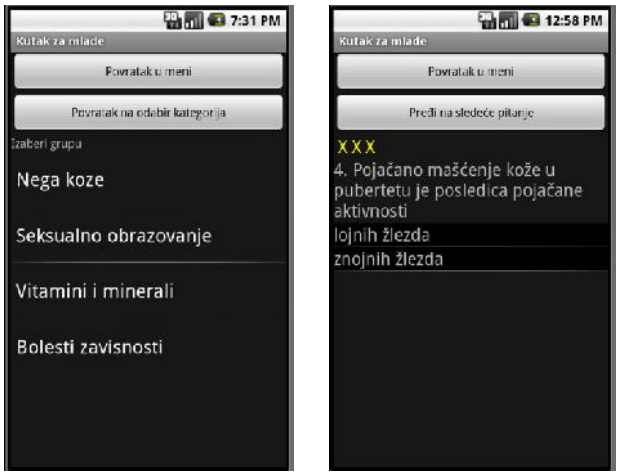

Figure 5. – Test option

Choosing the correct answer is not time-limited. If the user does not want or do not know the answer for question, he can pass it and go to the next question. For each question which is passed, the application counts as a wrong answer. During the test, progress bar is shown at the top. It contains an X or O symbol, where X presents the incorrect answer, while O is the correct answer. In this way, the user immediately receives information of its answer.

After finishing the test, application prints the test results and the time spent to complete the test. Information of the category and the test results are forwarded to the web server for statistical analysis of the success of the test. The user can return to the start menu or try to do the test again.

Figure 6. – Results of test

6. RESEARCH

The integrated system was tested by 40 participants aged 15 to 29 years. Participants were divided into two groups: experimental and control groups on the basis of whether a student has a cell phone with the ability to use mobile web or not. The experimental group used the web-based learning portal for the mobile-optimized version of the same portal. Within this group there were 10 females and 10 males. The control group had access only to web-based portal. Within the control group there were 7 females and 13 males. Mobile application is used by 3 students in the experimental group.

Every group got survey before and after using integrated learning system. Three participants in the experimental group which used a mobile application, did not receive additional survey, but they gave general impressions of the application:

"The application is simple to use. I like the speed of operation".

"I have not had any problems, I use it often."

"Mobile application is easy to use. Maybe it could contain more multimedia material."

7. CONCLUSION

This paper describes the implementation of the native mobile application for Android operating system. This application is developed to help learning and testing process in integrated learning system. Application can be used in online and offline mode. After initial testing, participants gave impressions of application. Based on that and on other consideration guidelines for further development are defined: put more multimedia content in application, expand content with learning material. Our next goal is to test this system and mobile application after improvements.

8. REFERENCES

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