Mobile Attendance Checking System on Android Platform for Kazakhstani University

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Abstract. In the 21st century- the century of Information Technology, it is difficult to imagine life without any gadgets: phones, tablets, computers, laptops, and so on. Today, smartphones and tablets are becoming popular, and thus their operating systems become popular too. Android is designed for low-power devices that run on battery power at full capacity, using all of its services, such as cameras, lights, GPS navigation, Wi-Fi, etc. In Kazakhstani universities, the process of checking students' attendance is one of the important issues, because final grade evaluation of students is based on their total number of appearances and their grades during the whole semester. This raises the question of having some tool to control students' attendance. There are many possible ways of controlling attendance: there are many examples when universities prefer to control attendance by the use of paper sheet, and some universities prefer to use two-stage way of controlling attendance: firstly, teachers and professors use paper sheet for checking students' attendance and after this, they fill out these information into a system manually. However, this is not an efficient way since there will be spent much of time for calling students names and putting marks like "presence" or "absence" if the class is a lecture class, and in this class at least 5 groups are presented. Furthermore, some students may call his/her friend as "presence" nevertheless to the fact that this student is currently absent. After taking into consideration all these issues and the fact that many gadgets use Android platform, authors of the following research paper decided to create a mobile system that makes easier to check students' attendance automatically, and this system is implemented in Almaty Management University, Kazakhstan. The system is based on Android platform, and in this paper, details of this system are presented.

1. Introduction

OS Android - an operating system that is based on the Linux kernel and is used in many different gadgets: cell phones, tablets, computers, laptops, televisions, watches and many other devices. Initially, the operating system was developed by the same company Android Inc., which later was purchased by Google, and then created an alliance within the company Open Handset Alliance (OHA), which is responsible for supporting and further development of the platform. The first version of the operating system Android coming from Google was released in September 2008. By the end of 2010 Android has become the best-selling operating system for mobile devices [1]. Android supports building applications that use phone features and at the same time, Android protects users by minimizing the consequences of bugs and malicious software. Android's process isolation precludes

the need for difficult policy configuration files for sandboxes. This gives applications the flexibility to utilize native code without compromising security of Android or granting the application additional rights [2]. Over one million Android applications were published by the Google Play store in July 2013 and over 50 billion applications were downloaded, and 71 % applications for Android were created which was founded by survey of mobile application developers in spring of 2013. In 2015, survey found that 40 % of full time professional developers see Android as the target platform which is more than iOS [3]. Figure 1 depicts the architecture of Android operating system. The operating system is based on Linux kernel version 2.6.x that is a monolithic kernel. The kernel consists of drivers for different mobile device hardware, like screen, keyboard, camera, USB, Bluetooth etc. Kernel provides interface hardware and memory management, processes and other resources.

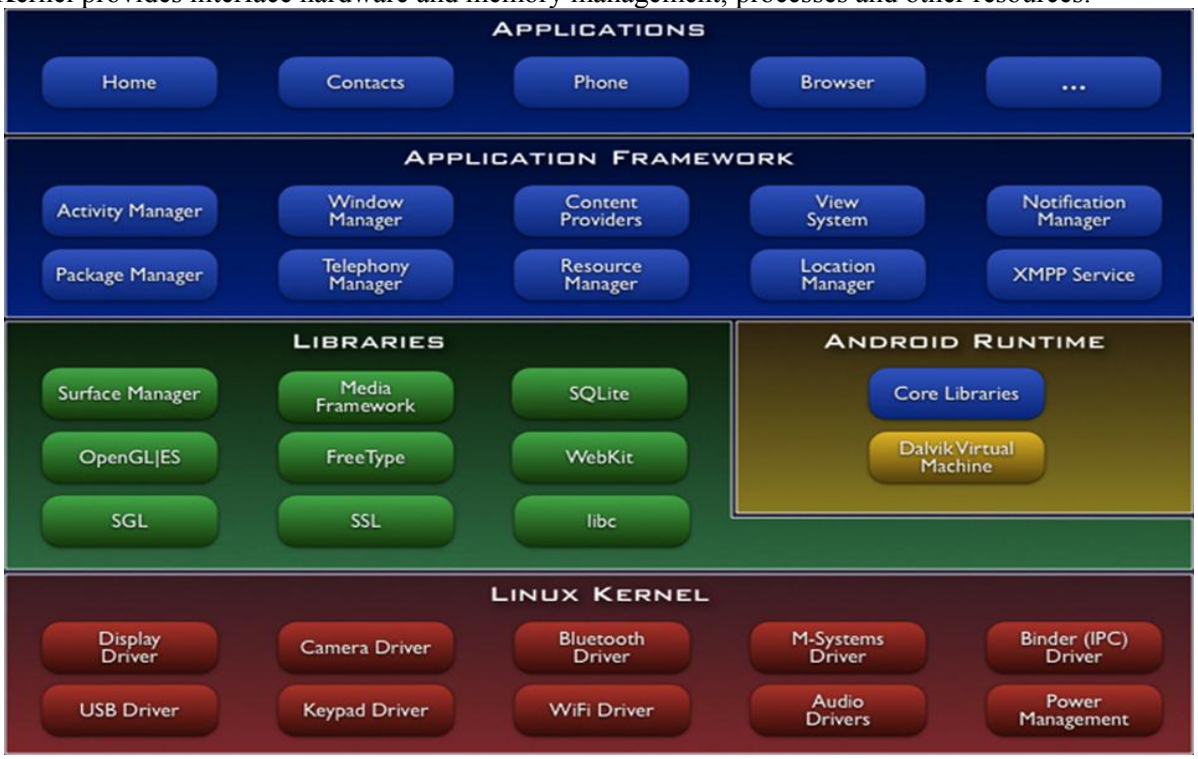

Figure 1. Android Architecture.

Native libraries on the next level are dependent on hardware architecture of the mobile device. These libraries include support for 2D and 3D graphics (Single, OpenGL ES), multimedia, security, storage, browsing (WebKit) and standard C library [4]. Android applications are developed by using Java programming language, and applications require an environment to manage their lifecycle. This includes a Java virtual machine (named Dalvik virtual machine) and Java class libraries that provide basic support for applications (collections, input/output operations management etc.). Android applications are not compatible with Java ME or Java SE. The applications are optimized for mobile devices constraints. The application programming interface allows accessing a framework that includes components used by all Android applications. The application framework includes components for Android application management (installation, execution), windows management and user interface graphical, event handling etc. Application level includes pre-installed applications (contact management, phone, calendar, Internet browser) and user applications. Applications are based on Java technologies and use classes provided through application programming interface. In addition, there is the possibility to use native functions in programs written in C/C++ programming language through NDK (Native Development Kit). Widgets unlike applications, occupies only part of the main

display screen and associated (Home). Android operating system is multitasking, each application running in a separate thread [5].
Android applications are developed using one or more basic components [6], [7]:

- activities (Activity base class);
- services (base class Services);
- content providers (ContentProvider base class);
- components that receive and act on messages sent to all applications (the base class BroadcastReceiver);
- messages (class Intent).

A particular importance in application development is the resources that enable separation of interface code. Activities represent the screen associated to an application. An application can have one or more activities. Services are routines that run in parallel with the main thread and do not have GUI. They allow the development of actions in the background without blocking the main thread execution and interaction with such application. Content providers are used for sharing data between applications. Data sharing is done through files, databases or other means. An alternative to content providers is the use of communication between processes. Applications can respond to the occurrence of events in the system by using classes derived from BroadcastReceiver. In order to activate components like activities, asynchronous messages encapsulated in objects of Intent type are used. Android applications are developed mainly using Eclipse IDE with Android Development Tools (ADT) plug-in. Android SDK and emulators are necessary for application development. According to [8], designing an Android app needs to be a constant collaboration between design and development. Additionally, app creators should target specific phones. There is too much trial and error involved in asset creation to be left squarely in the hands of a designer and this can lead to resource problems.

2. Motivation for implementing mobile application

In some Kazakhstani universities, professors and lectures take attendance by calling out the names and surnames of students, and then marking them, while, in others, teachers pass around a sheet of paper, asking students to sign in attendance sheet just next to their surnames. Both practices have their disadvantages. In the first case, if numerous groups attend the same lesson, checking all of these students by name and surname might take more than 10 minutes out of each lesson; in the second case, friends of absent students may sign for them next to their names and surnames. These practices place university professors, lectures and their institutions at considerable disadvantages when it comes to taking attendance. To rectify these systematic failings, we have decided to use mobile cell phones on Android platform for upgrading this service. We have taken into consideration the popularity of Samsung cell phones and smartphones here in Kazakhstan. We have found that many professors and lectures in ALMU use gadgets from this company. Each professor has its own cell phone, and each professor downloads this mobile application into his/her cell phone and adds specific data related to classes and courses he/she teaches. We wanted to show to our Administration that this mobile application has bright future, and that we need to get rid of paperwork and do everything by using innovative technologies. Our system allows our professors and lecturers to do the following:

- View the list of students;
- Add and delete groups;
- View the list of students in specific group;
- Add and remove students;
- Grading and checking attendance;
- Creating reports about attendance and students achievement;
- Viewing and changing reports about attendance and achievement;
- Ability to select the type of assessment for different classes (credit, 5 - point system, 10 - point system, a 100 point system);
- View information about a student and/or a group.

As, it was mentioned above, this was beta version, so we decided not to cover all the functionalities, instead, we wanted to have some application, which will perform basic, but important operations regarding the checking Student's attendance.

3. System architecture and its description

To begin with, we would like to go through some applications that exist on the market and do similar operations. There are many applications, but the most popular ones are: application titled "Educate", which was created for Apple iOS [9], and some other applications oriented for OS Android. This mobile app is very functional, and it allows users to store and edit schedule, information about students, students' attendance and performance. The program has a synchronization feature with Google Docs and the ability to send e-mails and calls to students. The screenshot of the application is shown in Fig. 2.

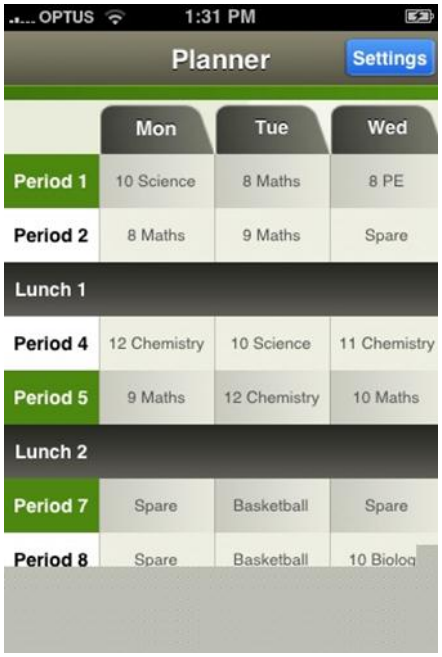

Figure 2. The "Educate" mobile application.

The most popular, similar mobile applications for OS Android are «Grade Book for Professors», «Attendance», and «GradeA». Applications «Grade Book for Professors» and «Attendance» are developed by Academy Geeks Inc[10-11]. These applications allow users to keep record of progress and attendance of students, respectively, and also they support synchronization with Google Docs. Screenshots of the application shown in Fig. 3 and Fig. 4 respectively.

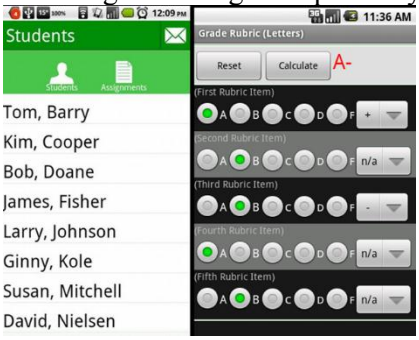

Figure 3. The screenshot of «Grade Book for Professors» application.

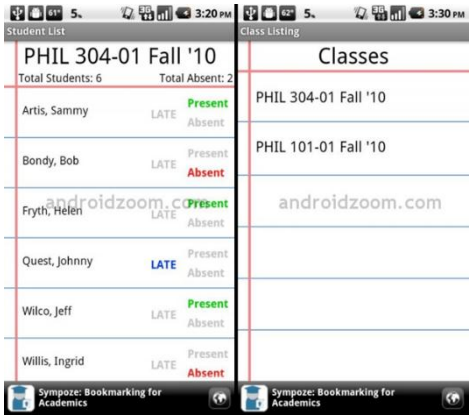

Figure 4. The screenshot of «Attendance» application.

Applications «Grade Book for Professors», «Attendance» and «GradeA» compared to «Educate» application are less convenient to use and do not allow you to create and store course schedule; moreover, in these applications instead of tables, lists are used. Also, they use American grading system, which is not the same as Kazakhstani grading system. The program, developed as part of this research paper in terms of functionality is closer to the program «Educate» and allows users to store and edit training schedule, information about students, their attendance and performance, but in our application compared to «Educate» application timetables are associated with students groups and journals. After learning and analysing all these applications we decided to create our own mobile application that allows professors and teaching staff of ALMU perform attendance checking automatically by the means of their smart phones. As a starting point for creating the architecture for this mobile application, we used previous work in [12], which was using RFID technology and cards instead of mobile smart phones. In Fig. 5, the diagram of how teachers use this mobile application is shown.

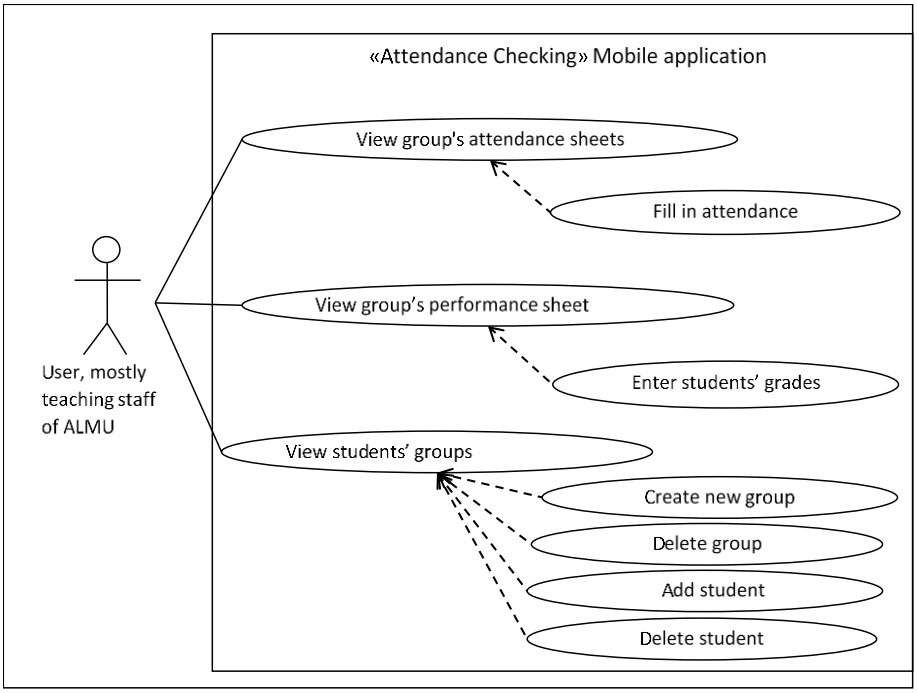

Figure 5. The diagram of the use of mobile application.

From the Fig. 5, we may see that this mobile application covers the most important operations that teaching staff of our University need, the operations of Attendance checking, Entrance of students' grade and so on. In the next section, we will describe this mobile application in more detailed form.

4. The description of mobile application

As programming language for implementing this mobile application, we have chosen Java. Java is an object-oriented programming language developed by Sun Microsystems. Java applications are usually convert into a special byte code, so they can run on any Java-virtual machine regardless of computer architecture. Java programs are translated into bytecode executed by the virtual machine Java (JVM), a program of processing the byte code and transmitting instructions to the hardware as an interpreter [13]. As the Development environment the newest modern IDE called AndroidStudio was chosen. Its main characteristics are as follows:

- In this IDE, the ability to layout in real-time is implemented;
- Many options of sizes and screen resolutions are added;
- Help section has been developed;
- Built-in-tools enabling improvement of the quality of applications and applications monetization are added;
- Tools for tracking the performance of ads, as well as tool for interaction with beta-testers are included in this IDE [14].

For DB, the SQLite was chosen due to its some characteristics that we liked. SQLite - a lightweight, embedded database. The word "embedded" means that SQLite does not use the client-server paradigm, meaning that SQLite engine is not a separate working process that program interacts with, instead of this, it provides a library, with which the program is assembled and the engine becomes an integral part of the program. Thus, as the exchange protocol function calls (API) of SQLite library are used. This approach reduces overhead costs, response time and simplifies the program. SQLite stores all database (including definitions, tables, indexes, and data) in a single standard file on the computer on which the program is executed. Ease of implementation is achieved due to the fact that prior to the execution of a transaction record the entire file that stores the database is locked; ACID-functions are achieved, including by creating a log file [15]. The structure of Database is described in Figure 6.

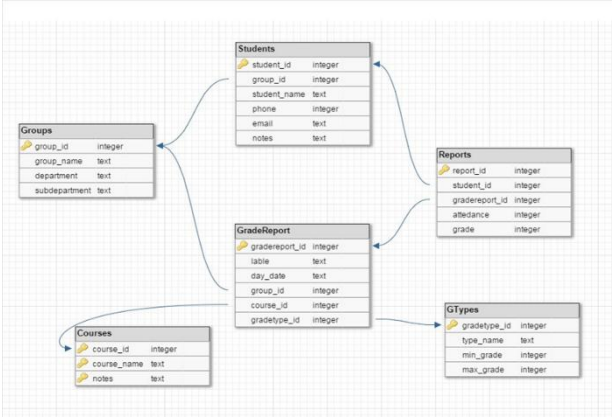

Figure 6. The structure of Database for Mobile system.

We have six tables, and each of these tables are used and due to the fact that our teachers may have difficulties we decided not to overload the process of attendance checking and for this reason, we minimized the number of tables.

After the successful compilation, our program will launch and at the screen of the smart phone the picture like in Fig. 7 will appear.

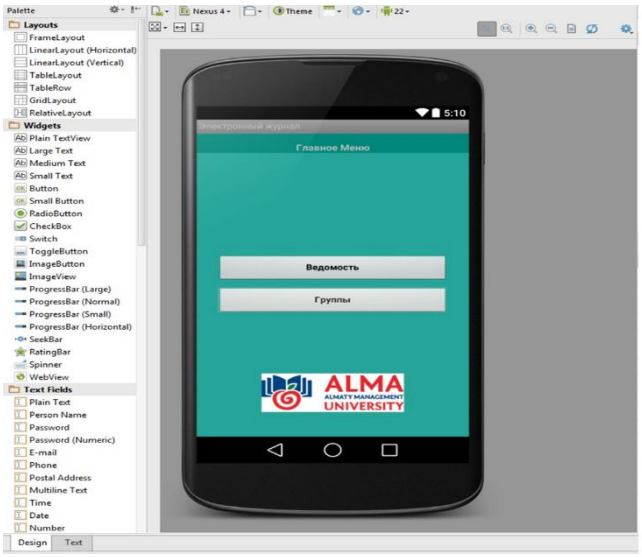

Figure 7. The start of our mobile application.

After this, user needs to choose appropriate group, and checks students' attendance by checking boxes near to students' last names. We have tested this application and used this application for one specific course, on which teacher used this application as attendance checking tool. During this period, application performed correctly and stable.

In general, after presenting this app, teaching staff of ALMU in general accepted this app with a joy, since they all are tired of manual checking and in their opinion, this is good replacement of paperwork.

5. Conclusion

In this research paper, the idea of implementing the mobile system checking students' attendance based on OS Android is discussed. This system is flexible and this is beta-version, which means that it may be extended by adding more functionalities. For the future work, this research should be extended by adding more modules and making some updates or changes. We are planning to extend this mobile system by adding some new modules, specifically "Library module", "Doors Access Control module", "Payment module", "Parking lot module", and so on. There was research done in [16], which showed how to build and implement Doors Access Control system based on NFC technology. Simultaneously, other versions for other Mobile OS should be implemented so that we can cover all possible smartphone models that our teaching staff use. Also, we plan to start doing research on secure wireless data transmission between the mobile smart phones and our server, meaning that we need to think about situations when students may try to attack our system for replacing their grades, putting Attended Mark near their surnames, and so on. We have to add some secure encryption algorithm that will exclude above-mentioned scenarios.

6. References

[1] Google's Android OS: Past, Present, and Future. Retrieved from: http://www.phonearena.com/news/Googles-Android-OS-Past-Present-and-Future_id21273.

[2] Jesse Burns, "Developing Secure Mobile Applications For Android: An introduction to making secure Android applications", October, 2008, Version 1.0. Retrieved from: https://www.isecpartners.com/.

[3] Need To Know Facts About Android Version. Posted on August 21, 2015. Retrieved from: http://androidnios.com/need-to-know-facts-about-android-version/.

[4] The Developer's Guide. Android Developers [Online]. Retrieved from: http://developer.android.com/guide/index.html.

[5] Paul Pocatilu, "Developing Mobile Learning Applications for Android using Web Services". Informatica Economică vol. 14, no. 3/2010.

[6] E. Burnette, "Hello, Android: Introducing Google's Mobile Development Platform". 2nd Edition, The Pragmatic Bookshelf, 2009.

[7] R. Meier, "Professional Android 2 Application Development". Wiley Publishing, Inc., 2010.

[8] Adam Beckley. "Android design guidelines. Version 1". Retrieved from: https://www.som.soton.ac.uk/learn/elearning/lab/mobile/images/MMAndroidDesignGuidelines.pdf.

[9] Official website: https://itunes.apple.com/en.

[10] Official website for application: http://androidforacademics.com/grade-book/.

[11] Official website for application: http://androidforacademics.com/attendance/.

[12] Nurbek Saparkhojayev and Selim Guvercin, "Attendance Control System based on RFID-technology", IJCSI International Journal of Computer Science Issues, Vol. 9, Issue 3, No 1, May 2012.

[13] Java. Official website: http://www.oracle.com/technetwork/java.

[14] AndroidStudio. Official website: http://developer.android.com/sdk/index.html.

[15] SQLite. Official website: https://www.sqlite.org/.

[16] Nurbek Saparkhojayev, Aigul Dauitbayeva, Aybek Nurtayev, Gulnaz Baimenshina. "NFC-enabled access control and management system". 2014 International Conference on Web and Open Access to Learning (ICWOAL), pp.1-4, Nov. 25-27 2014.