Design and Development of Android Application for Educational Institutes

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Abstract. The growth in the use android applications (Apps) has made it the most popular smart device operating system in use nowadays. Android has over 76% of the mobile operating system from December 2018 – January 2020 which is quite significant. Android phones are also becoming the most used electronics globally. Students of higher institutions of learning are also becoming accustomed to the use of applications such that they want everything available for them on their mobile device if possible. This paper deals on an android application that will aid students in planning their timetable and scheduling their classes as well as having full knowledge of days according to the school calendar, get access to academic resources and information about the school right on their smart devices. From the application, one can have access to the detailed and accurate information of the school.

Keywords. Android, Educational Institute, Java, Application, XML, SQLite

1. Introduction

Recently Android has become the most popular smart device’s operating system [1], in the first quarter of 2016, it amounted to about 84.1% of the market share of operating systems [2] but rose to about 86% in the first half of 2020. It is expected to increase continually and significantly in the forthcoming years. Android is said to be an operating system that relies on Linux, it is open source and is mainly developed for smart mobile devices, like smart phones and pads. November, 2007 was the first time when Google released the source code of Android with the GPL [1,3]. Recently, with the proliferation in the use of smartphones, mobile applications have been developed for various institutions such as banks, the social media, music, the marketing, to name but a few. Sadly, one of the institutions that lacks sufficient
mobile application is the educational institution. Ironically, it is this institution that designs most, if not all of these applications that other institutions use. For example, in the financial Institution, all banks have their own mobile applications, in the marketing scenario, each one has theirs too and so do social media platform. Needless to say, scholars from various institutions of learning are the ones who design and develop these applications and, in most case, maintain them. The scholars ensure that proper and necessary upgrades are implemented and that the newest technology is implemented too. From the foregoing, an attempt is made to design an android app that can be used in the educational institution which will assist students in their courses especially the international students in schools where there are differences language spoken by the foreign students and the locals. The application may also have the capacity of helping the lecturers and the school management at large [3].

The mobile application will offer services such management of timetable and schedule of every individual in the institution, semester schedule information including holidays and breaks, notices and updates, examination schedules, laboratory works, assignments, past and upcoming events, and the contact information of various departments and faculties of the institution. The application will also give useful information about the research areas of the lecturers and professors as well as their contact information, various links to the open resources in the institution among other useful information. This will be of great help to individuals who may not be in the school but may want to get information about the school.

2. Background

Android Inc. was established by Andy Rubin, Rich Miner, Nick Sears, and Chris White somewhere in California called Palo [4]. At the initial stage, Rubin said that the Android project will concentrate on developing smarter mobile devices that are more conscious of its owner's location and preferences. It is was gathered that the initial motives of the company were to develop an advanced operating system for digital cameras which will be able to accomplish the purpose of the initiating the Android Inc. This became their drive and they began to seek investors in second quarter 2004 [5]. The company quickly discovered then, that the market for cameras was adequately favorable for goals of its establishment. So, by the last quarter of that year, it had twist its focus and was pitching Android as a handset operating system that will have the capacity of competing with Symbian and Microsoft Windows Phones [5].

Android faced serious challenging in attracting investors initially and was facing eviction from its office space before it was acquired by Google in the second half of 2005 for about $50 million [6]. Some of the employees of Android Inc, including Rubin, Miner and White, also became members of staff in Google as part of the purchase or acquisition [7]. The only thing known about Android at that time was the few details that it was making software for mobile phones which the company disclosed. The team working with Google now, which was led by Rubin developed a mobile device platform powered by the Linux Kernel. After the development, Google advertised and marketed the platform to handset carriers and makers and promised provision of a more upgradeable and flexible system [8].

Google (Android) continued to work hard and showed its intentions of entering into the mobile communications market from then till December 2006 [9]. The result of the hard work was the development of a prototype which is closely related to a BlackBerry phone, that has only QWERTY physical keyboard. In 2007 when the Apple iPhone arrived, Android "had to go back to the basis" as the Apple iPhone became an inspiration as well as challenge to them [10]. Google (Android) specification documents that can support touchscreen was proposed and was almost immediately sketched and designed which also has discrete physical buttons. They added the physical buttons because they presumed that a touchscreen cannot replace physical buttons totally and entirely [11]. The announcement of both the Nokia and BlackBerry touch-screen-based smartphones in 2008 to rival the iPhone 3G, made Android to focus on the development of only touchscreens. This culminated to the announcement of the first commercially available smartphone running Android (HTC Dream also known as T-Mobile G1) on September 23 2008. Since then until presently, Android has witnessed
several updates with noticeable improvement in the operating system, inclusion of new features and fixing bugs in previous releases [12].

3. **Android architecture**

FUNDAMENTALS OF THE APPLICATION: Java programming Language otherwise called java is the programming language with which android applications are written. For the application to be executed effectively, a standard Java Virtual Machine (JVM) is used, for this reason, Google created a custom Virtual Machine (VM) called Dalvik [13]. The VM Dalvik transforms and also launches the Java byte code. The Dalvik VM utilizes Linux core properties such as multi-threading and memory management, which is built-in in the Java language. The Dalvik Virtual Machine permits all Android application to run in its own operation, with its own instance of the Dalvik VM [14].

Android operating system is a stack of software components categorized into four main layers and five sections as shown in the architectural design diagram (Fig. 1)

Linux kernel which is located at the bottom of the architecture has approximately 115 patches. This layer makes a provision for a level of abstraction between the device hardware. It also carries all the essential hardware drivers such as camera, keypad, display etc. In addition to the already stated functions of this layer, it also, takes care of other things that Linux is actually good at, which includes networking and a broad (vast) array of device drivers, which take the difficulty out of interfacing to peripheral hardware [15].

![Figure 1. Android Architectural Design](image_url)

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On top of Linux kernel lies a set of libraries which includes open-source Web browser engine WebKit, popularly known as library libc, SQLite database - a functional repository for storage and splitting of application data, libraries to record and play audio and video, SSL libraries responsible for Internet security etc. Android Libraries comprises those Java-based libraries that are particular to Android development. Some of the Libraries include android.app, android.content, android.database, android.os, android.opengl, android.text etc. Then the C/C++ based libraries which enclaves the android software stack is also located in this layer.

The third section of the architecture is the android runtime. As can be seen in the framework diagram Figure 2, it is encompassed in the second layer where the libraries are. This provides the DVM and a set of core libraries that permits the developers to write the codes using java language.
The application framework follow suite after the libraries. It provides many high-level services such as activity management, content provision, resource management, notification management and view system to the application.

The last layer is the applications layer located at the top. In this layer, the application to be installed are written. The most popular framework diagram is as shown in fig 2. It shows in more details the contents and composition of each layer.

![Android Architecture](image)

**Figure 2.** The Android Architecture framework

### 3.1. Developing Android Application

The Android Software Development Kits (SDK) provides all the required Application Programming Interface (API). The kit houses all the tools for android application development. It is both modern and resistant. Android application are characterized by their approachability and their ability to share data among themselves [13]. They also have the capacity of securely accessing shared resources in a system. These are some of the reasons it is used for the development of the Application.

### 3.2. Applied Technology

**Java:** The Java Programming Language (otherwise called java) is described as a general-purpose, concurrent, strongly typed, class-based object-oriented language which is normally compiled to the bytecode instruction set and binary format defined in the Java Virtual Machine Specification [16]. It has an architecture similar to C++ and also have the “look and feel” of the C++ language [13]. Java is useful in the design of full applications that can run on a single computer and/or be distributed and allocated among servers and client in the network. It can also be used to design applets [13]. The java code is what we used for building this application and its user interface [17,18]. Thus, the java codes were used in the design of this application, since it is quite suitable for that.

**XML** which is the abbreviation for Extensible Markup Language is a markup language which defines a group or set of collection of rules for encoding a record in a style which both human and machine can read. The design aim of XML lay more emphasis on simplicity, generality and it is easy to use across the internet. XML is also applicable in the representation of arbitrary data structures like those which are used in webservies [13]. For this application it was used alongside CSS to give this application a good appearance.
SQLite Another technology that was applied in this application is the SQLite. It is an in-process library that implement a self-satisfied, server less, zero-configuration, transactional SQL (Structured Query Language) which is a data base engine. SQLite is the most popular developed database with more application and high-profile projects. It does not have different server process like other SQL databases and it reads and writes to the ordinary disk file directly. This may be the primary reason why it is the most preferred among others [13]. Although other forms of databases will still be applicable here but we chose to use SQLite because of its simplicity.

3.3. Development Tools

Android Studio: The official Integrated Development Environment (IDE) for the Android App development is the Android studio [13]. It was built on JetBrain’s IntelliJ IDEA software [19]. That was what we used in the development of this application.

Android SDK: This is the Software Development Kit which allow developers to design applications for the Android platform. The SDK has the source code, development tools, an emulator and libraries for developing the Android applications using java [13].

4. The contents of the application

The application has a list view fig 3 of the School timetable, Courses, Schools/Faculties, The Management, the Students’ governing body, Resources, Settings, Entertainment. The application does not have any form of security and so is accessible by proposed applicants.

![Application’s list view](image)

**Figure 3.** The Application’s list view

The timetable section contains the days of the week including weekends. From there you will have each day’s activity. The schedule is on the default schedule of the school which includes the time allocation for each class Nevertheless, it is adjustable to the individual’s taste and schedule as shown in fig 4. The courses icon has in it the list of the schools/faculties in this institution and for each school, the courses owned by each school is with the content and reference textbook. The School contains the list of the Schools and the Lecturers/Professors in each school. The information of the each of the lecturers or professor is included in this section. The information comprises; the name of each lecturer/professor, their research area, their office address and contact information.
The Management section houses the members of staff in the management section of the institution. Their information is also there, like their images, office addresses, contact information and their duties. This is specifically to help the students to know who to meet when faced with a particular challenge. The students’ Governing body will have the information of the students’ leaders and their information. The notice board will be needing the internet to connect and get to know the current news in the school. This also gives the link to the school’s official site which is accessible via the internet and need the students’ security information to be accessed. This section basically opens to a link which is updated regularly. Another section here contains the emergency numbers that one can reach, at any point when in the school. Like the security, Hospital, fire Brigade etc. Resources opens to a link where you can access academic materials about the school, Course materials and School magazines among others. The Calendar houses the School schedule for the year including major breaks and holiday as shown in figure 5. Setting is where you can set the application to your taste and entertainment where you can access the videos, pictures and audio of the past events in the school including jingles.

**Figure 4.** The default schedule of the school.
5. Conclusion
The application was designed for the Post Graduate School of International Students of UESTC. Nevertheless, little modification can expand the horizon of the application to a whole institution. As mobile application is becoming the source of information, this application can serve the purpose of giving detailed information about a school. Since it is also housing the official websites of the school and the official contacts of the school, it will be of great assistance in reducing fraud as it concerns the institution. With the application official notices and information about the school are got. The application is designed in such a way that it will reduce the amount of paper work involved in information dissemination. It will also make information handy and easily accessible from any point in/off campus. Any prospective applicant who lays hand on the application will also have idea of the research areas of the school s/he wishes to apply to, the courses being offered the contents of each course and the reference textbooks. They can also see the schedule and who to contact when facing any challenge in the process of their application. This and much more are what this application will provide.

The application can also be modified and made to be smarter by incorporating AI algorithms to it. When the algorithm is incorporated, it may be able to alert the user of the next event and the venue. It will also have the capacity to display the event(s) on the home screen among others.

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Figure 5. The School calendar Section
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