Applying Mobile Technology for a Pervasive University Information System

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ABSTRACT

Technology has become an important asset in the contemporary human life. It is the fastest growing area and its influence and importance in the lives of people or companies is increasing together with the demand for faster and more efficient technologies. In this paper, we are going to describe the importance of technology in an education system such as university and we are going to explain how to implement mobile technology in university information system. Mobile technology enables the users to be current with the updates done to the system at any time. We will provide here the necessary outline to design structure and implement such system architecture together with the challenges it has and the benefits that it brings. We believe that an integration of mobile technologies in the university will have a positive impact on the university overall performance.

1 INTRODUCTION

Nowadays, it is a well-known and accepted fact that in companies all around the world, computers handle with the highest efficacy and in the shortest time possible the majority of tasks given to them. Computers reduce the human effort as well as error probability considerably, at the same time bringing higher profits to the companies or individuals. The human desire to get jobs done even faster has brought an emerging trend toward mobile environments.

Mobile applications are the new wide spreading trend that the companies are now willing to follow in order to get their jobs done faster and have real-time notifications regarding the job state or other issues related to company.

We all know that is impossible to be in front of a computer at all times for 24/7. This may cause serious damage to the company's success and benefits and in an important education environment such as the universities where such delays may damage the university performance. It is of vital importance for the university to have the professors and students in synchrony with the updates occurring in the system as delays may harm the student – professor interaction. Here the mobile application enters in scene. A mobile application that will make possible to perform changes in the system and provide real-time notification to its users regarding these changes and updates will increase the university's overall performance and efficacy. In the literature review section below, we are going to provide an overview of the work done so far in implementing different kind of technologies to the university information systems and how deep have the mobile phones penetrated in our society and especially in students life. Mobile environments main problem is the fact that there exist physical restrictions and limitations in mobile devices which cannot be surpassed no matter of the improvements done for instance it is impossible to have large student database information within a mobile device. This brings the necessity a distributed software system by the help of which the users' data might be elsewhere and yet again the user will be able to access

it and perform changes on it. In the software analysis and design section we will present to you the software engineering procedure that we have followed while analysing and designing the system. And in the implementation section will be shown information related to implementation, the way how we have integrated different kind of technologies into the system, the role that each of these technologies has and how are they used to have the results retrieved correctly and in a short time. Finally, we conclude by wrapping up the work done so far and proposing the future improvements that can be done to the system.

2 STATE OF THE ART

Mobile phones have entered in our lives and have become an inseparable part of our daily routines. People are connecting more and more their lives with them, using newest features or trying the latest applications out there in the market. Since it is an expanding field, mobile technology has attracted a lot of persons to delve into its unexplored areas and bring out applications which intent to help the users in their jobs or that are developed simply for the amusement of the user. Below we are providing a look related the work done in this field and especially the importance that information and communication technologies have in education and how much have mobile technologies penetrated in the education system.

2.1 ICT and Education

ICT influence in human life is present everywhere. Information and communication technologies maintain important roles in the success of a business, hospital, personal workplace, or even for entertainment reasons [1]. Of course, ICTs have successfully penetrated even in education. ICTs contribute in a constructive learning and also increase the activity of the students [2]. Making use of information and communication technologies, student can get access to the extensive amount of information available on the Internet, find information related to their courses or even follow online courses provided by some of the top universities in the world. From the other side, web based platforms enable the students to get information regarding their grades, courses, attendance and more and also making it easy for professors to update and maintain these tons of data, getting rid of the old-fashioned grade books [3]. Most of these tools are web based and little work has been done to provide their mobile version leaving in the dark all of the potential that mobile technology provides, and this is exactly the problem we aimed to solve because as Fisseha Mikre says in her paper: “If schools train children in yesterday’s skills and technologies they may not be effective and fit in tomorrow’s world [4]”.

2.2 Effects of Mobile Technology in Nowadays Life

In the section above it is noticeable the importance that a proper ICT implementation has in the education system. Mobile technologies are that branch of information and communication technologies whose expansion nowadays is exponential. In the “Oxford Advanced Learners Dictionary”, the word mobile is defined as something that can easily and quickly be moved from place to place [5]. This is the root of mobile technology success. The fact that mobile technology permits the users to move freely and still be in touch with their work without having the necessity to be in front of a PC in their workplace gives it a major advantage compared to static workplaces such as personal computers [6]. Mobile devices with the capabilities they have, the apps they provide, and possibilities that they give to the users are now a threat to the PC legacy [7]. Nowadays, the majority of activities that previously were carried out through Web are easily performed through tablets or smartphones [8]. Mobile applications for event promotion, concert ticketing, games, GPS location and more are spreading through app markets and their download number is only raising making smartphones omnipresent everywhere [9]. The biggest advantage of mobile devices and applications that come with them relays in the fact that mobile technology makes the services accessible to the user at any time and any place in the moment they request for them [10].

2.3 Challenges in Native App Development

Developing native apps for a mobile device is a challenge for every developer. The majority of people misunderstand this topic. They think that developing mobile apps is pretty much the same as developing traditional apps but when working on a mobile app a lot of things should be taken into consideration such as device type, operating system, display size, capabilities and more [7]. Native apps should be designed such that their usage is easy understandable for the user and the response is fast and smoothly presented [11]. Also, native apps, especially those that have to do with crucial user information such as their bank credentials should make security of data as their top priority. Developer should consider the algorithms to use for data encryption always by keeping in mind the devices computational power and capacities and should also consider keeping critical information on remote servers and call them only if and when necessary [12]. From this it can be deducted that developing a native mobile application should be a carefully designed process where each step plays an important role in the success or failure of the entire application.

2.4 Mobile Technology Usage in Education

The possibility of accessing information everywhere and at any time is intriguing and fascinating for everyone. This will lead to changes in the way how and where education is provided [10]. Since the majority of students own his/her own mobile device, this makes it a must for the university to provide them with data accessible via mobile devices and most of the top universities in the world nowadays have their mobile version of their websites available for their students [13]. This would make it possible for the students to have at any instant information regarding to their courses, exam timetable or any other activity occurring in the university. Concluding this section, it can be said that mobile technologies effect positively the education and further improvements and work done in this area would improve the education as a whole and especially university education.

3 ANALYSIS AND DESIGN OF UNIVERSITY INFORMATION SYSTEM (UIS)

In the previous sections, we have provided you with some background related to mobile technologies and also we brought into attention the need that university staff and students have for real-time information. Creating a mobile application which will facilitate the job in University Information System and notify in real-time the university members for the changes done to the system may result in an increase in university's performance and efficiency. In order to bring up such kind of system for a university and develop a mobile application which will perform these tasks, a careful analysis and design is necessary together with the correct and efficient use of different technologies.

Defining functional requirements during the analysis phase of the project enables us to identify what kind of services should be provided by the system, what kind of inputs are expected and their output [14]. Starting with the performance requirements, the application should be able to provide to the user in the shortest amount of time the desired information. Since, for such kind of information it is necessary to get information from the server, the applications requests to the server will be reduced considerably and at the same time optimized to retrieve the data fast and avoid delays. In order to achieve this, we format the response in JSON format, which is fast and can be easily parsed. In Figure. 1 below, we have presented the component diagram of the system. In the diagram below are shown the components and interfaces necessary to make the application work properly. For instance, smartphone is in need of three interfaces where the main interface will contain the application menus, users will select interfaces according to user credentials and SQLite, which will be used as local database to save important information on the smartphone for faster and more efficient information retrieval. The other components are the web server and student/staff server which will contain information for university and staff/student respectively. In the backend there are the interfaces necessary to provide the parsing of information, security and persistence.

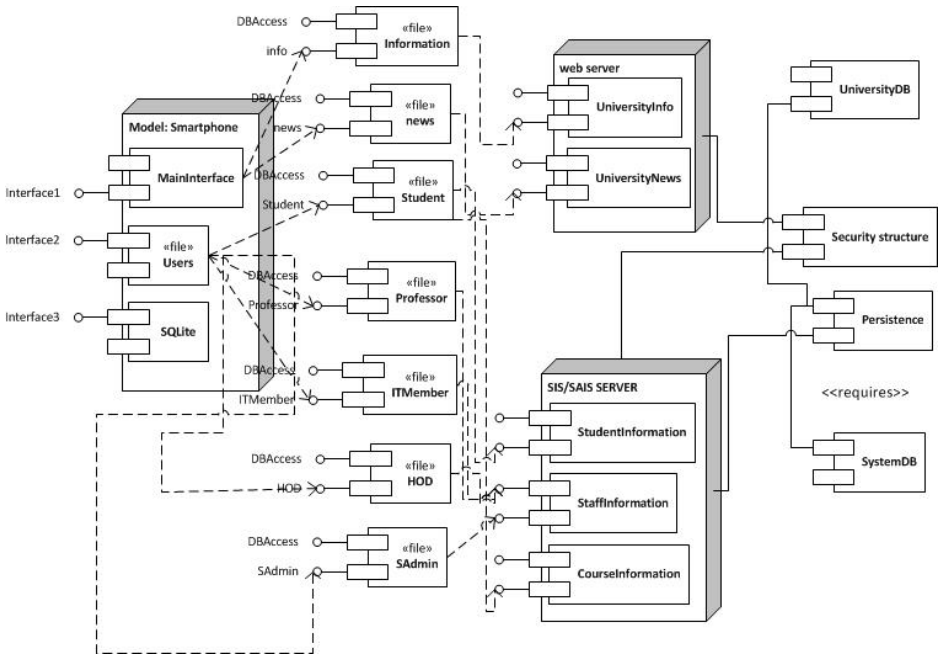

Figure 1: System's Component Diagram

Deployment diagram (Figure. 2) provides an overview of the system's architecture and also the way how the software components are related with each part of the system.

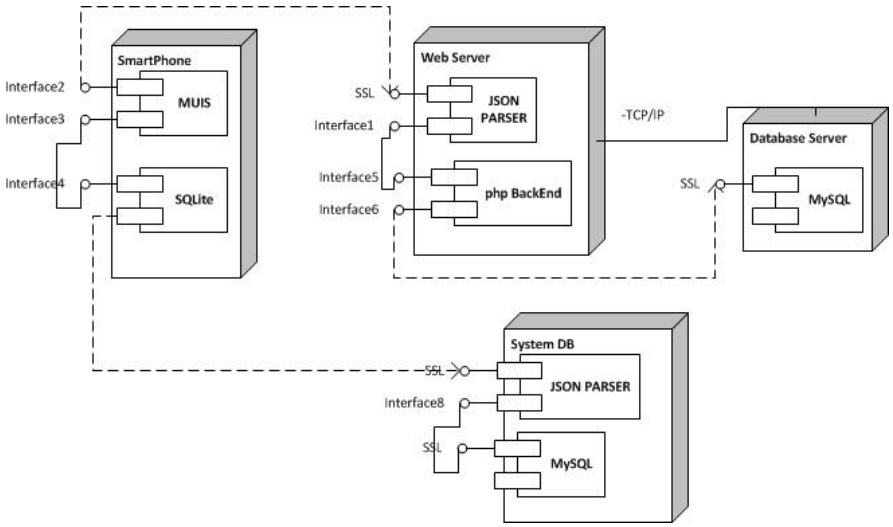

Figure 2: Deployment Diagram

As it can be understood, the mobile university system will consist of the smartphone device, the web server, university database server and the student/staff information container database. The smartphone will be the device containing the application, so as it can be deducted; it will consist of the application, its interfaces and also of the SQLite mobile local database. The university's web server will contain the PHP backend support and the JSON parser, so that information like university news, retrieved from the database will be parsed and processed faster. The system DB will contain the MySQL databases and also the JSON parses in order to parse the student or staff requested information.

4 IMPLEMENTATION

So far, we have provided information regarding analysis and design that we have done in order to achieve building such kind of a system. In order to make the system reality, it is important

to combine together different technologies and make them fit with each other and fulfill the needs of the other pieces of code so that the implementation process may be considered successful. In this section, we are providing information regarding the technologies and methods followed during the implementation phase of the mobile application for the university information system. Technologies play an important role in the development of a system. Chosen adequately, they increase the odds of bringing up a successful project. In order to build the university information system, we used technologies such as Android, Java, XML, JSON, SQLite, PHP and MySQL.

We selected to develop the application in Android, as it is an open source operating system provided by Google [15], built on Java framework. MySQL databases are used, based on the fact that they are widely spread and are quite powerful databases which combined with the functionalities that PHP provides to the programmer, makes it very easy to use and work with. We have used XML to structure the Android layouts. As we all know, XML can also be used for data-interchange, but after some research, JSON seemed the solution of choice as it is very lightweight, easier to parse and generate and also faster than XML when used for data interchange [16].

Databases are the core of nowadays systems. Data and information, which are the most important part of the application for the end-user, are stored there. So, if database structuring is not done carefully and in a detailed manner, the entire system performance will be affected. Mobile devices have physical limitations, making them impractical for storing huge amounts of information especially when we are talking about large information databases like the ones used to store university data. We have structured the tables of our database so that it will be compliant for our application and also we have related the tables with one another so that the information retrieval will be easier and faster and also there will not be any interference between the student and staff information.

In order to prevent requesting data always from the main database, the main information necessary for the application is gathered at login and stored in local SQLite database. SQLite databases do not use a complex relational schema like MySQL, but they are like files where you can write and then execute queries to get information from them. Being that SQLite databases are local in the device, storing users' crucial information in local database during login, will make it possible for the user to get data faster. Also, another feature implemented in the mobile application is the one we prefer to call, the offline login. So, in case the user does not have network availability, at the moment when he/she tries to log in and his/her data were previously stored in the SQLite database, then this user will have the possibility to login into the application and get information, which of course will be updated at the moment the network is available. Figure 3 gives some screenshots of the m-UIS.

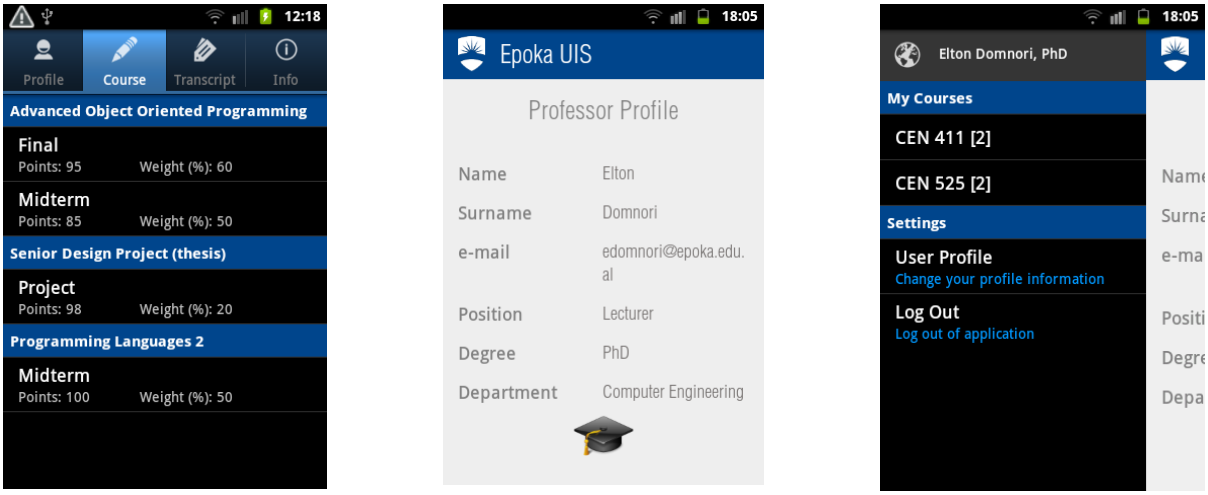

Figure 3: Mobile University Information System

5 CONCLUSION AND FUTURE WORK

Nowadays, in the fast lane of technology, starting from individuals to large scale companies, there exists a need for fast, real-time systems to perform the tasks and notify the users regarding the results. Computers are the selection of choice for performing most of the hard labor, and doing all of the tasks which were previously done by men. But even though computers are extremely fast, companies need to get real-time notifications about any change done to the system and they need to access that data anywhere and in any time. This makes mobile applications a necessity for the companies.

In a university information system, such kind of mobile application will reduce the efforts of the staff and students and at the same time increase the efficiency of the system. In this paper, we have performed a full software analysis and design for such a system dedicating our focus towards two of the main actors of a university; the student and the professors. With this mobile application, we aim to increase the student – professor interaction which hopefully will result in a higher performance for the universities.

In the near future, we intent to add to the application also the possibility to be available for other members of the university staff and respond to their needs and requests. Also, as the users' awareness towards the system will increase also their demand for more specific features and faster functions will increase, which will push us to add other even more sophisticated features to the application.

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