

Finding Ways to Bring Education to Everyone in Panama Through Mobile Learning

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Abstract

This paper presents the main features developed for a mobile learning application to expand the possibilities of learning for students from rural areas or those constrained by schedule and location to attend school. The work presented is focused on methodologies and tool selections to develop the system. Still remains one of the main concerns about the system, which consists on making sure the system is light in terms of power consumption and bandwidth needs.

1. Background

Universidad Tecnologica de Panama (UTP) started a virtual university program back in 2000 with Aulanet, a proprietary platform from a collaboration project with Pontificia Universidad Catolica de Rio de Janeiro (PUC-Rio) in Brazil. By the time, this was the first project of this kind in the country and the main idea was to integrate ICTs (Information and Communication Technologies) in learning and teaching activities in the university along its six branches along the country. According to Clunie, in 2003, UTP, aware of its role and responsibility with Panamanian society and lined up with its vision and mission, created Virtual UTP (UTP virtual) [1], taking advantage of hyper-technologies [2], in response to the needs of specialization and continuous education of people that due to work, schedules, distance, family responsibilities and/or physical despairs did not have possibilities to attend on site education [3].

In 2010 we started a project to design and develop MLEA – mobile learning environment adapter [4], an application to provide a customized access to Moodle in Android based devices. The reason for Moodle and Android laid in the fact in 2008 UTP moved to Moodle platform given the lack of upgrade of Aulanet with new operation systems, and even though by 2010 most smart phones in Panama were Blackberries, the trends worldwide pointed to Android devices.

2. Methodology

For the system design, Service Oriented Architecture (SOA) was implemented. It defines the use of services to support business requirements providing a methodology and a framework for building highly scalable information systems, at the time that offers a clear and well defined way to expose and invoke services, which as a result facilitates interaction among different systems [5], [6].

The client side applies Façade project pattern [6] make communication between screens and the class responsible for invoking web services. On the server side, project pattern DAO [7] is used for web services that make the connection with Moodle database. Also DAO classes are not instanced directly but through a DaoFactory [7] to create instances for each interface connecting to Moodle database.

3. Limitations

Although the scope of the project was to develop an application for mobile learning, we have found the mobile infrastructure in Panama does not cover all the country. Not all the population has access to mobile and wireless infrastructure. Figures show that 95% of the population in Panama has access to mobile networks, but most of this access is limited to 2G and up to 2.5G [8]. Also, since 2008 the government had started a project to deploy public wireless Internet access [9]; however, this project has focused on urban areas rather than in rural areas where there is still many problems reaching technology and so a big digital divide [10]. Therefore, a main issue is creating a light application that can work on 2G and 2.5G, but so far to use all its features MLEA requires either Wi-Fi or 2G and 2.5G, and for some features like localization, even 3G.

4. Mobile Learning System

MLEA, Mobile Learning Environment Adapter, is both an interface that connects with Moodle platform and a native application for Android based mobile devices. Rather than having all Moodle functionalities in the application, there is a set of features that were implemented, based on users preferences [11]. The idea is not to replace the computer as a tool to perform all the learning activities in Moodle, but rather to provide the user with those features they are more compelled to with a mobile device.

A survey was conducted to decide which Moodle features were important to be deployed in a mobile learning scenario. The selected features that resulted were: for synchronous communication – chat, while for asynchronous communication – forums and messaging. Other features include calendar, assignment, short quiz, evaluation, courses, download, and localization. Each of these features have different settings depending on a profile, either student or professor.

Based on the requirements gathered, the client application offers the following functions. Some of which come from Moodle and others from mobile devices' capabilities.

Synchronous and asynchronous communication tools. These tools refer to the regular real time communication tool – chat, as well as forums and email messaging tools provided by Moodle to allow sharing ideas and opinions asynchronously whenever users have the time to do it. These set of tools do not represent a big weight in terms of computation from the device, can be perform easily with a mobile device, and they represent one of the most important features for a mobile device user.

Agenda. It represents the calendar function provided by Moodle so that users keep updated with the ongoing activities by courses. This feature is useful and attractive for a mobile user.

Grading. It represents the grading feature offered by Moodle so that students and professors can keep track of their performance by course. This feature can be easily accessed by a mobile user and does not require great computation.

Evaluation. This feature is desirable because it allows the professor to check an assignment and give grades as well as students to see them.

Queries.

Download. This feature is highly desirable for a mobile user given the possibilities these devices offer in terms of time management.

Localization. This is not a Moodle feature, but one taking advantage of mobile devices. This feature is only available if the user allows it and can be useful for professor or students to determine aggrupation settings for teamwork.

Statistics. It is a Moodle feature that consists of reports according to specific items. It is available for professor role.

Users. This feature allows user to see which other enrolled student on a particular course is connected in Moodle a particular time.

Courses. This feature allows user to get connected to a course he has already being enrolled.

5. MLEA Architecture

In terms of architecture, MLEA has two sides – the server and the client [12]. The server deploys project pattern DAO using a DAO factory to create the classes with its corresponding interface instances. The client side is the Android application itself. It uses Façade project pattern to make communication between screens and the class responsible for invoking web services.

Each screen in this Android application holds an associated class. This way, for each functionality (i.e. forum, evaluation, courses, messages, chat...) provided there is a group of screens, therefore, a group of Java classes, represented in the architecture by the use of packets.

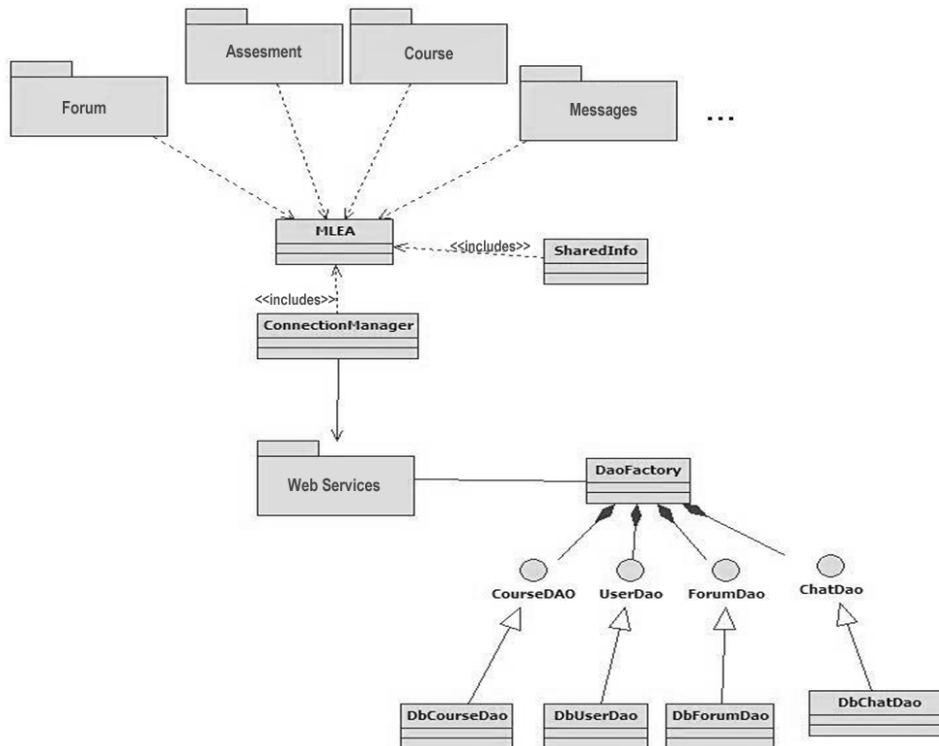
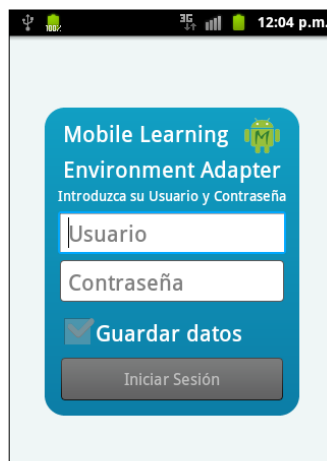


Figure 1. Server View

Figure No.1 illustrates the use of MLEA class that acts in the application like a façade to provide communication between classes and it is used by all the deployed requirements. In this image, it can be seen that the created modules (i.e. Forum, Evaluation, Course, Messages...) are clients of MLEA class, which defines an interface between ConnectionManager and SharedInfo classes, isolating them from the rest of the application. SharedInfo class manages the mobile device's database, where user information is stored such as authentication, connected users' ID, and chosen course, likewise cache data. This image shows only some of the modules developed.

6. Results

So far MLEA is in testing phase. As part of the project we have a Moodle server with some courses created for these purposes. However, the tests have been limited to students of our university given that the scope of the project financed by the Secretary of Science, Technology and Innovation was limited to create and test the application, which has been accomplished. Figures 2 and 3 show some screens of the client application.



3 show some screens of the client application.

Figure 2. Logging Screen



Figure 3. Course Selection Screen

7. Conclusion

MLEA includes users view, email, courses, agenda, forums, chat, grading, evaluation, download, statistics, queries, and localization, as the main features considered for mobile learning. The system architecture was designed applying SOA architecture, looking guarantees for a flexible, interoperable, and scalable system. Through the group of web services developed all the functions are achieved. Developing with Façade project pattern in the client side to isolate classes from the rest of the application, as well as using a project pattern DAO factory in the server to create DAO classes also helps achieving flexibility.

8. Future work

Maybe the main concern about a mobile learning system that can guarantee its use, especially in rural areas, is assuring a light application in terms of power consumption and bandwidth needs, given limitations in both aspects nowadays. We expect to address this issue next in coordination with the Ministry of Education in Panama.

Although Universidad Tecnológica de Panama does not have branches in rural areas, it has seven branches along the country in Chiriqui, Bocas del Toro, Veraguas, Azuero, Cocle, and Colon. This represents an opportunity to actually reach rural areas that concentrate elementary and high schools that lack connection to Internet, but some of which have connection to mobile networks [13], [14]. Moreover, our interest in moving forward with MLEA to reach these areas lays in the fact that the government, through the Ministry of Education, has a program “Tecnología para Todos” to provide laptops for children in high schools in the country [15], but so far has only reached urban schools.

9. Acknowledgement

This project is sponsored by the National Secretariat of Science and Technology, SENACYT, as part of the Public Announcement for I+D International Collaboration. Authors would like to express their gratitude to SENACYT, Universidad Tecnológica de Panama (UTP), and Universidade do Vale dos Sinos (UNISINOS) in Porto Alegre, Brazil for their support on this project.

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