Extended MOBILIS: an Integration of Learning Management System with Mobile Application to m-Learning Environment


Abstract — The present article presents the Extended MOBILIS architecture, which allows the integration of Virtual Learning Environments with Mobile Applications, using a layer of web services as the communications mediator between the two entities. In order to validate the architecture, the creation process of an application was started to introduce the utilization of voice in a web-forum through a mobile application made for the Android platform. In the process of development of the application, aspects of usability were taken into consideration in order to facilitate the use of the application in cell phones and enhance its resources in the context of Mobile Learning.

1. Introduction

Current Telematics Networks changed people’s pace of life and led to the increasing need to access information even outside the institutions where they work or study, or even in transit. Technologies such as mobile phone and notebook are responses to these new expectations.

There are today many types of portable devices that enable communication and implementation of computer applications. There are, for example, mobile phones, smartphones, tablets, notebooks and netbooks. As with other technologies that affected the educational setting, such as the case of computers, these mobile devices are also affecting the way education is done, thus providing new tools that enable the learning process, both face to face and at a distance.

The use of mobile devices in the learning process is called Learning through Mobile Devices, or, m-Learning (Mobile Learning) [1] [2] [3]. It is an example of these initiatives the experiment conducted at the University of Kingston, in Great Britain, where five groups of students were studied: one group would receive, by email, information about academic agenda, dates and places of examinations etc., three groups would receive the same information via SMS, and finally, the last group would receive this information by posts on the Web. The result of this research was that, in some cases, the SMS was preferred over e-mail or over the Web posts. Those students liked this kind of communication because it was more personal. [5]

Another experience in the use of Mobile Devices in the educational process was conducted by Aletheia University and by the National Central University in Taiwan. The objectives of such project were to develop a wireless platform for teachers and students that would make possible the construction of Ad Hoc classrooms, the conduction of learning activities in the classroom and the creation of an environment for self-learning. To achieve these goals, two solutions were developed: Ad Hoc Classroom System and eSchoolbag System. These systems used servers based on Personal Computers, notebook and PDA. The Ad Hoc Classroom System consisted of a set of tools and protocols designed for the establishment of Ad Hoc wireless networks, whose purpose was to connect teachers and students. The eSchoolbag system is formed by a set of applications that allow, among other things, scheduling homework, access to electronic books; sending weekly reports to teachers about students’ activities, school diary for communication between school and parents, a simplex communication system for transmitting video and audio from the teacher to the student, a chat system for text communication between teacher and student, a transmitter of PowerPoint presentations, and a subsystem of digital assessments in real time. Those systems were used in elementary schools in Taiwan, where students and teachers had access to PDA and notebook consecutively. In general, according to [5], teachers and students considered the contributions of the Classroom Ad Hoc System as positive for the educational activities outside the school. The applications of the eSchoolbag System were used inside and outside the schools.

It is in this context of m-Learning that the proposed integration of a Virtual Learning Environment (VLE) is included, in our case study, the SOLAR version 2.0, and
mobile applications to support distance education. The architecture proposed in this paper is an extension of MOBILIS, presented by Sarmento [6]. The MOBILIS architecture describes how a set of mobile applications can access a VLE, extending its traditional features and adding functions adapted to the reality of smartphones, keeping the focus of use according to the capabilities of those devices. What is proposed is a specific use of the essential features of a smartphone, such as microphone, internet connection, video playback, audio and touchscreen to access information and interact with a Virtual Learning Environment.

The extension of MOBILIS brings the possibility of use of current technologies such as Android and the Application Programming Interface (API) of the IOS. Thus, students and teachers will be able to interact in the forums of the VLE in an alternative way, using the audio feature through an application called Voiceforum. The proposed extension uses as foundation a basic resource of all phones, voice recording, via an API for the Android system. This technology will be further described in the following sections.

This way the possibilities for interaction and participation in the Virtual Learning Environment are broadened. We consider that after expanding the possibilities for interaction and learning, students can find new ways to participate that may be closer to their context of use and faster for their needs.

The main difference in the use of the Voiceforum is that students can access and participate in the forum from anywhere, literally typing or recording audio, simply by owning a smartphone with the Android operating system and internet connection.

The present research will present the extended MOBILIS (Extended MOBILIS or extMOBILIS) architecture, as well as a case study conducted with the VLE SOLAR 2.0 developed by The Virtual University Institute of the Federal University of Ceará (Brazil). The structure of this work is composed by Section 2, which presents the related work to the theme; Section 3, which describes in more detail the extended environment MOBILIS; Section 4 which presents the case study with the SOLAR version 2.0 and finally the findings of the current stage of this research.

2. Related Work

There are tools that allow the use of VLE features geared towards the context of mobile devices. With the arrival of smartphones, new ways of adapting this content were developed and, while the communication before was made possible solely by the phone browser, it is now possible to create applications specific to the device, allowing the total use of resources facing the same interaction with the VLE in question.

There are studies that suggest functionalities similar to those described above, in [7] a proposed application called M-learning and University Student Organizer (MUSO) is presented, that enables students to check for updates pertaining to their academic life, such as grades, absences, examination dates, university news and events. In [8] an application oriented towards smartphones is described, containing news, blogs, notes, audio and video, roster and discussion. The system [9] has more features geared towards m-learning, containing assessment tools such as Quizzes, Flashcards and study guides both online and offline, including not only smartphones, but also tablets.

Table 1 summarizes the environments being compared and a study on their resources. The values zero and one correspond consecutively, to the presence or absence of the feature. In addition to these environments, it is good to emphasize the environment that integrates VLE Moodle with mobile systems, called Mobile Learning Engine (MLE).

![Table 1: VLE Framework’s Mobility Comparison](image-url)
The Mobile Learning Engine Moodle project (MLE) has tools adapted to cell phones, where user can create and interact with Quizzes, Self Tests, Forum, Wikis and Instant Messages. However, all these tools are text based. The user can access this environment using browsers or a MLE-Client application [12] [13]. Many experiments were made using MLE with different groups of people and from undergraduate courses [14] to graduate courses [15]. In the experiment used by [15], Simple Message System is used with a group of students to interact with Moodle using Mobile Devices. This demonstrates a good use of cell phone resources but it is still text based.

In all environments studied the use of cell phones or smartphones resources are not used adequately. The user must type his interactions through keyboards and not through the use of audio records and audio players. This is our main contribution to develop a VLE with Mobile Applications that makes it easy to use the tools present in this environment. Therefore, audio, video, photo and simple text are used by the architecture, which makes possible a more natural interaction with VLE.

3. ExtMOBILIS Architecture

The MOBILIS Architecture (Fig. 1) allows participants of a distance learning course to keep informed about news regarding the schedule and publishing activities or contents in their courses, as well as replies to their posts in web-forums. Thus, the concept of a Virtual Learning Environment (VLE) extends to dimensions that extrapolate the boundaries of the Web, allowing individuals there are on the move or away from fixed internet connections to engage in the routine of the course, keeping a virtual connection to the information and discussions involved in distance education process. Such intent may be achieved by using a low cost communication technology, but extremely versatile, called Short Message Service (SMS)[3] together with an application that organizes and allows the navigation of information received by the VLE on mobile devices, such as a cell phone. Smartphone, Personal Digital Assistant (PDA) or Tablet PC. Information transmitted through the GPRS system is structured using the Extensible Markup Language (XML)[7], simplifying the treatment and organization process of the data by the client application, which receives and displays the data to the participant. This information can also be sent by using SMS. In this case, to lower data usage, text is not sent using XML markup, however it is equally structured so that the interagent can understand and identify from which section of the VLE the information originated.

As an example of an application used in the first version of the proposed architecture, fig. 3 shows the basic structure of an Asynchronous Actions Tracking application. Notice that this application was focused on the usage of Short Message System (SMS) technology.

For an easier integration between the applications being utilized and a higher quality data exchange between the mobile device and the web service, we propose the use of a new technology for the creation of the latter, as well as a lower use of text messages over the possibilities of mobile phone audio and video.

![Fig.1](image306x584.png) **Fig. 1 Overview of the Mobilis Architecture**

![Fig.2](image313x435.png) **Fig. 2 Architecture of the Asynchronous Actions Tracking application.**

Therefore, we propose an architecture that extends MOBILIS, called extMOBILIS.

Web services written in .Net and JAVA using Extensible Markup Language (XML) and web services written with Representational State Transfer (RESTful) architecture and using JavaScript Object Notation (JSON) are compared in [10]. The result is that the performance of a RESTful and JSON web service is superior. And [11] shows that the packages exchanged by the REST applications are smaller. This makes applications that use web technology over cellular communication more attractive because the data and financial costs are also reduced.

The Ruby on Rails web application framework, used on the creation of the VLE SOLAR 2.0, allows the data exchange over REST requisitions and also enables communication using JSON, that requires fewer unnecessary characters for communication. It is important to consider these features since the client application will be running on a device that has a smaller processing and connection capabilities, thus we have to transmit information using as little data as possible.

With less data being exchanged between the application we extended the usage of the tool to students who do not have a good internet connection.

Therefore, we propose the creation of a web service that will provide communication between extMOBILIS applications, as in the case of VoiceForum that will be...
discussed in this article, and the VLE using REST and JSON.

Development of extMOBILIS will be executed in three phases, the first of which is related to the implementation of VoiceForum on the Android platform; the second is the implementation of a notification tool and fieldwork; and, lastly, migration of extMOBILIS to the iOS platform.

4. Case Study

In order to validate the extMOBILIS architecture and verify its implementation in a real test VoiceForum was developed.

VoiceForum is an application for mobile devices initially built for the Android 2.2 operating system and focused on facilitating communication of the VLE students and their discussion forums.

A forum post can be done in two ways: the conventional way by sending a text reply to earlier posts; and by sending an audio recorded by the student as an attachment to the post, which may contain a textual description.

The goal is to encourage student participation in discussions. For this, the application facilitates communication by using the resources available on mobile devices, streamlining posting messages and by making this process more interesting to the user.

The development of the VoiceForum was divided in three steps or sub-phases, where each one adds a new functionality to the tool.

In the first step (that is being finalized by the development team to which we belong), the student can send audio files from his mobile device (fig. 3 and 5), attached to a post, which may contain text or not. This phase will also be used so that students can get used to the idea of using the resources of a mobile device in a VLE. At this step the audio files do not differ from other file types that can be sent as attachments to the forum.

The student will be able to see the latest messages posted in the forum, reply to them or create new ones.

Students will be able to visualize the latest messages published on the forum, answer to some of them or create new ones.
audio files and, thus, the facility for running these files will serve as an encouragement to using the app more often.

In the third phase, we added the audio transfer functionality. The app will make use of the mobile operational system sources and the own device to transcribe the audio into a text and send it as a reply to the forum posts. In this case, the reply that is being visualized (or the VoiceForum or through the web) is no different from the conventional written one, produced by the use of a keyboard. However, we maintained this information – amount of transcripts done – for future studies and statistics purposes, which will be used to guide us.

During the tools improvement and the possible creation of new application resources. The use of text transcriptions will facilitate the use of the tool in question, enabling students to use microphones rather than the keyboard of mobile devices, which sometimes is inconvenient due to its small size.

In terms of usefulness, the app was built to get adapted to the main screen sizes of the smartphone being currently used, as it is shown in fig. 6.

At the last part of the development phase number one, the app will be run in a set of tests with SOLAR 2.0, and only then it will be certified in the acceptance app test.

The extMOBILIS code is available on the source code server GitHub.

5. Conclusion

This article aims at the extension of the MOBILIS architecture and shows its feasibility through a case study developed using the VoiceForum app. The development of this new interface, named Extended MOBILIS (extMOBILIS), is being presented in three steps: the first one relates to the VoiceForum implementation into the Android system.

The second step has to do with the accomplishment of the notification tool and the field of work and, at last, the creation of an environment with support for IOS. Within the first stage of this project, there have been proposed three steps that would compose the construction of the app in question. This way, the goals for the first half of the extMOBILIS project have been successfully accomplished. Also, tests had been run according to the requirements proposed and the assessment in real time environment.

The VoiceForum, as a component of the extMOBILIS, allows the use of mobile devices to interact with the VLE SOLAR 2.0 forums. By making use of the original device resources, the app broadens the way the students deal with the environment, thus creating new experiences and encouraging the participation in the discussions proposed by the tutor and/or the professor. The testing on the app is being conducted into two manners. Firstly, through a test adequacy to the system requirements, also through the use of this app by the members of the team and also by the professors involved. This stage has already been finished, the data are published online through Google Docs and can be accessed by this link: http://migre.me/8bG24; as to the form, it can be reached through this link: http://migre.me/8bFBG. In the second stage of evaluation, an application test will be run with the pioneer group that will be taking place from March to June/2012. In this stage, it will be checked if the app generated an expansion and improvements in the forum interactions.

Making use of the original resources of the device, the app proposes an extension to the way the student interacts with the environment, thus creating and stimulating their participation in the discussions suggested by the tutor or professor. This proposal will be observed and analyzed through a test headed by the students and professors from two courses presented in the Sistemas e Mídias Digitais at Universidade Federal do Ceará.

Thinking ahead, we intend to implement the two left activities in the first extMOBILIS phase, as well as the two following stages, accomplishing the acceptance test with real groups on SOLAR 2.0 version.

The Forum application of the extMobilis architecture is just one of the apps that will be available to the participants of a course. It is expected that the tracking app of the actions of a course will be created as well as the app for field work, closing the three important apps to the students’ interaction with the VLE. This is the major goal of the project, to improve the tools presented in VLE, using mobile technology.

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