

## UNIVERSIDAD TECNOLÓGICA DE PANAMÁ

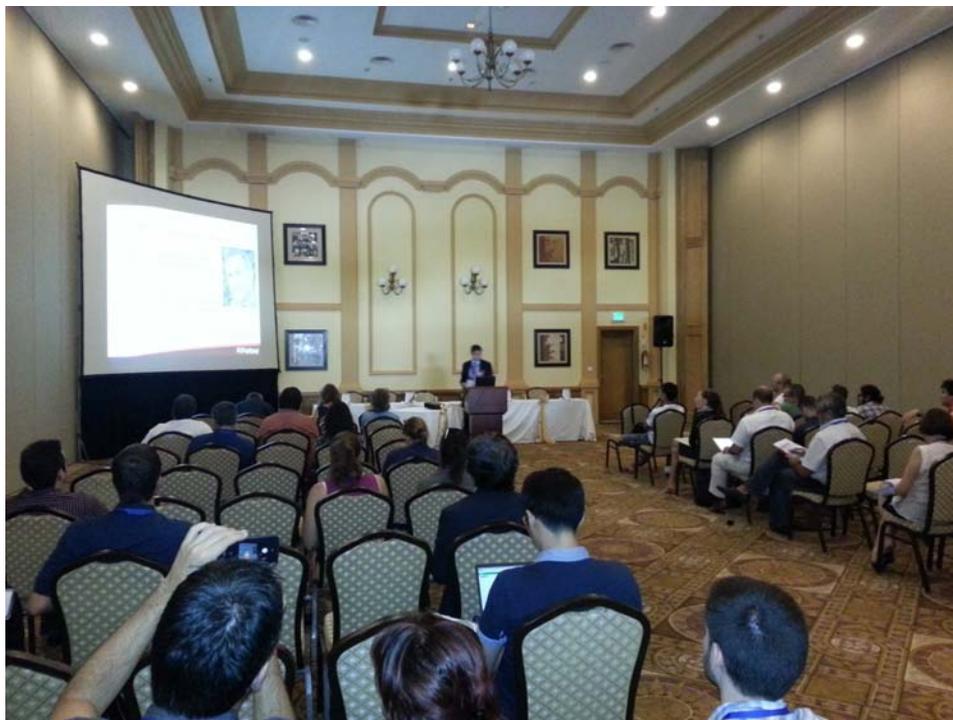
### INFORME DE VIAJE

El presente formato tiene el objetivo de consolidar toda la información obtenida por los colaboradores, que de una u otra forma se hayan beneficiado para realizar viaje al exterior, el cual, a la vez será reportado al Ministerio de la Presidencia para justificar la gestión realizada, en correlación con el presupuesto ejecutado.

TIPO Y NOMBRE DE LA ACTIVIDAD	VII International Conference on Ubiquitous Computing and Ambient Intelligence, V International Work-Conference on Ambient Assisted Living and VI Latin American Conference on Human Computer Interaction
LUGAR Y FECHA (DURACIÓN)	Guanacaste, Costa Rica del 2 al 6 de diciembre de 2013.
OBJETIVOS	<ul style="list-style-type: none"> <li>• Presentar el artículo titulado “Improving university quality of services through mobile devices: the case of the Technological University of Panama” que ha sido aceptado para el evento con publicación en el libro titulado: Ubiquitous Computing and Ambient Intelligence- Context Awareness and Context-Driven Interaction.</li> <li>• Firma de la propuesta de proyecto FRASE en el cual soy co-investigador.</li> <li>• Colaboración como Publicity Chair y Comité evaluador de los artículos presentados.</li> <li>• Integración de nuevos miembros a la red temática AmITIC que esta en estos momentos en conformación.</li> <li>• Reunión para la nueva edición de UCAmI 2014 en Irlanda del Norte.</li> </ul>
PARTICIPANTES	Dr. Vladimir Villarreal Contreras
ASPECTOS RELEVANTES EN EL DESARROLLO DE LA ACTIVIDAD	Este evento permitió intercambiar experiencias con otros grupos de investigación, en especial con la Universidad de Alicante y la Universidad Castilla La Mancha, con la cual definiremos nuevos proyectos conjuntos.
RESULTADOS OBTENIDOS (Contacto con futuros expositores, becas, firmas de convenios, etc.)	<ul style="list-style-type: none"> <li>• Publicación del artículo en actas (Proceeding) por IEEE titulado: “Ubiquitous Computing and Ambient Intelligence- Context Awareness and Context-Driven Interaction”.</li> <li>• Presentación del artículo titulado: “Improving university quality of services through mobile devices: the case of the Technological</li> </ul>

	University of Panama”.
CONCLUSIONES	Intercambiar conocimientos entre un gran número de expertos, nos da luces para saber en que camino estamos caminando en Panamá. He podido comprobar que los temas que desarrollamos están acordes a las exigencias y temas desarrollados por países mucho más grandes.
RECOMENDACIONES	Se debe promover la participación de nuestros investigadores en actividades y eventos de este tipo, ya que nos permite intercambiar las experiencias adquiridas en el área de investigación. Además podremos dar a conocer los proyectos sobre los cuales estamos trabajando en nuestra universidad.
ANEXOS	<ul style="list-style-type: none"> <li>• Fotos del evento</li> <li>• Copia del Certificado de participación</li> <li>• Copia certificado de Publicity Chair del evento</li> <li>• Artículo presentado.</li> </ul>







**The General Chair of UCAMi & IWAAL - CLIHC 2013  
certifies**

*The paper entitled:*

*“Improving university quality of services through  
mobile devices: the case of the Technological  
University of Panamá ”*

*authored by:*

Alex Sanchez, Lilia Muñoz and Vladimir Villarreal

*was presented at the 7<sup>th</sup> International Conference on Ubiquitous  
Computing and Ambient Intelligence (UCAMi 2013) & 5<sup>th</sup>  
International Work-conference on Ambient Assisted Living  
(IWAAL 2013) - 6<sup>th</sup> Latin American Conference on Human  
Computer Interaction (CLIHC 2013)*



**José Bravo**

*General Chair*

*Carrillo-Guanacaste, Costa Rica. December 2-6, 2013*



**The General Chair of UCAmI & IWAAL - CLIHC 2013  
certifies**

**Vladimir Villarreal Contreras**

*Has participated as Publicity Co-Chair*

*was presented at the 7<sup>th</sup> International Conference on Ubiquitous Computing and Ambient Intelligence (UCAmI 2013) & 5<sup>th</sup> International Work-conference on Ambient Assisted Living (IWAAL 2013) - 6<sup>th</sup> Latin American Conference on Human Computer Interaction (CLIHC 2013)*



**José Bravo**

*General Chair*

*Carrillo-Guanacaste, Costa Rica. December 2-6, 2013*



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## The General Chair of UCAmI & IWAAL - CLIHC 2013 certifies

**Vladimir Villarreal**

*Has attended to the*  
*7th International Conference on Ubiquitous Computing and Ambient Intelligence (UCAmI 2013)*  
*5<sup>th</sup> International Work-conference on Ambient Assisted Living (IWAAL 2013)*  
*6<sup>th</sup> Latin American Conference on Human Computer Interaction (CLIHC 2013)*



**José Bravo**

*General Chair*

*Carrillo-Guanacaste, Costa Rica. December 2-6, 2013*

Gabriel Urzaiz Sergio F. Ochoa  
José Bravo Liming Luke Chen  
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LNCS 8276

# Ubiquitous Computing and Ambient Intelligence

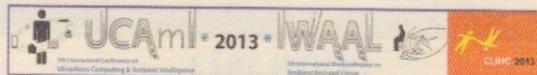
Context-Awareness  
and Context-Driven Interaction

7th International Conference, UCAmI 2013  
Carrillo, Costa Rica, December 2013  
Proceedings

 Springer

**Vladimir Villarreal**  
Technological University of  
Panama  
*Panama*

**Publicity Co-Chair**



# Improving university quality of services through mobile devices: the case of the Technological University of Panama

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**Abstract:** Society evolves at a rapid pace, integrates the latest everyday life technologies and squeezes the benefits of innovation. At the same time, universities follow these same steps, creating great possibilities by providing better services and formation as the result of this evolution. In this sense, mobile devices have become an instrument that allows a new way of interacting with the university services. This article describes the development of an app-tool called “*UTPMovil*”. This tool allows access to the University general information, as well as events, book consultation, schedules and others. “*UTPMovil*” has been developed for the Android platform. This project seeks to be at the forefront of technology hence providing a tool, using mobile devices, for the use of students, teachers and administrators of the Technological University of Panama.

**Keywords:** web services, software development, human computer interaction, mobile users interfaces design.

## 1 Introduction

The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it, said almost two decades ago, American Computer Scientist Mark Weiser [1]. In this sense, the globalization of the economy and the emergence of new information and communication technologies have change the way that XXI century organizations work. In this regard, higher education should be governed by parameters of social competitiveness: it should convey ideas of quality, organization, planning, and decision, among others, enabling them to staying at the forefront in terms of information technologies and communication.

The understanding of software is changing with the proliferation of applications for mobile devices. University education is beginning to take advantage of the integration of applications for mobile devices in the curriculum and designing their own to cover classroom materials. The potential of applications for mobile devices is being demonstrated in hundreds of projects carried out in institutions of higher education, e.g. at the University of Virginia, where WillowTree apps were selected to develop their own iPhone and Android app [2]. With this app you can search for buildings and other facilities on campus, use GPS to locate their location or use augmented reality to customize maps. It also has very useful components for students that allow them to be updated and interact with campus life at all times: live sport

events, curiosities, courses, directories, news, student support, alerts, etc [2] [2]. Access to the University of Panama electronic resources from mobile devices is a necessity. To solve this need in the University's community this project has been proposed and consists of the development of a software application for the University management called "UTPMovil", which allows access to the electronic services from different devices and mobile platforms.

## **2 Mobile Technologies in Universities**

It is a fact that mobile technologies have become an integral part of our lives. The growing demand for mobile devices is a sign that these devices are more immersed in our lives. A few years ago, a cell phone was a dedicated device, only for fulfill the function of making calls, today this function has been relegated to be one application within the smart phone that can hold even thousands of different applications [3]. In other words, mobile devices are being used as a mean of information, entertainment and production, leaving computers running the most complex tasks. In this sense, they are increasingly a reality, offering to the user in a same and reduced device, functions of communication and data processing that do much more than simple phone calls or the execution of basic applications. New mobile technologies have revolutionized human life. This has changed the way in which we learn about the world. Being possible of accomplish tasks tha before were computer exclusive of and now are conducted by mobile devices [4].

Some studies have concluded that integration of tablets in the curriculum has helped increase motivation in students and has improved learning experiences. The real innovation of tablets is how they're used [5], how the user interacts with the device giving it a little touch on the screen, in easy and intuitive requiring no manuals nor instructions. In addition, what makes them so powerful for education is that students already use them outside the classroom to download applications, connect to social networks and immerse themselves in informal learning experiences. These new technologies make possible today to speak of e-learning and m-Learning, providing great benefits for the student.

Currently you can see a great growth in smartphones taken during 2010 with an impressive trend reaching 100 million units in the fourth quarter and with upward trend [6]. There are several factors that have led to this change in such a short period of time. A large sector of the population already does not understand social relations without connectivity based on profiles of users and ongoing dialogue with a certain dose of permanent exhibition the other [7]. According to Rodríguez [5] a mobile device must have the following characteristics: portability, technical aspects (processing, connection, memory), integration (ability to connect to various systems to Web) and Internet without limits (access to Internet via WiFi or 3G, GPS). The way they interact with these computer systems must be completely different from the interaction that we carry out with desktops, and communicate with these new devices with an interaction that we could call natural [8], as we use the voice, fingerprints or eyes. Systems of dialogue for interaction with the devices used in ubiquitous computing are included in an area of growing expansion and, within these, the systems applied to educational environments [9]. Other areas apply an overlay-based solution between elements in the network (mobile phones, desktops, servers, etc.) in

order to provide a solid and versatile communications platform [10]. The use of mobile devices in educational environments can provide a high level of performance when interacting with other fixed or ubiquitous systems that can be done in offline mode, not being necessary to keep a communication channel busy. This allows optimizing the concurrent access to the central system in which information resides, as well as to reduce connection costs, since we must bear in mind that the end users of our system will be University students, which will be a decisive factor in the success of the implementation and use.

### **3 Proposed software architecture**

#### **3.1 Objective of the proposal**

We developed an application for the University services to be used via mobile devices, specifically Android devices. The development of applications for mobile devices is presented as a new alternative to the current approach in the Technological University of Panama.

#### **3.2 Services offered by the UTPMovil**

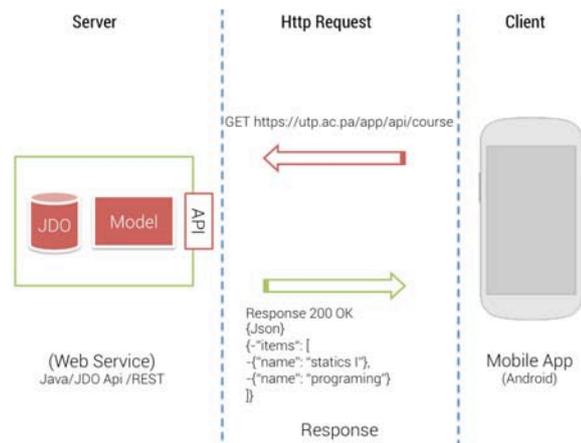
- Online Library: this component of the application gives students and teachers information about a book without having to go to the library, and fill out a form to find out that this was the book that they did not want.
- Class Schedule: This component can be one of the most used by students of the University, allowing students to know their class hours.
- Cafeteria: this component provides quick and easy access to the daily cafeteria menu.
- Student profile: contains a detailed summary of the academic activity of students during the course of his career at the University.
- Sport and Culture: include informative banners and alerts on the device of students, teachers and administrative personnel.
- Events: also includes a history or log of events in general of the University, including an alerting service to inform students, teachers and administrators about upcoming events.

#### **3.3 Previous study**

A survey was applied to a sample of 110 students. A total of 110 respondents, 96% said that they have cell phones and only 4% said that they do not had a cell phone, which tells of the high percentage of the University population that uses a cell phone. Another of the questions of the survey was what operating systems are used in the cell phones, to this question the results obtained were as follows: 40% used Android operating system, 30% Blackberry, 20% is of unknown type of operating system, 6% used iOS and only 4% use Windows Mobile. As for the type of use of respondents, 53% indicated that they use it to access any information and 47% for quick and simple tasks; these in turn prefer computers to perform more complex tasks. At the end of the analysis of the data collected in the surveys, it has come to the conclusions that the application needed to be developed will be under the Android platform. In the next section will explain the development of this app.

### 3.4 Development of the application

The scheme described below was used for the development of the application that will support the University. The University services app, UTPMovil, is more than a simple application installed on a Smartphone. UTPMovil uses a client-server application scheme. GAE and Android SDK have been used for rapid development of UTPMovil. The server side is built and supported by Google App Engine (GAE or AE). GAE offers a development environment on which a Web service can be build locally and then publish to be used immediately. In Figure 1 the three essential elements for the application client-server support are shown.



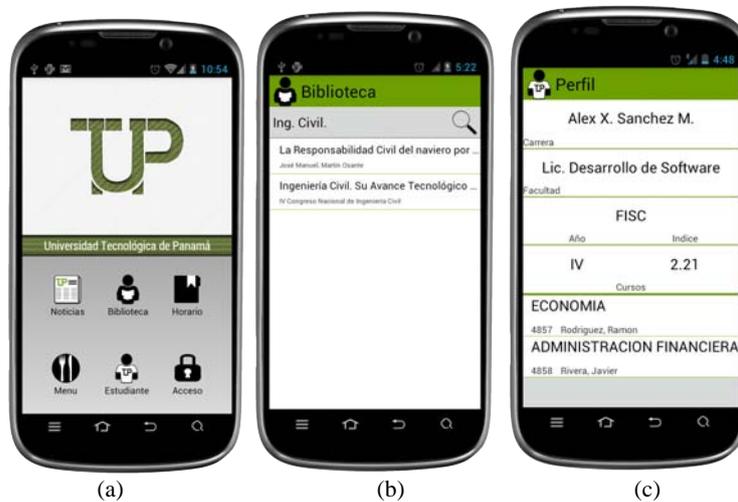
**Fig. 1. Model that defines the communication between the mobile device and the central server.**

- Model: this is probably, between three components, the most important. The model's function defines the behavior of the web service. The model is built using Java Programming Language (JPL) and Java Data Object (JDO) API.
- Database (DB): is an object-oriented or relational database. The database is built based on the model that was previously shown, using annotations for object persistence in java (@).
- API: As well as the Database, the API is built upon the model and persistence objects. The API is responsible for exposing model services to users (client) and persist data that were scored as persistent (@). The API implements a model REST in which available resources are exposed. Through a URI specified for each request to a remote client.
- The http request gives each client access to resources of the Web service. Requests contain the data that is send or remove from the Web service. Data are packaged using JSON (JavaScript Object Notation); it's a lightweight format for data exchange.
- The Client is in charge to make requests to the Web service, as you can see in Figure 1. It has a set of libraries, which are able to speak with the Web

service. Libraries make a bridge connection between the Web service and the application that consumes it.

At this point the client is free to persist, use and even destroy, if possible, those resources that the customer wants and in the way most suitable from the point of view of the customer. The most important general characteristic of applications based on the model client/server, is that customers who consume the Web service resources are not tied to a specific platform. The Web service exposes its resources regardless of the technology used by customers. This allows a wide variety of customers using a single application.

The device market is so fragmented that if a development team aims a market goal, the success of its application would be directly related to the success and acceptance that the platform has. That is why most of the developers have adopted this model of development. This new trend has become a pattern among successful developers. This is where Web services come to play their role as mediators of information and allow free communication between different users of different platforms.



**Fig. 2. a. Access to the functions of the application menu, b. library function for book search, c. student profile**

The application has the following elements on the main interface (Menu):

- News: access to University news and events.
- Library: provides access to the collection of books that are in the database of the University.
- Schedule: allows students see the schedule of classes.
- Menu: displays the per day menu that will take the University cafeteria.
- Student: allows the access to the student information.
- Access: through this option a user connection to the server is allowed.

The library section, which allows consulting books that currently exist in the database of the library of the University, can be seen in Figure 2b. The student can perform a search for the book of interest and check the book's table of contents. The user pressing the search book button triggers the search sequence. The user presses the button Search to shoot the method (`onTouch(View, MotionEvent):boolean`). This method is responsible for removing the string entered by the user, packaging the chain within a message and the request sent to the service. Service handler processes the request and asks the service to run a search for books with the string that was extracted from the message. The service executes the search using the string and sends a response to the client, once received the message, the handler informs the customer that received something from the service and executes the method (`loadBookResultSet(ArrayList<ParcelableRow>): void`).

The student can consult class's schedule (Figure 3a). This section shows the subject, the timetable and the classroom location. To make use of all these features, the user must be always registered in the application through a username and password as shown in Figure 3b. The activities of interest of the student and associated career are listed in the activities section (Figure 3 c).



Fig. 3. a. Student agenda, b. the student access to the system, c. news.

#### 4 Evaluating the functionality of the application

We present an evaluation of the functionality of the developed application. The students use the application and respond some questions about the functionality, usability, design and content. The initial aspects of the evaluation are:

- **Evaluation technique:** a questionnaire was applied where participants complete the specific questions then used the application.
- **Aspects of quality of Access:** We accessed the aspects of content, design and usefulness of the application in end users.

- **Assess of Context:** using the application to review the schedule and others activities.
- **Assess of Population:** the assessment has been applied to 20 people. Undergraduate university population ages range between of 18 to 21.
- **Assess of Time:** the time that the user will take using the application in the defined context. It will take 25 minutes. Then 15 minutes are use to respond to the questionnaire.
- **Scale of Usage:** a Likert Scale from 1 to 5 has been established to evaluate each question, 1 being the lowest evaluation for a question (very much in disagreement) and 5 the highest evaluation (very of agreement).

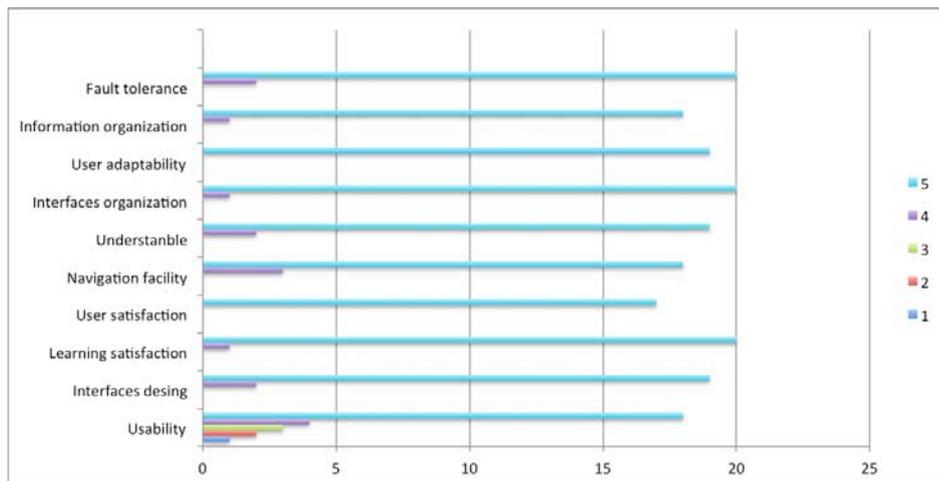


Fig. 4. Evaluation of quality aspects by the end user.

## 5 Conclusions

The generalization of mobile technologies usage in society favours that information reaches a greater number of people and more often; therefore it is presented as an option that increases virtual training. This creates a sense of empowerment in the student, who stands at an important position and activity. The developed application will allow students, teachers and administrative to access information in a more user-friendly and timely manner, contributing to improve the services provided by the University.

Ubiquity and accessibility are very important issues that should be considered, especially when designing new models that can satisfy and improve the experience of our users. These two aspects should be considered for the design of any application. It is important to note that all system oriented to a mobile device, such as a smartphone, should take into account different aspects from traditional application development, and this is due to the technical characteristics of the device. A smartphone is portable,

but its ability to data processing, screen resolution does not compare to big computers or laptops. We are currently working on a notes section, a form for teacher's evaluation, and other for academic documents (credits, official notes, plans, studio, etc.).

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