

COLLABORATIVE MULTIMEDIA MOBILE TOOL FOR TEACHING LABORATORIES

X. Basogain, M. Olabe, K. Espinosa, C. Rouèche¹ y J.C. Olabe²

Escuela Superior de Ingeniería de Bilbao, Basque Country University EHU, Bilbao, Spain

¹ESIGELEC, Rouen, France

²Electrical Department, Christian Brothers University, Memphis, TN, USA

email: xabier.basogain@ehu.es

Abstract

In this paper we present a collaborative multimedia mobile tool in the context of its application in an academic environment. This tool integrates several functionalities for the creation and editing of multimedia contents (text, image/picture, audio and video) in mobile devices such as PDAs and Smartphones. Moreover, this tool provides a set of collaborative functionalities such as send/receive/share the multimedia contents among users. This mobile application presented here is also designed to be used in other scenarios including such as in entertainment, museum guides, industrial environments, etc.

The academic laboratory presented in this paper is part of an Electronics course in engineering where the students implement a set of practical exercises proposed by teacher concerning discrete event simulations which are performed in the laboratory's computers. The students and the teacher use an elearning standard platform to support the exercises. This new developed tool adds services to the teaching-learning process including among others, multimedia records, collaborative multimedia contents, and a direct audiovisual communication environment.

This new tool uses .NET technologies and presents service oriented architecture built using web services. The physical laboratory is equipped with Wi-Fi and the students use PDAs or Smartphones running windows mobile 5.0.

Keywords: video/multimedia content, mobile collaboration, online education.

1.- INTRODUCTION

Market studies on the number of smartphones and Internet access through 3G technology carried out by operators and manufacturers [1], [2] indicate that in a short period of time the new mobile devices, handheld PCs with telephony, will be present in all areas. It may seem futuristic to think that students and teachers will use these devices in the academic environment. Similar ideas about the use of computers and communications in any field of society, including the education sector, failed to correctly predict the demands of the market. Today the computer and communications are ubiquitous.

There are different initiatives and projects aimed at developing applications for mobile devices that will help the user to perform a wide variety of tasks, such as among others, visiting a museum assisted by a mobile device [3], teaching art history collaboratively helped by a mobile device and using augmented reality [4], or creating augmented reality in simulation games in handheld computers [5]. Figure 1 illustrates the use of PDAs in different types of applications and services.



Figure 1 .- Use of PDAs in education and collaborative tasks.

Our working group, Multimedia Group-EHU, is developing a research project on processing-distribution of video, image recognition and augmented reality in mobile environments [6]; initial results of this project have been materialized in the design of an application called MobiMedia that integrates a variety of multimedia tools in a PDA.

MobiMedia provides the user with an application that lets her/him record video and audio, take pictures and draw or write over the photographs manually, or write text notes. All these tasks are performed on a single screen with intuitive menus. In addition, users can share their multimedia content, or content from other users, sent or received via wireless (Wi-Fi or 3G) using the send/receive options enabled on all the menus of the tools of the suite MobiMedia. The option send/receive is used in a mode transparent to the user to load and download multimedia content by services located on a server that can be in the same laboratory or thousands of miles away.

The following list includes advantages offered by MobiMedia with respect to other business applications such as Windows Mobile Notes (text and audio), proprietary software camera (video and images), and utilities sending content via email.

- ❖ integration into a single application
- ❖ standard file formats (txt, wav, mp3, avi, mp4, wmv)
- ❖ multimedia content records: local storage and remote storage
- ❖ collaborative content (send & receive)

The case study presented in this article has been implemented in an university environment, and has served as a testing ground for MobiMedia. Any other scenario where the PDA becomes a real personal assistant could have selected as a test ground, for example a visit to a museum or a cultural heritage site, a tour guide or a visit to an industrial exhibition, etc. We selected a laboratory course in engineering for two reasons: a) to demonstrate the suitability of MobiMedia in education and b) because of the proximity and easy access of this environment to the group Multimedia-EHU which develops its teaching activities in a school of engineering.

2.- TEACHING LABORATORIES

The group Multimedia-EHU offers a group courses taught at a school of engineering [xx] with several of these courses requiring laboratory practice. At present, all courses use the support teaching Moodle, where students find documentation, the course syllabus, exercises, transparencies, etc. The proposal to use MobiMedia in laboratories has several objectives:

- ❖ **complement the existing laboratories with added value.**
- ❖ **test the operation of this new mobile multimedia application.**
- ❖ **infer the applicability of MobiMedia to other areas.**

User Interface

MobiMedia main screen (see Figure 2) presents an integrated access to the four multimedia tools through Menu: Text Tool, Picture Tool, Audio Tool and Video Tool. Also there is a link Help to guide the user how to use MobiMedia and a Configuration section to configure the performance and environment settings. The user selects the multimedia tool and the corresponding tool screen is opened.



Figure 2.- MobiMedia main screen.

The four multimedia tools present a similar set of options to perform the basic operations to create, open, store, send and receive content of text, images, audio and video respectively, as shown in Table I.

<i>Tool</i> <i>Function</i>	Text Tool	Picture Tool	Audio Tool	Video Tool
Create	(default)	New	Record	Record
Open	Open	Open	Open	Open
Store	Save	Save	Save	Save
Send	Upload	Upload	Upload	Upload
Receive	Download	Download	Download	Download
Annotate	---	Draw	---	---
Return to Main Menu	Home	Home	Home	Home

Table I. - Options available from the tools menu MobiMedia.

Text Tool.-

This tool offers the user the functionality to create a new plain text (. Txt) using the keyboard, open a text file, save a text file, and the functionality to send and receive text files to / from the server.

Picture Tool.-

The image tool offers the user the functionality to create a new image taking a picture with the camera of the PDA, open an image file (JPG, BMP, GIF), store an image file, and the functionality to send and receive files image to / from the server.

The Picture Tool also offers the option Draw that allows the user to perform manual annotations (drawing, writing, underlining, etc.) on the image with different color and size line options, as well as clean the image.

Audio Tool.-

This tool offers the user the functionality to create a new audio file (. Wav, mp3) through the microphone of the PDA, open and play an audio file in the speaker of the PDA, storing an audio file, and the functionality to send and receive audio files to / from the server.

Video Tool.-

This tool offers the user the functionality to create a new video file (. Mp4, wmv), open-play a video file, store a video file, and the functionality to send and receive video files to / from the server.

Figure 3 illustrates elements of the multimedia tools of MobiMedia.

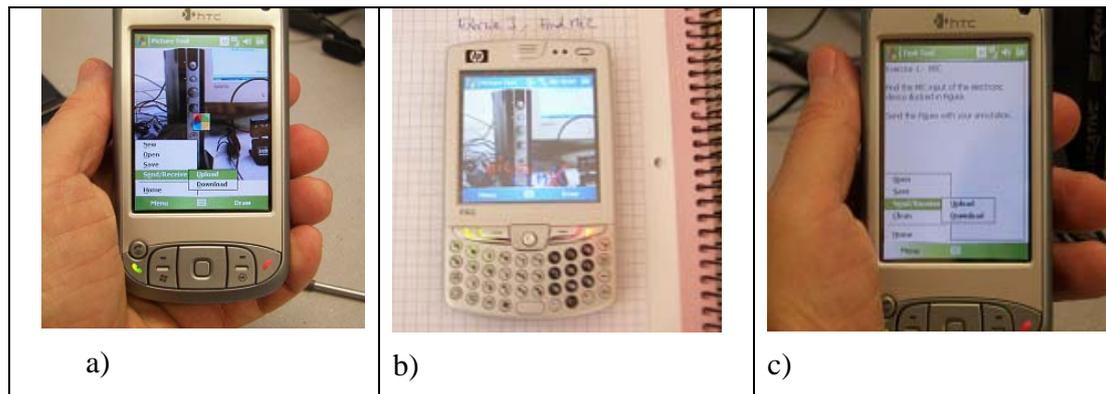


Figure 3.- Multimedia Tools of MobiMedia . a) Main menu of Picture Tool and Uploading the picture created. b) Drawing the downloaded picture. c) Main menu of Text Tool with a text created.

Collaborative Mode

The new tool provides mobile MobiMedia teaching in a laboratory more than the basic functions for creating and storing multimedia content locally. What teacher has not wished in a laboratory class to have the ability to add new information either through text or with a picture for students to work directly with this information? Or the ability to add new questions during practice? How many students would have liked to convey the teacher a difficulty or hesitation in carrying out the practice describing it with an image, or with an error message, or a description of the doubt that has arisen? These and many other situations that occur every day in teaching practices benefit from multimedia direct communication between teacher and students.

At present the collaborative process necessary in this type of teaching is implemented through annotations on the board of the laboratory and notes or voice messages (sometimes adding notices on the board of the VLE). With the new application MobiMedia this collaborative process could be complemented and improved efficiency.

For example during the laboratory meeting, if the teacher wants to incorporate a new graphic information about the practice, she/he can just draw a picture of the model or the electronic circuit or device of interest and select to send Picture Tool. At the same time students can download the image to their mobile device. If the teacher also creates a text and sends it (to the server), then the students can access live that text simply by pressing the option to download Text Tool.

The process can be bidirectional and students can upload their comments to the server as well as text or voice, pictures or videos for evaluation by the teacher. In addition to this collaborative process, the communication is recorded in the server, and becomes additional documentation for the practice.

Figure 4 illustrates some aspects of the collaborative process based on MobiMedia.

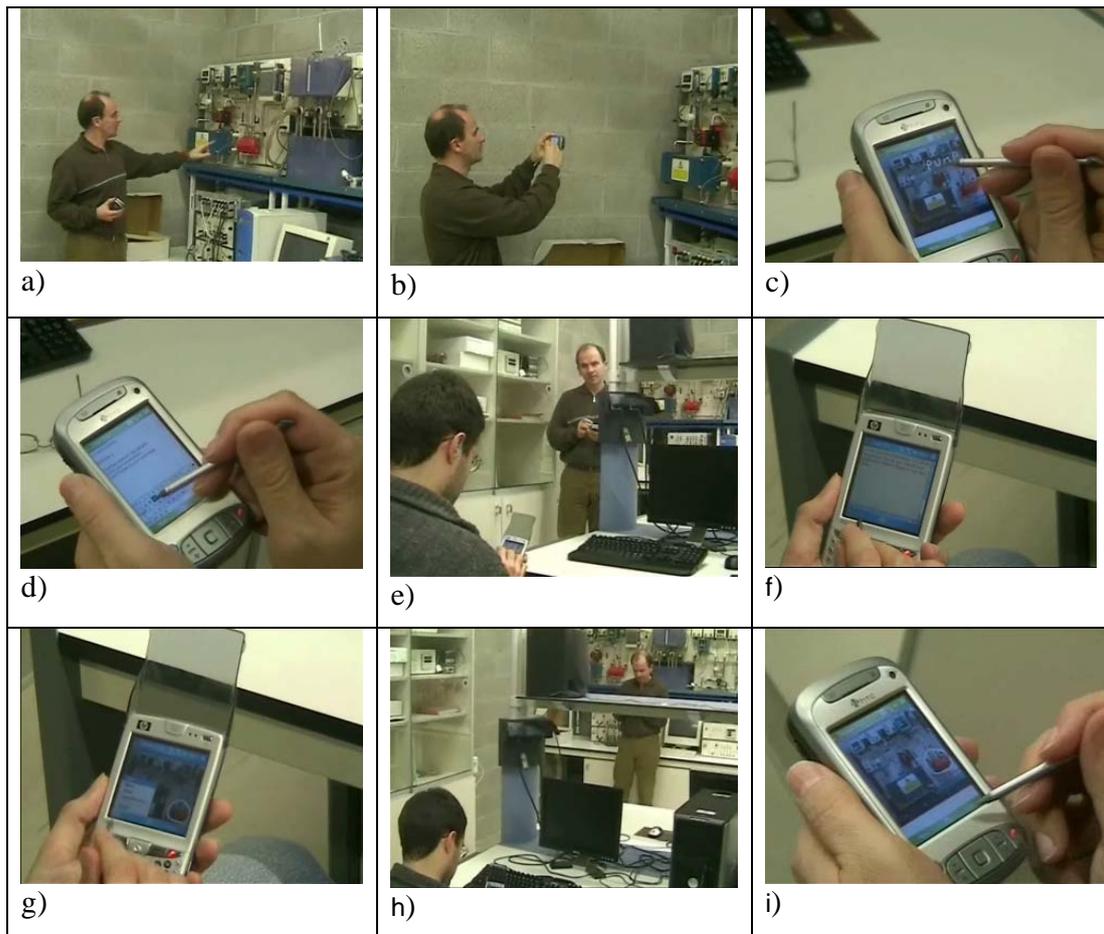


Figure 4.- Collaborative Laboratory with MobiMedia. a) Teacher explains an industrial system. b) Teacher takes a picture. c) Teacher makes manual annotations before sending it. d) Teacher writes and sends (upload) an exercise in text format. e) Students receive (download) the multimedia contents. f) Students read the exercise. g) Students make the assignment over the picture. h) Students send their work. i) Teacher corrects the student's answer.

3.- OVERALL SYSTEM ARCHITECTURE

Figure 5 represents the overall architecture and infrastructure of the MobiMedia system. The MobiMedia software has two components: the client-consumer resides on the mobile device that performs both actions in local mode and demand for Web services, and server-supplier resides in the server system that performs web services requested by consumers. The wireless Wi-Fi and 3G communications among consumer and provider allows the user to have the full mobility that is necessary both in indoor and outdoor environments.

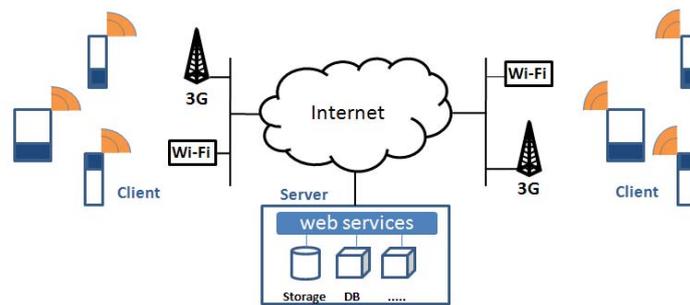


Figure 5 .- MobiMedia System Architecture.

The web services [7],[8] implemented on the server system include the basic processes of storing and sharing of multimedia content. The Upload and Download options in each of the tools of the MobiMedia client (Text Tool, Image Tool, Audio Tool and Video Tool) are a set of functions or methods which are defined in the web server system. These web services are accessible to all MobiMedia clients, and also to the new potential clients that add the reference to these web services published on the MobiMedia server system. The web services are defined and published on a web server of our research laboratory based on the Internet Information Server (IIS).

We have developed the application MobiMedia using .NET Compact Framework (the version of the .NET Framework for mobile/embedded devices) in Visual Studio 2005. The programming language is Microsoft Visual C # and also we used the Windows Mobile 5.0 SDK [9] for Pocket PC in order to write managed and native applications targeting Windows Mobile 5.0 based Pocket PC devices.

Mobile devices were used in developing MobiMedia are HP iPAQ hw6915, and HTC TyTN 3G, based on Microsoft windows mobile 5.0. The multimedia elements include the integrated microphone, speaker and one 2.5 mm stereo headphone jack, and the integrated camera. The PDAs have installed .NET Compact Framework 2.0 Service Pack 2 Redistributable and MobiMedia client and they use the Wi-Fi connectivity of the laboratory.

CONCLUSIONS

We have presented a mobile multimedia system, which has at its core MobiMedia, an application for PDAs that integrates various multimedia tools for mobile environments. The purpose of MobiMedia is to offer an integrated set of multimedia features that facilitates the collaboration and pervasive creation of text, pictures/photographs, audio and video on mobile devices based on windows mobile 5.0. We illustrated a typical scenario involving a teacher and students during a teaching laboratory where the teacher can share and receive multimedia content from students collected during the laboratory through their mobile devices. MobiMedia can be extended to many other fields such as teaching laboratories, education, entertainment, museums, medical assistance, industrial environments and others.

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AUTHORS

Xabier Basogain, Miguel Ángel Olabe and **Jon Koldobika Espinosa** joined in 1989 the faculty of the Automatic and Systems Engineering Department and the Electronic and Telecommunications Department of the Escuela Superior de Ingeniería of Bilbao (<http://www.ingenierosbilbao.com>), Spain. They teach engineering courses such as digital systems, modelling and simulation, computers programming, data communication, computer networks and services, computer architecture, operating systems, computer networks design and neural networks. Their research interests include soft computing, computer networks design using simulation, digital image processing software, optical character recognition, video transmission over the Internet and implementation of e-learning applications in higher education.

Juan Carlos Olabe joined in 1986 the faculty of Christian Brothers University, (<http://www.cbu.edu>) Memphis, TN. He is Professor of Electrical Engineering and he teaches courses in digital design, digital signal processing, digital communications, and computer network design. His research interests include implementation of logic systems using EPLD technology, speech processing, computer networks design, and implementation of multimedia applications in broad-band networks.

Christine Rouèche is Chair of the Department of Information and Communications Technology at École Supérieure d'Ingénieurs Généralistes, ESIGELEC (www.esigelec.fr), Mt. Saint Aignan, France. She teaches courses in database design and implementation, computer programming, and computer networks. Her research interests include database system design and implementation of e-learning applications in higher education.