

Accessing WebLabs from cellular phones

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Abstract – WebLab designs have traditionally not considered the use of mobile devices as potential clients. This is usually the result of WebLab architectures being based on the hardware side, instead of paying attention to software aspects of the project. With current software technologies under the terms of the Web 2.0, porting a WebLab to mobile devices can be a transparent and automatic task. Even if WebLab developers choose to develop rich clients based on Java or .NET, the impact of the development of the clients for this devices can be significantly reduced by using a service oriented architecture. In this paper, we describe a way to allow users accessing the WebLab from mobile devices and the benefits of doing this.

I. INTRODUCTION

The use of WebLabs or Remote Labs is widely extended nowadays. A WebLab is generically a hardware and software application which allows a student to complete his practices remotely, for example from his home, just as if she was in the laboratory. The student takes control of the devices in the laboratory through a web page, and she can monitor the results in the same web page, through a WebCam, a data file, or virtual instruments.

There are many and obvious advantages in a WebLab, making it unnecessary to emphasize them. In fact, the use of a WebLab is a quality stamp for the universities which make use of them. This situation involves the development of new WebLabs by many research teams, studying different aspects as technological or security aspects in depth. Present work focuses on answering the following question: Is it possible to access a WebLab from a cellular phone?

This work is divided into five sections. Section 2 presents the WebLab-Deusto for Programmable Logic developed in the University of Deusto. Section 3 describes the WebLab-Deusto 2.0. Section 4 is all about accessing to the WebLab from a cellular phone. The last section presents the conclusions and future work.

II. WEBLAB-DEUSTO FOR PROGRAMMABLE LOGIC AND ACADEMIC RESULTS

WebLab-Deusto (<http://weblab.deusto.es>) is a remote laboratory to control programmable devices of the PLD type, specifically CPLDs and FPGA of Xilinx. The figures 1 and 2 show the Web Page and the hardware implemented to be controlled in <http://weblab.deusto.es>.

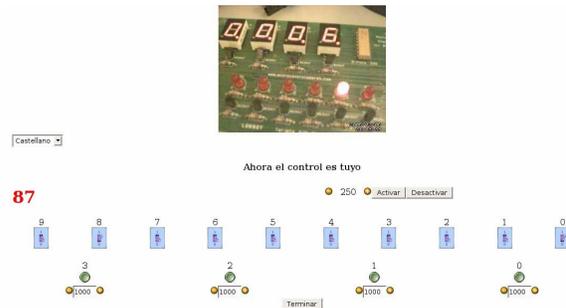


Figure 1. WebLab-PLD page



Figure 2. WebLab-PLD hardware

A complete work session would consist of the following steps: The student writes a program in VHDL and generates the corresponding JEDEC file; the server receives the file and sends it to the CPLD board; the student controls the inputs of the application using the client software; the CPLD controls the outputs using the programmed algorithm; the student sees the changes through the webcam, which is constantly monitoring the CPLD and any attached devices and finally the user can try out other input signals, or close the connection with the server.

More complete descriptions of the WebLab-Deusto and its characteristics may be found in [1], [2] and [3].

III. ARCHITECTURE OF THE WEBLAB-DEUSTO

The architecture of the WebLab-Deusto has undergone an evolution during last years, as it is visible in Fig.3.

WebLab	0.1	1.0	2.0	3.0
Device Server Client Proportion				
Connection with devices	RS-232 PLD	SERVER USB WEBCAM	SERVER Network	SERVER Network
Client side technology				
Server side technology				
Protocol	proprietary		SOAP	
Does it use HTTP for transporting everything?	No		Yes	
Data protection	-			

Figure 3. Evolution of WebLab-Deusto

The current stable architecture of WebLab-Deusto 2.0 shown in Fig. 4 is an AJAX Web-based Solution. The server core has been developed in Python, while the wrapper to provide SOAP Web Services to the client has been implemented in Mono. In the beginning of the 2.0 version and the previous versions, the WebLab depended on Microsoft Windows and Java, but right now we are in a point between 2.0 and 3.0, where the WebLab-Deusto is cross-platform, being actually the servers in use running under GNU/Linux. There is also no dependence on Java anymore.

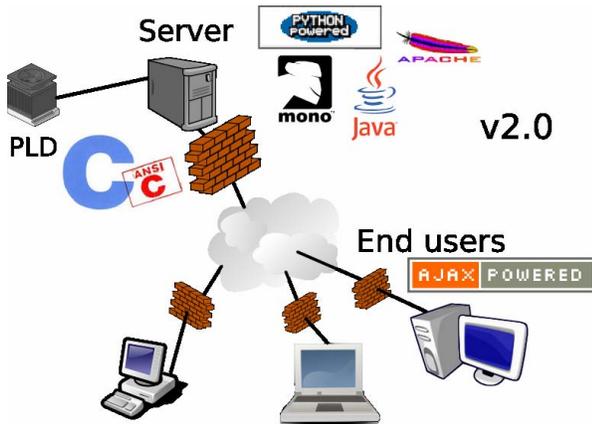


Figure 4. Architecture of WebLab-Deusto 2.0

The client is just a web browser, such as Microsoft Internet Explorer, Mozilla Firefox or Opera Web Browser. The communication between web browser and server is based on SOAP, so, firstly, a web browser can, thanks to

AJAX, call directly the server, and secondly, the development of new clients becomes easier. The use of SOAP in the communication also allows the client to be running behind any kind of firewall or Web proxy.

AJAX is a new Web development technique which allows calling asynchronously the server from any Web Browser. It is extensively and successfully used by Google or Yahoo in many sophisticated web applications, such as Gmail, Google Maps, or Flickr.

IV. IMPLEMENTATION OF A WEBLAB FROM A CELLULAR PHONE: WEBLAB-DEUSTO

As described in section 3, the client of the WebLab-Deusto is just a common Web Browser. It does not rely on any proprietary plug-in for the Web Browser such as Java or Macromedia Flash, so any Web Browser which implements the commonly used web standards required in AJAX (XHTML, CSS, JavaScript + XMLHttpRequest object, DOM) is a potential client of the WebLab-Deusto.

Due to this fact, it is easy to find potential clients in different platforms, including Microsoft Windows, Mac OS, GNU/Linux in different architectures, or, as focused in this paper, in mobile devices.

In this sense, Opera Software has a proprietary Web Browser available under many mobile platforms, like Nokia S60, S80, S90, smartphones with Windows Mobile, and so on. The access is granted to the WebLab-Deusto from any of these devices with the Opera Web Browser (see Fig. 5), without changing anything in the architecture of the WebLab-Deusto. There are also many efforts in developing both proprietary and Open Source Web Browsers for these devices, which will support AJAX.



Figure 5: WebLab-FPGA from Opera Web Browser on a Nokia 6630

The other approach to access a WebLab from a cellular phone is programming a specific client for the mobile device. In order to avoid losing portability between different mobile devices, there are cross-platform development platforms available, mainly J2ME (with Sun Microsystems and IBM as main providers) and Compact .NET (with Microsoft as only

provider). If the WebLab uses a standard protocol for communication as described in Section 3 with SOAP, the development of the client with these technologies would cost even less than the AJAX client. Today, with this approach, the WebLab developers can aim at a wider range of devices.

The main drawback of this approach is that it obviously requires the development and maintenance of a new client, so every new feature in the WebLab should be ported to both the Web client and the J2ME or Compact .NET client. With the AJAX approach used in WebLab-Deusto, the user would automatically download the last version of the WebLab client every time she enters the WebLab's web site.

V. CONCLUSIONS AND FUTURE WORK

The increasing acceptance of mobile devices as PDAs and cellular phones with support for sophisticated developing frameworks by the society makes it interesting for WebLab developers to research how can these devices can be integrated in their WebLabs, and which new ways this integration opens.

The developed architecture for WebLab-Deusto 2.0 is based on the Web 2.0 approach, so it is accessible from mobile devices without any modification. This architecture is better in portability issues than other architectures.

The technology described for the WebLab can be used in other fields. A worker could, for example, reconfigure a manufacturing process with his cellular phone, or she could even modify the logic or software of the process.

It is still pending how useful could a cellular phone be as a teaching tool, but it seems to be obvious that it could promote collaborative work and other techniques in modern teaching.

The main concept to remark is that WebLab developers should understand that the best way to reach a high level of complexity in the features of user-friendliness is making use of the latest technologies in Web development -currently under the terms of the Web 2.0-, focusing the efforts of the WebLab development in aiming at good software design.

VI. REFERENCES

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