Smart TV with Free Technologies in Support of Teaching-Learning Process

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Abstract. *The digital divide created between Cuba and the rest of the world has forced us to use alternative technologies in order to preserve and strengthen the achievements of the Revolution in the field of education. One of the actions undertaken in this regard consists of making audiovisual equipment and media become a supplementary element of the teacher's educational work, and thus ensuring the rational use of the aforesaid media. This paper shows how to use a new trend of information technology and communications, using hybrid or smart TVs. This low-cost solution for low energy consumption, conceived as part of the educational process at all levels of the Island, provides some technical aspects and also shows, in the outline, some other ideas for incorporating this technology into the teaching-learning process. The results of laboratory tests are likewise shown.*

1 Introduction

The birth of Information and Communication Technologies *(ICT)* has brought about deep changes in the structure of teaching aids, by adding some new tools and changing the existing, more traditional methods and techniques. These changes have also influenced the way of using teaching aids, since they have contributed to the optimization of newer techniques involved in the process of learning, granting more access to it *(Bravo, 2004)*.

Television is one of those teaching aids which have since long transformed education inside and outside the school. By the early Seventies, cartoons made for children in the Soviet Union played a major educational part, and the year 1985 would see the emergence of Discovery Channel in the United States, thus becoming the first worldwide learning channel.

In Cuba television sets are used as teaching aids since 1961, when they were first use during the literacy campaign was on its way. Later on, by the year 1968, a series of televised programs was conceived with the aim of supporting classes in elementary and high schools.

During the 2000 – 2001 school year, the initiative of using television as a teaching aid was taken up again and in some elementary, junior and senior high schools, a television set was used for every 100 students. At that time, the materials for teaching students only reached the audience as part of other programs broadcast by the national Cubavisión channel. All along the 2001 - 2002 school year, each of the 9970 schools *(Cuba, 2010)* received a TV set per classroom. The total figure of televisions reached the number of 109.117 and they came along with some other 40.858 video cassette players *(VICENT, 2005)*. This major boost for education was firmly intended to extend the range of teachers' options to enrich their classes, by replacing expensive teaching aids with audio-visual materials in a more interactive way. Two more learning channels were conceived, with the purpose of broadcasting televised classes and educational multimedia that would back up the teaching process.

The University of Computer Sciences (UCI) was inaugurated in the year 2002. Within the university, as part of the back-up equipment and of the upgrading of the educational system, at least two TV sets and a computer were placed in each classroom, as well as other devices allowing the connection with the aforementioned machines. Different television channels were opened for the broadcast of televised classes, consultation and other educational materials. Besides, there was a website that granted access to any of those resources at anytime from a computer.

From what has been said, one can conclude that since the economic situation of the country is not at its best, it would be advisable to look for cheaper alternatives (so as to be able to replace and/or repair the computers in case of damage) and a lower energy consumption (to grant a rational use) for the technologies used in classrooms all over the country.

And then? How could a teaching aid based on ICT be used as a supplement to the teaching process and be likewise as cheap and energy-saving?

The aim of the present research is to design a teaching aid based on ICT, using low-cost and energy-saving elements that can be used as a supplement to the teaching process.

2 Smart Television

A smart television (STV) is made up by a television designed to process and store data like a normal computer, allowing users to watch their favorite programs by request, without being overwhelmed by the flood of repetitive TV commercials. Instead, commercials appear in the guise of inserted messages or *gadgets* or over the broadcast itself. This kind of equipment may also take in games, applications and be able to interact with Internet through the e-mail, instant messages or Web surfing *(Kovach, 2010)*.

2.1 Background

By the year 2010, the enterprises like Google, Intel and Sony got together to announce to the world the news about a revolutionary appliance, the smart television, a technological novelty based on digital television. Yet, the social object for which STV were designed is much distant from the conception of a didactic teaching aid. Its introduction in Cuban schools may be favorable for the teaching-learning process because of the following reasons:

- The STV is a technological evolution of video cassette players, computers and televisions presently used at all levels of instruction in the country.
- The educational software would be easily inserted in the learning process as didactic materials.
- The STV would facilitate the use of the network and grant access to Internet in order to get information and the didactic resources.
- It could be put into service using low-cost and energy saving components.

The new potential of smart televisions is due to the inclusion, in their circuits, of small computers like the ones used in mobile phones, tablets or even in portable computers. There are several transnational companies which are presently developing this kind of TV; among them are the world-known LG, Google and Samsung. There are also important projects for Free and Open Code Software (FOSS) which have switched from desk computers to television sets, such as GNU/Linux Ubuntu and even some others which had initially foreseen a foray into this kind of media like the Android project.

On the other hand, there are some hardware projects whose aim is to have small computers plugged in to the television. These would be extremely cheap since they don't even come with a chassis. Most likely, there isn't any other solution as popular as Raspberry Pi. Its manufacturer describes it as: (…) a computer whose size is that of a credit card that is plugged in to a TV and a keyboard. It's a PC that can do many a thing like a desk PC: spreadsheets, text processing and games. It can also play high-definition videos *(Raspberry Pi, 2011)*.

After Raspberry Pi started marketing computers the size of a card, several other brands have arisen, having a higher quality with regards to the processing potential and other technical features. Among the most promising ones, being in the core of the present research, are Odroid and APC 8750, these two have an outstanding feature: they are sold with the operating Android system already installed. In response to the

primary goal set by this research, the use of the Raspberry Pi board was decided, mainly because it is cheaper than the two other options and presents an output device for the RCA video which is at the same time the standard input of television since the late Fifties.

A chart showing a comparison of the abovementioned boards is found below:

Table 1. Comparison of boards

Board	Price	CPU	RAM	Video
R. Pi (B)	$35	700 MHz	512MB	HDMI/RCA
Odroid (U2)	$89	1.7GHz	2GB	HDMI
APC (8750)	$49	800 MHz	512 MB	HDMI/VGA

2.2 Operating system

Since the year 2008, different free and/or open code projects have intended to provide an operating system for both types of devices. By the late 2009, Google released the first version of Android's operating system, which was backed up by the giant Internet transnational company and by Open Handset Alliance (OHA)[1]. Since 2010, the home page of Android's developers has announced that they are working on the transfer of this platform on to televisions.

Curiously, for Android, it was decided to have the architecture of a conventional GNU/Linux distribution changed. Why? Any GNU/Linux distribution has in its default settings some applications developed by using programming languages such as Perl, Python, Bash y C/C++, and also developed by using different graphic libraries like Ncurses, Gtk+ and/or Qt. This diversity causes a certain inefficiency that is not perceived or is just in any case of minor importance in a desk computer or telephone with limited resources. Standardizing development technologies (Java y C/C++) brought about the birth of powerful tools like SDKs and IDEs integrations like Eclipse, an incomparable phenomenon in the world of FOSS.

These tools have also given rise to some applications for Android in the last four years, surpassing the number of applications of any GNU / Linux distribution. Therefore, for the present research we propose the use of Android's operating system, for its maturity, and for it has a large number of applications and a version for Raspberry Pi.

2.3 Known Results

The STV has more interactive elements than presentations or slideshow based on static images do, since it can even contain live videos. For classes and teachers working in the field of information and communication, the television is a good chance to use educational applications.

It is advisable that the physical duration of the object ranges from 10 to 20 minutes. On its own side, the length of the student's learning period does not have a definite pattern, because it depends on her/his own skills *(FONDEF-APROA, 2005)*.

Applications for the STV are compared, in this case, to the objects of learning, since the structure of an application for Android (the operating system chosen) ensures all the good practices that have been previously described. Besides, these applications make the use of templates easier, as well as the television's design, since they save time and resources while generating objects and putting them into sequence in a similar learning context. The use of templates is favorable for the design of the object and also for the process of understanding of the contents by the students, who will rely on a standard-format object *(FONDEF-APROA, 2005)*.

Below, a chart shows a comparison of the energy consumed by some teaching aids:

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[1] *Association of 84 companies whose aim is to develop a platform that allows users to interact with mobile systems in a better and cheaper way (Open Handset Alliance), among its members are to be found: LG, Aser, ASUS, ALCATEL, ZTE, Huawey, DELL, Fujitsu, HTC, Samsung, inter alia.*

Table 2. Energy comparison among teaching aids

	Components' Power (W)				
Audiovisual aids	Television	Computer	Monitor	Video/DVD	Total
Use of video/DVD	75	-	-	20	95
Use of computer	75	300	60	-	435
Smart television	75	4	-	-	79

3 Conclusions

At the completion of the present research, a smart television set was designed, being able to work as a teaching aid and having the following features:

- Low production cost, since it can be manufactured by placing a 35 USD computer in the interior of the TV sets which are already in use in classrooms all over the country.
- Low energy consumption, since this brand-new device would only consume 4W more than a regular TV set.
- Lined up with the latest developments of information and telecommunication technologies, it would use Android as the fastest-expanding and most profitable operating system at present.
- Also lined up with the most recent information and telecommunication trends in education, it would propose the use of applications as subjects of study.

As from now on, this team will focus on introducing some samples of the teaching aid in real classrooms, in order to validate its proposal and to put this technology in service all over the nation as soon as possible.

Furthermore, the thread of software and hardware components used by the aforesaid system will be followed closely, since production costs tend to be lower all the time and it is likely that newer technologies will arise, making STV cheaper and more rational for Cuban education.

4 Bibliography

Ávila, M. A. A. (2010). Diez preguntas sobre el ahorro de energía eléctrica. Retrieved March 30, 2013, from http://www.cubasolar.cu/biblioteca/energia/Energia33/HTML/articulo03.htm

Bravo, J. L. R. (2004). LOS MEDIOS DE ENSEÑANZA: CLASIFICACIÓN, SELECCIÓN Y APLICACIÓN. *REVISTA PIXEL-BIT*, *24*. Retrieved from http://www.sav.us.es/pixelbit/pixelbit/articulos/n24/n24art/art2409.htm

Cuba, O. N. de E. (2010). Anuario Estadístico de Cuba 2010. Retrieved March 29, 2013, from http://www.one.cu/aec2010.htm

FONDEF-APROA. (2005). MANUAL_DE_BUENAS_PRACTICAS_PARA_EL_DESARROLLO.pdf. Retrieved from http://www .aproa.cl/ 1116/articles-68370_recurso_1.pdf

Kovach, S. (2010, December 8). What Is A Smart TV? - Business Insider. Retrieved March 29, 2013, from http://www.businessinsider.com/what-is-a-smart-tv-2010-12

Linux Infra Red Control. (n.d.). How to connect an IR receiver to an audio card. Retrieved March 29, 2013, from http://www.lirc.org/ir-audio.html

ODROID | Hardkernel. (2012). Retrieved March 29, 2013, from http://www.hardkernel.com/renewal_2011/products/prdt_info.php

Raspberry Pi. (2011). Raspberry Pi | An ARM GNU/Linux box for $25. Take a byte! Retrieved March 29, 2013, from http://www.raspberrypi.org/

VICENT, M. (2005, abril). Revolución en las aulas de Cuba | Edición impresa | EL PAÍS. Retrieved from http://elpais.com/diario/2005/04/04/educacion/1112565605_850215.html