E-learning in the Philippines through the Use of Affordable, High-Quality, and Custom-Designed Development Tools

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Abstract

The 2nd National E-learning Conference defines e-learning as:

"technologically-supported learning, which includes the use of electronic media such as the Internet, personal computers, phone bridging, audio and videotape, video teleconferencing, satellite broadcast, mobile phones, personal digital assistants, and other related technologies to enhance teaching and learning."

(http://www.elearning.ph)

The above definition denotes a better meaning of e-learning because it acknowledges other technological tools, aside from the usual association with the Internet or web-based applications since it is common knowledge that there is only a small number of Filipinos who have access to the Internet and its services.

This paper talks about the authors' efforts to contribute to the field of e-learning by providing an alternative tool, which is the *BlueZ Bluetooth™* module - an affordable, high-quality, and custom-designed development tool. This paper focuses its discussion on two major items: the e-learning tool, and the strategic activities that highlighted the experience of two students who benefited from this e-learning tool.

Using the *BlueZ Bluetooth™ module* in the *Bayanihan Linux version 2.0*, two students were able to develop a wireless mobile application called the *"BT Chatter"* – a chat with file transfer application.

Introduction

Since the start of rapid advances in technology, the need to integrate technological knowledge in education and industry has been recognized. In order to address this need, the concept of e-learning has been established. E-learning stands for 'electronic learning,' that is, associating the utilization of electronic materials to learning. Today, the term e-learning has captured a wider scope from the use of Personal Computers and the Internet to the utilization of more advanced applications, as well as devices or tools for more effective teaching and learning. Currently, the local academe and industry have incorporated e-learning but most of them are confined to the Internet or are web-based. There is only a small number of Filipinos who have an Internet connection and can avail of its services.

The Advanced Science & Technology Institute is the research and development organization of the Philippine government, under the Department of Science & Technology (DOST) that is mandated to pursue R&D in the advanced fields of Microelectronics and Information and Communication Technologies (ICT). The Mobile Systems & Applications Group (MSAG) is one of the technical teams in ASTI whose mission is to acquire, promote, and transfer knowledge and skills pertaining to wireless mobile technologies. The MSAG aims to contribute to the field of e-learning by supporting the concept of integrating e-learning in education and industry. Part of its plan is to encourage collaborative efforts in developing strategies and distributing e-learning tools.

Objectives

1. To present an e-learning tool which is the *BlueZ Bluetooth™* module - a low-cost, high-quality, and custom-designed development tool used in the local scenario
2. To discuss the team's strategic e-learning activities in the field of advanced wireless mobile technologies and to present the positive impact of the e-learning tool on students

Rationale

The Mobile Systems & Applications Group currently conducts R&D in Bluetooth™ technology. Bluetooth™ is a US$5B-industry that is expected to boom by the year 2005. The group would like to encourage local developers to enter the Bluetooth™ applications development market by providing the necessary tools. In order to do this, a Bluetooth™ protocol stack is needed.

Before extensive discussions, it may be necessary to first define important terms.

"Bluetooth™ is an emerging wireless standard, which aims to interconnect various personal devices in close proximity with each other. It uses short-range radio links to replace the cable(s) connecting portable and/or fixed electronic devices."
(Ballesteros, Borres, et.al., 2003)

"The Bluetooth™ protocol stack is a structured software defining a complete system from the radio right up to the application level. An example is *BlueZ*, which is the official Bluetooth™ protocol stack of Linux."
(Ballesteros, Borres, et.al., 2002)

"The kernel is the essential center of a computer operating system, the core that provides the basic services for all other parts of the operating system."
(http://whatis.techtarget.com/definition/0,289893,sid9_gci212439,00.html)

Generally, in order to develop applications using BlueZ, you need to do the following: 1) download the source files and 2) configure and recompile the kernel. In downloading the source files, one may encounter problems since there are several of them. The principal source elements are the *BlueZ Core* (which includes all the source files for *RFCOMM, HCI, L2CAP,* and *SDP* tools), *BlueZ Utils, Bluez Libs*, the *UART, USB*, and *HCI* emulation drivers. Aside from these, one would also need to download the

appropriate kernel to support BlueZ. All in all, these files amount to almost 40MB. This will require a reliable and fast Internet connection, which, as previously mentioned is a tool that only a few can avail of. When all the source files have been prepared, the next step is the kernel configuration. In order to run *BlueZ,* you need at least a version *2.4.4 Linux kernel*. However, if you wish to have efficient support for most of the modules, you would need to upgrade the kernel. This is a difficult and tedious task for a beginner. To solve these problems, every source module has been individually installed and the kernel has been configured and recompiled by the MSAG. A lot of other file editing, rehash, and setup, have also been completed. These are the core modules that the MSAG customized and included in the tool. For the modules to run, a Linux operating system is needed. One of the Linux distributions is the *Bayanihan Linux*. *Bayanihan Linux* is a fully customized desktop solution based on the popular *RedHat Linux* distribution. This has been developed by the *Bayanihan Linux* team in ASTI. It was chosen to be the operating system for the *BlueZ* module in order to consolidate the efforts of both ASTI groups in promoting an open source solution and reaching out to as many Filipinos as possible.

The end goal was to have a ready-to-use *BlueZ* system, without undergoing tedious installation, compilation, configuration, etc. Figure 1 shows some of the source modules installed in the *Bayanihan* CD.
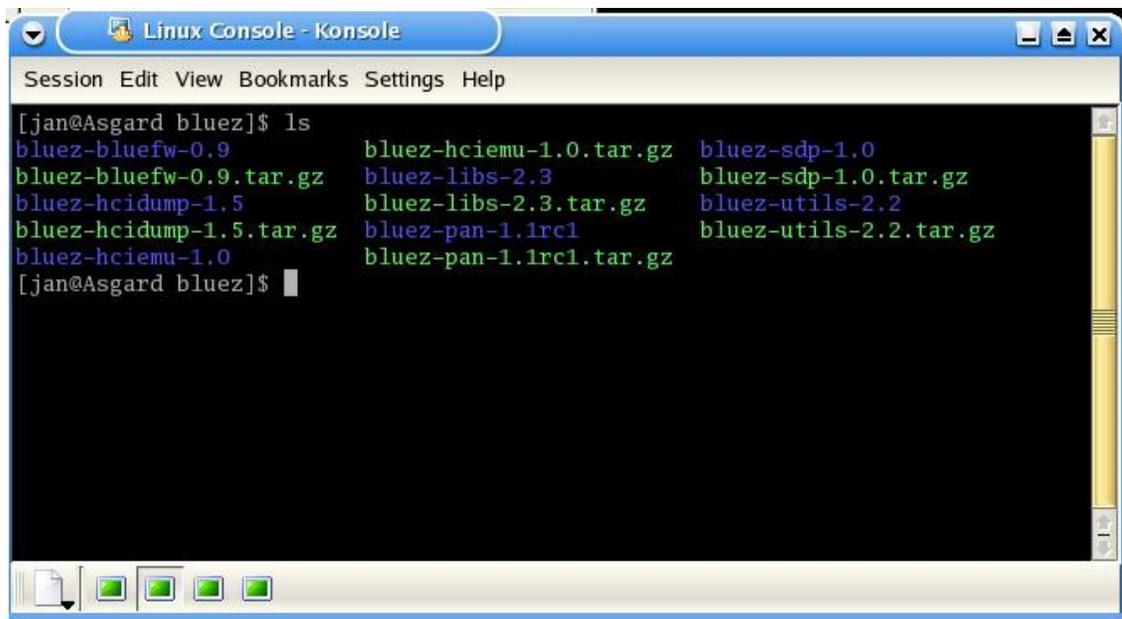

Figure 1 – BlueZ Source Files

The BlueZ Bluetooth™ Module in the Bayanihan Linux version 2.0:
An Affordable, High-Quality, and Custom-Designed Development Tool

The basic elements of a good learning solution include sound instructional design, high-quality, and affordability. The *BlueZ* module exemplifies good instructional design due to its being customized to fit the needs of a beginner. It is of high-quality for it is based on a stable open source software. It is affordable because it is essentially free.

It is said that open source software ensures high quality because it is always updated and continuously improving.

> "The basic idea behind open source is very simple: When programmers can read, redistribute, and modify the source code for a piece of software, the software evolves. People improve it, people adapt it, people fix bugs. And this can happen at a speed that, if one is used to the slow pace of conventional software development, seems astonishing. We in the open source community have learned that this rapid evolutionary process produces better software than the traditional closed model, in which only a very few programmers can see the source and everybody else must blindly use an opaque block of bits."
>
> (http://www.opensource.org)

Another essential feature of the *BlueZ Bluetooth™ module* is its affordability. In carrying out the team's plan of transferring knowledge and distributing e-learning tools, it is important that the tool is easily available and within the means of a developer's resources, because in most cases, particularly in the Philippines, the high cost of development tools has been a hindrance to software developers. Being open source, BlueZ is practically free. Table 1 compares the price of *BlueZ* with commercially available Bluetooth stacks.

Bluetooth™ Software	Price
BlueZ	US$ 0
Commercial Stacks	US$ 30,000 - 200,000

Table 1 - Bluetooth™ Software with Price

The Learners

Two students from a local college have been accepted to work in ASTI as on-the-job-trainees under the Philippine government's Presidential Summer Youth Workshop Program (PSYWP). As summer trainees, they were given a chance to choose their own short-term project that would focus on the Bluetooth™ technology. They were however confined to use the *BlueZ Bluetooth™ module* in *Bayanihan Linux* as their primary tool or resource. The students were chosen because they have no prior knowledge on the tool and on the Bluetooth technology. They however have a working technical background on basic C programming, a standard subject taught in Philippine universities/colleges. These were the team's requirements for the initial learners who would pilot test the e-learning tool.

The e-Learning Strategies

The main goal was provide minimum guidance to the students in their development of a wireless mobile application. One of the strategies was to give minimal supervision to the trainees, thus giving them more flexibility and freedom to explore what else there was to learn. Their hands-on experience with the technology, rather than the concepts or theories alone was effective since their knowledge was applied in creating a tangible output. Another strategy was to spur interest and encourage learning on their own. The last but not the least strategy was setting high standards or expectations on the students, as this imposed discipline and responsibility for learning on their part.

The Results

The students were able to come up with a wireless mobile application, utilizing the Bluetooth™ software tool included in the CD. Their project was called *"BT Chatter"*, a Bluetooth™ chat with file transfer application. The results demonstrate the positive impact of the e-learning tool on the students. Figure 2 shows the development environment and the codes in implementing the project. Figure 3 shows the screenshot of the "*BT Chatter"*.

The hands-on experience with the tool made it possible for them to develop, test, experiment, and apply their newly acquired theoretical knowledge. Even the students themselves were surprised that they were able to learn quickly, with very minimal supervision. The tool helped them by giving them a chance to study at their own pace and to have hands-on experience with the technology by utilizing the available tool.
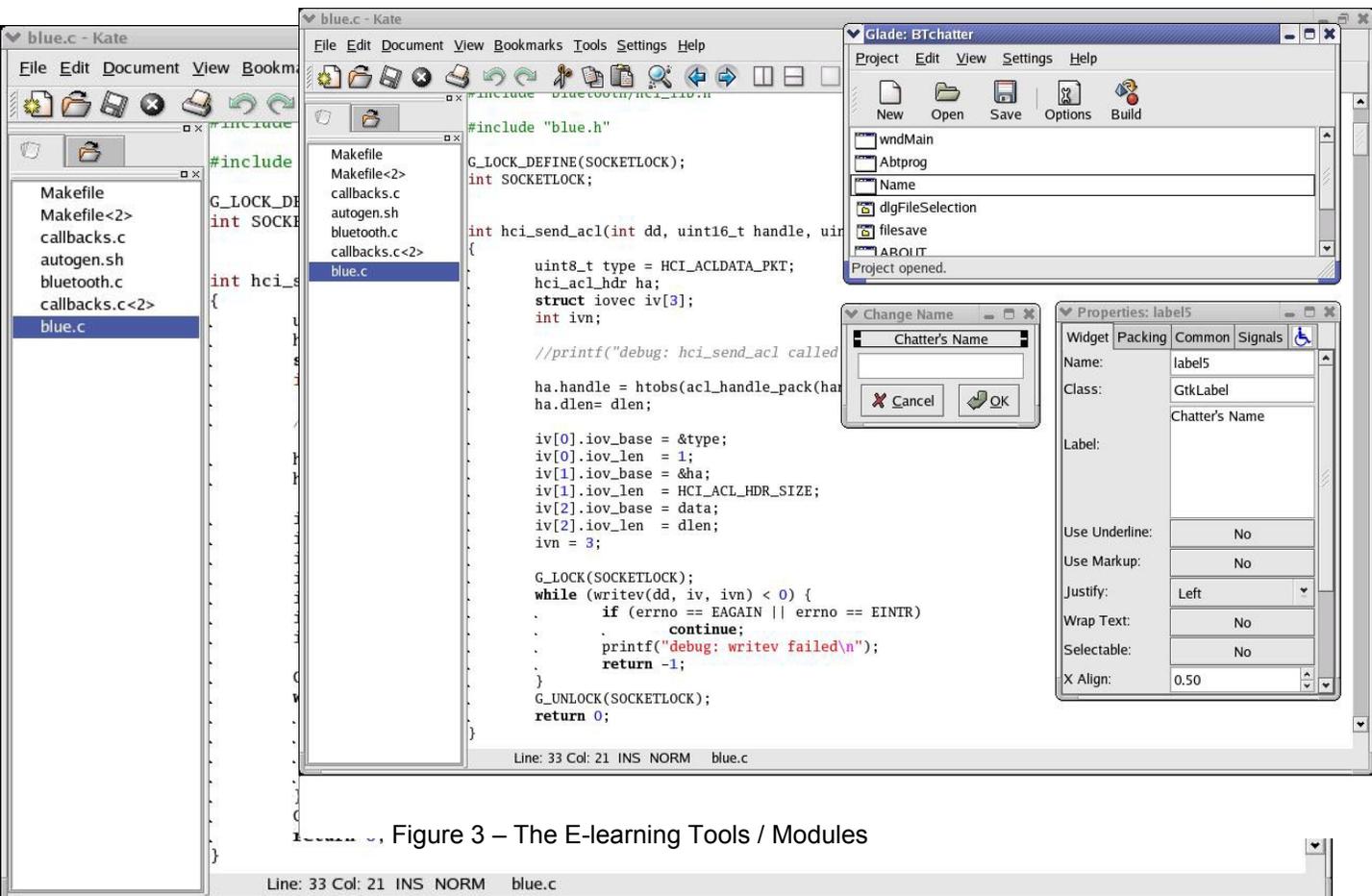

Figure 3 – The E-learning Tools / Modules

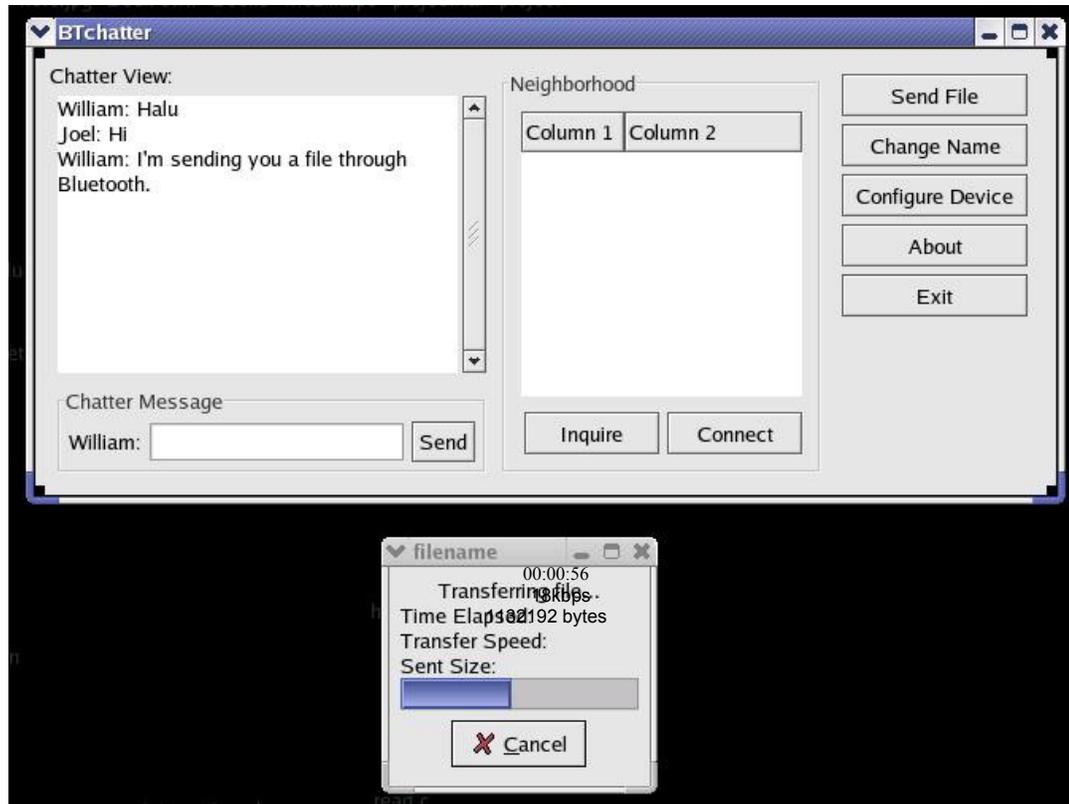Figure 5 – The Applications Development Environment

Figure 4 – The Result: BT Chatter & File Transfer Application

Conclusions and Recommendations

"There is indeed a vital need to integrate e-learning into education and industry because of its potential to make a huge impact on the corporate learning field."

(Guralnick, 2001)

Presently, e-learning is already integrated in some areas in the academe and the industry, but they are mostly confined to the Internet. Local e-learning is also possible through the use of low-cost, high-quality, and custom-designed development tools. This approach in e-learning was demonstrated to have positive impact on the students' learning process through the use of the *BlueZ Bluetooth™ module* in the *Bayanihan Linux version 2.0.*

Having these realizations, the team supports the concept to incorporate e-learning in the academe and industry. In doing so, the team fulfills its objectives, and at the same time addresses the learning needs and goals of the academe and industry. For future activities, the team plans to promote e-learning through the use of the *BlueZ Bluetooth™ module* in the *Bayanihan Linux version 2.0*, by conducting trainings and roadshows for faculty, students, industry developers, and other technology enthusiasts in the different regions of the Philippines. Another plan is to create a new version of the *Bayanihan Linux* CD, which is the *Bayanihan Linux Developer's Edition*, which would include tools for other wireless mobile technologies, not just Bluetooth™.

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