JorVoc: A Case Study in IrDA and a Wideray Jack.

Lizzie Narváez[†], Victor Chi[†], Erika Llanes[†]

[†]UADY, Unidad Tizimín, Tizimín, Yucatán, México.

Summary

This paper presents a case study showing the design and development of a system (software) for installation in a emitter content WideRay's Jack and makes the distribution of content using the infrared technology (IrDA) and personal digital assistants (PDA's), in order to have the information electronically rather than in physical format.

Key words:
Infrared, WideRay's Jack, distribution of content electronically, personal digital assistant.

1. Introduction

Technology continues to be vital to the development of many cities of the Mexican Republic. The digital divide between industrial cities and the developing world represents an opportunity for many universities to build sustainable models for the development of their students and their growth.

A peculiar trend in the development of the technological capabilities of the mobile handhelds (phones and PDA's) has taken place over the past few years [1]. This coupled with the proliferation of those around us.

The sophisticated development in communication is leading man to use the Wireless Communication day by day, to ease the connection between two electronic devices and to share data.

To interchange data, is of vital importance to use one of the following technologies as an intermediary: infrared sensors, internationally called IrDA Transceivers (Infra red Data Association Transmitter Receiver), Bluetooth, as well as the variants of the 802.11 protocol. Having in mind the reachable technology, it was used the infrared technology in this case-study; these devices are able to transmit and receive data in serial way without using any wire between them, but just a wireless connection of data using infrared light. Besides having a low cost, it is able to interchange data in both directions, with a transmission speed that goes from 1200 bps to 4 Mbps.

In February, 2000, a new stage of the Universidad Autonoma de Yucatan (UADY) is started in the city of Tizimín (located 160 kilometers from the capital, Merida), with the opening of a student unit, starting with the first semester of three degrees, plus another one which was opened in 2006. In May, 2001, the First Vocational Conference was carried out in the Unidad Tizimín, and from this moment a Vocational Conference is carried out year by year in this place (with the goal of showing to students the educational offer in the region, considering Tizimín and the city of Merida, where the head office is located). In these days, students from all the high schools of the municipality and closest cities come to the Unidad Tizimín, as well as advisor teachers, students' parents and people interested in knowing the educational offer.

Because of the amount of visitors, it was considered to give information in electronic way, instead of delivering leaflets of the degrees offered. So the idea is to develop a supporting system for the Vocational Conferences (called JorVoc from now), which contains relevant information of the different Schools that content the UADY, the degrees that are given in each one, the conferences, expositions and other activities that are carried out in the event.

This approach has the goal of obtain information in an efficient, easy and economic way, so a system was developed using wireless technology of infrared in an emitter content WideRay's Jack, so the student can have all the information he needs in a portable device, instead of taking a bunch of pieces of paper. (figura 1).

Figure 1. WideRay's Jack and a PDA.

The Vocational Conferences in the UADY implies that it is necessary to do a strong annual investment in publicity (mainly in leaflets and posters) from each School to promote the degrees to high school students, advisor teachers and any other person who could be interested.

This generates a big expense in material, which is thrown away most of the times. Most of the material ends in the trash cans because is not interesting enough for the student. There have been times when the schools run out of leaflets. This implies that a lot of resources are wasted and the method is not efficient for the UADY and at the same time for the environment.

Because of the situations explained before, having the relevant information of the event in a emitter content device WideRay's Jack, which main function is to emit advertising, promotional or general information to be upload in a PDA via infrared or Bluetooth, is an adequate option for events as described previously. The interested people can use this mean to download the information in

their mobile device, and besides, it would be a very efficient method for the university (there are no excessive expenses, as well it is very friendly with the environment) and for the student, since he or she can share it with another students, as well as they can analyze the information in other moment.

Many studies have been made to evaluate the WideRay Jack performance; for example in [2] SATELLIFE has used information technology to expand access to health and medical information in a variety of settings around the world. Over the past four years, SATELLIFE, UCH, and the Faculty of Medicine of Makerere University have successfully demonstrated that a network using handheld computers and wireless access points (specifically the WideRay "Jack") significantly improves communication, access to information, and the accuracy of data collection and analysis among health workers at the facility and district level in Uganda. In [3] mobile software publisher Handango Inc. and platform provider WideRay are joining forces to produce mobile kiosks that will offer Handago's catalog of 20,000 applications for devices such as personal digital assistants (PDA's). On the other hand, the content in [4] show us a very important point, WLAN hotspots are cool for internet access. However, there is actually a much larger addressable market of companies that want to provide focused content, information and services on location to a variety of mobile devices, rather than provide generic Internet access to laptops. A wired broadband back-end is overkill and is not scalable into the millions of points of presence. We solve the scalability problem by leveraging existing cellular networks for our back-end. The Service Point is a single-box concept that moves applications and content to the edge of the network and provides ad-hoc connections that offer real-time customer and workforce interaction opportunities. In [5] educators can use WideRay technology to publish, manage and retrieve data, such as homework assignments, school announcements and handheld-based examinations, as well as distribute third-party applications. In [6] is presented a case study of the use of WideRay, PDA´s and MTN Cellular Network. In [7] it is presented a mobile Catalogue of summaries of generation of the CFE, which contains basic information wherever the personnel go, independently if there is Internet connection. This system was developed using WideRay Jack.

2. IrDA Technology

In 1993, it was founded a no-lucrative strategic organization called IrDA, or InfraRed Data Association with about 160 companies as members. These companies develop computers, telecommunications, hardware, software, systems, components, adapters, as well as TV and telephone service and automobile suppliers [8]. This international organization creates and promotes the interoperability and standard interconnection of low-cost infrared data, which use peer to peer and mobile device models. The standards can be used with a wide range of applications, computers and communication devices.

Since 1994, IrDA defines a standard for a universal interoperability of the port of infrared transmission of data without using wire. The IrDA technology exists now in millions of electronic devices.

An infrared data interconnection is a connection using infrared light without using any wires. It is a technology for the interchange of data in two directions at a low cost.

It provides high digital speed of interchange, until the typical speed of a serial port (9600-115200 bps), and some compatible speeds to high speed, which run from 1 to 4Mbps of speed. The specifications of distance for infrared connections establish a standard with a 0~1 m range, although some companies specify their products in ranges larger than 1 m [9].

The infrared standard is used to assure the interoperation between devices of all of these types. One of the differences, between the different types of wireless communication is that the extended infrared connection lets the connection between a lot of devices, a direct line of vision is not required, and the connection can be unidirectional or bidirectional. It is based on visible light, which is a secure way of communication. The direct infrared connection is peer to peer, typically the communication one-to-one, it is not restricted by rules, it requires a line of vision and it is a secure way of transmission and reception of data, so it can access to a LAN with so much confidence as using a wire. The radio frequency is not sure considering that it can penetrate walls, it is restricted by an uncontrolled interference, and it is typically higher in power that the direct infrared [10].

IrDA specifies a wireless way to transfer data via infrared light. The specifications include the standards so the devices and protocols that they use can communicate one with another. The standards of IrDA needs to connect several mobile devices with others (the primary use for IrDA is to link notebooks or several devices of personal communication; however, some video cameras are equipped with IrDA interface).

The IrDA devices communicate with infrared light produced by LEDs. The wave length used is 875 nm +- the tolerance which is about 30 nm. The receptors uses the PIN photodiodes in the generation way, the light received release electrons and then the signal goes through a filter. This signal is only emitted by the frequencies permitted for a particular modulation of the IrDA. It exist a direct link between the energy of incoming radiation and the charge generated by the optical part of the receptor.

In IrDA it is defined an organization in layers, as it can be observed in figure 2.

IAS	IrLAN	OBEX	IrCOMM
	Tiny TP		
IrLMP			
IrLAP			
PHY			

Figure 2. Organización en Capas de IrDA.

Any device that want to obtain the approval of IrDA has to carry out the mandatory protocols IAS (Information Access Service, it acts as yellow pages for a device), IrLAP (Link Access Protocol, makes the connection and communication between devices easier), IrLMP (Link Management Protocol lets the multiplexation of the IrLAP layer) and PHY (Physical Signaling Layer establish the maximum distance, the transmission speed and the way in which the information is transmitted). However, it can omit some or all the optional protocols IrLAN (it lets to establish connections between portable computers and office LANs), OBEX (designed to let systems of any size and type to interchange commands in a standardized way), Tiny TP (improves the connection and the transmission of data respect to IrLAP) and IrCOMM (to adapt the IrDA to the method of operation of serial and parallel ports). This difference lets to developers to choose lighter and less expensive designs, which can be adequate to the most demanding requirements without stop using the standard IrDA.

Some examples of devices and protocols that use communication via IrDA are: printers, cell phones, PDA's, digital cameras, medical and industrial equipment and portable storage devices, among others.

3. WideRay Jack

WideRay Jack Service Point which is a solution for delivering local content to mobile devices over Bluetooth or IrDA. Jacks have been deployed in real end user environment, such as shopping malls and sports facilities.

WideRay Jacks are portable and can be wall-mounted in high-traffic areas and accessed by multiple PDA users. These jacks can support simultaneous synching of multiple PDA's within a 15 foot range [6].

WideRay is an equipment and integrated platform provider focused on the high-speed free-spectrum on-location wireless data services market. WideRay has developed a single-box architecture for deploying centrally managed, high-speed, low-cost wireless data services in scale, using both infrared and short-range RF for connecting with mobile devices. WideRay's back-end architecture is based on GSM/GPRS for global, always-on support [11].

In developing the system was used the WideRay Platform using a Jack Service Point. The model that we use for the development of the system supports infrared beaming.

Using the jack (figure 3):

Figure 3. Download the Application.

- Just turn on your handheld device and point it at the Jack.
- The first download, a short installer application, is quick - roughly 2 seconds.
- Download the WideRay installer.
- The installer application allows you to download the WideRay browser and content.
- The WideRay browser works like a web browser.
- Click buttons, links, images, and pulldown menus to navigate through content.
- Select the forward and back buttons to review pages. Select the home icon to return to the front page.
- Once downloaded, the WideRay browser can be used to access anywhere Jack. Select the WideRay icon to launch the browser. Point it at the Jack and download new information. You can stand up to 3 feet away from the Jack.

Some uses for jack are mention in the next:

- Retail.
- Trade Show / Conference.
- Sports / Entertainment Venue.
- Education.
- Healthcare.
- Information kiosks.
- Among others.

The Jack supports all Pocket PC 2002 devices, all Palm OS 3.0 and higher devices (including all Palm devices, the Handspring Visor, the Sony Clie, and the Kyocera Smartphone), and Symbian Series 60 devices (including the Nokia 3650 and 7650).

To receive the WideRay Browser (the first time you access a WideRay Jack) it's best to stand 2 to 3 feet from the Jack. If you have the Palm OS WideRay Browser installed and open on your handheld, you can stand up to 15 feet away to receive information. The WideRay Browser application

takes up approximately 100 kb of storage space on your handheld. The size of the content can vary; a typical content piece is 80 kb. It takes approximately 10 seconds to receive the WideRay Browser and approximately 10 seconds to receive content. A dialog box on your handheld will let you know that you are receiving the Browser. A status bar will progress as you receive the Browser and content. You do not need to download the WideRay Browser every time you want new content, simply open the WideRay Browser and then point your handheld at the Jack to receive the new content. The Jack will automatically detect that the program is open and will immediately send you content [12].

Whit the jack more than one person download at one time, because the Jack uses a proprietary beaming technology that allows an unlimited number of users to download information simultaneously.

Using a Palm OS device, beam the WideRay Browser and content to anyone with a Palm OS device. Open the content that you would like to beam, tap the menu key, and select "Beam to Friend." Aim the infrared port on your handheld towards the infrared port of the receiving handheld. If you are using a Pocket PC, you cannot beam to another handheld at this time [10].

If you want delete WideRay content from my Palm, is very simple, only open the WideRay Browser, open the content that you wish to delete, tap the menu key on your handheld, and select "delete." You can also delete the WideRay Browser application using the Palm Home menu. Deleting the WideRay Browser will delete the Browser and all its content [12].

4. Case Study: JorVoc

The UADY, Unidad Tizimín, trusts in the use of the digital technology; having this in mind, the system JorVoc was developed, which is offered to those people who are interested in knowing the options of degrees that can be studied in the UADY.

The motivation of the JorVoc case study was to give students and general public interested in degrees in UADY a quick reference of the educational range, as well as getting the technology closer to students who come to our University.

4.1 Design and Development of JorVoc

Once the potential users (students, teachers, vocational advisors, parents and high schools' principals) and their necessities (to know the options of degrees that are imparted in the UADY, including their description, work field, study program, the places where the conferences will be developed, the time, the speaker, as well as the plane of

the place to identify the different buildings) have been identified, the system was developed with the following modules:

- Relation of Schools that form UADY.
- To know the degrees which are imparted in each school.
- To know the description, the study program and the work field of each degree.
- A map to locate the Unidad Tizimín, in the city of Tizimín, place where the JorVoc system will be implanted.
- A map of the Unidad Tizimín, showing access to each building.
- When selecting the section of the map, a picture and the name of the place will be displayed.
- Relation of each one of the places where the conferences will be carried out, having access to the map, so the places can be physically located.
- The design of the map will have several detailed levels.
- The schedule of the conferences, including the hour, the speaker and the school.
- Furthermore, it is possible to add to ToDo (list of things to do) the conferences the person wants.

The information to manage the system JorVoc is divided in four basic functions, in the following way:

Schools.
- List of degrees.
  - Description.
  - Study program.
  - Work places.

Map of the Unidad Tizimín.
- Location of the Unidad Tizimín, in Tizimín city.
- Map of the Unidad Tizimín with access to each buildings.

Conferences.
- Places.
- Speakers.
- Schedule.
- Possibility to add some conference to ToDo.

Expositions.
- Location of the expositions divided in areas.
- Access to the map.

Using the UML (Unified Modeling Language) methodology, the use-case diagram used in the development of the system is showed in figure 4.
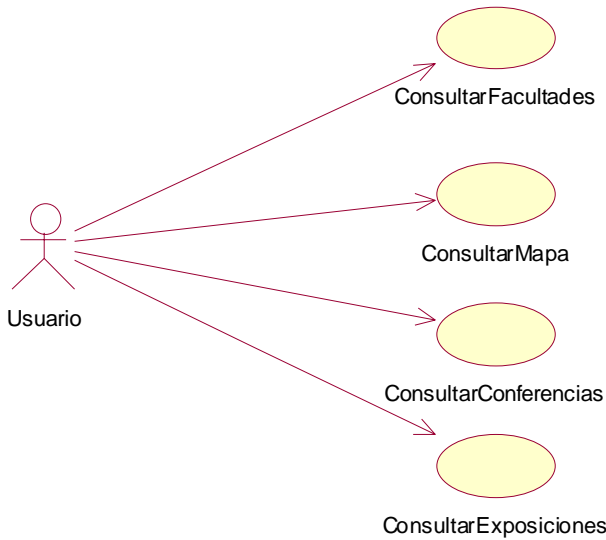
Figure 4.Use-Case Diagram of the System JorVoc.

Next it is presented a description of the previous diagram.

- The use-case ConsultarFacultades is described in table 1 and figure 5.
- The use-case ConsultarMapa is described in table 2 and figure 6.
- The use-case ConsultarConferencias is described in table 3 and figure 7.
- The use-case ConsultarExposiciones is described in table 4 and figure 8.

Table 1. Use-Case of *ConsultarFacultades.*

Use-case Name	*ConsultarFacultades*
Description	This use-case is used when a user wants to consult the list of schools of the university, as well as the degrees, the description of each one, the study program and the length of them.
Stakeholders	*Usuario*
Basic Flow	1. The *Usuario* selects the option *Facultades.* 2. The *Usuario* chooses a school from the list of schools displayed. 3. The *Usuario* selects a *Degree* from the list displayed, corresponding to the School previously selected. 4. The *Usuario* consults the information of the selected degree (description, study program and length).

Figure 5. Use-Case Diagram of *ConsultarFacultades.*

Table 2. Use-Case of *ConsultarMapa.*

Use-case Name	*ConsultarMapa*
Description	This use-case is used when a user wants to consult the location of the Unidad Tizimín and the location of each one of the buildings.
Stakeholders	*Usuario*
Basic Flow	1. The *Usuario* selects the option *Mapa*. 2. The *Usuario* selects the area of the Unidad Tizimín. 3. The *Usuario* selects an area of the map of the Unidad Tizimín. 4. A picture of the selected area is displayed

Figure 6. Use-Case Diagram of *ConsultarMapa.*

Table 3. Use-Case of *ConsultarConferencias.*

Use-case Name	*ConsultarConferencias*
Description	This use-case is used when a user wants to consult the conferences that will be carried out, where and when, as well as who will be the speaker.
Stakeholders	*Usuario*
Basic Flow	1. The *Usuario* selects the option *Conferencias.* 2. The *Usuario* selects one of the places where a conference will be carried out. 3. The list of the conferences in the selected place is displayed. 4. The *Usuario* adds a conference to his / her list.

Figure 7. Use-Case Diagram of *ConsultarConferencias.*

Table 4. Use-Case of *ConsultarExposiciones.*

Use-case Name	*ConsultarExposiciones*
Description	This use-case is used when a user wants to consult the exposition which will be carried out, the place where it will be carried out, and additionally they will be located in the map.
Stakeholders	*Usuario*
Basic Flow	1. The *Usuario* selects the option *Expo*. 2. The *Usuario* selects one of the places where a conference will be carried out. 3. A picture of the place is displayed.

Figure 8. Use-Case Diagram of *ConsultarExposiciones.*

The following components were used for the development of JorVoc, both hardware and software:

- A PDA device.
- A html editor.
- Software of graphic design, Fireworks.
- A WideRay Jack device for the emission of content.

An extract of the code of JorVoc is presented, which corresponds to the initial screen:

```
<html>
<head>
<title> Jornadas Vocacionales </title>
</head>
<body bgcolor="#FFFFFF">
   <table>
      <tr>
         <td align="center"> <IMG src="index_logo.gif"></td>
      </tr>
      <tr>
         <td align="center"> <A HREF="facs.htm"> <IMG
            src="index_menu_facs.gif"> </a> </td>
      </tr>
      <tr>
         <td align="center"> <A HREF="mapa.htm"><IMG
            src="index_menu_mapa.gif"> </a> </td>
      </tr>
      <tr>
         <td align="center"> <A HREF="conferencias.htm"><IMG
            src="index_menu_conf.gif"> </a> </td>
      </tr>
      <tr>
         <td align="center"> <A HREF="exposiciones.htm"><IMG
            src="index_menu_expo.gif"> </a></td>
      </tr>
   </table>
</body>
</html>
```

Once the programming of the system was ended using html and a text editor, the next step was to upload it in the WideRay's Jack, and to access to it, it was used a PDA with infrared technology to download it and then interact.

4.2 The System JorVoc.

The main screen of the system from the user can access to all options (being the 4 basic the mentioned before: Facultades, Mapa, Conferencias and Expo) is shown in figure 9. It is important to mention that the simulator of PalmOS was used to test the system.

Figure 9. Main Screen of the System.

The main screen of the option *Facultades* is presented in figure 10. In it, the student has to select the School he/she prefers from a list of 16, and then it is presented the list of degrees that the selected school offers and by choosing an option it is displayed: the description, the study program and the work field of the chosen degree.

Figure 10. Option Facultades.

Another of the basic options is *Mapa*; the screen of this option is shown in figure 11a. In this screen the student can locate the Unidad Tizimín in the city of Tizimín and choose UT UADY, and it will be displayed the screen that as is shown in figure 11b; using this option the user can know the location of each one of the sections; furthermore, it is displayed a picture of the place.
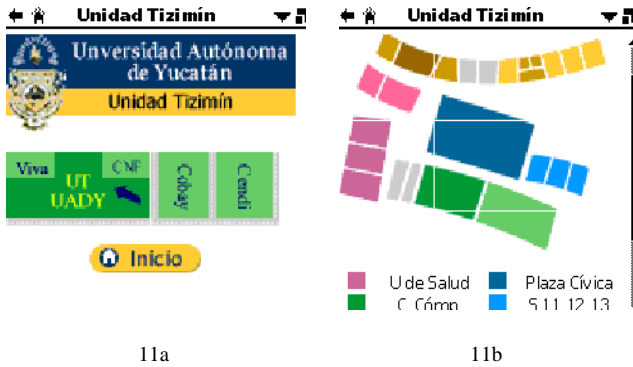
11a   11b

Figure 11. Option Mapa.

The next basic option is *Conferencias*. By selecting this option, it is displayed a screen as it is shown in picture 12a; in it the user can select one of the places that are shown, and then the name of the conference and the speaker are displayed. As we can see in figure 12b, this section has the functionality to add conferences using ToDo option.

12a   12b

Figure 12. Option Conferencias.

The last main option is *Expo*. By selecting it, a screen as is shown in figure 13 is displayed; the user will select a color that indicates one of the areas of the map and it is displayed a picture of the place so the user has a better image of the picture.

Figure 13. Option Expo.

6. Conclusion

The sophisticated growth in the world communication is leading man to use the wireless communication more frequently to ease the connection between two or more electronic devices.

This paper presents a study case of a service, which is based on wireless distribution of rich mobile multimedia content. Beforehand, the generated static content was uploaded into a WideRay Jack service point, from which users could download it using infrared connection to a Personal Digital Assistant device.

First, the service was tested in an experimental way in the laboratory and then was implemented and downloaded (in a controlled environment) for a determined amount of users, who reported to be comfortable with the system, as well as they were satisfied with the content of the information, so it can be stored for more time and share in every moment.

The next step to this investigation is to implement the system JorVoc in a real environment and evaluate it especially useful.

Referencias

[1] Mobile Kärpät – A Case Study in Wireless Personal Area Networking. Ojala, T; Korhonen, J; Sutinen, T; Parhi, P; Aalto, L. MediaTeam Oulu; University of Oulu. Finland. 2004.

[2] Development and Testing of African Access Point (AAP). Faculty of Medicine of Makerere University. March 2007.

[3] Handango, WideRay to deliver wireless downloads from a kiosk. Consultado el 3 de abril de 2009 en https://www.kioskmarketplace.com/article.php?id=122 41

[4] Teliasonera/WideIay launch Jack Service Point. Worldwide Telecom. May 2003.

[5] Technology Training Is Top Priority for Educators at New York's All-Digital Education Conference. el 3 de abril de 2009 en http://files.shareholder.com/downloads/PALM/0x0x24 1154/1fd9bc5e-0370-41d3-9881-fc265f2b630c/340724.pdf

[6] What Works: Healthnet Ugand's Evolution from NGO to Sustainable Enterprise. Phipps, K; Sangudi, G; Woolway, S. World Resources Institute. August 2003

[7] Mobil Power. Catálogo de Móvil de Centrales de Generación de Energía Eléctrica. Galván, I. IIE-CFE. Mayo 2006.

[8] Infrared Data Association. Consulted in January 2009. http://es.wikipedia.org/wiki/IrDA

[9] IrDA, (InfraRed Data Asociation). Ochoa A., Rosaldo

S., Tequitlalpa M. Notas de curso de Redes Inalámbricas. Cuernavaca, Morelos, México, Octubre de 2003

[10]WIDERAY, Content Development Guide and Tutorial. 2002-2003. WideRay Corporation. USA.

[11]Portable Computer and Communications Association. Newsletter, Volume 7, Number 2. June 2002.

[12]WideRay: a new information delivery system. David M. Urbanski. November 2004.

Lizzie   Edmea   Narváez-Díaz [lendiaz@uady.mx] received the degree in Computer Science from the the Autonomous University of Yucatán (UADY) in 1997. She received the Master of Computer Science degree from Monterrey Technological Institute (ITESM), Campus Cuernavaca, in 2007.
Currently, she is a full time teacher at the Autonomous University of Yucatán since 2000 at the Network department in Tizimín México. She has participated in development projects of software engineering. Currently is giving courses on wireless networks in the professional programs in the UADY.

Victor   Manuel   Chi-Pech [victor.chi@uady.mx] obtained his degree in Computer Science from the Autonomous University of Yucatan (UADY) in 1996 and his M. Sc. degree in Wireless Network from Monterrey Technological Institute (ITESM), Campus Cuernavaca, in 2007.
Victor Chi works since 2000 in the Autonomous University of Yucatan, as a full time professor. He has participated in development projects of software engineering. Currently is giving courses on wireless networks and software engineering in the professional programs in the UADY.

Erika   Rossana   Llanes-Castro [lcastro@uady.mx] received the degree in Computer Science from the Autonomous University of Yucatan (UADY) in 2002. She this next one to receive Computer Science degree from Monterrey Technological Institute (ITESM), Campus Estado de Mexico.
Currently, she is a full time academic technician at the Autonomous University of Yucatan since 2002 at the department of computer in Tizimín México. She has participated in development projects of software engineering. Currently is giving courses on programming mobile devices in the professional programs in the UADY.