Journal of Information Technology Impact
Vol. 4, No. 3, pp. 161-170, 2004

Universal Wireless Center: A Multi-Purpose Small Business Model

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Abstract

The electronics that overwhelm our life are no longer standalone devices. Interconnection has almost turned into a requirement. These connections require wiring. These wires have become an unsightly, unmanageable, and tangled nuisance. To address this nuisance, we propose a wireless model called Universal Wireless Center (UWC). This model connects electronic devices wirelessly. The UWC--which uses Bluetooth technology as a component-- can be used for multi-purposes by businesses including the small businesses. UWC can be used to transmit information of small, medium and large sized businesses; the various types of businesses which the UWC support include manufacturing factories, software development facilities, health facilities, educational settings, and sales facilities. Another benefit of using the UWC is that it reduces business expenses by elimination of technical support and cable connectivity. The model also helps in attraction of new customers and theft-protection of business environment. The UWC model provides efficient, reliable, and secured wireless communication.

Keywords: Bluetooth wireless technology, Universal Wireless Model, software development, security, data transmission, small business

Introduction

The electronics devices that overwhelm our life are no longer standalone. Interconnection has almost turned into a requirement. These connections require wiring. These wires have become an unsightly, unmanageable, and tangled nuisance. To address this nuisance, we propose a wireless model called Universal Wireless Center (UWC). This model connects electronic devices wirelessly. One of the components of the model is the Bluetooth wireless technology.

Bluetooth is a low cost, low power, short-range radio frequency technology. Bluetooth is a chip that works by using small RF (radio frequency) modules that are imbedded in electronic devices. These radios operate at the unlicensed frequency of 2.4 GHz. They send out a signal of only one milliwatt in the standard mode. This allows a range of about ten meters (Blankenbeckler, n.d.; Mitrovic, 2002). Bluetooth creates a personal area network (PAN) also known as piconets. A piconet consists of two to eight Bluetooth equipped devices that hold

communication links (Franklin, n.d.). Bluetooth has much stronger success in Europe and Japan (Brown, 2002).

Thus, the UWC—which uses Bluetooth technology-- can be used for multi-purposes by businesses including the small businesses. For example, the UWC can be used to transmit data and information of small, medium and large sized businesses; some the various types of businesses which the UWC support include manufacturing factories, software development facilities, health facilities, educational settings, and sales facilities.

The format of the rest of the paper is as follows: Section 2 describes Bluetooth overview. Section 3 proposes a new model, Universal Wireless Center. Section 4 discusses applications of the Universal Wireless Center. Section 5 presents the benefit/impact of the proposed Universal Wireless Center application (in the small, medium and large sized businesses). Section 5 presents the summary and conclusion.

Bluetooth Overview

This section discusses an overview of the Bluetooth, including communications and security issues.

Communication

When one Bluetooth enabled device comes within range of another, they will open communications to determine if a connection is required. This determination is made based upon what profiles each device was developed for. Once a device receives the 48-bit address of another device, the profiles available can be determined. If the devices have a common profile, a connection will be established (Franklin, n.d.; Bluetooth, 2004).

Four automated steps are required in this connection process to allow Bluetooth to be used. The first is device discovery. Here a Bluetooth device is sensed, addresses are exchanged, and the device type identifier is detected (for example, printer, phone, PDA, etc.). Next a logical name for each device is given. This can be a name set by the equipment owner or a default name from the manufacturer. Association then occurs as the third step. This is where the devices actually make a connection. Once the need for a connection is determined, the devices will decide which device should be the master and which should be the slave. This is determined by the functions of the devices within the profile. The master device will determine these. It will dictate the exact timing of the hopping in order to sync the devices. It will also make the slave aware of the pseudo-random frequency hopping sequence that is to be used (Brown, 2002; Frazier, 2000; Proust, 2000). The devices will use their agreed upon methods to hop between 79 different frequencies at a rate of 1600 times a second. Communication consists of packets passed between slave and master devices. The master device will transmit data in the even numbered time slots. Slaves transmit in odd numbered slots. Communication connection remains until one of the devices terminates the link, the devices drift too far apart, or a slave becomes parked. (Blankenbeckler, n.d.; Bluetooth, 2004).

A network (piconet) consists of two to eight Bluetooth equipped devices that hold communication links. Each network has a master that controls up to seven slave devices. Every slave in the network receives a 3-bit active member address; that is 1-7 slave addresses and one master address can be received. If a network requires more than eight devices to connect, a slave can be parked. Networks can overlap to form a scatter-network.

Figure 1 shows an example of a scatter-network, which consists of three networks (piconets) where the master devices are personal computer, PDA, and cell phone. The remaining devices serve as slaves.

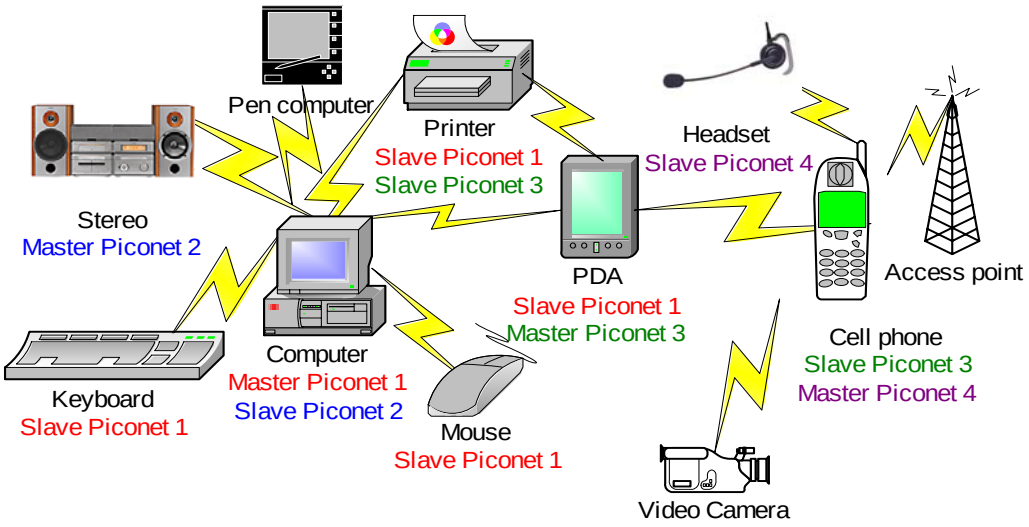

Figure 1. A Scatter-Network

Security

Of course any time data is transmitted and especially when it is done through the air, security is an important concern. Bluetooth addresses this in several ways. The security for Bluetooth are inherited by its nature. The signal for Bluetooth devices only extends ten meters in any direction. This makes it very difficult to tap into. A person with malicious intent would have to be very close to a device to eavesdrop. The frequency hopping that Bluetooth uses also increases its security. In order to read data that is transmitted from a device, you will need to be on the same frequency. However, since there are 79 frequencies visited at a rate of 1,600 a second, it is very difficult to follow without knowledge of the timing and sequence (Bluetooth SIG, 2002; Schwartz, 2003; Schwartz, 2003; Ries, 2002). Application developers are also encouraged to add security within the host application (Bluetooth SIG, 2002).

Universal Wireless Center Model

We propose a Bluetooth wireless communication model called Universal Wireless Center as seen in Table 1. This UWC model is arrived at by consulting with businesses that use various wireless devices on daily basis. Some of these devices include PDAs, laptops, mobile phones, printers, faxes, home appliances, factory devices, car accessory, medical devices, and headsets. Of course, the UWC is updated as time goes by based on revised required needs of the users of the center. In Table 1 we propose different devices/equipment.

Table 1. Universal Wireless Model

Devices/Equipment					
Devices	Quantity	Devices	Quantity	Devices	Quantity
Camera	2	Server-DB	2	laptop	3
Desk top	2	Printer	2	fax	2
PDA	1	Mouse	5	Scanners	4
Mobile Phones	2	Keyboard	5	Speaker phone	4
Plotter	1	Projector	3		
Vehicle	2	Thermometer	1		
Head Set	2	Lightening	2		

To use the UWC for a particular business activity, specific devices and quantities that meet the requirements specification of the business are selected. (User/business required software –such as Microsoft Visio, Word, Project, and Visual Basic programming language-- will be pre-installed and configured on the appropriate devices.) . The selection is submitted to the UWC management.

After submission, the UWC management sees to it that the devices are brought to a building premise and the devices are automatically connected.

In the following subsections we will discuss some examples based on the UWC model. The examples are cordless computer system, ultimate head set system, and Internet Bridge.

The Cordless Computer System

The cordless computer system can be set up by attaching peripherals to computer using Bluetooth wireless communication as shown in Figure 2. In this figure, the laptop is the master and the other devices -- printer, fax/phone, scanner, access point, Personal Digital Assistant (PDA) keyboards, and mouse -- serve as slaves. We have to stress that the master can also be a different type of device, say the speakerphone.

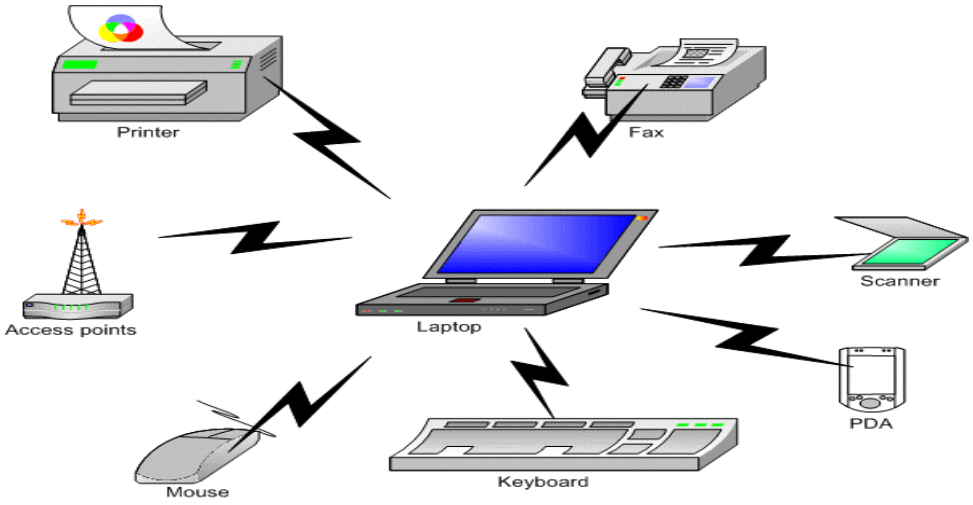

Figure 2. Cordless Computer

This system can be implemented in a small business environment, such as an insurance agency office, pharmacy, and home based businesses. Most importantly, businesses in depressed areas of advanced countries and those in developing countries –where money and technical support is hard to come by--can take advantage of the UWC.

The Ultimate Headset System

The ultimate head set system can be set up by placing different devices including wire-line phone, laptop, and mobile phone to communicate with the ultimate headset using Bluetooth wireless voice and data communications as shown in Figure 3.

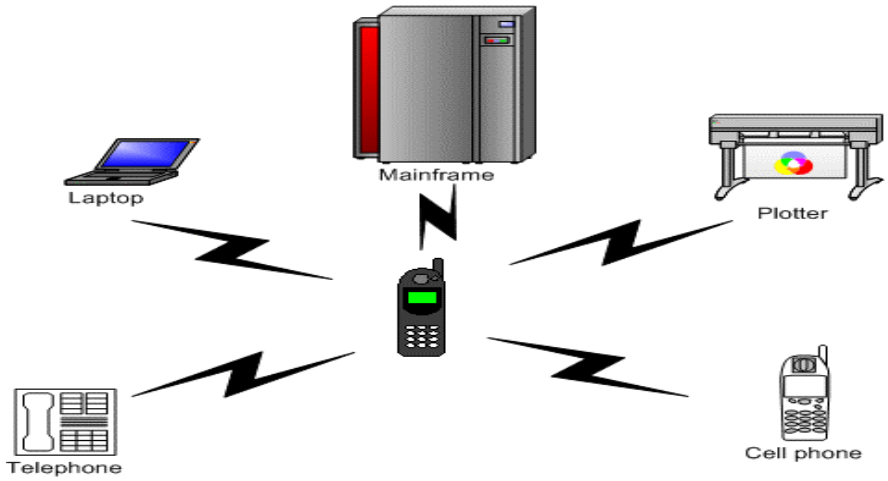

Figure 3. The ultimate Headset System

Figure 3 shows the mobile phone at the center of the network serving as the master that controls the other devices -- printer, telephone, cell phone, mainframe computer laptop and plotter -- serving as slaves.

This system can be implemented in small and medium business environments, such as medium size factory, an architect office, and business that deal with data crunching. Meeting can be held within the confines of the business environment.

3.3 An Internet Bridge

An Internet bridge can be set up using data access point with the Bluetooth chip as bridge between Internet and other devices such as printers, faxes, phones, PDAs, and laptops. Therefore, data access point can simply provide a "wireless plug" to connect to the Internet and other devices as shown in Figure 4.

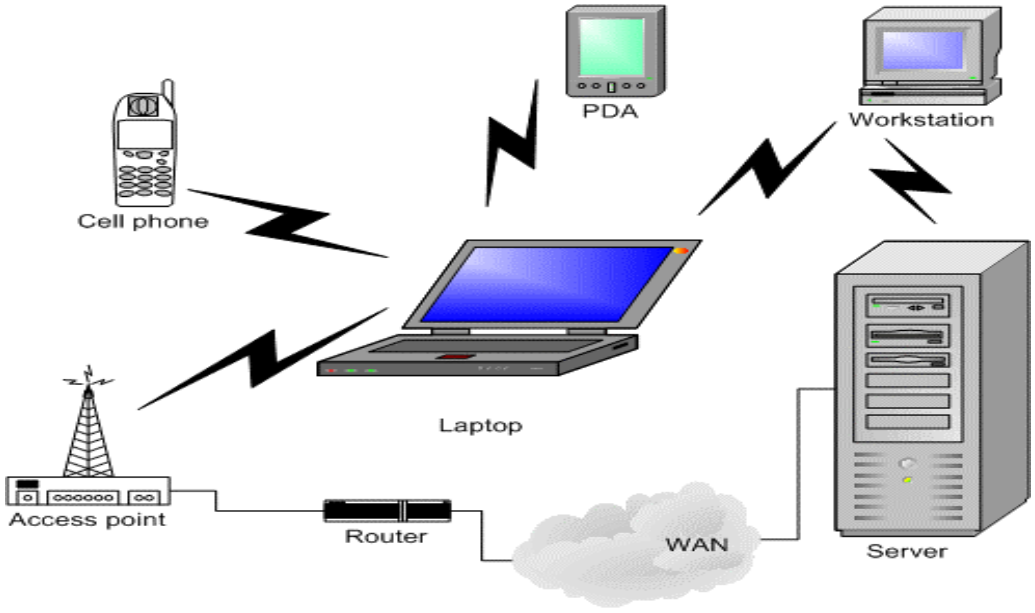

Figure 4. Internet Bridge System

Figure 4 shows a laptop at the center of the network serving as the master that controls the other devices including server and access point. Moreover, the WAN serves as an Internet bridge between the server and the router to the access point (Tanenbaum 1996).

This system can be implemented in small, medium and large business environments, such as an automobile factory.

In the next section, we present some detailed applications of the UWC model.

Applications of the Universal Wireless Center

In this section, we apply the Universal Wireless Center as applicable in small, medium and large size businesses. To use the UWC for a particular business activity, specific devices that meet the requirements specification of the business are selected. Upon selection and submission, the devices are brought to a building premise and the devices are automatically connected for use. We describe some of the possible business activities that the UWC can be used for. Examples can be found in manufacturing factories, software development facilities, health facilities, educational settings, and sales facilities.

- Manufacturing Factories
- Software development facilities
- Healthcare facilities such as hospitals
- Educational facilities
- Business: Delivery/Ordering/Sales Service

We will describe the activities and device requirements for each of the business types.

Manufacturing Factory

And example of a manufacturing factory is one that manufactures vehicles. Here the UWC is set up by identifying devices required to manufacture automobiles. These devices include automated guided vehicles, tire assemble and painting. An automated guided vehicle on a vehicle factory floor 1) picks vehicle parts for assembling of a new vehicle and 2) parks the complete manufactured vehicle. Here we set in a Bluetooth chip in the vehicle to serve as a slave that is remotely controlled by say a Bluetooth mobile phone—serving as a master. We can also have the Bluetooth mobile phone integrated into the other factory manned-vehicles microphone and speakers, thereby freeing the hands and eyes of the driver; this allows the driver to be more productive and efficient with is hands and eyes doing other functions.

We will also use the PAN to perform Security Systems work. No human security is needed; we have remote unattended devices provide security surveillance on during a 24-7-365 hours a year. This ensures that small and medium size properties are theft-free. Lights can be automatically turned on and off as programmed.

We can have a Bluetooth device function as an equipment locator/finder for locating Bluetooth items in the factory.

Software Development Facility

Application software systems include business, network, engineering, and educational and musical systems. We can apply an appropriate software development life cycle, such as the waterfall model, to develop new systems. Of course, we will apply best practices of project management and total quality management to ensure high quality systems that will benefit both suppliers and end-users. The Internet bridge system, cordless computer system, and/or ultimate headset system can be used for file transfer among the system developers. Yes, the ultimate headset systems can facilitate communication among developers; for example, developers can

gather high quality, correct and complete requirements (Pressman 2001, Young 2002) from customers without having to walk to them. Business video conferencing meetings can be conducted from the comfort of offices of meeting participants via wireless video conference devices connected as PAN. In the same way, the cordless computer system can be used by designers to design systems. Of course, programmers can use the same cordless computer system to program and test systems. Testers including the customers and end-users can test systems. And most importantly, project managers can use Internet bridge system, cordless computer system, and/or ultimate headset system for managing software projects; developing project plans, track and control projects. Project manager can use PAN to report project status to upper management.

Healthcare facility

The ultimate headset system can be used to augment heath care activities. The user of the headset is not physically tied to the audio device and thus is free to roam in an area while keeping the connection intact. This headset system can be applied in healthcare facility; nurses and doctors, for example, apply such a system to assist in performing surgery. Health care video conferencing meetings can be conducted from the comfort of healthcare providers' offices in diagnosing patient cases. Of course, the providers can access patients' medical records stored in an electronic medical record system via cordless computer and ultimate headset systems.

Relatives of hospital patients, who live in neighboring hotels, can contact hospital personnel and other relatives via Internet bridge system and ultimate headset system; That is a hotel room telephone or a relative's own mobile phone could be used as a the ultimate headset system; the hotel may provide Bluetooth chips for clients' personal mobile phones.

The health care facility can have a 24-hour Security System. No human security is needed; we have remote unattended devices provide security surveillance during every hour of the year. When healthcare providers are discussing patients' medical records, the records are protected from eavesdropping of bystanders since Bluetooth chip provides secured voices and data transmissions.

Educational Facility

Educational meetings can be conducted from the comfort of the offices and/or homes of the students and instructors. Courseware can be developed by faculty; students can access the courseware. Students can work on assignments remotely and efficiently.

Also the educational facility such as parking lots can have a 24-hour Security System. Remote unattended devices provide security surveillance on campus every hour of the academic year.

Business: Delivery/Ordering/Sales Service

Business meetings via video conference can be conducted from the comfort of offices. Customer relations management system can be remotely accessed to provide efficient services for new and old customers, which will enhance and maintain good customer relationship.

A delivery system can have a call center to support business. Businesses can transmit support data and voice information without being tampered, which will enhance the customer trust in the business.

A financial system can be accesses from any office in the small business premises. Business network security and management systems can also be provide via UWC. Remote cashier can operate Bluetooth keyboard or mouse at a cashier's checkpoint computers systems by picking and scanning the items, and assisting a customer to make payments.

UWC can also be used by the marketing department of a business to target a market segment and to position a premium priced and high quality product in the minds of the people in the segment (Kotler 2003).

Conclusion and Benefits

This paper discussed Bluetooth and how it can play vital and secured roles in different business environments. In this paper we proposed a new model called Universal Wireless Center. Using the Model we proposed several applications such as manufacturing and software development facilities.

The benefits of the UWC include enhancing of businesses. UWC provides efficient, reliable, and secured wireless communication. This model reduces business expenses by elimination of technical support and cable connectivity. It helps in attraction of new customers and theft-protection of business environment.

For future work, we intend to further interview businesses for specific requirements. We will use the result to update the UWC model to be applicable to other types of businesses not listed in this paper. In additions, we will survey the benefits –including cost reduction, profit margin, and ease of use-- of the UWC. Software will also be developed to automate the UWC model.

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