Exploring the implementation and application of Bluetooth technology in the shipping industry

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Abstract

Bluetooth technology has become more and more popular in today's worldwide operations. Its impact on the shipping industry is specifically unique and profound. The purpose of this study is to explore the implementation and application of Bluetooth technology in the shipping industry. This article first introduces the standard and technology of Bluetooth as well as the efforts to develop and promote the standard. Then, the current status of Bluetooth applications in the shipping industry is discussed. Further, three cases, including FedEx, UPS and DHL, are studied along with a Strategic-Managerial-Organizational-Technological-Security-Social (SMOTSS) analysis. The article is concluded with the implications and future of Bluetooth technology.
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1. Introduction

Bluetooth technology has recently become more and more popular among companies and personal users alike [1]. One of the main attractions for companies today is that Bluetooth enables wireless connection without needing a line of sight connection. Bluetooth is a short-range radio technology that was originally designed to be low cost, low power, and a replacement for cabled technologies [2]. The technology enables users to sap data and synchronize files without having to physically connect the devices together.

Before Bluetooth technology was used by shipping companies, the tasks involving their daily activities were usually very redundant. For example, instead of having peripherals communicating with each other automatically, companies had to hire extra help in order for some of the tasks to be done. These particular jobs include keying shipping data, package data, shipping routes, etc. into databases manually. It was not a difficult job at all, but it was a tedious task. Most importantly, it required shipping companies to contribute a massive amount of time to the process. As an operating rule of thumb, shipping companies live on time. Without the technology, drivers who might be considered some of the most important workers in the business are more in danger because of a lack of hands-free technology when they are on the road. These particular examples illustrate the need for a wireless technology for the package shipping industry. Therefore, many companies have selected Bluetooth wireless technology to help them improve their daily business operations.

The purpose of this study is to explore the implementation and application of Bluetooth technology in the shipping industry. Section 2 introduces the Bluetooth standard and technology as well as the efforts to develop and promote the standard. The current status of Bluetooth applications in the shipping industry is discussed in Section 3. Further, case studies of FedEx, UPS and DHL are reported in Section 4. In Section 5, a SMOTSS analysis is conducted based on the case studies.

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Implications and the future of Bluetooth technology is discussed in the conclusion.

2. Bluetooth: the standard, technology and efforts

2.1. The standard and technology

Bluetooth.org [3] describes Bluetooth wireless technology as a global wireless standard for personal connectivity of a broad range of electronic devices. According to TechEncyclopedia [4], Bluetooth is defined as an open standard for short-range transmission of digital voice and data that supports point-to-point and multipoint applications. In reference to Bluetooth.com [5], the latest core specification, Version 2.1+EDR, was published on July 26, 2007 to advance its short-range wireless technology and make it easier for consumers to connect Bluetooth devices with improved security and lower battery consumption. The development of this technology is established upon its inherent strengths — small-form factor radio, low power, low cost, built-in security, robustness, ease-of-use, and ad hoc networking abilities.

This inexpensive communication standard allows various types of electronic equipment to communicate with each other through a wireless system without direct action from a user. These communication speeds from Bluetooth are real time and do not require humans to plug or pull the cables [6]. Besides elimination of cables, Bluetooth eliminates the drawbacks of other wireless connections such as infrared and cable synchronizing. First, Bluetooth uses a radio frequency to communicate through the devices. Second, Bluetooth provides agreement on when and how many bits are sent at a time, and it makes sure the message sent is the same message received. Once the agreement is reached, the Bluetooth enabled products communicate at a frequency of 2.45 GHz [7].

When Bluetooth devices come within proximity of each other, they electronically and automatically communicate and establish if they have data to share or when one needs to control the other. Each Bluetooth enabled peripheral has a programmed address transmitter in it, which is within a range of addresses established for a certain device. The device sends out radio signals, and if another device within the same address range receives this signal, it will send a signal back to the original device and a personal area network (PAN) is formed. Bluetooth devices can only communicate with each other if they have the same profile and capabilities [6,7].

In order for two electronic devices to communicate with each other, the devices have to be in agreement on several levels before the conversation can begin. First the devices need to agree on what type of connection they are going to communicate through. Communication can be through wires or a type of wireless signal. The next level that needs to be determined is how the information is to be sent. The information can be sent through a serial communication scheme, which sends information one bit at a time, or it can be sent in sets of bits using a parallel communication scheme. Lastly, the devices need to know what the bits mean and establish a protocol for all the devices to communicate with each other [7].

Bluetooth enabled products provide companies with many advantages. For example, a company has Bluetooth technology installed in its offices on peripherals such as headphone sets, PDAs, computers, and printers. Instead of plugging in all of the wires necessary for the peripherals to work properly, the wireless connection will establish itself when it comes into range. The headphones also provide a hands-free environment for the workers, and it will enable more multi-tasking jobs by the employees. Another advantage is that Bluetooth deals with interference problems by using a weak signal of one mill watt. Since the signal is so low, Bluetooth devices can only communicate up to 10 m. This short distance eliminates the chances of two devices interfering with each other. Even with several different Bluetooth devices in one room, interference is still not a problem because of spread-spectrum frequency hopping [7].

Security is one of main concerns for Bluetooth. Since it is an open standard, it is easy for hackers to get into it. It is also a problem when a device comes into range with another device that is not from the same user because it might accidentally snag data from the other device and create a security problem. Bluetooth's communication range is also a disadvantage when compared with other wireless communications such as the 802.11 which is capable of providing several hundred feet of communication. Even though it is more difficult to interfere between two peripherals with a short distance, Bluetooth still needs to find a way to improve this particular aspect of the technology and, at the same time, provide a better security system. An improved security architecture is needed because when the communication range goes up, it will be even easier for outside intruders to try to hack into the peripherals. Nevertheless, the newly released Bluetooth 2.1 is expected to enhance the security of future devices [8].

2.2. The efforts to develop and promote the standard

The early research and development of Bluetooth technology should be accredited to Ericsson Mobile Communications. In 1994 the company began to look for different alternatives to cables, which could be used to connect to their cellular phones and accessories [9]. In their studies, Ericsson looked into radio rather than infrared technologies. They learned that radio is better for wireless systems in that it does not require a line-of-sight link. This allows for a more reliable link between the two devices being connected.

In 1998 Ericsson, along with Intel, IBM, Toshiba and Nokia, formed the Bluetooth Special Interest Group (SIG) [5]. It was an immense surprise to most companies that there is no Bluetooth headquarters and not even a Bluetooth organization or any sort of legal entity. The SIG is responsible for the promotion of Bluetooth along with the development of specifications and protocols associated with Bluetooth products. One year after the formation of the SIG, version 1.0 of the Bluetooth specification was published [9]. In late 1999, the SIG inducted four new core promoters to their group. These companies were Microsoft, Lucent, 3Com, and Motorola. Miller [1] predicted that by mid 2000 there would be 1790 SIG members. The fact is that,