1.1 INTRODUCTION

Radio technology has become an integral part of our daily life. Devices based on this technology are slated to become a significant market in the years to follow. The wide use of mobile phones, walkie-talkies, car door openers and garage door openers are examples of the successful wireless revolution that has silently swept the market place.

Though, there have been a number of innovations in wireless radio technology in the past several years but two such innovative technologies have caught our imagination the most. They are Bluetooth™ and Wi-Fi™ (IEEE 802.11b). These wireless communication technologies have changed the thought process of people in terms of their working style and communication.

The people concerned with these technologies such as the media and the technology analysts are up in arms against each other on the merits and demerits of Bluetooth and Wi-Fi (IEEE 802.11b). They sometime put one or the other as the supreme for its widespread usage in electronic devices and acceptance by consumers and corporate technology buyers. The availability of large amount of information is rather confusing to consumers puzzled on their choice. Further, it also perplexes the corporate world wanting to select a technology to set up mobile work forces [1].

This paper was introduced by Socket Communications to introduce the basis and nature of each technology and also to diminish some of the disorientation around them. We will discuss the pros and cons of each technology to compare them in a better way and discuss them in the pages to come. We will reveal how these two technologies can complement each other and better the lives of consumers as well as benefit the corporate world making a workforce to stay connected, informed and thus be more fruitful.

1.2 WIRELESS COMMUNICATIONS

The transfer of information such as messages, ideas or thoughts between two bodies is called communication. The discovery of telegraph, telephone, radio and television made communication immediate over long distances. In relation to information technology (IT) and computers the data
are either represented by binary digit or bit. Perhaps, it is known to all that it has only two values-
ZEROE’S (0s) or ONES (1s).

As the computer deals only with the above mentioned two values, it is called discrete or digital.
Digital world represents ideas or thoughts, messages, numbers… etc indifferent streams of 0s and 1s.

*The subject-Data Communications deals with the technology, tools, products and equipment to make this happen.*

Data communication is involved with the sending and receiving of information between two places with the use of electric signals. The electric signals are of two types. They are analog and digital [2]. It is defined as a communication where information exchange occurs in the form of 0’s and 1’s over wired or wireless media.

**1.3 IMPORTANCE OF STUDY**

Bluetooth and ZigBee are similar in many ways. Both of these technologies are types of IEEE 802.15, WPANs or wireless personal area networks. They also run in the unlicensed frequency band of 2.4-GHz and also use low power and small form factors.

Mr. Bhupender Virk, president and CEO of WPAN components maker CompXs classified the applications and technical differences between Bluetooth (IEEE 802.15.1) and the ZigBee specification (based on IEEE 802.15.4) at the Wireless Communications Alliance's February meeting in Silicon Valley which was affirmed in December.

ZigBee protocols ascertain a type of sensor network for residential and commercial applications such as air conditioning, heating and lighting control. It combines IEEE 802.15.4 which illustrates the physical and MAC protocol layers with security, network, and application software layers as described by the ZigBee Alliance, a corporation of technology companies.

Now, think of a world where light switches become wireless getting rid off electrical cabling through the walls.

Bluetooth works under this principle. It gets rid off cabling between electronic appliances and accessories such as between phones and headsets and between computers and printers. The users
of Bluetooth with handhelds such as mobile or laptops can transfer files, calendar appointments and business cards etc. It is more aligned towards user mobility and getting rid off short distance cabling whereas the main purpose of ZigBee is large-scale automation and remote control.

According to Virk, the first ZigBee products are now under inter-operability test from April. He believes that alliance-certified appliances to be attainable in the third quarter when CompXs will dispatch a protocol analyzer. Industry reports indicate that ultimately ZigBee might be assembled into mobile phones through dual function ZigBee-Bluetooth chips for remote control of almost anything we can think of and for purchasing items from marketing or trading machines.

**Bluetooth**

A short-range radio technology that facilitates wireless connectivity between mobile devices is what we call the Bluetooth. The three main aims for Bluetooth in terms of design were small size, least power consumption and low price. This technology was designed to be simple and its aim was to become an actual standard in wireless connectivity.

Bluetooth is a radio based technology which operates at 2.4 GHz in the unlicensed ISM band. This band is set aside for military use in some countries but now they have understood its commercial importance and started liberating the band for general use. 1 Mbps is its maximum gross data.

The magnitude of Bluetooth relies upon the potential class of the radio. Most accessories generally use the class 2 radio. It gives 0 dBm minimal output power providing a range of up to 10 meters in an obstacle-free environment [3]. It is enough for cable replacement applications. When a greater range is required such as in case of access points, a more potential radio class that is class 1 may be used. If the tool or accessory is fixed greater power utility is not an issue. In accessories such as mobile phones, power consumption issues are important and thus class 2 is the best available option.

**Zigbee Technology**

The wireless network technology has been built to remit sensor and control applications with its commitment of sound and dependable, self-configuring and self-restorative networks that can
support a plain, cost-effective and also battery-adaptive modus operandi in adding wireless to any appliances that may be static, mobile or portable [4].

The blueprint was released by the ZigBee Alliance to the public in the month of June in 2005. Later, the playing field for the accessories designers has become much simpler who like to add wireless technology to their sensors or control appliances. It is more than 180 companies which includes system/product OEM’s, application developers, semiconductor companies that the ZigBee has worked hard to provide a technology that preempts best advantage of the powerfully built IEEE STD 802.15.4 short range wireless protocol with the addition of flexible interstice networking powerful security tools and also application characteristics that are clearly defined. Further, their complete inter-operability, certification and agreement program to make sure that the end products bound for usage in commercial, industrial and residential places work well and mesh information easily.

1.4 THE ROLE OF ZIGBEE TECHNOLOGY IN WIRELESS COMMUNICATION SYSTEM

The main role of ZigBee being an IEEE 802.15.4 standard is for data communications with business and consumer devices. It is designed in such away that it consumes around low-power permitting batteries to compulsorily last forever. The ZigBee standard gives network, security, and application support services operating on top of the IEEE 802.15.4 Medium Access Control (MAC) and Physical Layer (PHY) wireless standard. It makes use of a series of technologies to provide measurable, self-organizing, self-restorative networks that can maintain various data traffic arrangements. ZigBee is a less costly, minimal power consuming, wireless web networking standard. [5]

1.5 ROLE OF BLUETOOTH TECHNOLOGY IN WIRELESS COMMUNICATION

The most important feature of Bluetooth technology is that it makes data communication quick, easy and convenient. It is regarded as the as a short range answer for low to medium speed appliances since speeds and distances are presently limited. It provides extraordinary adaptability
by communicating through walls and other hindrances that make it a perfect choice for residential or official networks. Sharing a printer with a number of PCs placed in different rooms on the same floor is good example of the effectiveness of this technology. It also increases the functions of a mobile phone, making it to work as a modem for Internet connections, or allowing it to communicate with other accessories--such as the probability of using mobile phones in buying drinks from vending machines.[6]

1.6 COMPARATIVE STUDY AND PERFORMANCE

Bluetooth and ZigBee are similar in many ways. Both of these technologies are types of IEEE 802.15, WPANs or wireless personal area networks. They also run in the unlicensed frequency band of 2.4-GHz and also use low power and small form factors. [7]

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ZigBee vs. Bluetooth

In terms of look ZigBee and Bluetooth are similar but Zigbee is simpler, with a lower data rate and snoozes most of its time.
The operational magnitude of ZigBee is 10-75m while that of Bluetooth is 10 m (without a power amplifier).

In terms of data rate, ZigBee has 250kbps at 2.4GHz, 40kbps at 915MHz and 20kbps at 868MHz while that of Bluetooth is 1Mbps.

ZigBee uses a fundamental master-slave arrangement appropriate for fixed star networks of many occasionally used applications that talk with the help of small data packets. It allocates up to 254 nodes. Bluetooth’s rules of conduct are more heterogeneous as it is equipped with handling voice, images and file transfers in specific networks [8]. Bluetooth accessories can aid scatter nets of a number of smaller non-synchronized networks (piconets). Only up to 8 slave nodes in a basic master-slave piconet arrangement is allowed by Bluetooth. When powered down, Bluetooth device takes around 3sec to wake up and reply whereas Zigbee can wakes up and get a packet in around 15 msec.
<table>
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<tr>
<th>Standard</th>
<th>Bluetooth</th>
<th>Zigbee</th>
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<tbody>
<tr>
<td>Work Distance</td>
<td>10 Meters</td>
<td>From typ. 10 to max.100 meters</td>
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<tr>
<td>Data Rate</td>
<td>From 1Mbps to 3 Mbps</td>
<td>20 Kbit/s (868 MHz), 40 Kbit/s (915 MHz), 250 Kbit/s (2.4 GHz)</td>
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<td>General use Remote Control, battery operated Products,</td>
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<td>$5</td>
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<tr>
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<tr>
<td>Complexity</td>
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<tr>
<td>Density</td>
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<tr>
<td>Ease of Use</td>
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<tr>
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