

A Survey on Enhanced Wireless Systems for Enterprise Automation

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Abstract

Wireless system transfers information between two or more communication points. The most common wireless technologies use radio waves within a short as well as distant coverage area. It encompasses various types of fixed, mobile, and portable applications. Wireless systems can use Free-space optical communication (FSO) technique which is an optical communication technology that uses light propagating in free space to wirelessly transmit data for telecommunications or computer networking. Wireless systems can also use Electromagnetic induction which involves short range communication and power. Typical wireless equipment includes –Wi-Fi, Infrared/Ultrasonic remote control devices, Bluetooth, GPS (Global Positioning System)/Satellite communication. These equipments are used to build enhanced wireless systems for enterprise or industrial automation.

Bluetooth(IEEE 802.15.1) and Wi-Fi(IEEE 802.11) are most commonly used communication protocol standards that define a Physical layer and MAC layer for wireless communications within a short range (from a few meters up to 100 m) with low power consumption (from less than 1 mW up to 100 mW). Bluetooth is dedicated in connecting close devices whereas Wi-Fi is dedicated in computer-to-computer connections as an extension or substitution of wired LANs.

In this paper an overview of these popular wireless communication standards, comparing their features and usages will be covered.

Keywords

Wireless Systems, Wi-Fi, Bluetooth, Automation

I. Introduction

Wireless systems are used to meet several needs. These are commonly used to connect laptops who travel from location to location and for mobile networks that connect via satellite.

A wireless transmission mechanism is a logical option to network a LAN segment which frequently change locations. Wireless technology can be used - to span a distance beyond the capabilities of typical cabling, to provide a backup communications link in case of normal network failure, to link portable or temporary workstations, to overcome situations where normal cabling is difficult or financially impractical, or to remotely connect mobile users or networks.

Implementers need to consider some parameters involving Wireless RF technology for better implementation of wireless networks in enhanced systems:

- Sub-GHz versus 2.4 GHz frequency trends
- Operating range and battery life
- Sensitivity and data rate
- Network topology and node intelligence

Applications may involve point-to-point communication, point-to-multipoint communication, broadcasting, cellular networks and other wireless networks, Wi-Fi technology.

Wireless systems can be applied in:

- Mobile telephones:

These wireless phones use radio waves from signal-transmission towers to enable their users to make phone calls from many locations worldwide.

- Data communications:

Wireless data communications are an essential component of mobile computing. The various available technologies differ in local availability, coverage range and performance and in some circumstances, users must be able to employ multiple connection

types and switch between them. To simplify the experience for the user, connection manager software can be used or a mobile VPN deployed to handle the multiple connections as a secure, single virtual network. Following technologies are included:

Cellular Data Services- offers coverage within a range of 10-15 miles from the nearest cell site.

Mobile Satellite Communications- may be used where other wireless connections are unavailable, such as in largely rural areas or remote locations.

Wireless Sensor Networks-are responsible for sensing noise, interference, and activity in data collection networks.

- Wireless energy transfer:

Wireless energy transfer is a process whereby electrical energy is transmitted from a power source to an electrical load that does not have a built-in power source without the use of interconnecting wires.

There are two basic methods for wireless energy transfer, such as-using either far-field methods involving beam power/lasers and radio or microwave transmissions involving near-field using induction. Both methods utilize electromagnetism and magnetic fields.

II. Literature Review

A lot of researches have been carried out in wireless systems and it's enhancement to be used for enterprise automations. Although some of them are used for general purposes and some of them are used for special purposes.

Several wireless methodologies are used for enhanced usages, Bluetooth and Wi-Fi are the most popular among them.

Bluetooth is a wireless technology standard for exchanging data over short distances (using short-wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz from fixed and mobile devices, and building personal area networks (PANs). Invented by

telecom vendor Ericsson, it was originally conceived as a wireless alternative to RS-232 data cables. It can connect several devices, overcoming problems of synchronization. Bluetooth is a wireless technology using low power radio wave which connects computers and phones over short distance about 30ft to 150 ft. Bluetooth protocol stack contains a Bluetooth core of Bluetooth-specific protocols: Bluetooth radio, baseband, link manager protocol (LMP), logical link control and adaptation protocol (L2CAP), service discovery protocol (SDP).

Bluetooth radio provides the physical links among Bluetooth devices and baseband layer provides a transport service of packets on the physical links. The LMP sets-up and manages physical links. LMP also implements security capabilities at link level. The radio, baseband and LMP are used in the Bluetooth device. The device will be attached to a host, thus providing that host with Bluetooth wireless communication.

The L2CAP services are used only for data transmissions.

Wi-Fi is a wireless local area network for computer networking technology which allows electronic devices to connect to the network, mainly using the 2.4 gigahertz (12 cm) UHF and 5 gigahertz (6 cm) SHF ISM radio bands.

'Wi-Fi' is a trademark of the Wi-Fi Alliance. Many devices can use Wi-Fi, e.g. personal computers, video-game consoles, smart phones, digital cameras, tablet computers and digital audio players. These can connect to a network resource such as the Internet via a wireless network access point. Such an access point (or hotspot) has a range of about 20 meters (66 feet) indoors and a greater range outdoors. Hotspot coverage can be as small as a single room with walls that block radio waves, or as large as many square kilo metres achieved by using multiple overlapping access points.

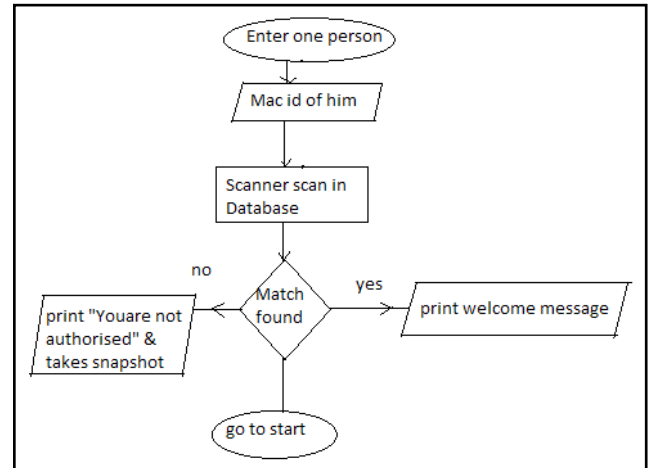
Wi-Fi can be less secure than wired connections, such as Ethernet, precisely because an intruder does not need a physical connection. Web pages that use TLS are secure, but unencrypted internet access can easily be detected by intruders. To connect to a Wi-Fi LAN, a computer has to be equipped with a wireless network interface controller. The combination of computer and interface controller is called a station. For all stations that share a single radio frequency communication channel, transmissions on this channel are received by all stations within range. The transmission is not guaranteed to be delivered and is therefore a best-effort delivery mechanism. A carrier wave is used to transmit the data. The data is organized in packets, referred to as 'Ethernet frames'. Wi-Fi technology may be used to provide internet access to devices that are within the range of a wireless network that is connected to the Internet.

Wi-Fi provides service in private homes, businesses, as well as in public spaces at Wi-Fi hotspots set up either free-of-charge or commercially, Routers that incorporate a digital subscriber line modem or a cable modem and a Wi-Fi access point, often set up in homes and other buildings, provide Internet access and inter networking to all devices connected to them, wirelessly or via cable.

III. Implementation Method

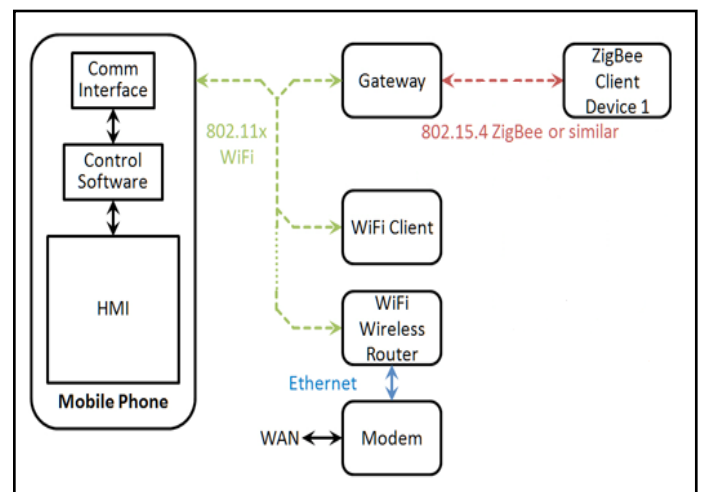
A Bluetooth based enhanced system uses mobile phone terminals to build a virtual networking by combining GPS and Bluetooth technology with mobile Internet. The Bluetooth scanners perform Bluetooth discovery process and assign location information to found Bluetooth IDs based on GPS co-ordinates. The new system can be developed by the use of an enhanced communication

protocol based on RFCOMM layer of Bluetooth stack. The protocol will be designed along with the security measurements. The security features will make the system more secure from the outside attacks and vulnerability. The new system can be designed using enhanced Bluetooth protocol as:



Enhanced Wireless System Design using Bluetooth

The WI-Fi based enhanced system is used as a distributed automation system, consists of server, hardware interface modules. Server controls hardware one interface module, and can be easily configured to handle more hardware interface module. The hardware interface module in turn controls its alarms and actuators. Server is a normal PC, with built in Wi-Fi card, which acts as web server. System can be accessed from the web browser of any local PC in the same LAN using server IP, or remotely from any PC or mobile handheld device connected to the internet with appropriate web browser supports asp.net technology through server real IP (internet IP). Wi-Fi technology is selected to be the network infrastructure that connects server and hardware interface modules. Wi-Fi is chosen to improve system security (by using secure Wi-Fi connection), and to increase system mobility and scalability. Even if, user intends to add new hardware interface modules out of the coverage of central access point, repeaters or managed wireless LAN will perfectly solve that problem. The main functions of the server is to manage, control, and monitor distrusted system components.



Enhanced Wireless System Design using Wi-Fi

IV. Comparison and Analysis

Bluetooth and Wi-Fi are different standards for wireless

communication.

Bluetooth is useful for low-bandwidth applications like transferring sound data with telephones (i.e. with a Bluetooth headset) or byte data with hand-held computers (transferring files) or keyboard and mouse.

Wi-Fi is better suited for operating full-scale networks because it enables a faster connection, better range from base station, and better wireless security (if configured properly) than Bluetooth.

Comparison between Bluetooth and Wi-Fi standards can be tabulated as:

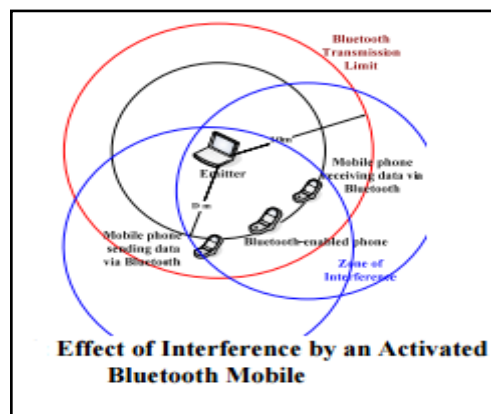
	Bluetooth	Wi-Fi
Frequency	2.4 GHz	2.4, 3.6, 5 GHz
Cost	Low	High
Bandwidth	Low (800 Kbps)	High (11 Mbps)
Specifications Authority	Bluetooth SIG	IEEE, WECA
Security	It is less secure	Security issues are already being debated.
Launching Year	1994	1991
Primary Devices	Mobile phones, mouse, keyboards, office and industrial automation devices i.e. activity trackers.	Notebook computers, desktop computers, servers, mobiles.
Hardware Requirement	Bluetooth adaptors on all devices	Wireless routers, adaptor and wireless access points
Range	5-30 meters	With 802.11b/g, range is 32 meters indoors and 95 meters outdoors. With 802.11n, range is greater. 2.5GHz Wi-Fi has greater range than 5GHz.
Bit Rate	2.1Mbps	600 Mbps
Power Consumption	Low	High
Usage	Very Simple to use which be used to connect up to seven devices at a time.	More complex to use and which requires hardware and software configuration.
Latency	200ms	150ms

Bluetooth is a direct device-to-device technology and used for so many different things, it typically requires that you first 'pair' the two devices being linked whereas Wi-Fi means 'Wireless Fidelity', is primarily about connecting one or many devices to the Internet depending on a base station(s). Bluetooth typically does not involve any wireless routers whereas Wi-Fi needs wireless

router installed by Internet service provider(ISP).

v. Performance Factors

Wi-Fi performance are affected by-External interference, Quantity of wireless access points, Quantity of SSIDs and devices, Use of legacy access points (802.11 a/b) and Channel management. Interference effect by Bluetooth device is caused by several RF signals.



VI. Conclusion

The objective of this paper was to survey on enhanced wireless system for enterprise automation using Bluetooth and Wi-Fi wireless technologies. The result or outcome of the enhanced wireless system developed using either Bluetooth or Wi-Fi would be much effective in the enterprises for their commercial usages. The appliances connected over a Bluetooth or Wi-Fi network in automation system have been demonstrated to be functioning by developing enhanced wireless systems either extending or manipulating. This paper would provide a great scope for further developments in wireless system enhancement.

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