The Practical Application of Bluetooth Media Technology and Outlook for Development

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<요 약>

이 논문은 블루투스 장치의 전 세계적으로 사용되는 무허가 ISM 대역의 2.4GHZ로 동작한다. 이 대역은 널리 사용되고 있지만, 블루투스 이외의 수많은 다른 시스템들이 이 주파수대를 사용하고 있고 마이크 웨이브 오븐과 같은 잡음원이 이 주파수대를 차지하고 있기 때문에 오히려 방해가 심한 주파수 대역이 되고 있다. 블루투스는 이와 같이 방해가 심한 전파환경을 극복하기 위해 빠른 주파수 호핑법과, 에러방지 및 정정 기술을 사용하고 있다. 이와 같은 상황에도 불구하고, 저가의 블루투스 시스템이 신뢰성 있고 안정하게 하기 위해 언급할 몇 가지 중요한 설계 상 문제점이 있고 시스템 설계시 몇 가지 면밀한 주의가 필요하므로 연구하고자 한다.

ABSTRACT

This is paper, with the development of computer and network communications technology, the technology of digital computer and modern communications has integrated into the field of intelligent home appliances, making them intelligentize with the function of a network information terminal. The paper introduces the Bluetooth SIG(Special Interesting Group) and the development of the standard of the Bluetooth. Researches the application model and the practical application of the Bluetooth technology, and the component elements of the Bluetooth. Finally deals with the outlook for the development of the Bluetooth technology.

키워드

Bluetooth, technique, BSIG

I. 서 론

1. Bluetooth SIG and the development of Bluetooth standard

With the aim of establishing wireless connection system worldwide and developing a new type of technology to be characterized by being user- friendly and applicable to and compatible with various kinds of equipment and establishing an actual wireless interface and associated software standard and promoting more equipment manufactures to support this protocol, Bluetooth SIG was established to research a new generation of wireless transmission technology by Eriksson, Nokia, IBM, Toshiba and Intel in February, 1998. Up to now, the

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number of enterprise members of SIG has reached 2500, of which can be classified into many groups by grade and function.

With the latter being categorized into four grades. As shown below:

The sponsor group is responsible for leading Bluetooth SIG whose members include 3Com, Ericsson, Intel, Microsoft and Motorola etc.

The cooperation group includes companies having signed and adopted the protocol 1.1 in the early period which is also those that have signed and adopted the protocol 1.0.

With most SIG members being this grade.

The independent group includes SIG members who are interested in Bluetooth but in relatively independent state.

Currently, the interfaces of electronic, computer, communication equipment and the communication standard and even many differences exist, thus resulting in difficulty in intercommunicating. Bluetooth is designed to make a consistent standard for this unconformity. The prime advantage is in its capacity of providing various kinds of appliance equipment which deal with people, with additional communication ability to make it equipped with ability to access to the Internet and other networks.

Bluetooth SIG has continuously announced the upgraded Bluetooth standard to the public since the second haft year of 1998, successively, being the version 0.7, 0.8, 0.9, 1.0 and 1.0A. Bluetooth announced the formal standardized 1.0B version in July, 1999. The version 1.1 was also announced in December, 2000. Each version beginning from 1.0B can be producible, in other words, various kinds of upgraded version of standards will be compatible with 1.0B version. In the future, Bluetooth SIG will continuously launch new version. Meanwhile, the Bluetooth technology has been adopted as a part of IEEE802.15, which marks Bluetooth being a protocol with important proportion and becoming one of the mainstream protocols internationally in the field of short distance wireless digital communication, will open a new chapter in the development of communication.

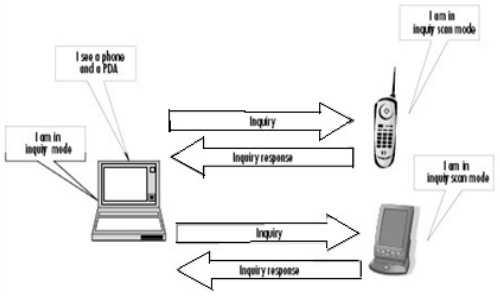

Fig. 1 The Transmission of Bluetooth

2. The application model and practical application

According to the communication protocol, various kinds of Bluetooth equipment anywhere can be found by means of manual or automatic inquiry, thus constituting micro-micro networks or decentralized networks to realize information sharing and perform various functions provided by system. Currently, multiple application models in the Bluetooth standard are available as follows: basic access model, service discovery application model, cordless telephone application model, intercommunication system model, serial application model, earphone application model, dial network application model, facsimile application mode, local area network access application model, universal object exchange application model, object push application model, file transfer application model, synchronous application model etc. Thus it can be seen that Bluetooth can add new functions to the current network such as cellular telephone system, cordless communication system, wireless local area network and Internet etc to provide various kinds of computers, fax machines, printers, indoor subsystems and appliance equipment with new functions with a wide range of applications. Since the technology of

hybrid multiple access modes such as frequency jumping, time division duplex and time-division multiple address and code division multiple access were introduced, the radio-frequency circuit of Bluetooth became more simple and most part of contents of the communication protocol can be realized though application-specific integrated circuit and software, therefore, technologically, to ensure the high performance and low cost of Bluetooth equipment.

Based on the above-mentioned more than ten types of application models combined with our research, the Bluetooth products may feature many types of practical applications and integrate the following several types especially some embedded systems.

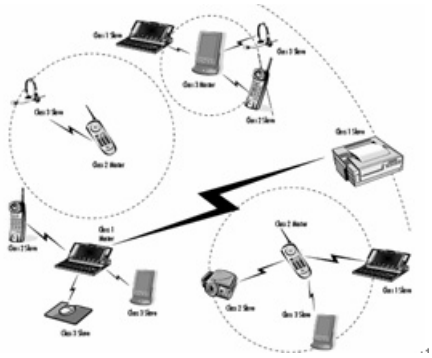

Fig. 2 The Bluetooth Equipments

2.1. Telephone systems

Bluetooth products will firstly be applied to telephone systems such as digital mobile phone, home and office telephone, miniature P BX etc and personal communication can be fully realized. In this manner, for consumers, it can bring both convenience and low cost to them and facilitate them to use mobile phone, at the same time, connect to the cellular system and PSTN, office telephone system and local area network and the Internet with low expenditure for communication; for the operators, besides the increase of traffic resulting from PSTN, it seems that charges for the cellular system may be reduced due to influence of traffic of mobile phone to systems of PSTN and PBX etc but the decrease of average traffic of mobile phone will enhance the capacity of system ,especially, the capacity problem will be more pronounced since more and more opportunities of access to the Internet by mobile phone will become realized with the use of WAP protocol, therefore, the mobile communication operators are willing to accept Bluetooth. Currently, the mobile phone manufactures in the international arena are stepping their efforts to develop Bluetooth mobile phone and the manufactures of cordless telephone and wire telephone are also preparing to usher in the opportunities and face the challenge Bluetooth brings to them and flock to develop Bluetooth-based products, thus making it develop more rapidly.

2.2. Wireless cable

Computer and peripheral equipment has become more and more popular, either in the laboratory or office or at home, which, conventionally, communicates with each other though wiring, thus bring a lot of inconvenience to users. The Bluetooth based on the concept of wireless cable can connect these information transmission equipment excluding power cords and even keyboard and mouse etc wirelessly. Bluetooth is designed to establish a fully wireless working and living environment and provides a great market potential to be untapped due to the wide range applications of these kinds of equipment both in hardware and software.

2.3. Wireless briefcase

Wireless mode is introduced to connect portable computer and palm computer with other equipment or networks to make people have a mobile office when it comes to portable computer and palm computer. The application of embedded wireless chip still constitutes a

large proportion even though this type of application is based on the computer environment. The Bluetooth standard has formulated network interface protocol such as computer and Internet, PSTN, ISDN, LAN, WAN and XDSL with the purpose of building connection with many international standards by the single Bluetooth standard. Even though people are more and more concerned with the low speed of 1Mb/s of Bluetooth, it can justify this job with low cost. According to the development strategy concerning Bluetooth and IEEE802.15, the speed will be increased to 20Mb/s in the near future.

2.4. The digital electronic equipment

Devices such as digital camera equipped with Bluetooth chip can either avoid the inconvenience caused by using cable or make itself free from besetting by storage overflow and pictures or images can be transmitted to the designated computer through mobile phone with Bluetooth system or other equipment based on Bluetooth anytime and anywhere.

The Bluetooth-chip-built-in personal digital assistant (PDA) adopts wireless receiving and sanding E-mail and browsing web site with more convenience.

The hardware circuit of Bluetooth can be miniaturized and well-suited for application of Headset. The Headset with Bluetooth system can connect with mobile phone wirelessly and be used to make a telephone call and listen to music in a narrow area in the state of walking and convene teleconference in a relatively large scope with attractive prospect.

The Bluetooth featuring miniaturization, low power consumption and low cost creates a limitless space in the application of people's life. For example, the Blue-based wireless electronic lock is safer and has more applicability than other non- contact electronic lock or IC lock and various kinds of wireless remote controllers(especially anti-theft and remote control of cars) perform better than infrared remote controller. It is more convenient to render special services through duplex wireless transmission of menus or catching server's eye in restaurant.

2.5. E-Commerce

The security and secrecy of Bluetooth will substantially enhance the function of current E-commerce system. For example, it can provide electronic billing system in many consumer occasions and serve as electronic registration in hotel's reception centre.

3. Component of Bluetooth technology

3.1. Radio frequency unit

Antenna transmit power of Bluetooth system complies with the requirement of ISM wave band of FCC. The maximum frequency jumping speed is at the range of 1 600s-1and 2.402GHz-2.480GHz with adoption of 79 frequency points of 1MHz bandwidth. The designed communication distance of system is 0. 1m～10 m.

3.2. Link control unit

Link control unit(base band) describes the hardware of digital signal processing---- link controller, which suits base band protocol and other bottom link regulations.

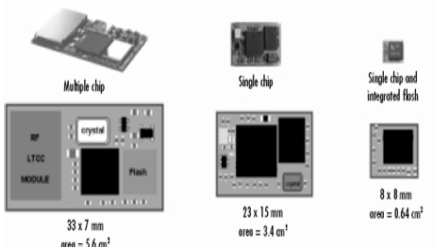

Fig. 3 The Bluetooth Hardware

3.2.1. Established connection

All equipment is in the state of pare ration before the establishment of rate cutaneum. Under such condition, the unconnected equipment monitors information at a time at intervals of 1.28 s. In case of equipment being awaken, monitoring will be conducted on the predetermined 32 frequency jumping frequency points. The number of frequency jumping may vary with different locations but 32 frequency jumping frequency points are adopted by most countries. Link process is initialized by primary device. Currently, Bluetooth base band technical support has two mode of link: connect-oriented (SCO) mode-mainly used in speech transmission and connectionless (ACL) mode mainly used in grouped data transmission.

3.2.2. Error control

Baseband controller adopts three types of error checking and correction as follows: 1/3 forward error correction code (FEC), 2/3 forward error correction code and automatic request for repetition (ARQ).

3.2.3 Authentification and encryption

Authentification and encryption is supplied by physical layer. Authentification adopts password-response mode. Authentifi-cation at a time or twice is required or no authentification is required during the process of link. Authentification forms an important part of any Bluetooth system which allows user to add itself dependable Bluetooth equipment. For example, only user own notebook computer can communicate by means of his mobile phone. The security mechanism is to provide a proper classified protection. The effective security mechanism of transport layer and application layer can be employed at the request of higher class security from user.

3.3. Link management

Link manager (LM) software realizes the establishment, authentification and link layout etc of link. Link manager can discover other link managers and build connection through link management protocol (LMP) and use services provided by link controller (LC) to perform the above functions. The service items of LC include: sending and receiving data, equipment number request, link address inquiry, building link, authentification, consultation and establishing link mode, determining frame type of grouping, set-up of monitoring mode, setting hold mode and dormancy mode etc.

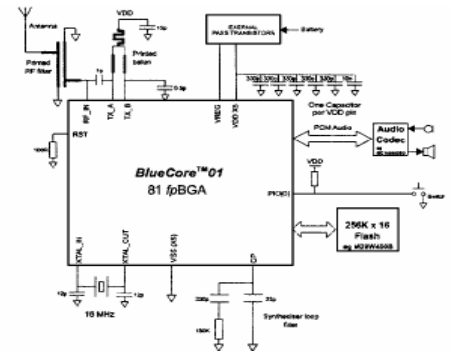

Fig. 4 The schematic diagram of connection of Bluetooth chip in Terminal Equipment

4. Conclusion

With the development and perfection of Bluetooth technology, it will breed a revolution in the field of short distant wireless communication of intelligent home appliance. The integration of intelligent mobile phone and notebook computer, various kinds of intelligent devices and Bluetooth technology can further expand the application scope of mobile computer equipment and share information by means of connecting various kinds of digital

portable devices with Internet through omnipresent Bluetooth technology.

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