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Standards and Technologies of Radio Interfaces and Wireless Networks for Home Environment[1]

Hristina Daskalova

Institute of Information Technologies, 1113 Sofia

Abstract: *The paper presents a survey of the existing standards and technologies of the radio interfaces and wireless networks for home and office environment. It makes a comparative analysis and considers the perspective application of these networks for intelligent remote control of different processes and objects and for multimedia information transfer. The main technical features of the available radio interfaces and wireless networks, intended for home and office usage are presented and estimated. The future problems and perspectives in this area are discussed.*

Keywords: *Wireless home networks, transmission rate, wireless adapters, access points, standards.*

I. Introduction

Wireless technologies suggest an efficient way to overcome the restrictions of cable networks and to meet the high and strict demands of business and private clients, concerning data acquisition and vocal connection. At the same time new problems appear, connected with the introduction of enhanced safety requirements, with the application of new technologies and with the development of wireless infrastructures. The companies, working in the field of new wireless communication technologies, wish to offer their clients a lot of new information services, as well as access to the global network with the help of the design, introduction and support of wideband network solutions. Many wireless technologies, such as CDMA (Code Division Multiple Access, a technology with code division of the channels), GSM (Global for Mobile Communications, a global system for mobile communications), TDMA (Time Division Multiple Access), 802.11, WAP (Wireless Application Protocol), 3G (third generation), GPRS

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(General Packet Radio Service, a service for packet data transfer), Bluetooth, EDGE (Enhanced Data Rates for GSM Evolution, increased data transmission speed for GSM), i-mode, etc., show revolutionary development in this area. Lately, there is considerable progress also in the development of wireless local networks (WLAN), Bluetooth (networks for middle and short distances), of wireless networks at airports, universities, hotels, restaurants, enterprises. The use of wireless Internet supposes different problems connected with unauthorized access to confidential information of secret services, of commercial companies or private persons, malicious use of credit cards, misuse of another's paid connection time, obstacles in the operation of the communication centres, etc. The solution of these problems is connected with the improvement of the standards for connection.

The raising of the home comfort by uniting its structure and objects (computers, TV sets, digital cameras, home entertainment centres, security systems, air conditioning, kitchen equipment and others), is realized mainly with the application of wireless technologies.

The study of the radio interfaces and wireless home networks at the Institute of Information Technologies is connected with the development of tools for system integration of heterogeneous hardware and software products of the human interaction with smart environment. These problems are included in the Institute activity, concerning the projects: Methods and Tools for Integration of Information Resources in Distributed Networks and Systems (Project No 010083); Theoretical Methods for the Design of Distributed Information Networks and Systems (IIT-BAS/IITP-RAS); Intelligent Framework for Generating Open (Adaptable) Development Platforms for Web-Service Enabled Applications Using Semantic Web Technologies, Distributed Decision Support Units and Multi-Agent Systems, FP6 – No IST–2003-511723 INFRAWEBS; as well as in the engagements of IIT, required by its participation in the Bulgarian-Russian working group "Information Society and Information and Communication Technologies" of the Intergovernmental Bulgarian-Russian Economic Commission. The investigations in this area in future have the purpose to develop methods and technologies of interaction of different digital systems in living environment, that will be applied for the construction of a system for acquisition, processing and control of distributed heterogeneous information, meeting certain economic, social and technical requirements, and reflected in the project proposal "Development of Models and Methods for Integration and Control of Heterogeneous Information Processes in Construction of Energy Saving Smart Living Environment (i-House)", which is applying for financial support by the National Science Fund.

General characteristics

Depending on the zones where used, the wireless technologies are usually classified as:

- radio interfaces,
- local,
- regional networks,
- global networks.

The purpose of the survey is to give the basic technical features of the radio interfaces and wireless networks intended for home environment, to make a comparative analysis and to outline the perspective usage of these networks for intelligent remote control of different processes and objects, and also to provide systems for personal information support and for multimedia information transfer.

Together with the local radio interfaces discussed, Bluetooth, ZigBee and WirelessUSB technologies are considered; Wi-Fi technology is described in details as one of the technologies and standards for wireless home networks; and briefly, HomeRF technology.

II. Standards and technologies of local radio interfaces

II.1. Bluetooth technologies

Bluetooth technology is radio interface with low power, developed to replace the existing cable and infra-red connections between electronic devices at home or office, enabling the organization of point-to-point connections, as well as a multipoint radio channel, not necessarily in the direct visibility zone. In the radio frequency spectrum Bluetooth possesses 79 radio channels within the range 2.4465-2.4835 GHz, about 1 MHz each. The range of 2.4 GHz refers to the industrial, scientific and medical license free range ISM (Industrial, Scientific, Medical), which allows free use of Bluetooth devices. Bluetooth modules transmit at a speed up to 720 Kbits/s for a distance from 10 up to 100 m.

The shortcoming of Bluetooth technology is the narrow transfer band of the radio channels, hence they do not assure high transmission speed. Additional information may be found at address www.bluetooth.com.

II. 2. ZigBee standards and technologies

ZigBee wireless technology is designed for application in systems for data acquisition and control. It has low electrical consumption and good information security, compatible with the devices of different users. The technology enables the realization of a common wireless network for buildings and other large sites with a great number of nodes (up to 65 thousand by standard). For this purpose some complicated mechanisms for messages routing are used, enabling information transmission from dozens of intermediate nodes of the network to its end point. ZigBee 1.0 version with Home Control description may be used in a network with a “tree” topology, and Home Control Lighting application – for the control of lighting bodies. The leaders of ZigBee on the market are companies like Freescale, Texas Instruments (Chipcon) and Jennic. In fact the name ZigBee denotes a set of protocols and extensions to the international IEEE 802.15.4 standard. In this way compatibility of devices made by different manufacturers is achieved. IEEE 802.15.4 standard contains description of the radio frequency part of the network: types of modulation, frequency bands and the respective transmission rates.

ZigBee specification suggests information transfer in a radius of 10 up to 75 m at a speed of 250 Kbits/s. ZigBee standard is connected with 27 channels in three frequency ranges – 2.4 GHz (16 channels), 915 MHz (10 channels) and 868 MHz (1 channel). The maximal rates in these ranges are 250 Kbits/s, 40 Kbits/s and 20

kbits/s respectively. The access to the channel is accomplished with a carrier control (Carrier Sense, Multiple Access, CSMA). With the help of their software, ZigBee networks are self organized and self restored, so that the network devices can find themselves when the power supply is turned on. The network contains three types of main nodes: co-coordinators, routers and end devices. Though ZigBee equipment cannot ensure transmission at a distance longer than 70-80 m, it can be used as a tunnel of the traffic of Wi-Fi or Bluetooth devices in case they are found in the direct visibility zone. After blocking ZigBee devices have the possibility to self restore. The low capacity and small action radius of ZigBee networks do not allow the transmission of multimedia information, nor the connection between distant offices. (For such purposes the wideband wireless technology WiMAX is used). The main application area of ZigBee devices could be observation, security and control of medical apparatus, etc. It is supposed that ZigBee networks will be an undividable part of the "intelligent home", controlling the operation of all the devices with the help of a unified panel for remote control or a mobile phone. It is expected that ZigBee wireless networks will be a serious rival to Bluetooth technology in the future. Additional information may be found at www.zigbee.org site**.**

II. 3. Wireless USB standards and technologies

Wireless USB is a standard of a whole series of wireless interfaces, based on the use of the technologies of ultra-wideband modulation (UWB) in the frequency range of 7.5 GHz, recommended by MultiBand OFDM Alliance (MBOA) and WiMedia Alliance, which are open industrial groups aimed at the introduction of personal wireless networks WPAN (Wireless Personal Area Networks). The wireless interfaces on the basis of UWB have common organization of the protocols at channel and physical level in compliance with the model Open System Interconnection (OSI) and IEEE 802.15.3 specification. This technology is intended to transfer data at short distances, up to 10 m, with high capacity (up to 480 Mbits/s) and low consumed power. Multiplexing along the orthogonal carrier frequencies (OFDM, Orthogonal Frequency Division Multiplexing) is used in data transmission through UWB channels, combining several frequency ranges (MultiBand OFDM), which defines the presence of wide frequency ranges. The wide transmission band helps the overcoming of the speed limits in the design of wireless local interfaces. Due to this reason, UWB is a solution for wireless transmission of multimedia content (video streams) of high quality. Another advantage of this technology is that it does not cause interferences for other wireless solutions. The data packets are formed in analogy with USB 2.0 standard and transmitted with the help of a protocol for access with time division of the channels, TDMA (Time Division Multiple Access). Every OFDM transmission in the transmission bandwidth of 4 MHz contains 100 data packets. The packets format is not altered for the different exchange rates. Six packets form a base packet with a duration of 1.875 μs. The standard determines base rates of transmission of 53.3 Mbits/s, 106.7 Mbits/s and 200 Mbits/s, and optionally – 80 Mbits/s, 160 Mbits/s, 320 Mbits/s, 400 Mbits/s and 480 Mbits/s. The advantage of this technology is that depending on the distance between the devices, the speed can be altered within the

limits from 53.3 Mbits/s up to 480 Mbits/s. Similarly to the cable USB, the Wireless USB devices have their own address, assigned with their connecting. Every Wireless USB device supports one or several channels for connection. The basic elements of the infrastructure of the wireless networks Wireless USB are the network hub and the radial lines.

Table 1 gives the main technical parameters of Bluetooth technology, of ZigBee networks, and Wireless USB connection.

Table 1

Feature/ functions	Characteristics		
	Bluetooth	ZigBee	Wireless USB
Way of transmission	by radio waves	by radio waves	by wideband radio pulses (Shaped pulse)
Frequency range	2.4465-2.4835 GHz	868, 902 and 2400 MHz	districts are separated within the range 3.1-10.6 GHz
Channels number	79	2400 MHz (16 channels, 902 MHz (10 channels) and 868 MHz (1 channel)	
Channel width	1 MHz	–	> 500 MHz
Methods of transmission	Frequency-Hopping Spread Spectrum (FHSS) and duplex mode with channel time division (Time Division Duplex – TDD)	spectrum expansion with the help of direct sequence method Direct Sequence Spread Spectrum (DSSS)	multifrequency OFDM (Frequency Swiched OFDM) modulation
Duration of the time window	625 μs	–	1.875 μs
Power of transmission	three classes of transmitters: 1-100 mW; 0.25 up to 2.5 mW; up to 1 mW	1 mW	three classes of transmitters: 1-100 mW; 0.25 up to 2.5 mW; up to 1 mW
Speed of data transmission	from 721 Kbits/s up to 3 Mbits/s, at Bluetooth 2.0 standard with EDR (Enhanced Data Rate)	up to 250 Kbits/s	base rates of exchange 53.3 Mbits/s, 106.7 Mbits/s and 200 Mbits/s and optionally – 80 Mbits/s, 160 bits/s, 320 Mbits/s, 400 Mbits/s and 480 Mbits/s.
Radius of action	depending on the power up to 100 m	up to 70 m	up to 10 m
Number of devices in the network	from 8 up to 256	number of nodes 65536 (64-bit addresses), 264 (16-bit addresses)	up to 127 m
Data security and addressing	resetting of the frequency, use of PIN-codes, unique 48-bit network address, compatible with IEEE 802 standards	data encryption by AES algorithm with a key length of 128 bits; Unique 64-bit address at MAC level, an additional 16-bit address (PAN-ID)	the devices are assigned their own addresses when connected

III. Standards and technologies of home wireless networks

III.1. Wi-Fi standards and technologies

The wireless access to a Wi-Fi network (after the English "Wireless Fidelity") is in compliance with 802.11 standard, which exists in several variants, differing by the speed of data exchange among the wireless devices. IEEE 802.11b standard ensures data transmission at a speed of 11 Mbits/s, 802.11g standard offers transmission rate up to 54 Mbits/s. The two standards are compatible and use a frequency of 2.4 GHz. There is also available Wi-Fi 802.11a version, providing data transmission rate of 54 Mbits/s, but at frequencies higher than 5 GHz. In addition, there exist devices on the basis of 802.11n specification with a capacity of 150 Mbits/s.

The wireless access points enable switching for a distance of 300-400 m, which in practice is limited by the antenna power and the barrier walls for the signal. When focusing in one direction, the discovery of the wireless devices is considerably increased. The standard radius of action of Wi-Fi networks depends on the type of 802.11 protocol used; on the general power of the transmitter; on the amplifying coefficient of the antenna; on the length and attenuation in the cables, connecting the antenna; on the type of the barriers and interferences along the signal propagation in the given region (Table 2).

Table 2

Protocol	Frequency used, GHz	Maximal theoretic speed, Mbits/s	Usual speed in practice, Mbytes/s	Remoteness of the connection indoors, m	Remoteness of the connection outdoors, m
802.11 b	2,4	11	0.4	38	140
802.11 a	5	54	2.3	35	120
802.11 g	2.4	54	1.9	38	140
802.11 n	2.4 and 5	600	7.4	70	250

The following parameters are determined when setting up a certain wireless segment:

- The type of the wireless network – if the access point supports several standards, the specific one is defined.
- Number of the channel – 802.11g protocol supports channels from 1 up to 13 and hence it must be explicitly indicated.
- SSID (Service Set ID) – every wireless network has its unique SSID identifier, which is a conditional name that is indicated for every access point. The identifier may be connected with the name of a premise or of a device.
- Speed – the rate of the established connection is pointed out for each access point, or automatic definition is set (auto/best).

In order to make the connection more reliable, the access points support the mode of a hidden identifier for protection against external users, who are scanning the ether.

III. 2. Necessary equipment

Each device, connected to the wireless network must have a wireless network adapter (wireless network card). Modern portable computers and other devices (thanks to Centrino and Sonomo platforms) have built in cards, but in many cases they are separately attached.

The adapters for portable computers are a PC Card (PCMCIA), for desktop computers there are models with a **PCI** interface, and wireless USB adapters can be connected to portable and desktop systems; for PDA techniques there exist adapters with interfaces like CompactFlash and SDIO. In order to create small wireless local networks, the presence of the corresponding number of network adapters is sufficient (supporting AdHoc mode). In networks of higher capacity and action radius, wireless access points and/or wireless routers are used, analog in functions to the traditional routers. Wireless routers are usually used in the primary construction of the wireless network. The access points are an alternative of the wireless routers and they enable the connection of the wireless network to the existing cable network, which operates with a switch or a router. In order to build a home local network, one access point is necessary, in order to ensure the necessary action radius; for office networks several access points and/or routers are required. They use also more powerful antennas in order to increase the action radius.

III. 3. Routers and modems

Compex NetPassage 28G, Standard Wi-Fi 802.11b**,** supporting SuperG mode, rate of data transmission up to 108 Mbits/s, 3-port commutator Ethernet10/100 Mbits/s; additional features: a print server, a server with a web camera, FTP server; quantity of WAN ports: 1; quantity of LAN: 3; quantity of channels: 13; encryption protocols: WEP.

ASUS WL-500G Deluxe, Standard**:** Wi-Fi 802.11g, IEEE 802.11b; rate of data transmission: 4-port commutator Ethernet 10/100 Mbits/s; additional features: NAT – a router with the possibility to filter the packets, a print server or a server for web, FTP server, has two USB 2.0 ports, operates both in a bridge mode and as an access point; quantity of WAN ports: 1; quantity of LAN ports: 4; quantity of channels: 13; encryption protocols: WEP, WPA.

D-Link DSL-G604T, Standard: Wi-Fi 802.11g, IEEE 802.11b; rate of data transmission up to 54 Mbits/s; additional features: DHCP server, supports VPN; quantity of channels: 13; quantity of LAN ports: 4; quantity of DSL ports: 1; encryption protocols: WPA, WEP.

Table 3 gives some examples of available adapters used to organize wideband wireless networks.

In addition, the network adapter Zyxel Prestige 660HW could be mentioned with the following features: standard: Wi-Fi 802.11g, IEEE 802.11b; rate of data transmission up to 100 Mbits/s; ADSL automatic configuration, DHCP server, support of VPN; quantity of WAN ports: 1; quantity of LAN ports: 4; quantity of channels: 13; encryption protocols: WPA, WEP-encoding.

Table 3. Wireless network adapters

Adapter	Interface	Transmission speed	Wi-Fi standard	Encryption	Remark
Apple AirPort Extreme	PCMCIA	up to 54 Mbits/s	IEEE 802.11g	–	–
ASUS WL-100G	PCMCIA	up to 54 Mbits/s	IEEE 802.11g	–	–
TRENDnet TEW-421PC	PCMCIA	up to 54 Mbits/s	IEEE 802.11b, IEEE 802.11g	–	–
D-Link DCF-660W	CompactFlash/ has an adapter for PCMCIA	up to 11 Mbits/s	IEEE 802.11b	128-bit WEP-encoding	With an Integrated antenna, supports Ad-Hoc modes/ Infrastructure, Interaction with Ethernet networks by access points
ASUS WL-110	CompactFlash	up to 11 Mbits/s	IEEE 802.11b	128-bit WEP-encoding	–
TRENDnet TEW-222CF	CompactFlash	up to 11 Mbits/s	IEEE 802.11b	128-bit WEP-encoding	–
Sandisk Wi-Fi CF	CompactFlash	up to 11 Mbits/s	IEEE 802.11b	128-bit WEP-encoding	–
CD adapters, made by Sandisk company		up to 11 Mbits/s	IEEE 802.11b	64/128-bit WEP-encoding	Operating With Microsoft Pocket PC 2002, Pocket PC 2003,WM 2003 and WM 5.0, at a distance of 35-100 m indoors and 300 m outdoors

III. 4. Exemplary access points

3Com OfficeConnect, Access Point**,** standards Wi-Fi 802.11a, 802.11b and 802.11g, rate of data transmission up to 54 Mbits/s in wireless networks 802.11g or 802.11a. Distance of the connection up to 100 m, additional features: Hide SSID – a function for disabling the propagation of SSID identifier (SSID Broadcast Disable), control of the access on the basis of MAC addresses with the purpose to avoid

unauthorized users, scanning the wireless networks, support of 128 clients and dynamic alteration of the data transmission rate. Encryption**:** WPA with a 256-rate switch and WEP with dividable 40/64-rate and 128-rate switches.

D-Link DWL-2000AP+, standards: Wi-Fi 802.11b, and 802.11g, rate of data transmission up to 54 Mbits/s in the wireless networks of 802.11g standards, distance of the connection up to 100 m indoors and up to 400 m outdoors, additional features: MAC filtration, transmission prohibition SSID.

III. 5. Modes of operation of the access points

Access Point Mode (access point) – this mode is designed for wireless connection of portable, desktop and pocket computers to the access point. The wireless clients can connect to the access point only in Access Point mode.

Access Point Client/Wireless Client Mode (wireless client) – in this mode it is possible the access point to become a wireless client of another access point. In this case the access point executes the functions of a wireless network adapter. This mode can be used for data transmission between two access points, but the data exchange between the wireless adapter and the access point in this case is impossible.

Point-to-Point/Wireless Bridge (wireless bridge point-to-point) – this mode allows the wireless point to exchange data with another access point, supporting the mode of wireless bridge point-to-point. Most of the manufacturers have their own setups for activating the mode of wireless bridge at the access point. This mode is usually applied for wireless connection between equipments, found in different buildings. The wireless clients cannot exchange data with the access point in this mode.

Point-to-Multipoint/Multi-point Bridge (wireless bridge point-to-multipoint) – this mode is analogous to the mode Point-to-point/Wireless Bridge with the exception, that the use of more than two access points is allowed. The wireless clients cannot exchange data with the access point in this mode.

Repeater Mode (repeater) – in this mode the access point expands the action area of the wireless network, repeating the signal towards the remote point. The Ethernet MAC address of the remote point must be indicated in the configuration of the access point, so that it will execute the functions of a wireless expander of the action radius of another access point. In this mode the wireless clients can exchange information with the access point.

WDS (Wireless Distribution System) – in this mode wireless clients can be simultaneously connected to points, working either in the mode Bridge (bridge point-to point) or Multipoint Bridge (bridge point-to-multipoint), but then the operation speed decreases.

The access points and the wireless routers are usually configured by web-interface or applied software, which simplifies the setup procedures.

When the wireless network adapter is directly connected to the other adapters, the Ad Hoc mode is realized in a wireless network; when the adapter establishes connection to the wireless network by an access point, the mode is called Infrastructure. In order to select the way of connection, the adaptor must be set to

operate either in Ad Hoc or Infrastructure mode, using the access point as an autonomous module with a built-in microcomputer and a receiving-transmitting device. With the help of the access point, interaction and information exchange is accomplished between the wireless adaptors and connection to the cable part of the network (Ethernet). For this purpose the wireless local network (WLAN), the wireless access point and all the wireless clients must have one and the same SSID (Service Set ID). The expansion of the infrastructure and the access to more clients requires additional access points. The advantages of wireless networks, organized in Infrastructure mode, compared to the networks, organized in Ad-Hoc mode, is the centralized security and widened radius of action on the account of an additional access point. The wireless routers, intended for use in home environments, have a built-in possibility to support Infrastructure mode.

802.11 standard supposes several ways for network security – different mechanisms for clients authentication and encryption in data transmission. The protocols used for security are **WEP** (Wired Equivalent Privacy) and **WPA** (Wi-Fi Protected Access). The technology of MAC addresses filtration and the mode of hidden SSID are used for additional protection. Unfortunately, this type of protections is not sufficiently efficient (**www.spectrum.ieee.org** and **www.standards.ieee.org/getieee802**).

Except for portable, pocket computers, cell phones Wi-Fi, they are also used in digital cameras, at first made by Nikon, Coolpix P1 and P2 and later on by Kodak EasyShare. The MP3 devices with wireless adapters, such as Tao Wireless Media are also popular. Hitachi company produces an original apparatus for book reading, supplied with a Wi-Fi module. The solutions of Wi-Fi technology are not intended for very long distances, hence it is a partner of Wi-Max technology that offers wireless connection for the distance of several scores of kilometers. Samsung company announces Wi-Bro technology (Wireless BROadband), which ensures data transmission at a speed of 100 Mbits/s up to approximately 5 km from the base station.

IV. HomeRF standard and technologies

Another wireless technology, using the license free ISM range of 2.4 GHz, is HomeRF 2.0 standard. It is supported by at least 100 companies, belonging to HomeRF consortium (**http://www.home.rf.org/**). Its specification is based on a protocol for shared wireless access (Shared Wireless Access Protocol – SWAP), which determines the common interface, supporting wireless networks for transmission of voice and data inside a building. SWAP protocol ensures interaction of different electronic devices by different manufacturers, suggesting completed network solutions, which support interaction with Internet and with a commutating phone network. In HomeRF technology the method of Frequency-Hopping Spread Spectrum (FHSS) is used. Time Division of the channels is used (TDMA) as an access method in speech transmission, and in data transmission – multiple access with control of the carrier frequency and collisions avoidance (Carrier Sense

Multiple Access with Collision Avoidance – CSMA/CA). The maximal speed is 20 Mbits/s. Table 4 contains the main technical parameters of HomeRF 2.0.

Table 4

Characteristics/functions	Features
Type of connection	Frequency-Hopping Spread Spectrum (FHSS)
Frequency range	from 2.4 up to 2.4835 GHz
Power of transmission	100 mW
Rate of transmission	up to 20 Mbits/s
Radius of action	100-300 m
Number of devices in the network	up to 127
Channels for speech	up to 6
Data security	blowfish encryption algorithm
Addressing	48-bit MAC address

V. Organization of a home wireless network

In order to organize a home wireless network, a wireless access point and the design of a distributed network is required, which would provide Internet access to every premise. Since cable and wireless devices may be included in the network, a wireless router is used as a common access point in Internet, such as the ones produced by **D-Link**, **Asus**, **Gigabyte** and other companies. There is a possibility to connect an Ethernet segment from a local area network (**LAN**) or WAN to the router, towards which a channel for Internet access is connected. The wireless segment of the router provides one of the protocols above described, 802.11g for example. The router is connected to ADSL or to another channel; in every room additional points of wireless access are supplied, which are connected to the router. The available computers are also connected to the router. Thus a distributed network with cable and wireless segments is obtained. In order to determine the network address of the router, the data in its operation instructions are usually used. The devices and access points, connected to the router through Ethernet, must have network addresses from the same network, to which the router belongs. The MAC addresses of the other access points, comprising the distributed network, are included in the access points. After the access points are adjusted, the client's part is set up, which consists of different portable, pocket and other devices with wireless adapters.

VI. Conclusion

Nowadays a number of scientific and applied investigations are performed in the area of wireless technologies, directed to overcoming the existing limits in the transmission speed and noise resistance. Many developments pay attention to ultra wideband data transmission (UWB). The most active research in this field is done at university laboratories in USA, China, Japan and Korea. The license free cheap and reliable technologies, such as Bluetooth and ZigBee, offer very good perspectives. Bluetooth SIG Consortium has already published Bluetooth 3.0. standard, which

solves the problem, connected with the low transfer speed on the account of the use of an additional wideband channel IEEE 802.11 when transmitting large files. For the medium size files ERD technology of 2.0 standard is still used. Bluetooth 3.0. is not contradictary to Wi-Fi networks (IEEE 802.11b/g/n), since it uses a common principle of transport environment organization, not the concrete Wi-Fi realizations. Even the best standards, pressed by their rivals, tend to develop in time. There is a tendency to use stationary autonomous radio modules with low energy consumption and some intelligent functions in the wireless self-organizing networks of information exchange, that might be used in different areas. The development of complexes for personal information support of mobile devices users is expected, which will provide real time text, graphical and multimedia information. Wireless systems for technological processes remote control are designed, which transmit multimedia information with the purpose to realize video conferences, digital TV, video images from remote objects, etc.

The requirements of the users of new technologies do not restrict to high speed only, but demand mobility as well, which presumes the perspectives for accelerated development of wireless technologies.

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