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A Novel Study of and Comparative Survey of Future Wireless Communication

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Abstract— *Now a days wireless communication is important role in future world. This technology yields better communication in case of its speed and their performance. The chief objective of the paper is to compare the different technologies with VLC in terms of cost factor, bandwidth and performancefactor.Todayeveryone(Business,institutions,organizations ,entrepreneurs is thrust for getting right information at the right time and right place .Which requires fast internet connectivity, Technology and large range of channels. Present paper reflects the Future of Communication (LI-FI) which may affect all lives. It a technology that may be as fast as 500MBPS (30GBPS per minute) an substitute, cost effective and more robust and useful than Wi-Fi. The Visible light communication which may be the future of Internet.*

Keywords—*Wi-Fi, Li-Fi, VLC, Visible light communication, ICT, MBPS, VLC transmitter, photo detector, amplification and processing, data utilization, server, lamp driver, LED based headlights, LED based backlights, penetrate through wall*

1. INTRODUCTION

Internet services are very highly demanding and necessary accessories in ICT. Wireless communication provides communication up to places where cannot be reached with cables but it has low data transmission rates. Also it has not a wide range transmission network, generally it is pointed to use in HAN and NAN communication with wireless communication. Wireless-fidelity (Wi-Fi) is a technology which allows wireless communication of all devices that connected to it. Through the agency of Wi-Fi products, which want to connect a network, connect to LAN with Personal Access Points (PAPs). PAPs connect to wired internet network by a router and transmit receiver data signals to media as RF signals. WiMAX is Worldwide Interoperability for Microwave Access technology and a part of 802.16 standard series for Wireless Metropolitan Area Network (WMAN)[1]. According to this standard, it defined the wide operating range of 10-66GHz for communication infrastructure [2].

Cellular communication uses 2G standards that defined for 1.9 GHz band and have GSM, IS-36 and IS-95 licenses. The 3G and 4G cellular technology operates on 824–894 MHz/1900 MHz spectrum range [3]. It used in the most recent technology whereas LTE and LTE-A standards [4]. It has features that detach from other wireless communications technologies make it more applicable for smart grid. Bluetooth technology operates in the 2.4 GHz ISM frequency band and it is able to transmit voice and data. Bluetooth-enabled devices capable of transferring data at up to 24 mbps are the effective distance is about 10 to 100 meters. ZigBee takes its name from the zigzag area of the complex structure and based on the IEEE 802.15.4 standard. The purpose of that standard helps to creation of personal wireless networks which has low infrastructure cost, slow transfer rate and low power consumption [5].

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As per the Cisco Survey of the usability of the existing range, we are presently using about 80% of the existing capabilities of the data utilization. Presently we are utilizing the Wi-Fi services within the campus and around the 10-100 meter distances to connect our P.C., Laptops, palmtops and P.C. notes etc.

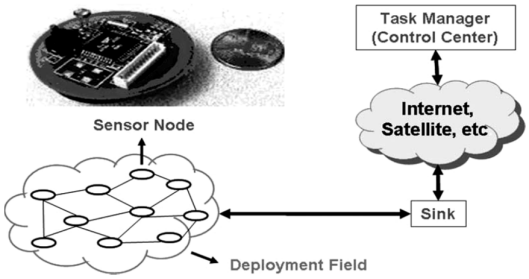

Fig 1: An illustrated architecture of wireless communication

Present paper deals with the visible light communication which may give a wide and fast data rate like something 500MBPS. Study made comparison between Wi-Fi and Li-Fi. and other main parameters of the communication process. In present paper the visual light communication communicates to connect the different devices and media and also shows the probable path of the communication and of course transmitting the data and audio-video signals.

2. Literature Review

2. 1. Wireless Communication

Wireless communication provides communication up to places where cannot be reached with cables but it has low data transmission rates. Also it has not a wide range transmission network, generally it is pointed to use in HAN and NAN communication with wireless communication. Wireless communication gives communication up to places where cannot be reached with cables but it has low data transmission rates. Also it has not wide range transmission network, generally it is pointed to use in HAN and NAN communication with wireless communication. It has better connectivity and improves the performance as well as data rates with minimum time consumption. Also it does not need wire or cable for better communication with low cost system. The overall structure of wireless communication system is shown in figure 1. In this system consists of sensor node, sink and control centre [14 – 17].

2.2. Wi-Fi Communication

Wireless networking technologies (Wi-Fi) allows computers and other devices to communicating over a wireless signal [6]. A typical Wi-Fi network includes three parts: a wired connection to a broadband provider, an access point, and a computer connected by wired and wireless connections [7]. It offers dissimilar broadband speeds and operates in Industrial, Scientific, and Medical band (ISM band) [8]. The communication between nodes or computers is done via Access Points (APs). The access point also plays a role as a wireless ethernet adapter. Wi-Fi has gained popularity because of installation ease and the increased number of Wi-Fi radio equipped laptops [18 – 23].

Currently, many businesses like airports, cafés, restaurants, and shopping areas offering wireless internet-services to customers. Demand for wireless technologies has gained more significance in business and everyday-life, as population is getting denser by closely spaced buildings. Wi-Fi networks have easy deployment in markets, offices, airports, and other locations providing advantages like flexibility, mobility, ease of use, and low cost.

2.3. WI-Max Communication

Wi-Max 802.16 (Wireless Metro Area Network) technology can serve the customer from a distance of 50 Km from base station whereas Wi-Fi 802.11a/b/g (Wireless LAN) has an Access Point range of about 100 meters. WiMax is more suitable to serve the outdoor area whereas Wi-Fi is more suitable for indoor location. Wi-Max is designed to deliver a metro area broadband wireless access (BWA), but Wi-Fi is a local network technology designed to add mobility to private LANs.

Figure 2 shows coverage of Wi-Fi and Wi-Max. According to the figure, the Wi-Max provides maximum coverage compare with Bluetooth providing minimum coverage and range. Wi-Max is Worldwide Interoperability for Microwave Access technology and a part of 802.16 standard series for Wireless Metropolitan Area Network (WMAN) [1].The coverage description of Wi-Max and Wi-Fi is shown in figure 2. According to this standard, it defined the wide operating range of 10-66GHz for communication infrastructure [2].

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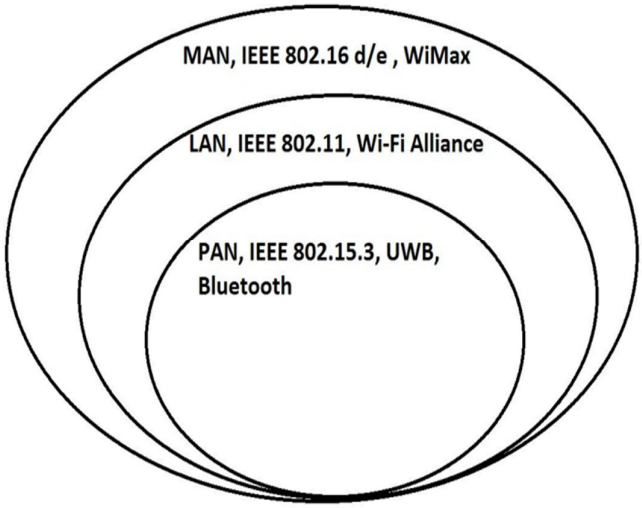

Fig 2: Coverage description of Wi-Max and Wi-Fi

2.4. Cellular Communication

Cellular communication uses 2G standards that defined for 1.9 GHz band and have GSM, IS-36 and IS-95 licenses. The 3G and 4G cellular technology operates on 824–894 MHz/1900 MHz spectrum range [3]. It used in the latest technology whereas LTE and LTE-A standards [4]. It has features that different from other wireless communications technologies make it more applicable for smart grid. For example it has high volume capacity that can move huge amount of data on the smart grid applications. And the power grids are already being used it, therefore initial investment cost does not exist, so the data can be transmitted with existing infrastructure. In addition to the cellular communication system has developed infrastructure security [9], [10].

2.5. Bluetooth

Bluetooth technology operates in the 2.4 GHz ISM frequency band and it is capable to transmit voice and data. Bluetooth-enabled devices capable of transferring data at up to 24 mbps are the effective distance is about 10 to 100 meters. Bluetooth installed on small, high-performance incorporated radio transceiver units. Each of these units, with addresses that are derived from the IEEE 802.11 standards and it is capable of high data transmission with low power consumption. [11] This technology is suitable for the use of the Smart Grid LAN networks. It has the following disadvantages over compared to the other technology is to transfer the data bytes between the system is slowly with a distance of minimum meters.

2.6. ZigBee

ZigBee takes its name from the zigzag area of the difficult structure and based on the IEEE 802.15.4 standard. The purpose of that standard helps to creation of personal wireless networks which has low infrastructure cost, slow transfer rate and low power consumption [5]. Although ZigBee has advantages like long battery life, requested network building, it has the disadvantage of not capable to provide data flow in the larger sizes as Bluetooth and Wi-Fi.

2.7. Li-Fi Communication

Li-Fi technology has higher potential, it is very much possible to transmit the data via light by changing the flicker rate that provide dissimilar strings of 1 and 0, and its intensity is modulated so quickly that the human eyes cannot notice. There are around 19 billion light emits worldwide. Which in turns may be replaced by LED, i.e. potential source of transmitting data? “At the heart of this technology is a new generation of high brightness (LED) light emitting diodes,” says Herald Hass, from the University of Edinburg, U.K. Very simply, if the LED is on, you transmit a digital 1 if it’s off, you transmit a 0, “They can be switched on and off very quickly, which gives nice opportunities for connectivity and transfer the data very quickly, efficiently and accurate without any external hindrances.

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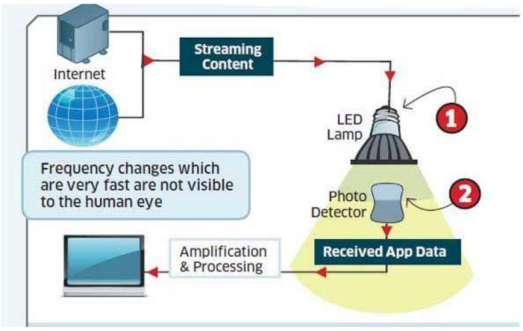

Figure 3: Li-Fi communication

Li-Fi is a fast and economical optical version of Wi-Fi, which is based on Visible Light Communication. VLC is a data communication medium using visible light between 400THz (780nm) to 800THz (375nm) as optical carrier for data transmission and illumination. Data can be encoded in the light to generate a new data stream by changing the flickering rate, to be clearer, by modulating the LED light with the data signal, the LED illumination can be used as a communication source.The working principle of light fidelity technology is shown in figure 3.

2.7.1. Visible Light Communication

Visible light communication is a medium of data Communication using visible light band of 400 THz- 800THz (780nm –375nm) as a carrier for data transmission and illumination.

2.7.2. Spectrum Used In Radio & Light Wave

Utilization of spectrum for radio and light wave: 1) The systems such as wireless remote control infrared wireless LAN and infrared inter-building communication etc. uses Infrared light for communication. 2) Visible light LEDs communication is very well useful in offices which makes ideal for ubiquitous data transmission. 3) The applications such as indoor navigation, augmented reality, accurate control of robots or vehicles and accurate position measurement are not possible radio wave technology which is possible with the help of VLC [12]. Image sensor (receiver) used to detect incoming data and direction of incoming vector from transmitter to receiver. The frequency range for the different technology is shown in figure 4.

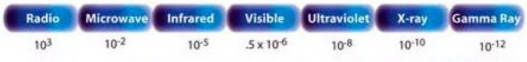

Figure 4: frequency spectrum

2.7.3. Devices Used In VLC

There are variety of devices used for transmission in visible light communication is LED and fluorescent lamp.

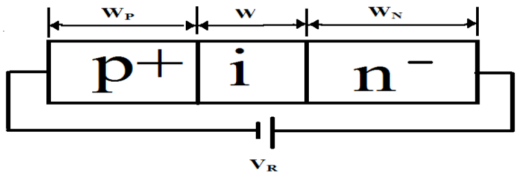

Figure 5: Pin diode

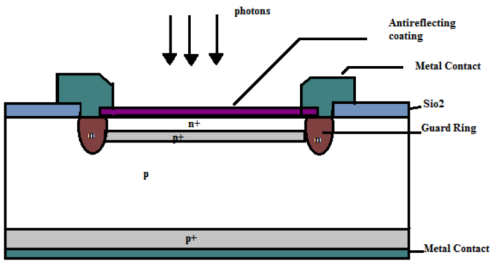

Figure 6: Avalanche photo diode

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Figure 7: Image sensor

Light intensity of LED is modulated by controlling the current. Fluorescent lamp transmit signal at 10bit/s and LEDs are up to 500 MBPS. Devices such as pin photodiode (high speed reception up to 1Gbps), avalanche photo diode and image sensor are used for reception purpose [12].The various devices used in VLC is shown in figure 5, figure 6, figure7.

Advantages

1) 1000 times more range than radio waves. 2) Light box is present. It contains 1000s of LED make it possible to transfer 1000s of data stream parallel at a very high speed. 3) LED lights consume less energy, so it is highly efficient. 4) It is available at all places where light is present. 5) Light waves do not penetrate through walls & hence cannot be intercept & misused by anyone having any bad intension.

Limitation

The biggest disadvantage is that it needs straight line of sight to transmit data so one wouldn't be able to have a single router in his/her house and the data goes through walls etc.

5. Conclusion

The possibilities are numerous and can be explore further that development of micron sized LED provides flickering of about 1000 times faster than larger LED. They offer very fast data transfers and take up less space so we can save time and space. Also, 1000 micron sized LED required area of 1sq.mm large single LED. A 1 sq.mm sized array of micron sized LED's could communicate 1000×1000 (i.e. a million) times as much information as a single 1mm LED. If this technology can be place into practical use, every bulb can be used something like a Wi-Fi hotspot to transmit wireless data and we will progress toward the cleaner, greener, safer and brighter future.

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