

Advancement in Wireless Communication System: A Review

Rishika Sen¹, Sushmita¹, Sunil¹, Cherry Bhargava^{2*}

¹Research Student, Department of electronics and communication, Lovely Professional University, Phagwara, Punjab

²Associate Professor and Head VLSI Design, Department of electronics and communication, Lovely Professional University, Phagwara, Punjab.

Abstract-*This paper presents the advancement in wireless communication from the initial stage of emerging wireless fidelity network and WiMAX to nowadays using massive MIMO technology and future hybrid technology using light fidelity(Li-Fi) , MIMO and Millimeter wave that is also the idea towards upcoming 5G technology to overcome the limitations of currently used Wi-Fi and 4G technology. As we know the number of users are gradually increasing in wireless network, their requirement also increases, due to this speed also decreases proportionally. Wi-Fi has the speed of 150mbps which is insufficient for the users. This gives limitation of Wi-Fi hence to overcome we introduce the concept of Li-Fi. Li-Fi stands for Light-Fidelity. Li-Fi is a type of visible light communication that uses LED as a medium to transfer information between the two users.*

Keywords-*Wireless communication, Wi-Fi, WiMAX, MIMO, Li-Fi, Communication System, 5g, Visible Light Communication*

INTRODUCTION

Wireless network provides the user to communicate and access the information without using wires like coaxial cables and so on. This wireless network provides freedom of movement and ability to extend different applications like different parts of buildings, of a city or anywhere in the world[2]. Due to limited coverage area of Wi-Fi , the next advancement was WiMAX[4] . WiMAX is a digital communication also know as wireless ‘‘Metropolitan area network’’(MAN). It provides features such as handover and power management. WiMAX can provide broadband wireless access up to 30 miles (50 km) for mobile station[2].

The 5G technology brings big concerns to the cybersecurity as will be easier to use malware and tools to hacker system for spying, data stealing and malware attacks[3]. China is the leader of this technology and is prepared to interfere with the sovereignty of other counties through communications systems. Ensuring the integrity, reliability and robustness of industrial, smart cities, administration and national defence communication is a mandatory requirement. At the same time, important architecture and design specifications for 5G are currently being defined. Security cannot be implemented later[1-2]. It must be integrated into the design from the very beginning in order to achieve the above-mentioned goals and thus the industrial suitability. The companies want customization of the standard in their industrial applications - especially for security mechanisms[4-5]. Only by incorporating security into standardization as early as possible can this flexibility and the added value for users be realized.

Overview of various technological advancement in wireless has been presented in this paper along with literature review and then comparison of research work is done according to years and finally results and conclusion is presented describing all the important point related to wireless communication.

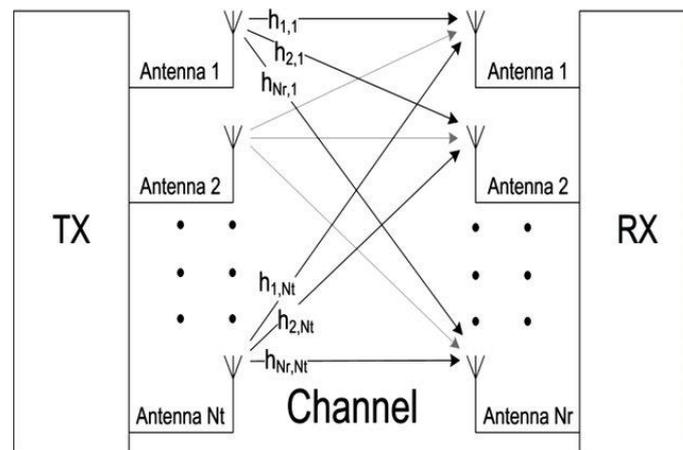


Fig 3. Massive MIMO

More innovation, more social security, and more prosperity: 5G technology is the key to the digital world[6-8]. Digitization brings a new chapter in the history of an economical, technology and social change. Already, new technologies have given us completely new scope for action: they have made life easier and better for people [9-10].

Comparison of Research Work

Serial No.	Title of paper	Author	Technology	Research Gap
1	Wi-Fi Technology	Adel-Ismail Al Alwai, University of Bahrain	Wireless fidelity Technology	In 1997 , IEEE standard 802.11 protocol for wi-fi came and research done in 2006 (9 years gap)
2	The use of MIMO technologies in wireless communication networks	Nikos Mastorakis, Technical University of Sofia	Multiple input and Multiple output Technology	In 2009 ,3 years gap
3	A scalable distributed positioning system augmenting WiFi technology	G. Manes, University of Florence	Advance Wireless fidelity Technology	In 2013, 4 years gap
4	Massive MIMO technology and challenges towards 5G	Chenwei Wang DOCOMO Innovations, Palo Alto, United States	Massive MIMO	In 2016,3 years gap
5	Modulation techniques for Li-Fi	Harald Hass, Mohamed Sufyan Islim, University of Edinburg	Light Fidelity Technology using Visible Light Communication	In 2016, No research gap
6	Latest Advancement in Light Fidelity Technology	Anwasha Chakraborty St. Xavier's College, Kolkata	Advancement in Li-Fi Technology	In January 2018, 2 years research gap

7	Performance and Environmental Impact Review of Li-fi and Wi-fi	Christoforus Williem Deo Lumoindong, President University	Li-Fi and Wi-Fi Technology	In October 2018,9 years research Gap
8	Li-Fi Technology: Increasing the range of Li-Fi by using mirror	Md Masuduzzaman Kumoh National Institute of Technology	Advancement in Li-Fi using mirror	In 2019,10 months research gap
9	Cybersecurity on 5g Technology	Artur Victoria	5G Technology	In 2019,No research gap
10	The road to 5G Technology, Politics and beyond	Munish sharma	5G technology	In October 2019,3 months research gap

Results and Discussion

To overcome this limited range "WiMAX" was created by the WiMAX Forum, which was formed to promote conformity and interoperability of the standard that includes the definition of predefined system profiles for commercial vendors. WiMAX was initially designed to provide 30 to 40 megabit-per-second data rates with the 2011 update providing up to 1 Gbit/s for fixed stations. Then for accelerating the speed of data rates and range Nikos provided solution by describing the MIMO technology that uses Multiple input and multiple output antennas at the transmitter end and the receiving end and multiple input could be send at the same time and simultaneously can be received which enhances the speed of the data transmission and reception. Also the concept of millimetre wave is now being used by the researchers which lies in the band spectrum of 30 GHz to 300GHz. This MM wave concept is nowadays used by researchers in the 5G technology for the improvement of 4G technology. Next Li-Fi that is light Fidelity technology came into existence where transmission of data will be done using Light that is Led and with this simple concept we will be able to send the data faster than ever. As we know that speed of light is faster than anything on this earth . Also this medium is also license free , we can use this available visible light to see as well as for wireless communication.

Conclusion

This rapidly increasing advancement in wireless technology are going to unleash novel applications and also it leads to the development of different industries. This advancement will make our task easy and more secure with extremely high data rates . This advancement allows us move one step further in the technology. Technologies underpinning 5G such as Network Function Virtualization, Network Slicing, massive MIMO, Software Defined Networks, and the utilization of millimeter band have made strides over the years, resulting in spectral efficiency, energy efficiency, and better infrastructure utilization. In aggregate, these technologies have brought 5G to the cusp of commercial deployment towards early 2020. The competition could be termed almost cut-throat, not just among the technology titans, but also among nation states. This is partially because, for the first time in the history of mobile standards, an "outsider" has made inroads into the "elite" club of standard-setting bodies. Apparently, unlike the previous generations of mobile communication standards, more than technology, 5G is about technology leadership. 5G is also one among the basket of emerging technologies — such as Artificial Intelligence and Quantum Information Science — through which China aspires to challenge or alter the existing global technology leadership positions. India's telecommunications market should also house a globally competitive innovation ecosystem comprising of the private sector, government bodies, and academic and research institutions. The domestic industry should receive a preferential treatment if it is able to demonstrate technology process. Technology transfer is also one of the ways to benefit the domestic industry at this stage, but it is not a long-term solution. The government should continue to build an innovation culture in the higher education and research institutions. However, the

industrial research and development activities should be driven by the market forces — without interference, but with the generous support of the government. 5G deployment should not be looked upon as a onetime investment activity. The research for 6G has already begun, which involves harnessing extremely high frequencies of the levels of 300 GHz, or even the terahertz band. 5G should rather be seen as an opportunity to move up the value chain for the forthcoming generations of wireless mobile communication systems.

References

- [1] M. S. I. Harald Hass, "Modulation Techniques for Li-Fi," 2016.
- [2] A. I. Al-Alwai, "Wi-Fi Technology:Future Market Challenges and Opportunities," *Journal of Computer Science*, 2006.
- [3] N. Mastorakis, "The use of MIMO technologies in Wireless Communication Networks," in *PROCEEDINGS OF THE 3RD INTERNATIONAL CONFERENCE ON COMMUNICATIONS AND INFORMATION TECHNOLOGY*, 2009.
- [4] G.Manes, "A Scalable distributed positioning system augmenting Wi-Fi Technology," in *INTERNATIONAL CONFERENCE ON INDOOR POSITIONING AND INDOOR NAVIGATION*, 2013.
- [5] C. Wang, "Massive MIMO Technologies and Challenges towards 5G," *IEICE Transactions on Communications*, 2016.
- [6] T. D. Anwasha Chakraborty, "Latest Advancements in Light Fidelity(Li-Fi)Technology," *International Journal of Advance Research in Computer Science and Management Studies*, vol. 5, no. 12, 2018.
- [7] C. L. Mia Galina, "Performance and Environmental Impacts Review of Li-Fi and Wi-Fi Technologies," *Journal of Environmental Engineering & Waste management*, vol. 3, no. 2, 2018.