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LiFi- Future Technology

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Abstract

The introduction of Wi-Fi into the residences is creating a biological havoc among humans. A lot of research has been evolved and presented depicting the various imperfections caused by the radiation of Wi-Fi. To overcome this LiFi technology may be used for indoor communication instead of Wi-Fi. LiFi communication needs line of sight for communication. LiFi transfers the information through visible light. Light cannot travel through opaque objects. The various properties of light like Reflection, Refraction, scattering effects on visible light will lead to data loss. Hence LiFi is preferably used indoors. This article discusses on the effects of biological degradation caused by Wi-Fi, Bluetooth etc. in short, this article enlists the effects of radio waves in accordance with the psychological changes caused in mankind. This in turn will lead to build a system which will also ensure the safety of the ecosystem for the development of mankind.

Keywords: LiFi and Healthcare, Wi-Fi, Bluetooth, radio wave effects, IoE

1. Introduction

Lifi technology is a buzzing term in European and American market today. The term Lifi was coined by the great Professor Harald Hasss who was the Chair of Mobile Communications at the University of Edinburg [1]. The world was introduced to this technology during Harald's TED Global talk during 2011 [2]. From this juncture various organizations that were in optical communication started Consortiums on Lifi. Initially Lifi was termed as Visible Light Communication (VLC) before Professor Harald showed the data transfer during his talk [1,2]. Enormous research was taking place in VLC as the researchers predicted a deficient of delay when the data transfer occurs through light. In the unguided media the data travels as an electromagnetic wave or radio wave. The general spectrum of

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communication technology evolution is shown in figure 1 [1]. The effect of this wireless transmission has caused several catastrophic damages in the ecology.

Due to several up gradation in the technology and the terrible disaster COVID human work style came to a pause state. This was rekindled due to Wi-Fi at home. Most of the offices were into the mode of work from home other than health care. Due to the increased usage of internet for education, work, entertainment etc people are installing Wi-Fi broadband connections in the residence. This made life comfortable. Prolonged exposure of the radio waves on human beings within a limited space will cause several physclogical problems on the individuals [3]. As increased exposure to radio waves is booming up now more concentration was on the integration of all gadgets and appliances to the internet is happening jet fast. Everyone is concentrating on the Internet of Things and Internet of Everything. Everyone will agree that IoT and IoE have made the living simpler. We are living in an online world. Unless critical even the health care has come online.

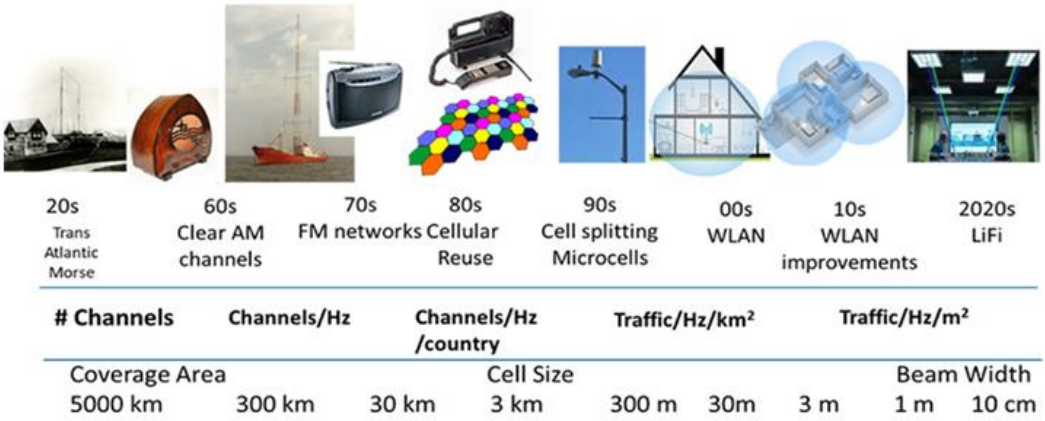

Figure 1. Evolution of communication technology [1]

For effective QoS efficient methodologies are followed. This improves the signal strength and directivity of the EMF wave passing out of the Smart antenna from the Smart device. Extensive studies have been carried out in this direction and several researches has published their findings, let's ponder on few of it.

2. Literature Survey

Martin [3] found that the millimetre wave and electromagnetic fields fail in producing penetrating effects in human body. But they are being completely absorbed about 1mm by the outer body due to its high dielectric constant and biological aqueous phases. Magnetic fields

thus produced are with very high penetration effects. In humans these millimetre wave and electromagnetic fields have impacts on brain functioning, changes in EEG, neuropsychiatric changes, neurological changes and cardiac activity. The significant action by low intense EMFs in causing biological variation effects is through activating the voltage-gated calcium channels (VGCCs)through its voltage sensor. The millimetre wave's directly acts on pacemaker cells in sinus articular node. Hence continuous exposure can change the rhythm of heart which is dangerous.

Martin [4] puts forth the influence of EMFs in the chemistry of biological cells. This review support in the creation of VGCCs. This biological pathway is due to microwave EMFs, ultralow frequency, static electrical or magnetic fields. EMF activation of VGCCs creates a rapid spike within the cells i.e., intracellular Ca2+, nitric oxide and in certain cases peroxynitrite rises. This peroxynitrite is highly unstable; hence it is a very effective oxidative agent which helps in the creation of free radicals in the biological system. This is one of the most damaging nitrogen species found in the biological system. Oxidative stress will lead to metabolic syndrome.

Martin [5] has extensively studied and proved that Wi-Fi radiations causes lot of detonating issues like oxidative stress, sperm/testicular damage, it also leads to several neuropsychiatric effects like change in EEG, apoptosis, DNA damages in cellular level, variations in endocrine gland functionality, and calcium overload. These seven causes have been repeatedly reported after the exposure to Wi-Fi and other EMF radiations.

Santini et al. [6], states that mitochondria plays a significant role in sourcing the production of ROS (reactive oxygen species) in male and female reproductive systems under EMF exposure. ROS are cell signalling molecules. Elevated ROS leads to loss of sperm mobility and vitality in male reproductive system and creates lot of complex diseases including infertility in female reproductive system. ROS production is an outcome of cell oxidation.

Panagopoulos et al. [7], On continuous exposure to human created electromagnetic fields (EMFs), especially in the extremely low frequency (ELF) and RF band leads to DNA damage. Also, it found that increased ELF exposure increases cancer risk. DNA damage is because of reactive oxygen species/free radical overproduction. This DNA damage is connected with cell death. This in turn causes infertility and several other pathologies, including cancer. Non thermal biological effects attributed to RF EMFs are because of its

ELF components. Cao et al. [8], proposes from the study that comparing the persons using mobile devices to those who are non-using, the usage of mobile phones have resulted in higher risk of mental health disorders, eye diseases, headaches, neoplasms. When these data are subjected to subgroup analysis it also confirmed the risk of accidents and chronic disorders. Povolotskiy [9] puts forth from recent survey that in recent years, head and neck injuries related to mobile phones have increased sharply. Berry et al. [10] provided a systematic review with a deep analysis on the acceptance of online and mobile delivered interventions for severe mental illness (SMI) was relatively low, while actual acceptance was very high. Hypothetical acceptability was higher for interventions delivered via text messages than by emails.

Mònica et al. [11] narrates on the environmental effects of RF-EMF exposure from mobile phone base stations, and also from several indoor sources like cordless phone stations, Wi-Fi access points. Also watching television is associated with several specified emotional and behavioural problems in children. Children exposed to higher RF-EMF levels from mobile phone base stations are reported with increased maternal-reported emotional symptoms in comparison with the other hand. Children with cordless phones at home reported very few problematic pro-social behaviours. Also, children with cordless phone at home had maternal-reported peer relationship problems. Children who had more screen time were reported with maternal-reported hyperactivity or inert attention. Mònica et al. [12] has observed significant associations from various sources of RF-EMF exposure and its cognitive functions among children. (5-6 years). A high RF-EMF exposure in residences causes reduction in visuomotor coordination. A decreased inhibitory control with cognitive flexibility was observed with increased usage of personal cordless phone like devices. Haas et al. [13] discusses the advantages and the actual implementation strategies involved in building up a hybrid network of Lifi and Wi-Fi.

3. Conclusion

In IoE which is an effective and emerging field today, we must be held responsible in developing a better world. Rather than concentrating on effective data delivery and service researchers must also concentrate on building an eco-friendly framework for communication. Growth is inevitable. It is the responsibility of the future scientists and engineers to build in an efficient system. The outcome of this article is to help in framing an efficient framework which will provide a efficient and effective communication system not only in terms of

throughput, goodput, delay ie., based on QoS but also based on building a good ecosystem. The technology must not be a disaster to humanity but it must be a blessing which helps in building a better ecosystem.

References

[1] https://www.signify.com/global/our-company/blog/innovation/honey-i-shrunk-the-cell

[2] https://lifi.co/the-history-of-lifi/

[3] Pall, Martin L. "Millimeter (MM) wave and microwave frequency radiation produce deeply penetrating effects: the biology and the physics." Reviews on Environmental Health 37, no. 2 (2022): 247-258.

[4] Pall, Martin L. "Electromagnetic field activation of voltage-gated calcium channels: role in therapeutic effects." Electromagnetic Biology and Medicine 33, no. 4 (2014): 251-251.

[5] Pall, Martin L. "Wi-Fi is an important threat to human health." Environmental research 164 (2018): 405-416.

[6] Santini S.J., Cordone V., Falone S., Mijit M., Tatone C., Amicarelli F., Di Emidio G., "Role of mitochondria in the oxidative stress induced by electromagnetic fields: Focus on reproductive systems." Oxidative Medicine and Cell Longevity 2018; 2018:5076271. doi: 10.1155/2018/5076271. - DOI - PMC – PubMed.

[7] Panagopoulos, D. J., Karabarbounis, A., Yakymenko, I., Chrousos, G. P. "Human made electromagnetic fields: Ion forced oscillation and voltage gated ion channel dysfunction, oxidative stress and DNA damage (Review)", Spandidos Publications: International Journal of Oncology 59, no. 5 (2021): 92. https://doi.org/10.3892/ijo.2021.5272.

[8] Cao X, Cheng Y, Xu C, Hou Y, Yang H, Li S, Gao Y, Jia P, Wang Y, " Risk of Accidents or Chronic Disorders From Improper Use of Mobile Phones: A Systematic Review and Meta-analysis", JIMR Publications: Journal of Medical Internet Research 2022; 24 (1) : e21313 , doi: 10.2196/21313 PMID: 35049511

[9] Povolotskiy R, Gupta N, Leverant AB, Kandinov A, Paskhover B., " Head and Neck Injuries Associated With Cell Phone Use." JAMA Otolaryngology- Head & Neck Surgery. 2020 Feb; 146(2): 122-127.DOI: 10.1001/jamaoto.2019.3678. PMID: 31804678; PMCID: PMC6902153.

[10] Berry N, Lobban F, Emsley R, Bucci S, "Acceptability of Interventions Delivered Online and Through Mobile Phones for People Who Experience Severe Mental Health

Problems: A Systematic Review" , JIMR Publications: Journal of Medical Internet Research, 2016;18(5):e121 doi: 10.2196/jmir.5250:PMID: 27245693:PMCID: 4908305.

[11] Mònica Guxens, Roel Vermeulen, Ilona Steenkamer, Johan Beekhuizen, Tanja G.M. Vrijkotte, Hans Kromhout, Anke Huss, "Radiofrequency electromagnetic fields, screen time, and emotional and behavioural problems in 5-year-old children", Elsevier : International Journal of Hygiene and Environmental Health, Volume 222, Issue 2, 2019,Pages 188-194, ISSN 1438-4639, https://doi.org/10.1016/j.ijheh.2018.09.006.

[12] Mònica Guxens, Roel Vermeulen, Manon van Eijsden, Johan Beekhuizen, Tanja G.M. Vrijkotte, Rob T. van Strien, Hans Kromhout, Anke Huss, "Outdoor and indoor sources of residential radio frequency electromagnetic fields, personal cell phone and cordless phone use, and cognitive function in 5–6 years old children", Elsevier : Environmental Research, Volume 150, 2016, Pages 364-374,ISSN:0013-9351, https://doi.org/10.1016/j.envres.2016. 06.021.

[13] X. Wu, M. D. Soltani, L. Zhou, M. Safari and H. Haas, "Hybrid LiFi and WiFi Networks: A Survey," IEEE Communications Surveys & Tutorials, vol. 23, no. 2, pp. 1398-1420, Second quarter 2021, doi: 10.1109/COMST.2021.3058296.

Author's biography

S.Smys received his M.E. and Ph.D. degrees in Wireless Communication and Networking from Anna University and Karunya University, India. His main area of research activity is localization and routing architecture in wireless networks. He serves as Associate Editor of Computers and Electrical Engineering (C&EE) Journal, Elsevier, and Guest Editor of MONET Journal, Springer. He served as Reviewer for IET, Springer, Inderscience and Elsevier journals. He has published many research articles in refereed journals and IEEE conferences. He has been General chair, Session Chair, TPC Chair and Panelist in several conferences. He is Member of IEEE and Senior Member of IACSIT wireless research group. He has been serving as Organizing Chair and Program Chair of several International conferences and in the Program Committees of several International conferences. Currently, he is working as Professor in the Department of Information Technology at RVS technical Campus, Coimbatore, India.

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