LIFI AS A REVOLUTIONARY WIRELESS COMMUNICATION TECHNOLOGY

LIFI

Global mobile traffic has been increasing rapidly for several years now. While radio frequencies become overloaded, the visible range of the spectrum remains an unused resource with a large bandwidth suitable for stable connection of a large number of devices. Many scientists and companies have come to the conclusion that it is necessary to find a way to create a technology that would use visible light communications and outstrip existing technologies based on radio waves. That's how the idea of LiFi appeared [1].

For today the new technology is known as LiFi or "Light Fidelity". It's better to begin with some uninspiring general information because it is necessary to understand how the system works. LiFi is a wireless optical networking technology. Specifically, it is a form of visible light communications (VLC) system that makes use of light-emitting diodes (LED) [2] for data transmission at visible wavelengths between 400 and 800 THz [3]. It was first announced in 2011 by professor Harald Haas at the TED Global Talk.

Good and bad sides of LiFi in comparison with Wi-Fi. The technology allows you to use the Internet in the most inaccessible places due to the mechanism and simpleness. Practical applications are mostly underwater communications, security, hospitals, industrial automation, airplanes, military, retail, museums, trains and so on [3].

Connectivity speed. It uses a light spectrum which can open up 1000 times more bandwidth. With LiFi we can efficiently use our existing light infrastructures to provide high-speed secure wireless communications. During lab tests, researchers were able to reach bidirectional transfer speeds of 224 gigabits per second [5]. Of course, it would be difficult to reach those speeds in a real-world setting. But reaching even 1% of that means speeds of 2.24 gigabits per second – a significant improvement over WiFi, which nets transfer speeds of about 20 megabits per second. So, seems like LiFi can be an integral part of the future of wireless networks such as 5G.

Universality and flexibility. With the current operational concepts of LiFi, its experimental applications center on the use of LED bulbs and lamps. Hence, it is easily integrated into areas that already use LED lighting systems. The inter-

net is readily-accessible wherever there is light and can be used in a variety of applications that require an internet connection [3].

Because LED lamps are inexpensive to produce, analysts predict that the deployment of LiFi would be easier and ten times cheaper than WiFi [6]. Plus, they are more energy-efficient than any other lighting technology. As LiFi systems operate to provide illumination and for internet connectivity, you save up on energy costs.

Data security and control. LiFi does not interfere with radio frequencies which means you can use it in hospitals, power plants, petrochemical plants and airplanes. RF (radio frequencies) communication technology has always been vulnerable to eavesdropping, signal hijacking, or even brute force attacks [4]. However, visible light is unable to permeate opaque surfaces. Signals emitted by LiFi as well as the data transmitted through it remain confined within the space. The illumination area of LiFi is confined to the area that the light touches which means that unlike WiFi your signal remains hidden to anyone outside this area [6]. The light is controllable – simply shut the door or pull the blinds to protect your network from prying eyes.

Now we see that there are a lot of advantages of using LiFi. It is smart, soft, cheap and opens up many ways for the development of this light technology in other industries. But nothing's perfect and there are some cons of LiFi.

LiFi offers a limited range. While this may prove useful for security, it also creates disadvantages. Physical barriers limit its operational scope[6]. In order to increase its scope, lamps or bulbs must be strategically placed in various rooms. In contrast, a single WiFi router has a wider, longer range, making them an ideal selection for public networks.

Interference is a key element. LiFi signals are susceptible to light interferences, including sunlight. Receivers may have a difficult time to process signals when other sources of light are present. Moreover, because LED lamps must remain on to function, they can further contribute to light pollution, especially if set at higher brightness levels to compensate for possible interference.

It's more expensive than it seems. Theoretically speaking, deploying LiFi systems are inexpensive because they only make use of LED lamps. In reality, the installation of LiFi systems can become expensive due to the lack of infrastructure. Additionally, due to its limited range, several LiFi routers will need to be installed for greater connectivity.

We're talking about downsides, but its needed to say that it's still more profitable than WiFi. The upfront cost of LiFi may be a bit steep, but it offers significant savings in the long run. With LiFi, you can ditch your monthly WiFi bills [6]. And since LiFi can be integrated into any existing LED lighting fixture or infrastructure, you don't have to worry about huge additional costs on your energy bills. Moreover, it's a low-maintenance device.

Ultimately, the end goal of the developers and manufacturers is to have LiFi in every mobile device by maximizing existing lighting infrastructures, like street lights, headlights, gallery lighting, and more. Creators are already trying to contact with mobile developers to integrate LiFi technology to phone's mechanism. Reports suggest that Apple may build future iPhones with Li-Fi capabilities. Some people found that within iOS code there were references to Li-Fi written as 'LiFiCapability'.

For now some companies such as PureLiFi, Zero1, OLEDCOMM and Velmenni are working successfully on this technology [3]. LiFi emerged as a research field in the 2010's, in line with a long history of works on IR and visible light wireless network access. Then, it rapidly translated into the industrial sector by the creation of several specialized companies, which developed a certain experience of the LiFi market. The current market feedback show that secure connection is the most appreciated advantage of LiFi [3].

However, the massive deployment of LiFi remains conditioned firstly by the progress of the standardization process. This process aims at ensuring the integration of LiFi among the other RF technologies by reducing as far as possible the various technical and market entry barriers. It will also provide a stable framework for the mass production of dedicated chipsets, which are vital for an integration of LiFi into mass-market devices such as smartphones. Another crucial process is the development of a LiFi ecosystem, started with the LCA (life-cycle assessment), and including a wide variety of actors interested in LiFi for the technology promotion but also to set up its certification and interoperability processes[1]. In parallel, many technical challenges remain to be solved in order to improve the performance of this technology and to impose it as an essential solution to the rising spectrum shortage and cybersecurity threats issues.

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LAW ENFORCEMENT ACTIVITY OF CUSTOMS AUTHORITIES AND ITS PSYCHOLOGICAL FEATURES

The system of Customs authorities occupies important positions in the economic, legal and social policy of the state. It is based on effective customs control in the interests of ensuring the economic security of the Republic of Belarus, protecting the health and morals of its population. It includes the State Customs Committee of the Republic of Belarus, 8 customs offices, state institutions established to ensure the performance of functions assigned to customs authorities.

The main functions of customs authorities: organization interaction and coordinate the activities of state bodies and other organizations in the implementation of state customs policy; ensure, within their competence, economic security of the Republic of Belarus, protection of its economic interests; perform customs operations, conduct customs control and customs examinations, to create conditions that will speed up trade turnover when importing goods to the Republic of Belarus and exporting goods from the Republic of Belarus through the customs border of the Customs Union; they collect customs and other payments, the collection of which is entrusted to the customs authorities, monitor the correctness of the calculation and their timely payment, take measures to ensure them; ensure compliance with the procedure for moving goods across the customs border of the Customs Union on the territory of the Republic of Belarus; ensure, within their competence, the protection of intellectual property rights, combat smuggling and other crimes, the proceedings on which are attributed to their competence, etc.