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TRANSFORMATION OF BROAD BAND AND MEDIA INFORMATION TO MULTIPLE USERS USING UP-AND-COMING LI-FI TECHNOLOGY INSIDE THE TRAIN

B.Anitha Vijayalakshmi [#1], A.Aruna[*2], Ms.Akkanshalilly[*3],

Ms.Givisha [*4,]Ms.Angelin[*5] & Ms.Arunthathi[*6.]

[1,2]Assistant Professor, Department of Electronics & Communication Engineering, Kings Engineering College[3,4,5,6]UG Students, Department of Electronics & Communication Engineering, Kings Engineering College

***Abstract*: One of the vital necessitate of people in today's lives is sharing information's. With the continually increasing traffic demand the accessible RF spectrum with proficient frequency and spatial reuse corroborate the scarcity to support multiple users in delivering broad band and multimedia content. In onboard rail networks the delivering of smooth Wi-Fi access is critical. The 5G visible light communication (VLC) technology using the visible light spectrum includes hundreds of terahertz of license free bandwidth, and much more talented in providing high data rate and security. This paper focuses in transformation of broad band and media information to multiple users in train using Li-Fi technology under VLC.**

***Key words:* Multiple users, Li-Fi, Train, VLC**

I. INTRODUCTION

The RF based wireless communication has turned up to bottle neck due to the spectrum scarcity in radio frequency (RF) spectra. The license free bandwidth in the order of hundreds of terahertz of visible light spectrum is at a halt, untouched condition for communication. The Visible Light Communication (VLC) harmonizes the RF-based mobile communication systems for underhanded high-capacity mobile data networks. Communication using visible light wave at a wavelength of 380–780 nm is persistently gaining attention, due to its enormous communication bandwidth, unregulated spectrum, high data rate services, and license-free predominantly. Visible light signals don't penetrate through most of the surfaces in the environment like walls and others so that it offers intrinsic wireless communication security. In the place where a VLC system is deployed, information may be contained within the confined space of the specific premises. This practically eliminates the possibility of casual eavesdropping.

Traditional fluorescent and incandescent light sources can be rapidly replaced by light emitting diode (LED) due to its energy e□ciency and longer lifetime for the purpose of illumination. The use of LEDs in VLC creates scope for communication together with illumination. A light emitting diode (LED) as a transmitter and a photodiode (PD) as a detector can be comprehend in VLC system. Coherent modulation/detection techniques are not possible in VLC due to the incoherent emission of the LED. Therefore, intensity modulation with direct detection techniques has to be used to encode data. In LEDs, data is modulated into the intensity of the light source and transmission takes place across an optical wireless channel.

To ensure the passengers with real time multimedia information, access to social networks in station or in train and to meet the traffic demand it's required to put in place the broadband telecommunication networks, using a variety of technologies whether fixed or wireless [1]. Heterogeneity of networks like Wi-Fi, GSM-R, Satellite, 3G / 4G networks is becoming a real headache for train operators and infrastructure managers [1]. The VLC technology combines communication in addition to illumination and also affords security, intelligent lighting, indoor localization and much more. In the future prospects of 5G wireless access networks the VLC technology will show its greater impact due to its inherent advantages.

II GENERAL PURPOSE ILLUMINATION WITH LED TECHNOLOGY

The VLC technology's vital source is LED. General purpose illumination for home, public places and industries demand white or amber lighting. Presently, lighting companies are engaged in developing high power white LED clusters for such applications by achieving similar light output as incandescent or fluorescent lamps while reducing power wastage. In the years that followed, high brightness white LEDs were formed by mixing of high power blue LED with yellow phosphors, white phosphor LEDs have recently reached luminous efficacies of 150 lm/W. White Light from (R/G/B) LEDs directly mixes light in required proportions from three i.e., red, green and blue (RGB) LEDs to produce white light of desired chromaticity. The luminous efficacy of this "RGB" solution is very high, with about 29 lm/W.

The LEDs can create the white light illumination in two ways, the blue emitters with phosphor layer and red–green–blue–amble (RGBA) emitters. The phosphor-based LEDs has improved data rate, higher bandwidth than RGB LEDs. Recently, data rates in excess of 1 Gbps has been reported using off-the-shelf phosphor-coated white LEDs and 3.4 Gbps has been demonstrated with an off-the-shelf red-green-blue (RGB) LED. Another similar Gigabit/s wireless system with phosphor-coated white LEDs has been demonstrated using a 4×4 multiple-input-multiple-output (MIMO) configuration [2].

LED facilitates with unmatched energy efficiency and lifespan. The acceptance of LEDs practice will be of constant in rise in future due to its compact form factor, reduced usage of harmful materials in design and lower heat generation in long period of unremitting usage.

Fig.1 LEDs installed in train

The LEDs are competent in switching to different light intensity levels imperceptible by a human eye at a very fast rate when comparable with older illumination technologies. The data will be encoded in the emitting light and the photo detector referred as light sensor, receives the modulated signals and decodes the data. This means that the LEDs can give out both the dual purpose of illumination and communication.

III PROBLEM IN EMPLOYING WI-FI ON ONBOARD RAIL NETWORKS

In onboard rail networks the delivering of smooth Wi-Fi access is critical. Onboard environments are prone to vibrations, have limited space and it requires modified wireless devices to ensure system stability. The wireless devices used in onboard must make sure that every passenger has allotted sufficient bandwidth and provided secured network access, without having to be anxious about being hacked.

Most of the passengers in high-density trains, expects internet access to read emails or watch online videos. The onboard network designers must know about the kind of applications that passengers are habituated to exercise over the internet. So that they may eliminate the possibility of the train's passengers troubled by unstable internet access. To ensure the safety in onboard systems from hackers connected to the same network topology, the public network environments must be protected and the privacy of passengers must be preserved for those who access the train's Wi-Fi access point (AP)s.

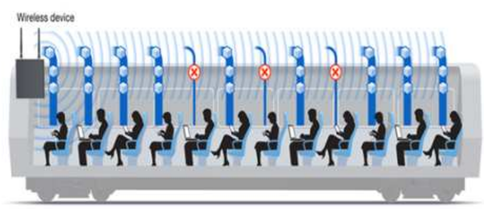

Fig.2 Problem of hacking

System implementation:

In onboard train, the recommended block is shown in Fig. 3 [3] to provide effective data transmission from the base station to receiving station. The system has a Li-Fi RF driver to sense the signal from the base station using the medium of light and the photo detector in the device captures the signal and passes the information to the passengers. ‘1’ is transmitted if the LED is on; if it’s off the transmitted output is ‘0’. LEDs can be toggled on and off very quickly, such that it offers pleasant opportunities for transmitting data. Li-Fi may not be able to replace conventional radios altogether, but it could enhance the development of wireless data transmission inside the train and make it easier to throw a wireless signal to the multiple users.

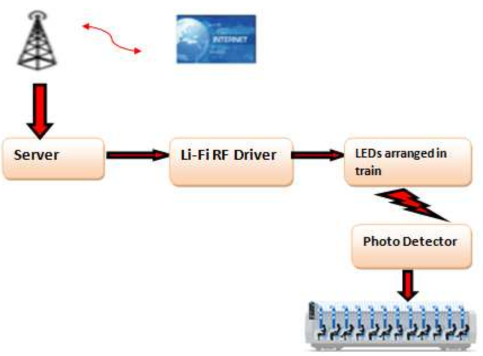

Fig.3 Recommended block

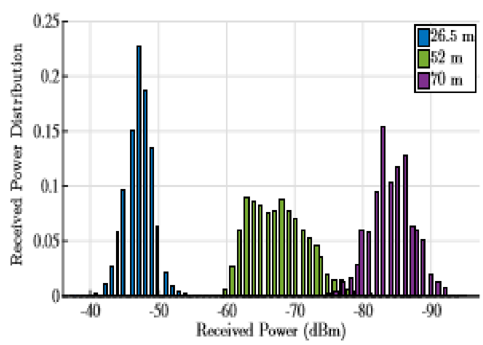

Fig. 4 Distribution of the received power at low speed of 50km/h

Measurement shows a good fit at low speed of 50km/h as shown in figure 4 [4]. With increase in speed there will be higher drop in the received power [4]. The issue is in regard of using RF communication in train and can be overcome by utilizing VLC.

IV CONCLUSION

Visible light communication using Li-Fi technology will be the best solution in the future for better illumination and communication inside trains using LED luminaire for lighting system.

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