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Vehicle to Vehicle Road Mishap Regulating using Visible Light Communication

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ABSTRACT

The latest technology called as LI-FI which has been developing a lot in few years. Traffic congestion and tidal flow management are two major problems in modern urban areas which lead to road accident and loss of life. Using the conceptof LI-FI two vehicles are communicated with the help of LEDs bulbs with the help of transmitter and receiver circuit. A very chip device called as ultrasonic sensor which is used to measure the distance and also todetect any obstacles is used here just to communicate the two vehicles when they comes in the contact in some range which is preferred for the ultrasonic sensor. Using this LI-FI the data are transmitted from one vehicle to another. The data that is transmitted through LIFI can be any datalike audio, video or text. This system aims at communicating with the vehicle in its surrounding with the help of its location to indicate their proximity. In this way the drivers can communicate with each other and act according to the situation. Visible light communication(VLC) is act as medium of this lifi technology to send a data at high speed between two devices. VLC are conducted to overcome the radio spectrumcongestion.

Keywords: ***LIFI, Visible light communication, Vehicle, LED bulbs, ultrasonic sensor***

INTRODUCTION:

Vehicle-to-vehicle communication (V2V) is a rapidly evolving technology that has the potential to revolutionize the transportation industry By allowing vehicles to communicate with each other in real-time,V2V systems can improve safety, reduce congestion, and increase efficiency on the roads. However, traditional radio frequency (RF) based V2V systems have limitations such as signal interference, limited bandwidth, and security concerns. Researchers are turning to alternative technologies such as Li-Fi, which uses visible light communication (VLC) to transmit data, to overcome these challenges. Li-Fi technology has gained significant attention in recent years due to its potential to provide faster and more secure wireless communication than traditional RF- based systems. Li-Fi uses visible light to transmit data, allowing for higher bandwidth and less interference than RF-based systems. Li-Fi technology has been used in a variety of applications such as indoor lighting, underwater communication, and secure data transfer. The potential for Li-Fi technology in V2V communication is gaining attention, as it may provide a more reliable and secure alternative totraditional RF-based V2V systems. This paper aims to explore the potential of Li-Fi technologyfor V2V communication. The paper begins by discussing the current state of V2V technology

and the challenges faced by traditional RF- based systems. We then provide an overview of Li-Fi technology, including its advantages and limitations, and discuss how it can be used in V2V communication. We explore the potential applications of Li-Fi V2V systems, including their use in autonomous driving, traffic management, and emergency response. Finally, we discuss the challenges and future directions of Li-Fi V2V technology.

Current State of V2V Technology

V2V communication has the potential to enhance safety, reduce traffic congestion, and increase fuel efficiency. V2V systems allow vehicles to share information with each other in real-time, such as location, speed, and direction. This information can be used to warn drivers of potential collisions, recommend alternative routes, and optimize traffic flow. V2V systems can also be used in combination with other technologies, such as autonomous driving, to further improve safetyand efficiency on the roads.

The current state of V2V technology is primarily based on RF-based systems, such as Dedicated Short-Range Communications (DSRC) and Cellular Vehicle-to-Everything (C-V2X). DSRC is a communication standard developed specifically for V2V and Vehicle- to Infrastructure(V2I) communication. DSRC operates in the 5.9 GHz frequency band and provides a range of up to 1,000 meters. C- V2X, on the other hand, uses cellular networksto provide V2V and V2I communication. C- V2X provides a longer range than DSRC, butalso requires a cellular network to operate.

While RF-based V2V systems have shown promise, they also have limitations. RF-based systems are susceptible to interference, signal degradation, and security breaches. RF signals can also be affected by weather and terrain, which can limit their effectiveness in certain environments.These limitations have led researchers to explore alternative technologies for V2V communication.

Overview of Li-Fi Technology

Li-Fi is a wireless communication technologythat uses visible light to transmit data. Li-Fi isbased on the principle of VLC, which uses therapid modulation of light intensity to transmitdata. In Li-Fi, light-emitting diodes (LEDs) areused to transmit data between devices. The LED emits light at a high frequency, which is modulated to encode data. The modulated lightis then detected by a photodiode receiver, which converts the light signal back into digital data. Li-Fi has several advantages overRF-based systems. Li-Fi can provide higher bandwidth and faster data transfer rates than RF-based systems.

LITERATURE SURVEY

***X*iong Deng, Kumar Arulandu, Yan Wu, GuofuZhou, and Jean-Paul M. G. Linnartz, [2019]**

This paper analyzed Binary Phase Modulation (BPM) in VLC for an arbitrary modulation depth and duty cycle of the symbols, taking into account signal-dependent shot noise, power efficiency and imperfections(ripple) of typical LED drivers. In particular, our proposed Delta approximation for the non-Gaussian triangular ripple can well predictthe effect of ripple on BER. Ripple interference particularly deteriorates the BER performance for small modulation depths, significantly, below 10%. Our model and our simulations show that at deeper modulation depths the effects is modest even for ripple percentage larger than the modulation depth.

Thus, from a power consumption perspective, one even prefers to tolerate higher ripple levels. However, this may in practice pose some challenges to synchronization and setting the decision thresholds in the receiver, particularly, for direct sampling systems.

The ripple interference can be alleviated furtherby low-pass filtering in the receiver. Two Buck-based LED drivers for BPM
are analyzed and simulated for a practical implementation.

Firstly, our proposed control-loop adapting driver can realize
high power efficiency. In this case, data rate isconstrained by the frequency of buck self-oscillation PWM frequency but one can increase the PWM frequency by using a small inductor or adapting the hysteresis levels.

Secondly, binary shunting supports high datarate but that is at the cost of high extra power consumption (EEPS).
Due to the output capacitor, high data
rate can significantly decrease the efficiency ofLED drivers. To minimize the effect of capacitor on power efficiency, a small capacitor should be used only for EMIprotection in binary shunting. If the modulation frequency increases, in both cases, the switching loss becomes relevant and it also depends on the switch property. In general, ourproposed control-loop
adapting driver outperforms the reported binaryshunting one in terms of higher powerefficiency, lower EEPS and better achievableBER performance given a power budget.Usually, for many indoor applications wherethe required data rate is relatively low, the control-loop adapting is attractive for Joint Illumination and Communication (JIC)systems.

Yang Hong, Lian-Kuan Chen, Senior , and JianZhao,[2020]

Proposed and experimentally demonstrated a
full-duplex PNC scheme to double the throughput of relay assisted VLC network.TO Optimize the transmission performance of the overall network, achannel aware APNC scheme with adaptively loaded OFDM is proposed and investigated the performance of the proposed scheme is experimentally evaluate via the comparison with other feasible solution including the half duplex network scheduling and the PNC scheme with uniform loading. Experimental results show that the proposed scheme exhibits the optimal transmission performance and achieves around two orders of magnitude improvement in the BER performance from (-10^-2 to 10^-4) for a 600Mb/s TWR-VLC network. The Proposed channel aware APWC scheme provides a feasible solution to boost the capacity of VLCnetwork

Jiajia Liu, Nei Kato, Fellow, Jianfeng Ma, andNaoto Kadowaki,[2021]

Propesed work D2D communication in theemerging LTE-A networks, which hasattracted intensive research Interests fromacademia, industry, and standard bodies. In particular, we first provided an extensivesurvey of the stateof-the-art research works onD2D communications according to the major research topics, ranging from D2D discoveryand link establishment to D2D applicationsand services.
We reviewed the available D2D prototypes and experiments, namely FlashLinQ, Data Spotting, and Relay-by-Smartphone,
and discussed in details their architecture features and system implementations. We also summarized the latest progress of 3GPP activities on D2D modeling and evaluation. Based on the above survey of available works.

Qingqing Wu, Wen Chen, Derrick Wing Kwan Ng, and Robert Schober[2021]

In this paper, we have answered afundamental question:
Does NOMA improve SE and/or reduce the total energy consumption of the wireless powered IoT networks? By taking into account the circuit energy consumption of the IoT devices,
we have found that N-WPCN is neither spectral efficient nor energy efficient,compared to T-WPCN.
This suggests that NOMA may not be a practical solution for spectral and energy efficient wireless IoT networks with energy constrained devices. The case with user fairness consideration is an interesting topic for future work.

Manjing Zhu, yuhao Wang,Xia odong Liu,shuai Ma, Xun Zhang and yaru Fu[2022]

proposed to improve the system outage performance of the cell-edge users. Moreover,interference among NOMA users
and the constraints on the peak amplitude andaverage power are considered in the proposedsystem. In order to accurately analyze thesystem outage performance, a statistical probability method is employed and the closed-form expression of the OP is derived. Simulation results verify the accuracy of the theoretical expression and illustrate that the proposed DF relaying system can improve thecommunication robustness of the cell-edgeusers. It can obtain 15 dB transmission SNR gains in 10−3 OP level compared with the DT system. Furthermore, by investigating the impact factors of the OP, the optimal relay LED-PD transmit Semi-angle and relay LED- PD deployment height are obtained to achieve the optimal system outage performance

EXISTING SYSTEM

Currently, there are no commercially available Li-Fi V2V communication systems.Most research in this area is focused on developing and testing prototype systems in laboratory settings. However, some researchers have proposed and demonstrated the potential of Li-Fi V2V communication systems. One example of a proposed Li-Fi V2V communication system is the Visible Light Communication for Inter-Vehicle Communication (VLC4IVC) system.The VLC4IVC system uses LED headlights and taillights to transmit data between vehicles. The system uses a centralized controller to coordinate communication between vehicles, and can transmit information such as vehicle speed, direction, and location. The VLC4IVC system has beentested in simulation and in a small-scale fieldtest, demonstrating the potential of Li-Fi technology for V2V communication. Another example is the Li-Fi enabled smart car system developed by researchers at the University ofEdinburgh. The system uses LED lights on thecar to transmit data, such as speed and location, to other vehicles and to roadside infrastructure. The system has been tested in laboratory settings and has shown promise for improving V2V communication. While there are currently no commercially available Li-Fi V2V communication systems, these examples demonstrate the potential of Li-Fi technology for improving V2V communication. Further research and development is needed to bring Li-Fi V2V systems to the market and to ensure their safety, reliability, and effectiveness in real-world settings.

The main problems faced in the existing system by using zigbee and GPS are inaccuracies in the calculation of speed, distance measurement, and slow response time, etc. The problems of traffic congestion in urban arterials are increasing day by day and it is very difficult to handle it during emergencies.

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PROPOSED SYSTEM

This system aims at communicating with thevehicle in its surrounding with the help of its location (i.e., using the latitude and longitude)to indicate their proximity. When these vehicles are very close in proximity the drivers are cautioned with the help of a message. In this way the drivers can communicate with each other and act according to the situation where while driving few sensors are used for some alerting /indications like alcohol sensor,heart beart sensor,seat belt alerting,and lifi transmitter to transmit and communicate toother vehicle as well as with known member when driver is in danger a message is given in cloud source,this setup uses arduinomicrocontroller.

BLOCK DIAGRAM

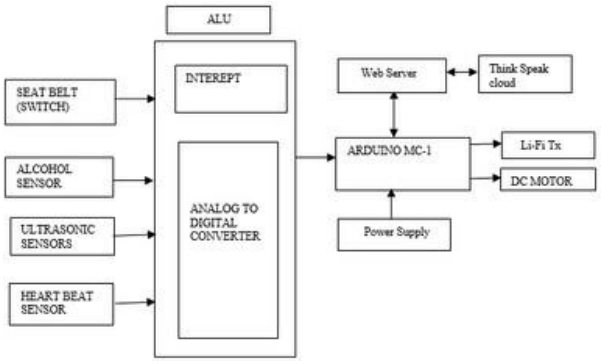

Figure 1:Transmitter

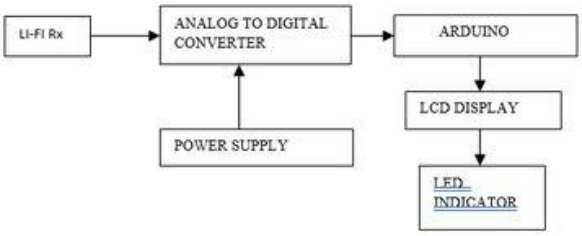

Figure 2:Receiver

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WORKING

Alcohol Gas Sensor MQ-3Description:

This alcohol sensor is suitable for detecting alcohol concentration on your breath, just like your common breathalyzer. It has a high sensitivity and fast response time. Sensor provides an analog resistive output based on alcohol concentration. The drive circuit is very simple, all it needs is one resistor. A simple interface could be a 0-3.3V ADC.

ULTRASONIC SENSOR

Description:

A special sonic transducer is used for the ultrasonic proximity sensors, which allows for alternate transmission and reception of soundwaves. The sonic waves emitted by the transducer are reflected by an object andreceived back in the transducer. After having emitted the sound waves, the ultrasonic sensor will switch to receive mode. The time elapsed between emitting and receiving is proportional to the distance of the object from the sensor.

HEART BEAT SENSOR

Description:

Heart beat sensors are designed to give digitaloutput heart beat when a finger is placed on it. When the heart beat detector starts working, the light emitting detector (LED) blinks simultaneously for every heartbeat.

Timing and Interpret :

only need to supply a short 10us pulse to the trigger input to start the ranging, and then the module will send out an 8 cycle burst of ultrasound at 40 khz and raise its echo. The Echois a distance object that is pulse width and the range in proportion .You can calculate the range through the time interval between sending triggersignal and receiving echo signal.

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Longer read range (300 feet)
Typically can be* velocity (340 M/S) of
Interrogators Cost around 50 to 250
dollars.

Formula: us / 58 = centimetres or us / 148 =inch;or: the range= high level time* velocity (340M/S)/ 2.

RELAY

A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and they are double throw (changeover) switches.

Relays allow one circuit to switch a second circuit which can be completely separate from the first. For example a low voltage battery circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits, the link is magnetic and mechanical. Relays are very simple devices. There are four major parts in every relay. They are Electromagnet Armature that can be attracted by the electromagnet Spring Set of electrical contacts

DC MOTOR

There are some special types of application of electrical motor where rotation of the motor is required for just a certain angle not continuously for long period of time. For these applications, some special types of motor are required with some special arrangement which makes the motor to rotate a certain angle for a given electrical input (signal). This is normally a simple DC motor which is controlled for specific angular rotation with the help of additional servomechanism (a typical closed loop feedback control system). Now day's servo system has huge industrial applications. This is unlike a normal electrical motor which starts rotating as and when power is applied to it and the rotation continues until we switch off the power. We cannot control the rotational progress of electrical motor but we can only control the speed of rotation and can turn it ON and OFF.

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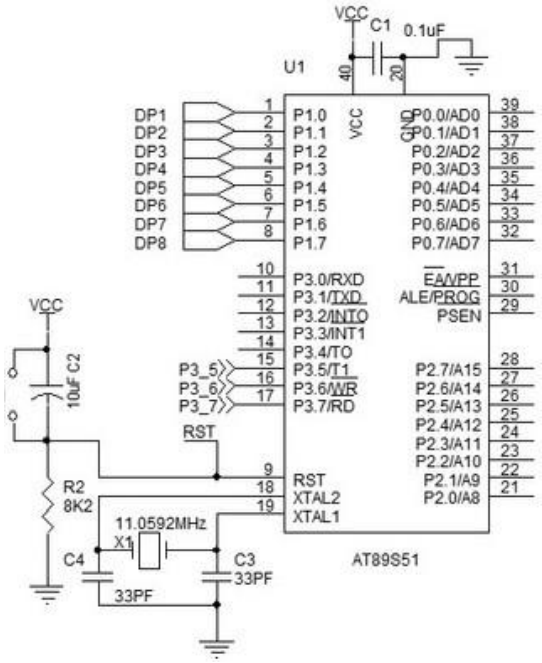

Figure 3: PIN DIAGRAM OF MICROCONTROLLER

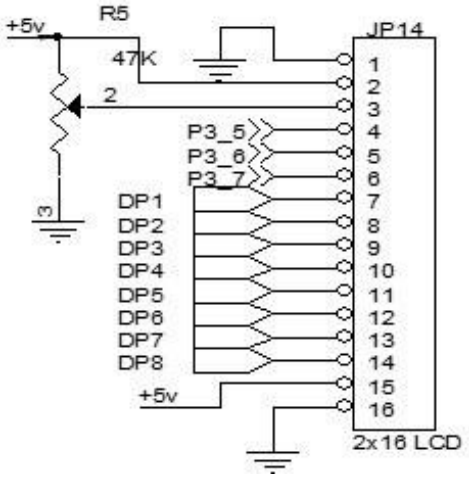

Figure 4:PIN DIAGRAM OF LCD MODULE

This circuit consists of a Microcontroller and aLCD. This LCD is operating with an 8-bit data bus. So totally 11 data lines are required(8 Data lines and 3 control lines). The 8 bit data lines are connected to the Port1 and the 3control lines to the Port3.5-Port3.7. The EN line is called "Enable."

This control line indicates to the LCD that weare sending it data. To send data to the LCD,the EN should be low (0) and then set the other two control lines and/or put data on thedata bus. When the other lines are completely ready, bring EN high (1) and wait for the minimum amount of time required by the LCD datasheet (this varies from LCD to LCD), and end by bringing it low (0) again.

The RS line is the "Register Select" line. When RS is low (0), the data is to be treatedas a command or special instruction (such asclear screen, position cursor, etc.). When RSis high (1), the data being sent is text data, which should be displayed on the screen. Forexample, to display the letter "T" on thescreen we would set RS high.

The RW line is the "Read/Write" control line.When RW is low (0), the information on thedata bus is being written to the LCD. When RW is high (1), the program is effectively querying (or reading) the LCD. Only one instruction ("Get LCD status") is a read command. All others are written commands so RW will almost always be low.

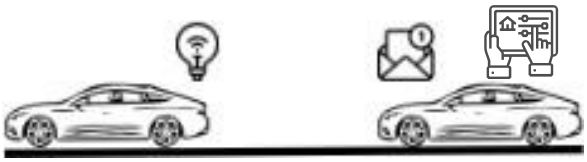

Figure 5: Li-Fi communication

V2V (Vehicle-to-Vehicle) communication has become an increasingly important technology for enhancing safety and efficiency in the automotive industry. Li-Fi (Light Fidelity) is apromising wireless communication technology that uses light waves instead of radio waves to transmit data. Li-Fi can provide high-speed data transfer, improved security and reduced interference compared to traditional radio frequency (RF) communication technologies.

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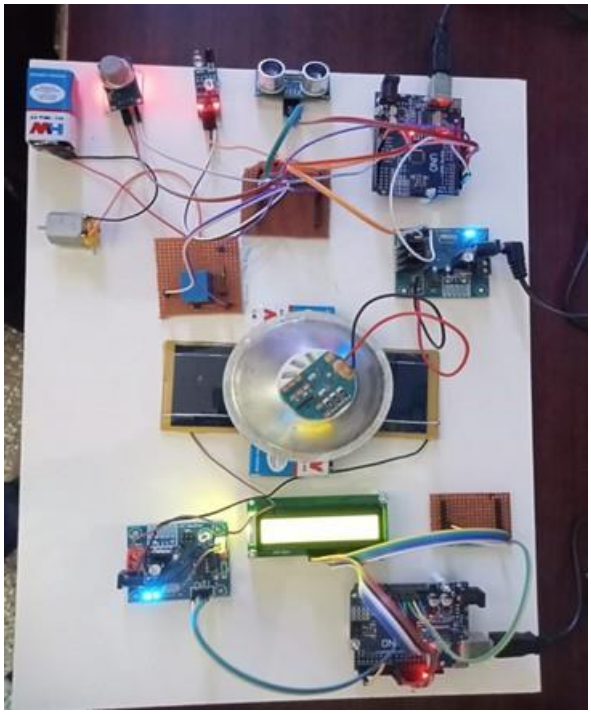

Figure 6: Outout of V2V Li-Fi communication

Feature Extracrion

Operating Voltage	5V
Load resistance	200 KΩ
Heat resistance	33Ω ± 5%
Heating consumption	<800mw
Sensing resistance	1 MΩ – 8 MΩ
Concentration range	25 – 500 ppm
Pre heat time	Over 24 hours

Table 1: Alcohol Sensor

Operating voltage	DC5V
Operating current	15mA
Operating frequency	40KHz
Dimension	45x20x15mm
Tigger Input signal	1S TTL pulse0μ

Table 2: Ultrasonic Sensor

FUTURE SCOPE

Vehicle-to-vehicle (V2V) communication is becoming an increasingly important area ofresearch in the automotive industry with the potential to significantly improve road safety and traffic efficiency. Li-Fi is a wireless communication technology that uses visible light to transmit data, rather than radio waves used by Wi-Fi or Bluetooth.

As for the future scope of using Li-Fi for regulating V2V mishaps. Researchers may explore ways to further increase the speed and reliability of Li-Fi communication, as well as tointegrate it with other sensor and communication technologies to create a more comprehensive V2V system. Overall, Li-Fi technology has the potential to revolutionize theway we think about road safety and trafficmanagement and could play a key role in the future of transportation and to develop the lineof sight in different lane.

CONCLUSION:

V2V communication is simple and straightforward to use. With the proposed system, warning signals can be given at quickerrates, allowing drivers to make strategic decisions more quickly, which is crucial in preventing accidents and congestion. The project can be expanded in the future to transmit smart city infrastructure amongstvehicles. In this project we implement the emergency warning system and control the speed of front and following vehicle during emergencies situation.

Visible light communication is a rapidly developing technology in the wireless communications. There are many hurdles in thissector, but there are also equal or greater benefits.

REFERENCES

[1]R. Gandhi, T. Rajkumar, J. Chandramohan and T. Guha, "Energy Consumption Reduction using Ant Colony Optimization in Manet using Machine Learning Techniques," 2022 IEEE 2nd Mysore Sub Section International Conference (MysuruCon), Mysuru, India, 2022, pp. 1-5, doi: 10.1109/MysuruCon55714.2022.9972456

[2] World Health Organization, "GlobalStatus Report on Road safety 2018," no.9789241565684, 2018. [Online]. Available:https://www.who.int/ publications/i/item/9789241565684

[3] S. Rehman, S. Ullah, P. Chong, S. Yongchareon, and D. Komosny, "Visible light communication: A system perspective-overview and challenges," Sensors, vol. 19, no. 5, Mar. 2019, Art. no. 1153.

[4] A. Al-Kinani, J. Sun, C. Wang, W. Zhang, X. Ge, and H. Haas, "A 2-D non-stationary GBSM for vehicular visible light communication channels," IEEE Trans. Wireless Commun., vol. 17, no. 12, pp. 7981–7992, Dec. 2018.

[5] C. X. Wang, J. Huang, H. Wang, X. Gao, X. You, and Y. Hao, "6G wireless channel measurements and models: Trends and challenges," IEEE Veh. Technol. Mag., vol. 15, no. 4, pp. 22–32, Dec. 2020.

[6] Q. Chen, C. X. Wang, J. Sun, W. Zhang,and Q. Zhu, "A nonstationary VVLC MIMOchannel model for street corner scenarios," in Proc. Int. Wireless Commun. Mobile Comput., Limassol, Cyprus, 2020, pp. 365– 370.

[7] X. You et al., "Towards 6G wireless communication networks: Vision, enabling technologies, and new paradigm shifts," Sci.China Inf. Sci., vol. 64, no. 1, pp. 1–74, Jan. 2021.

[8] M. Uysal, Z. Ghassemlooy, A. Bekkali, A. Kadri, and H.Menouar, "Visible light communication for vehicular networking: Performance study of a V2V system using a measured headlamp beam pattern model," IEEE Veh. Technol. Mag., vol. 10, no. 4, pp.45–53, Dec. 2015.

[9] B. Béchadergue, L. Chassagne, and H.Guan, "Simultaneous visible lightcommunication and distance measurementbased on the automotive lighting," IEEE Trans. Intell. Veh., vol. 4, no. 4, pp. 532–547,Aug. 2019.

[10] J. Chen and Z. Wang, "Topology control in hybrid VLC/RF vehicular ad-hoc network,"IEEE Trans. Wireless Commun., vol. 19, no. 3, pp. 1965–1976, Mar. 2020. [11] L. U. Khan, "Visible light communication: Applications, architecture, standardization and research challenges," Digit. Commun. Netw.,vol. 3, no. 2, pp. 78–88, May. 2017.

[12] Z. Ghassemlooy, W. Popoola, and S.Rajbhandari, Optical Wireless Communications: System and Channel Modelling With Matlab. Boca Raton, FL, USA: CRC Press, 2019.

[13] G. Singh, A. Srivastava, and V. A. Bohara, "Impact of weather conditions and interference on the performance of VLC based V2V communication," in Proc. Int. Conf. Transparent Opt. Netw., Angers, France, 2019, pp. 1–4.

[14] I. E. Lee, M. L. Sim, and F. W. L. Kung, "Performance enhancement of outdoor visible-light communication system using selective combining receiver," IET Optoelectron., vol. 3, no. 1, pp. 30–39, Feb. 2009.

[15] M. S. Islim et al., "The impact of solar irradiance on visible light communications," J. Lightw. Technol., vol. 36, no. 12, pp. 2376– 2386, Mar. 2018.

[16] Y. H. Chung and S. Oh, "Efficient optical filtering for outdoor visible light ,communications in the presence of sunlight orartificial light," in Proc. Int. Symp. Intell. Signal Process. Commun. Syst., Naha, Japan, 2013, pp. 749–752.
[17] D. Cervinka, Z. Ahmad, O. Salih, and S.Rajbhandari, "A study of yearly sunlightvariance effect on vehicular visible lightcommunication for emergency servicevehicles," in Proc. 12th IEEE/IET Int. Symp.Commun. Syst. Netw. Digit. Signal Process. Porto, Portugal, 2020, pp. 1–6.
[18] R. Khoder, R. Naja, and S. Tohme, "Impact of interference on visible light communication performance in a
vehicular platoon," in Proc. Int. Wireless Commun. Mobile Comput., Limassol, Cyprus, Jul. 2020, pp. 1935–1939.
[19] P. Luo, Z. Ghassemlooy, H. L. Minh, E. Bentley, A. Burton, and X. Tang, "Performanceanalysis of a car-to-car visible light communication system," Appl. Opt., vol. 54, no. 7, pp. 1696–1706, Mar. 2015.
[20] P. Luo,
Z. Ghassemlooy, E. Bentley, A. Burton, and X. Tang, "Bit-error-rate performance of a car-to- car VLC system using 2 MIMO,"Mediterranean J. Comput. Netw., vol. 11, pp. 400–407, Jan. 2015.
[21] A. Al-Kinani et al., "A 3D non-stationary GBSM for vehicular visible light communication MISO channels," IEEE Access, vol. 8, pp. 140 333– 140347, 2020