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Automation in Vehicle to Vehicle Communication using Li-fi

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ABSTRACT: India's traditional road network requires an intelligence transport system that ensures vehicle communication, road safety, and traffic control. Several studies have shown that 57% of accidents are caused by a driver's behavior, decision-making abilities, reaction time, and awareness. Several studies show that accidents could be avoided if drivers were alerted to real-time road dangers within the first few seconds of driving. There aren't any interactive billboards to help drivers decide quickly. Thus, the primary focus of this research is on the interaction between VV and RV communication devices based on LI-FI.

The proposed system will investigate and assess in real time whether Li-Fi technology is appropriate for Indian roads by informing drivers in advance of the state of the roads day and night. This will create the safest and most advanced driving environment possible. Designing, putting into practice, and evaluating LI-FI based R-V (road to vehicle) and V-V (vehicle to vehicle) interaction systems is essential. The development, application, and evaluation of LI-FI technology as a channel for communication between V-V and R-V modules is the aim of this project. Distributing warning signs in advance of approaching speed limits, speed-restricted areas (like schools, hospitals, temples, crowded areas, and accident zones), and other significant road signage. Even in dangerous situations, the voice will inform the driver of the condition of the roads. Cars that have adaptive lighting systems that use LI-FI technology to switch headlight positions must have a safe driving zone and an accident-free road. During nighttime and prolonged driving, this alert signal is utilized.

Everyone wants to live in a modern lifestyle in the twenty-first century, and the majority of them desire their own car. This led to a sharp increase in traffic on the roads as well. The accident rate increased proportionately to the rise in vehicle rates. It is possible to overcome and reduce the rate of traffic collisions by proposing an appropriate technique that makes use of faster, more reliable, and efficient communication. The current WiFi-based methods have certain limitations and may not be as effective in certain road conditions. This paper presents a reliable and suitable technology for establishing vehicle-to-vehicle communication. This study used LIFI technology to address issues in the automotive setting. Our solution has an embedded, basic design with some

I. INTRODUCTION

We are at the cusp of a revolution in digital wireless communication. Light Fidelity, or Li-Fi, is Wi-Fi'simprovedversion. It is among the best and most recent inventions of the twenty-first century. The idea behind this equipment is that LED light, whose intensity varies faster than the human eye can perceive and is detected by a detector, can be used to transmit the information needed for communication. This type of VLC, which is a component of optical wireless communications, may be used in place of radio frequency (RF), such as that used in cellular network and Wi-Fi communication.

This new Li-Fi technology is till now calculated to be more than 10,000 times faster than many of Wi-Fi implementations , reaching up to the speeds of 250 gigabits per second. HARALD HASS, who is known to be the father of Li-Fi from Edinburgh University at United Kingdom, says that at the centre of this technology there is a new generation of very sensitive ultra LEDs. He said, “My greatest vision is that light bulbs will become part of broadband communications equipment, so that the light emitting diode is not only able to provide light but also become a more

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necessary tool for visible light communication". As the transmission of the data takes place by using light emitting diodes (LED's) the equipments are comparatively small. Now, days, it is called as the optimized version of WI-FI. The advantage is the wireless communication through visible light which decreases the cost and instead of Wi-Fi modems and routers. Li-Fi would use transceiver fitted LED lamps that can serve dual purpose lighting a room as well as transmit and receive information in bits. As simple light bulbs are used, there be in principle many number of access points. This technology uses a part of the electromagnetic spectrum other than RF.

Great thing about this technology is that we can encode data in the light by varying the rate at which the LED bulbs flicker on and off to give different strings and sequences of 1s and 0s. The intensity of LED can be modulated so rapidly that human eyes cannot notice, so the output appears almost constant . More advance techniques could raise VLC data rates dramatically. Researchers at the University of Oxford and Edinburgh are focusing on analogous data communication by means of arrays of LEDs, where each LED transmits a dissimilar data stream than earlier. Some groups are using mixtures of red, green and blue LED bulbs to alter the frequency of light, so that each frequency can encode a different data channel.

II. METHOD OF DATA TRANSMISSION USING LI-FI

The components of the suggested structure are a drive, an Arduino, a photodiode, and a 16x2 LCD display. The research framework has the potential to leverage Earth's existing light sources to establish a resilient device delivery system. This system serves as an example of how a system configuration that is dependent on light is achievable. Every light source has the potential to serve as a route to the information correspondence office if the system is operational. The framework was applied in a range of scenarios in order to assess its presentation. The benefit of this system is that it guarantees effective remote communication.

IV. WORKING OF LI-FI

Li-Fi transmits data by using overhang lighting, which produces a noticeable light. This can be accomplished through the use of the Visible Light Communications (VLC) information transfer framework. Li-Fi communication consists of two parts. a single Li-Fi transmitter The initial transmitter connection will be made to the Arduino board. After that, the Arduino board will send the data to the transmitter, which will translate it to binary and prepare it for transmission via an LED bulb. If the binary value is 1, the LED will blink; if the binary number is 0, it won't. No one will be able to see the LED bulb because of how quickly it will turn on and off. This is one manner that data can be sent over Li-Fi. B. Li-FiReceiver Light from the LED will be absorbed by the photovoltaic cell.

V. VEHICLE-TO-VEHICLE COMMUNICATION

Vehicle-to-vehicle (V2V) communication enables vehicles to wirelessly exchange information about their speed, location, and heading. The technology behind V2V communication allows vehicles to broadcast and receive omni-directional messages (up to 10 times per second), creating a 360-degree "awareness" of other vehicles in proximity. Vehicles equipped with appropriate software (or safety applications) can use the messages from surrounding vehicles to determine potential crash threats as they develop. The technology can then employ visual, tactile, and audible alerts—or, a combination of these alerts—to warn drivers. These alerts allow drivers the ability to take action to avoid crashes.

These V2V communication messages have a range of more than 300 meters and can detect dangers obscured by traffic, terrain, or weather. V2V communication extends and enhances currently available crash avoidance systems that use radars and cameras to detect collision threats. This new technology doesn't just help drivers survive a crash—it helps them avoid the crash altogether.

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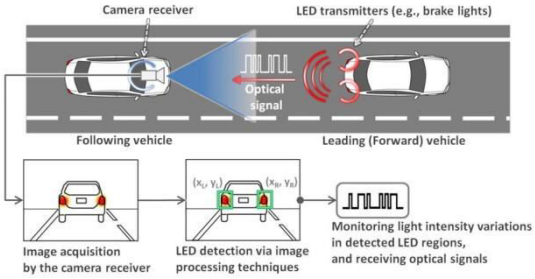


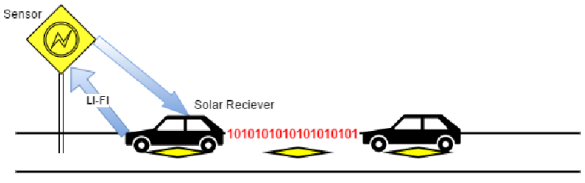
Vehicles that could use V2V communication technology range from cars and trucks to buses and motorcycles. Even bicycles and pedestrians may one day leverage V2V communication technology to enhance their visibility to motorists. Additionally, vehicle information communicated does not identify the driver or vehicle, and technical controls are available to deter vehicle tracking and tampering with the system.

V2V communication technology can increase the performance of vehicle safety systems and help save lives. There were an estimated 6.8 million police-reported crashes in 2019, resulting in 36,096 fatalities and an estimated 2.7 million people injured. Connected vehicle technologies will provide drivers with the tools they need to anticipate potential crashes and significantly reduce the number of lives lost each year.

VI. REQUIREMENTS OF V-V

All new light-duty vehicles would be equipped with V2V communication technology, according to a Notice of Proposed Rulemaking (NPRM) released by the Department of Transportation in an attempt to drastically lower the likelihood of a car accident on American roads. The following was achieved by the V2V NPRM:

- Mandated that automobiles send and receive standardized messages;
- suggested a single communication platform;
- allowed for the market's application and implementation;
- offered support for substitute technologies; and
- remained open to any workable, verifiable technology.



Following a 90-day comment period that ended in January 2017, the NHTSA received 450 comments on the NPRM. Important subjects for comments were as follows:

- The technology strategy,
- The timing of implementation,

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- The technical details, the cost estimates,
- The potential health effects, and
- Privacy and security are all important considerations.

VII. THE STANDARDS DEBATE: AND THE CHALLENGE FOR DESIGNERS

Many emerging technology areas, there's often a debate about technologies and standardization – similar to the famous VHS / Betamax battle. In the case of V2V, the main debate is around the communications technology that will be used to form the mesh.

There are already some vehicles with V2V capability; one example is the 2017 Cadillac CTS sedan. This uses DSRC technology which comes as no surprise as this technology was prescribed by federal regulators in the US, and the FCC allocated 75MHz of bandwidth in the 5.9GHz band in 1999. Commercially, the Global Automakers trade association (which includes Honda, Nissan, Subaru, Kia and Toyota) is a supporter of DSRC. Pushing the point further, in 2016 the NHTSA began a process that would eventually mandate the inclusion of DSRC-based V2V technology for all cars sold in 2023 (and after).

However, DSRC isn't the only option; 5GLTE cellular communication is another contender that has some strong advocates including Baidu in China who recently completed a test of 5GLTE-connected autonomous cars, and Volkswagen in Germany who stated that 5GLTE will connect all of their autonomous vehicles.

Those that advocate 5GLTE over DSRC cite various advantages including greater interoperability, wider bandwidth, increased security and the ability to use existing cell towers instead of dedicated roadside units. While the cell tower point is an issue on paper, it will only become 'real' once the dedicated roadside units have to be funded.

However, many powerful chipmakers that will develop the components that are essential for realising V2X/V2V are favouring cellular technologies such as C-V2X, with both Qualcomm and Ericsson stating they will develop solutions.

VIII. CONCLUSION

V2V promises to be an important development in its own right as well as forming an important building block for the fully autonomous vehicles of the future. With the inclusion of hundreds of sensors in modern vehicles, much of the information needed (speed, direction etc.) already exists and the final challenge is to develop the mesh networking infrastructure to allow vehicles to communicate with each other.

As standards evolve, decisions have to be made as to which communications standard will prevail in the long term and this forces designers to be agile with their solutions. Fortunately, many critical components such as antennas are available that will address multiple protocols, easing some of the pressure on design teams. Even though v-v communication using li-fi is more useful among now a day transport.

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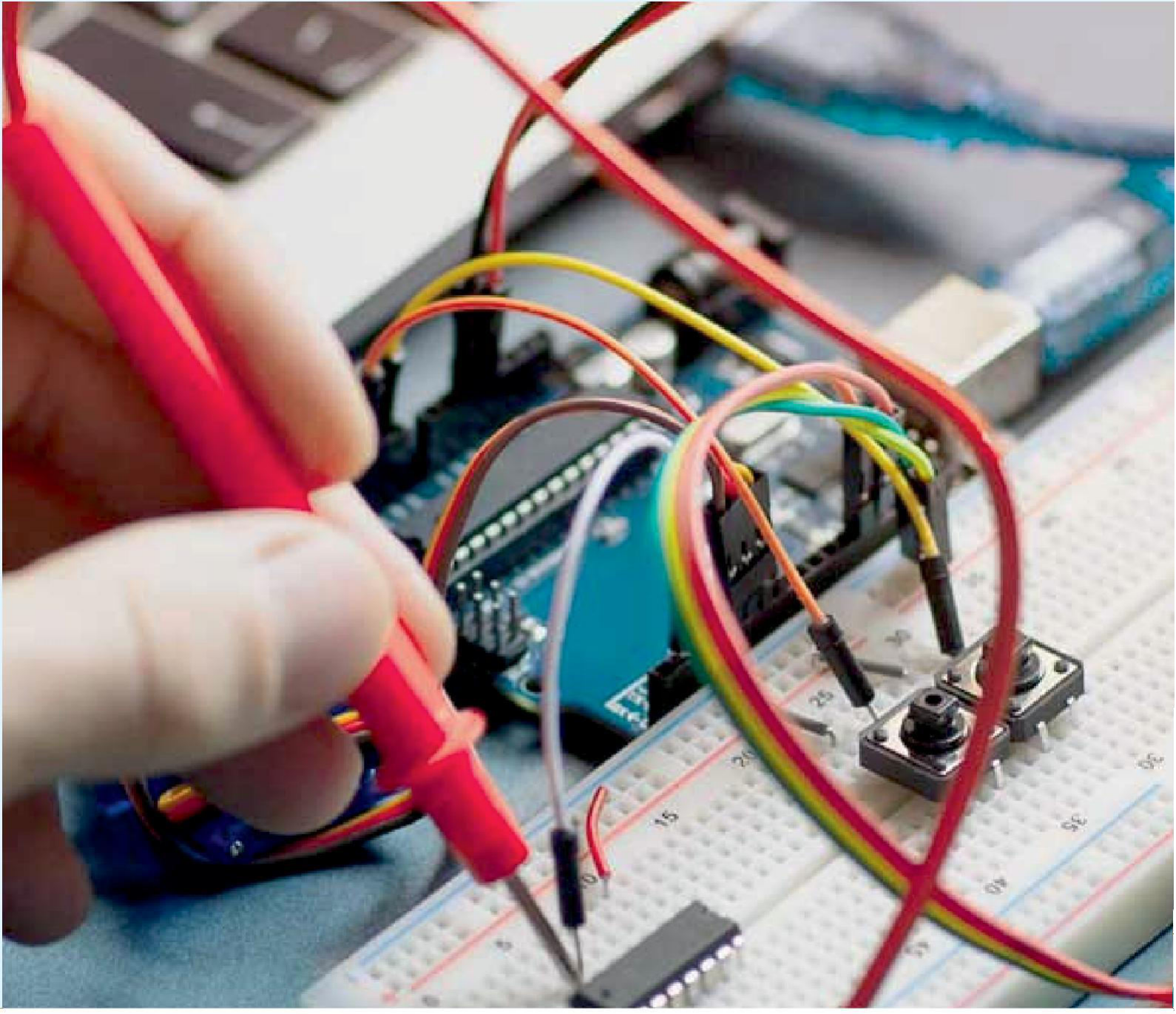

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