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Visible Light Communication for Vehicle Monitoring

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ABSTRACT: High number of accidents is having placed all over the world due to the collision between automobile vehicles. More than 1.2 million peoples died in road accidents in 2018, according to the report of the world health organization (WHO). Vehicle and people safety are very important. The idea here is proposing to reduce the misshapes of accidents in our daily lives and avoid accident between vehicles. There are various reasons for such adverse condition that results in death or disabilities. This involves sudden loss of driver's conscious, brake failures, loss of traction on tires. These dangerous situations can be overcome if there is communication protocol used in all vehicles on the road and depending on their position drivers control the vehicles to avoid road accidents. There are various vehicular methods and protocols are available. These radio frequency (RF) based communication idea has some limitations i.e., data interference, spectrum break and security issues. These draw backs can be overcome by using Visible Light Communication. This produces high frequency bandwidth, standard security, interference reduction, and high speed data rate. Visible Light Communication is a data communication system which uses visible light for high rate data transmission and receiving operation. This method of technology is called as Light Fidelity (Li-Fi). This presents the highly accurate method to avoid accidents between two vehicles.

KEYWORDS: LIFI, Safety.

I. INTRODUCTION

Visible Light Communications (VLC) is becoming a mature communication technology, particularly for indoor usage. The application in outdoor environments is especially interesting in the scope of Vehicular VLC (V-VLC), however, there are some critical challenges remaining. In general, VLC is a good complement to Radio Frequency (RF)-based communication. For automotive use cases, V-VLC can benefit from the huge available spectrum and the readily available Light Emitting Diode (LED)- based lighting systems of modern cars. Its Line Of Sight (LOS) characteristics, the directionality of the light, and the smaller collision domain substantially reduces interference. In this survey article, we study the state of the art of V-VLC and identify open issues and challenges. We study the V-VLC communication system as a whole and also dig into the characteristics of the VLC channel. For the beginner in the field, this review acts as a guide to the most relevant literature to quickly catch up with current trends and achievements. For the expert, we identify open research questions and also introduce the V-VLC research community as a whole. Transportation systems of today are closer than ever bound to experience a major technological transformation. Vehicles on roads have come a long way from the bare metal-on-wheels they used to be, to the sensing and computation capable machines they are today. High-end models of last generation vehicles nowadays are equipped with hundreds of embedded computers and sensors which allow them to perceive their surroundings, and interact with it in semi-autonomous, and eventually, fully-autonomous fashion. Although at a slower pace, the road infrastructure has evolved as well, as adaptive traffic lights and communication capable pay tolls are being deployed on roads. An anticipated next step in the evolution course of transportation systems is to adopt the concept of communication and enable information exchange between vehicles and with infrastructure. This will unleash the full potential of next generation transportation systems while shifting the paradigm from autonomous driving to cooperative driving.

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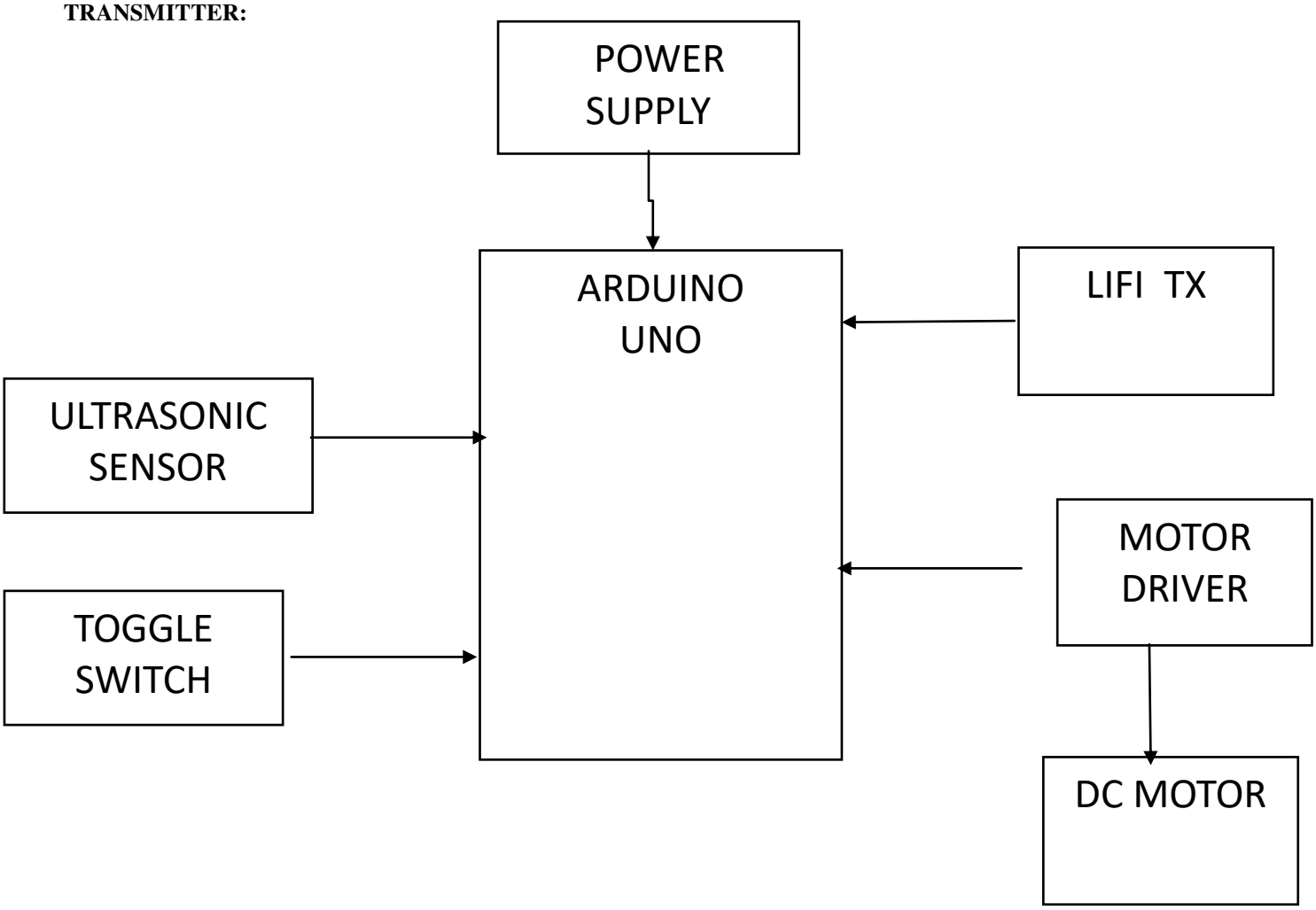
II. SYSTEM ARCHITECTURE

In our proposed system, vehicles are communicating each other, so that the possibility of accident happens less. Here, we have Visual light based communication between vehicles so that, the vehicle informs to other

2.1 BLOCK DIAGRAM :

TRANSMITTER:



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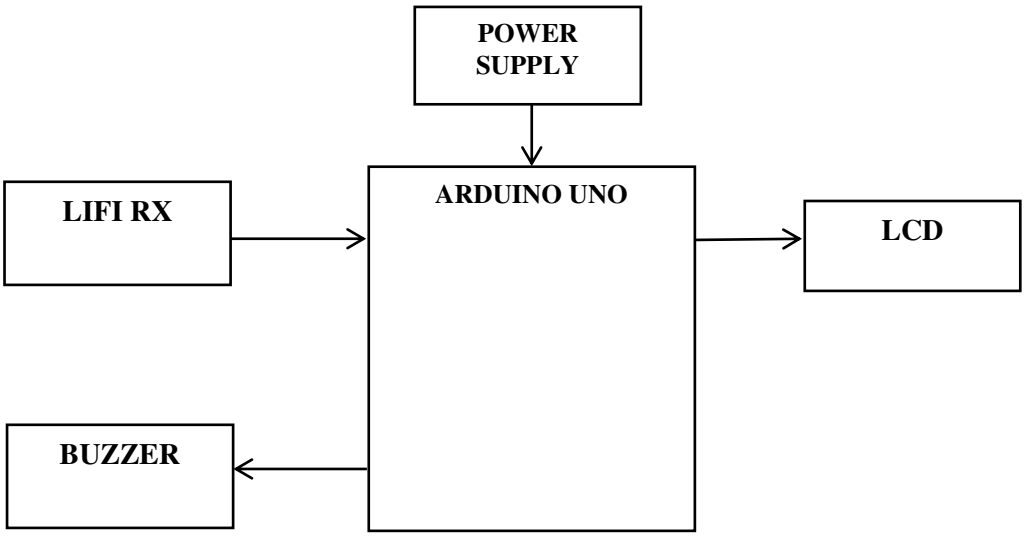
RECEIVER:



The transmitter consists of a signal processing block including the modulator, and the transmitter front-end (i.e., LED-based headlamps and taillamps). The receiver side consists of optical elements, which can be used optionally in front of the receiver, the actual receiver device, and the receiver-specific signal processing block for demodulation and decoding. The space between the transmitter and receiver is referred to as the optical channel.

Modulation and digital-to-analog conversion of the information bits is done in the scope of the signal processing block [19]. The exact structure and functioning of the signal processing block depends on the actual deployed platform. Popular approaches include Software Defined Radio (SDR)-based platforms [77], [78], FPGAs [79], and custom development platforms [80]. However, commercially available VLC-enabling devices, like Li-1st have also been deployed [62]. Since V-VLC is in an early stage of development, most of the platforms from the literature, including the aforementioned, are used for rapid prototyping and small-scale field tests. The LED driving circuit combines the modulated signal with the bias current required to drive the high-power LEDs [18] (as opposed to low-power LEDs used for indoor VLC). This way, information gets modulated onto the intensity of the light that is emitted by the transmitter front-end [81, Ch. 2.2]. The design of the driver circuit is crucial for VLC as it has to provide correct biasing to ensure that the LEDs are driven at optimal operating point, and there is no signal clipping before modulation. A low operating point of the LED causes clipping of the negative parts of the signal, whereas a high operating point might exceed the linear region of the LED, distorting the signal and possibly damaging the LED. Open Source implementations of the driving circuit have been presented, for example, in [82], [83]. Once the light is emitted by the LEDs, it interacts with the optical elements within the lighting module that control the shape of the emitted beam according to automotive regulations [75]. Optical elements have a strong influence on the resulting signal. For example, lenses can be used to focus Authorized licensed use limited to: Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology. Downloaded on June 29,2021 at 06:23:28 UTC from IEEE Xplore. Restrictions apply.

III. HARDWARE AND SOFTWARE DESCRIPTION

3.1 HARDWARE DESCRIPTION:

3.1.2.ARDUINO

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board.

Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike.

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Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IOT applications, wearable, 3D printing, and embedded environments. All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt them to their particular needs. The software, too, is open-source, and it is growing through the contributions of users worldwide.

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.
Technical specification:

3.1.3 POWER SUPPLY

This section describes how to generate +5V DC power supply

The power supply section is the important one. It should deliver constant output regulated power supply for successful working of the project. A 0-12V/1 mA transformer is used for this purpose. The primary of this transformer is connected in to main supply through on/off switch& fuse for protecting from overload and short circuit protection. The secondary is connected to the diodes to convert 12V AC to 12V DC voltage. And filtered by the capacitors, which is further regulated to +5v, by using IC 7805.

3.1.4 LCD

LCD screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. Click to learn more about internal structure of a LCD.We come across LCD displays everywhere around us. Computers, calculators, television sets, mobile phones, digital watches use some kind of display to display the time. An LCD is an electronic display module which uses liquid crystal to produce a visible image. The 16×2 LCD display is a very basic module commonly used in projects. The 16×2 translates to a display 16 characters per line in 2 such lines. In this LCD each character is displayed in a 5×7 pixel matrix.

3.1.5 BUZZER:

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

1.MAGNETIC TRANSDUCER:

Magnetic transducers contain a magnetic circuit consisting of a iron core with a wound coil and a yoke plate, a permanent magnet and a vibrating diaphragm with a movable iron piece. The diaphragm is slightly pulled towards the top of the core by the magnet's magnetic field. When a positive AC signal is applied, the current flowing through the excitation coil produces a fluctuating magnetic field, which causes the diaphragm to vibrate up and down, thus vibrating air. Resonance amplifies vibration through resonator consisting of sound hole(s) and cavity and produces a loud sound.

2. MAGNETIC BUZZER (SOUNDER):

Buzzers like the TMB-series are magnetic audible signal devices with built-in oscillating circuits. The construction combines an oscillation circuit unit with a detection coil, a drive coil and a magnetic transducer. Transistors, resistors, diodes and other small devices act as circuit devices for driving sound generators. With the application of voltage, current flows to the drive coil on primary side and to the detection coil on the secondary side. The amplification circuit, including the transistor and the feedback circuit, causes vibration. The oscillation current excites the coil and the unit generates an AC magnetic field corresponding to an oscillation frequency. This AC

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magnetic field magnetizes the yoke comprising the magnetic circuit. The oscillation from the intermittent magnetization prompts the vibration diaphragm to vibrate up and down, generating buzzer sounds through the resonator.

3.1.6ULTRASONICSENSOR

Description:

The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object like bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package. It comes complete with ultrasonic transmitter and receiver modules.as the name indicates measure distance by using ultrasonic waves .the sensor head emits ultrasonic wave and receives the wave reflected back from the target .Ultrasonic measures the distance through the target by measuring time between emission and reception

3.1.7 SWITCH:

Switch is an electrical component which can make or break electrical circuit automatically or manually. Switch is mainly works with ON (open) and OFF (closed) mechanism. Numerous circuits hold switches that control how the circuit works or actuate different characteristics of the circuit. The classification of switches depends on the connection they make. Two vital components that confirm what sorts of connections a switch makes are pole and throw.

These are classified on based the connections they make. If you were under the impression that switches simply turn circuits on and off, guess again.

The terms pole and throw are also used to describe switch contact variations. The number of “poles” is the number of separate circuits which are controlled by a switch. The number of “throws” is the number of separate positions that the switch can adopt. A single-throw switch has one pair of contacts that can either be closed or open. A double-throw switch has a contact that can be connected to either of two other contacts; a triple-throw has a contact which can be connected to one of three other contacts, etc.

- **Pole:** The amount of circuits controlled by the switch is indicated by poles. Single pole (SP) switch controls only one electrical circuit. Double pole (DP) switch controls two independent circuits.
- **Throw:** The number of throws indicates how many different output connections every switch pole can connect its input. A single throw (ST) switch is a simple on/off switch. When the switch is ON, the two terminals of switch are connected and current flows between them. When the switch is OFF the terminals are not connected, so current does not flow.

3.1.8 MOTOR DRIVER IC:

Common DC gear head motors need current above 250mA. There are many integrated circuits like ATmega16 Microcontroller, 555 timers IC. But, IC 74 series cannot supply this amount of current. When the motor is directly connected to the o/p of the above ICs then, they might damage. To overcome this problem, a motor control circuit is required, which can act as a bridge between the above motors and ICs (integrated circuits). There are various ways of making H-bridge motor control circuit such as using transistor, relays and using L293D/L298.

SOFTWARE REQUIREMENTS:

3.1.9. EMBEDDED C

Embedded C is most popular programming language in software field for developing electronic gadgets. Each processor used in electronic system is associated with embedded software.

Embedded C programming plays a key role in performing specific function by the processor. In day-to-day life we used many electronic devices such as mobile phone, washing machine, digital camera, etc. These all device working is based on microcontroller that are programmed by embedded C.

Let's see the block diagram representation of embedded system programming:

3.1.10 ARDUINO SOFTWARE IDE

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

Programs written using Arduino Software (IDE) are called **sketches**. These sketches are written in the text editor and are saved with the file extension **.ino**. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by

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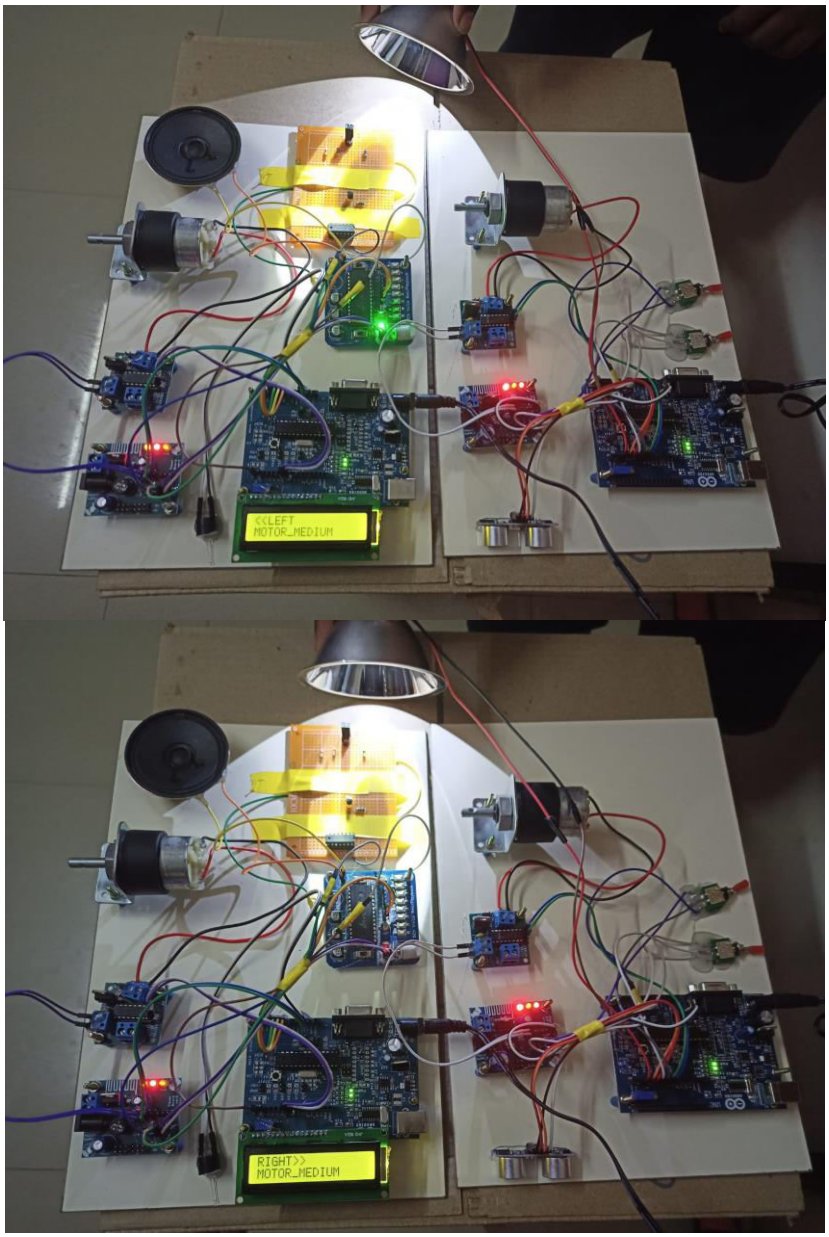
the Arduino Software (IDE), including complete error messages and other information. The bottom right hand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

RESULTS:



Here, the LCD is displaying the direction of the vehicle moving.

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IV. CONCULSIONS

In conclusion, it can be said that the V-VLC research domain is catching more and more momentum, both in the academic research community as well as in the automotive industry. Building upon concept, methods, and technologies known from indoor VLC as well as from IEEE 802.11 WLAN, substantial progress has been made recently. This ranges from early conceptual studies to simulation experiments and now to first prototypes. Nevertheless, there are still many open questions that need to be investigated in order to mature the technology. In this survey, we revisited the state of the art in V-VLC communication systems and highlighted open challenges to be studied by our research community. We see this survey as a reference as well as a guide for both experts and beginners in the field

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