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Inter-Vehicle Communication System Using Li-Fi Technology

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Abstract

To improve the safety of the car passenger and driver, cooperation driving is proposed, it will help to improve the efficiency by enabling vehicles to communicate by sending and receiving emergency or help related messages with each other. Inter-vehicle communication is an effective method in which the communication take place between the vehicles by which one can maintains safe distance between the vehicles to prevent accidents. It transmits various messages such as rash driving, fuel leakage etc. In Li-Fi technology, for communication between two vehicles, data is transmitted using LED panel and at receiving end we use photo-detector or receive the data. In this application, no need to use any protocol therefore it reduces the complexity.

Keywords: *Buzzer, light emitting diode panel, LCD, photodiode, ultrasonic sensor, V to V*

INTRODUCTION

In basic terms, Li-Fi can be thought of as a light based Wi-Fi. One big difference between Wi-Fi and Li-Fi is that it carry 10,000 time more space accessible [1,2]. In this range vehicular communication, system are becoming more widely adopted as vehicle are given increased autonomy in the world, the response time of electronic system are much faster than human-in-loop control system, Light and light speed more as compare to electromagnetic signal and Bandwidth is also more. The major challenge with existing technologies is that its low data transmission bandwidth [3]. This technology uses LED for data transmission which ultimately increases the power consumption and use the wide range of bandwidth visible light eliminates protocol (electromagnetic) reducing the complexity of system [4].

METHODOLOGY

In the inter-vehicle communication system using Li-Fi technology two vehicles communicate to each other on the road and calculation of the distance between vehicles is achieved by using ultrasonic sensor that is a vehicle (vehicle 1) which having ultrasonic sensor it gives the information about distance between target vehicle (vehicle 2) and communication between two vehicle occurs [5]. In this project, we can send messages to the receiving vehicle one by one depending on situations. We are also using buzzer for the voice output and LCD to display messages on both transmitter and receiver side. To avoid the accidents of cars, we are using ultrasonic sensor to maintain safe distance between two vehicles. If the distance between two vehicles is less than minimum reference distance then buzzer will get turned on and create the sound signals otherwise it will remain off [6].

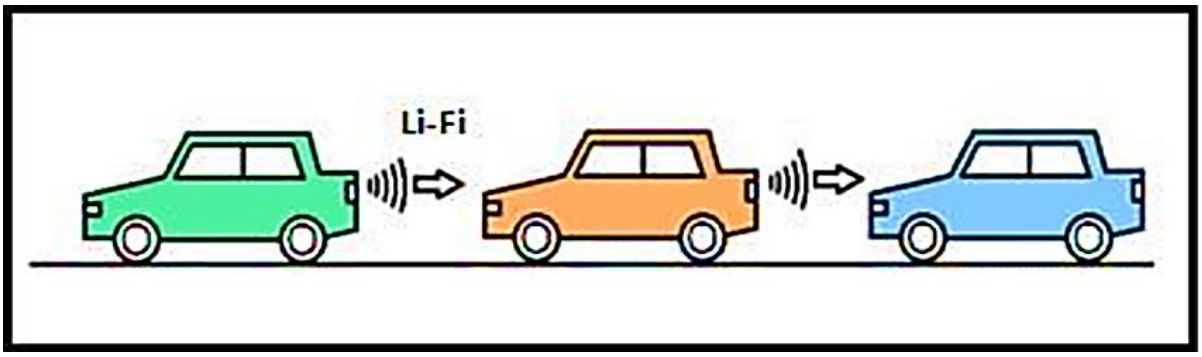

Figure 1: *Inter vehicle communication using Li-Fi.*

PROPOSED SYSTEM

The propose plan of activity for our undertaking is between vehicles correspondence utilizing optical remote model having high information rates (in the scope of MHz to GHz) and transmission separations is close around 1m. For transmission of data starting with one device then onto the next device required Driven. In this framework at transmitter section, input information is given for switching control system. As per the information, the microcontroller creates a surge of 0s in this way decipher the information in paired. The yield of this controller is given to the LEDs which is associated with transmitter side. Which turn ON and OFF at high speeds. This ON-OFF control then transmits information through light. Driven is chosen for light source since it devours less power when contrasted with fluorescent light or a light. It expends less power than that of ordinary strategy for lightning that is one-tenth of the power required. Also, the life expectancy of a normal LED knob is a few a huge numbers of hours. LEDs additionally have brisk exchanging with great deceivability. In this manner, LEDs are the best decision for transmitting the data. On beneficiary area, photograph diode is utilized, for example, silicon photograph indicator. The photograph finder disentangles the approaching got data in view of the succession of 0s. At that point, the decoded flag is given to yield gadget, for example, LCD show or speaker. Therefore, Li-Fi arranges is affirmed.

SYSTEM ARCHITECTURE

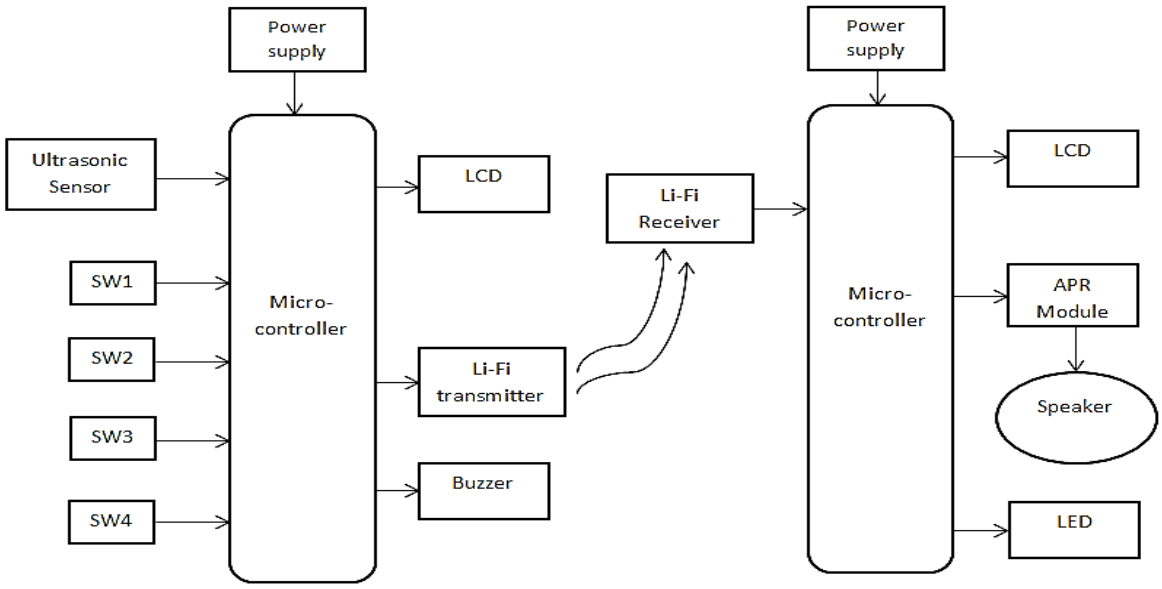

Figure 2*: Block design of vehicle to vehicle data transmission application using Li-Fi technology.*

Li-Fi system included mainly two parts that is transmitter and receiver. The transmitter part modulates the input signal with the required time period and transmits the data in the form of 1's and 0's using a LED bulb. These 1's and 0's are nothing but the flashes of the vehicle. The receiver part catches these flashes using a photodiode and amplifies the signal and presents the output. Light emitting diodes can be switched on and off very rapidly than the human eye allowing the light source to appear continuously. The data transmission is done through binary codes which involve switch ON LED that can be done by logic 1 and switch OFF using logic 0.The encoding of information in light can therefore be identified by varying the rate at which the LED's flicker on and off to give strings of 0's and 1's. Visible light communication is the method of used rapid pulses of light to transmit information without using wires. Ultrasonic sensor is used to maintain safe distance between two vehicles.

Li-Fi Transmitter

Receives the modulated information from the transmitter section and demodulates the signal in order to recover the original data. The receiver part catches these

In the Li-Fi transmitter, transmitter receives the information from the controller and it modulates the data to light signal and transmits to the receiver section. The transmitter part modulates the input signal with the required time period and transmits the data in the form of 1's and 0's using a LED bulb. These 1's and 0's are nothing but the flashes of the bulb. Power supply DC +12V and Data UART (universal asynchronous receiver transmitter) and input (TTL) are the input specification for the transmitter section. 1's and 0's are using a LED bulb. These 1's and 0's are nothing but the flashes of the bulb. In the receiver section, it receives the modulated information from the transmitter section and demodulates the signal in order to recover the original data. The receiver part catches these flashes using a photodiode and amplifies the signal and also transmits to the controller so that the speed of the following vehicle can be reduced which will be indicated in the LCD display present in the receiver section.

Li-Fi Receiver

flashes using a photodiode and amplifies the signal and presents the output.

Ultrasonic Sensor

***Figure 3**: Ultrasonic sensor.*

Ultrasonic transducer allows for alternate transmission and reception of sound waves. The transducer emits a number of ultrasonic waves which are reflected by an object. A single input output pin is used to trigger an ultrasonic burst and then listen for the echo return pulse. The sensor measures the time required for echo return and return this value to the microcontroller as a variable width pulse via same input

output pin. The basic principle of work is mentioned below.

- Using trigger for at least 10us high level signal.
- The module automatically sends eight 40 kHz and detect whether there is a pulse signal back or not.
- IF the signal back, through high level, time of high output IO duration is the time from sending ultrasonic to returning.
  Test distance = (high level time*velocity of sound)

Atmel®AVR® 8-bit Microcontroller

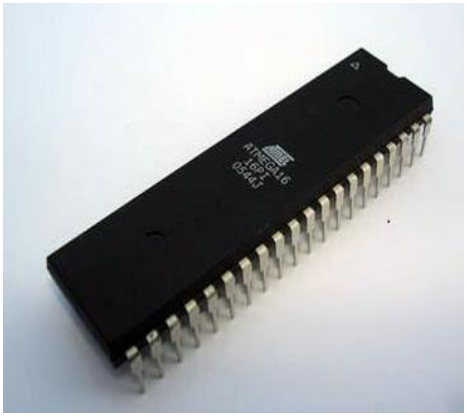

Figure 4: *Atmel AVR.*

Features

- High-performance, Low-power Atmel® AVR® 8-bit Microcontroller
- Advanced RISC Architecture
  – 130 powerful instructions
  – Most single-clock cycle execution

– 32 × 8 general purpose working registers
– Fully static operation
– Up to 16MIPS throughput at 16MHz
– On-chip 2-cycle multiplier

• High Endurance Non-volatile Memory segments
– 8Kbytes of In-System Self-programmable Flash program memory
– 512Bytes EEPROM
– 1Kbyte Internal SRAM
– Write/Erase Cycles: 10,000 Flash/100,000 EEPROM
– Data retention: 20 years at 85°C/100 years at 25°C
– Optional boot code section with independent lock bits in-system programming by On-chip boot program true read-while-write operation
– Programming Lock for Software Security

• Peripheral Features
– Two 8-bit Timer/Counters with Separate Prescaler, one Compare Mode
– One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture Mode
– Real Time Counter with Separate Oscillator
– Three PWM Channels
– 8-channel ADC in TQFP and QFN/MLF package
Eight Channels 10-bit Accuracy
– 6-channel ADC in PDIP package Six Channels 10-bit Accuracy
– Byte-oriented Two-wire Serial Interface
– Programmable Serial USART
– Master/Slave SPI Serial Interface
– Programmable Watchdog Timer with Separate On-chip Oscillator
– On-chip Analog Comparator

• Special Microcontroller Features
– Power-on Reset and Programmable Brown-out Detection
– Internal Calibrated RC Oscillator
– External and Internal Interrupt Sources

– Five Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, and Standby
• I/O and Packages
– 23 Programmable I/O Lines
– 28-lead PDIP, 32-lead TQFP, and 32-pad QFN/MLF
• Operating Voltages
– 2.7V - 5.5V (ATmega8L)
– 4.5V - 5.5V (ATmega8)
• Speed Grades
– 0 - 8MHz (ATmega8L)
– 0 - 16MHz (ATmega8)
• Power Consumption at 4Mhz, 3V, 25 C
– Active: 3.6mA
– Idle Mode: 1.0mA
– Power-down Mode: 0.5µA

CONCLUSION

We have presented an Inter-Vehicle Communication system consisting of a Li-Fi transmitter and receiver that is targeted at communication between vehicles; Li-Fi can be used to communicate with the LED lights of the cars and number of accidents can be prevented. Li-fi is ideal for high density coverage in a restricted region. It is believed that the technology can yield a speed more than 10 Gbps. It is the fastest and cheapest wireless communication systems which is suitable for communication. Li-Fi will make all our lives more technology driven in the near future.

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