

Highway Navigation Using Light Fidelity Technology

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ABSTRACT

Light is everywhere street lamp, traffic light and meeting hall. Imagine that all these light bulbs are high speed wireless transmitter that connects either human to human or systems with systems. Light fidelity or we can say LIFI, a new WIFI is based on the very recent intelligence of light emitting diode(LED) technology as the source of lightning. LIFI is a fully networked, bidirectional high speed wireless connection system. Unlike wireless networks, LIFI networks do not rely on any fixed frequency spectrum which is very limited. Instead, LIFI is based on visible light spectrum which provide the spectrum which is more than 10,000 times to radio wave to deliver desired data. These unique characteristics of LIFI pose a number of challenges for the implementation of capacity, efficiency, availability and security in the wireless network system. In this paper, we study the LIFI use in highway navigation system thus understanding the vulnerabilities and how LIFI will use full in future. Further, we discuss the various issues in WIFI and explore approaches to solve the problems in communication.

Keywords

Li-Fi, Wi-Fi, VLC

1. INTRODUCTION

We have five billion of cellular phones and around 7000 terra byte data we transmit every month. Wireless communication has become necessary or we can say utility just like water, electricity in our day to day life. Our private and business life all are surrounded with wireless communication system. In LIFI we transmit data in parallel bit stream with high speed. Li-Fi is a VLC, visible light communication. Li-Fi is now part of the Visible Light Communications (VLC) PAN IEEE

802.15.7 standard. SIMOFDM and special modulation technologies use to enable the LED lights to transmit the data.

WIFI is a very successful technology but being raised about possible health issues due to empower of brain so close radio wave transmission system.). Over here we explore the possibilities of using Li-Fi in highway navigation. This will revolutionize highway navigation as it will provide for an alternative to GPS.

2. PROCESS

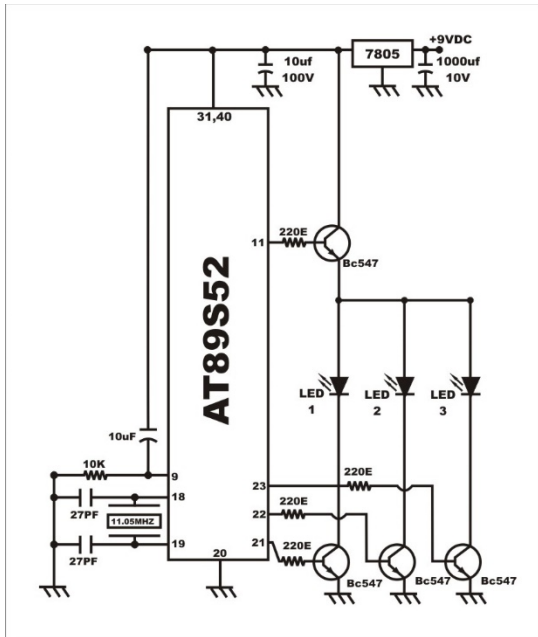
LED is connected to the transmitter and light sensor to the receiver. LED, photo detector registers a binary '1' for ON else its '0' for OFF. The LED'S can be switched ON and OFF very quickly which gives nice opportunities for transmitting data. LED is light illuminating Device and its intensity can modulate in a way that indictable to the human eye. The basic idea by ganging together many small light source rather than one light source we still have capability to do lightning. We are dividing active area into many thousands of much smaller elements and these individual elements that we called micro LED's which is very small on micro scale and when we shrunk the individual potential illumination device then effect come into the play. The effect offers us to switch ON and OFF the device much more quickly. This is the basic approach that we can divide up large area device into many thousand much smaller devices and it increases the bandwidth for ON and OFF the switching capability, speed and some other beneficial characteristics come into play.

When the device come into play then it will give the possibility to send independent communication signal from each individual element in the array. We have more than thousand potentially independent lightning communication channel to start the operation. This is the basic idea of very small devices which is capable of transmitting very high amount of data with speed around 10mbps rather than a single LED or large LED. This is very helpful in transmitting data to many vehicles at a single point of time. The receiver in vehicles will intercept these incoming data with the help of Photodiode and display on The LCD which will provide for assistance to the driver.

3. TRANSMITTER

The transmitter is a main component in the process. It has many components.

3.1 Circuit diagram



3.2 Light Emitting Diode

LED'S are semiconductor electronic device. Tiny LED is being developed that could do simultaneously many task such as deliver data, display information and provide lightning. It is a next stage to research visible light to transmit essentially means that we take new generation of energy saving light bulbs which is made of LED and we use same illumination end for data transmission and not only data transmission but very high data transmission. The tiny LED is made from gallium nitrate, a manmade semiconductor material. It's very good characteristics that its intensity can be modulated at a very high speed that means switched ON and OFF at a very high speed which is the basic fundamental property used in LIFI.

3.3 Crystal Oscillator

The crystal oscillator used in this transmitter works at a frequency of 11.05MHz. It provides with a constant and stable frequency so as to maintain a standard clock pulse in the circuit.

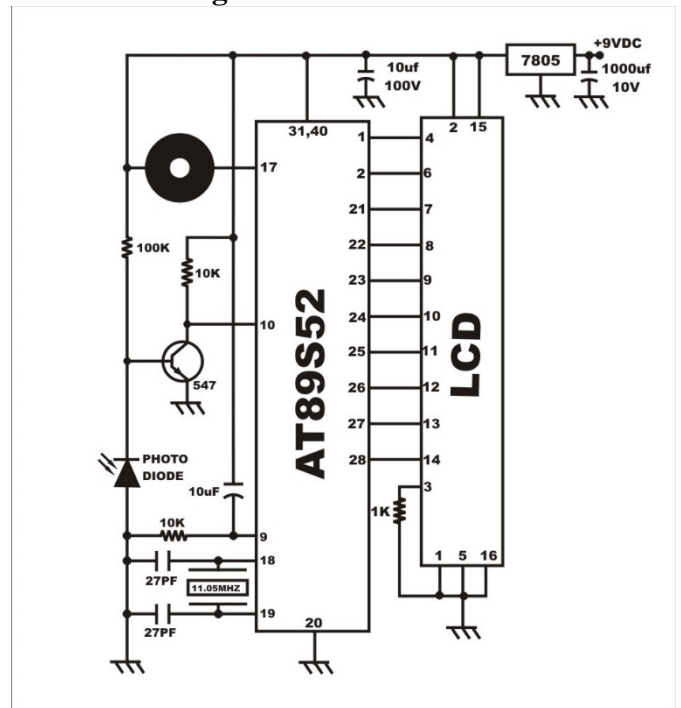
3.4 Microcontroller

It is a common and an important component in both transmitter and receiver. It has 256 x 8 bits internal RAM, it has an In system reprogrammable flash memory of 8000 bytes. The microcontroller is programmed with the data of highway routes. In transmitter it interfaces with LED and in receiver it interfaces with photodiode and LCD.

4. RECEIVER

Receiver receives signal through photo detector and signal processing is done in the receiver section. Receiver ignores constant light because receiver is interested only in certain changes or modulated intensity at very high speed. The certain changes in amplitude in light bulb occur at the same time of illumination of light bulb and transmission of data. Other components of the receiver are buzzer, LCD.

4.1 Circuit Diagram



4.2 Photo Detector

The Photo Detector is a sensor of light and electromechanical energy. It works in forward bias by absorbing light. In this

paper the photo detector absorbs light from the light emitting diode. The photo detector picks up the signal which is converted back into a data stream and sent to the client. The client can communicate through its own LED output or over the existing network.

4.3 Buzzer

Buzzer in the receiver alerts when ever it intercepts an incoming signal , in this case when the photo detector comes in contact with the visible light of the LED.

4.4 Liquid Crystal Display

LCD is an electronic visual display which uses light modulating properties of liquid crystals as they do not emit directly. It is capable of displaying fixed and flat images. The LCD used is 2x16 grids in dimension. It displays the data of highway routes from the microcontroller into readable form by parallel communication.

4.5 Voltage Regulator

The voltage regulator is designed to automatically maintain constant level of voltage. It can be a simple feed forward or have a negative feedback loop. Voltage controller has been used in both transmitter and receiver. The controller used here is to step down the voltage supplied in transmitter and receiver respectively.

5. WORKING

Project highway navigation is based on LI-FI. Two basic components of any project are its transmitter and receiver. The transmitter we have used here is a smart pole. It has many components such as LED which is a high glow white light emitting diode, crystal oscillator which is working at 11.085 MHz to provide constant frequency so as to maintain constant clock pulse, voltage regulator, which is giving a constant voltage of 5V by stepping down the supply voltage from transmitter and receiver. The microcontroller present is a

common component in both transmitter and receiver. The microcontroller has the data of highway routes fed in. It is data programmed in it. It also contributes in interfacing. The receiver

in the project is a moving vehicle or any ordinary car which has photo detector, buzzer. The photo detector absorbs the incoming light from the LED's and passes onto the microcontroller which intercepts the light into data to visible on the LCD in the vehicle. The buzzer will beep as soon as the data is received by the photo detector.

To summarize, the project is basically a transmission and reception of information and data in form of light energy which is used for navigation.

6. ADVANTAGES

1. LIFI is faster than WIFI.
2. More secure because data cannot be intercepted without a clear line of sight.
3. Prevent piggybacking.
4. We can eliminate the neighboring.
5. No inference by radio waves.
6. We can use in sensitive areas like airplane hospitals petro chemical industries.

7. DISADVANTAGES

1. Presence of light is very necessary.
2. Necessary clear line of sight (LOS).
3. It works better with the fluorescent light.

8. APPLICATIONS OF Li-Fi

- **Relief from RF Spectrum** : Excess capacity demands of cellular networks can be reduced with help of Li-Fi networks where available.
- **Smart Lights**: Private or public lighting including street lamps can be used to provide Li-Fi hotspots and sensor infrastructure can be used for monitoring and controlling lighting and data.
- **Mobile Connectivity**: Laptops, smart phones and other mobile devices can interconnect directly using Li-Fi. It gives very high data rates and also provides security.

- **Hospital & Healthcare:** Li-Fi emits no electromagnetic interference and so does not interfere with the medical instruments, and it is not interfered with by MRI scanners.
- **Aviation:** Li-Fi can be used to reduce weight and cabling and add flexibility to seating layouts in aircraft passenger cabins where LED lights are already deployed.
- **Underwater Communications:** Due to strong signal absorption in water, use of RF is impractical. Acoustic waves have extremely low bandwidth and disturb and harm marine life. Li-Fi provides a much better solution for short-range communications.
- **Vehicles & Transportation:** LED headlights and taillights are being introduced. Street lamps and traffic signals are also moving to LED. This technology can be used for vehicle-to-vehicle and vehicle-to-roadside communications. This can also be applied for road safety and traffic management.

9. FUTURE SCOPE

Light Fidelity is the future of communication. It is a fast and cheap system of communication and an optical version of LiFi. It will increase the speed of wireless data communication. This project has very wide scope in near future as it can help

11. REFERENCES

- 1) "Visible-light communication: Tripping the light fantastic: A fast and cheap optical version of Wi-Fi is coming". *The Economist*. 28 January 2012. Retrieved 22 October 2013.
- 2) Haas, Harald (July 2011). "Wireless data from every light bulb". TED Global. Edinburgh, Scotland.
- 3) Iain Thomson (18 October 2013). "Forget Wi-Fi, boffins' get 150Mbps Li-Fi connection from a light bulb: Many hands make light work". *The Register*. Retrieved 22Oct13.
- 4) Wi-Fi Alliance: organizationl Retrieved august 23, 2011.
- 5) Hassan Yagoobi, —Scalable OFDMA Physical Layer in IEEE 802.16 Wireless MANl, *Intel Technology Journal*, Vol 08, August 2004.
- 6) W. Xiao and R. Ratasuk,- Analysis of Hybrid ARQ with Link Adaptationl, *Proceedings of the Annual Allerton Conference on Communications, Control and Computing* pp. 1618-1619, Oct 2002.

navigate better not only on highways but anywhere we want. This Li-Fi based highway navigation can also be modified to navigate on a different level, like navigation for people at night, blind people, etc.

10. CONCLUSION

The possibilities are numerous and can be explored further. If this technology is put into practical use, every bulb can be used something like a Wi-Fi hotspot to transmit wireless data. We have discussed the all technologies here. Now we will recall a brief overview of this paper. LIFI overcomes the limitation present in radio spectrum. Large Data transmit with very high speed approx. 10gbps. A small chip fit into the potential illumination device it gives lightning as well as wireless data transmission to a clean green and bright future. The project highway navigation thus is a technological advancement in field of wireless communication. It is also economical as it requires only one time investment. Highway navigation as it is or with modification can be very helpful to the society where today everything is technology based.