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An Advance Approach to Highway Routing

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Abstract: Li-fi is a future upcoming technology and a subset of optical wireless communication. The scope of this paper is to provide highway routing in areas which lack sign and direction board, network or GPS system, using microcontroller, street light poles and LED. Stored data is transmitted by the street light bulb-LED by modulating the visible light, to any vehicle approaching to that particular pole having Li-Fi receiver. Li-Fi transmitters are installed at a gap of few kilometers and at each pole transmitter give the direction with respect to its position. This project can prove to a great relief for the travelers specially those travelling at night. It provides high speed, high security and low cost.

Keywords: Li-Fi, Visible Light Communication (VLC), Light Emitting Diode (LED)

I. INTRODUCTION

It is often heard that it is difficult to find the right pathway for the traveler travelling to remote areas. During day time, one can find the path, simply by asking the passerby or any sign board. But problem grown up during night, due to lack of visibility, non-functioning of GPS and difficult to find any passerby. Not everywhere on the highway we find the mobile networks which can be used for navigation, at that time if there is another mean which can provide the traveler with the right pathway and location. It will reduce the panic and encourage more travelers to take the road trip.

So in order to overcome up with this problem, we propose to install Li-Fi. Now Li-Fi is a part of visible light communication (VLC) PAN IEEE 802.15.7 standard. VLC works by switching the current to the LEDs off and on at a very high rate. This is so quick to be observed by human eye as light got the fastest speed.

Here, street light pole consist of a transmitting unit. These units have microcontrollers which consist of previously stored data (i.e. direction indications). Whenever a vehicle comes in the range of the visible light of the LED of light poles, it transmits the data to that vehicle. SIMOFDM and special modulation technologies use to enable the LED lights to transmit the data. The available data is displayed on the LCD installed with receiver unit in the vehicle.

Over here we simulate proposed paper on PROTEUS 8 professional software to explore the possibilities of using li-fi in highway routing. This will revolutionize the highway routing as it become a better alternative to GPS system.

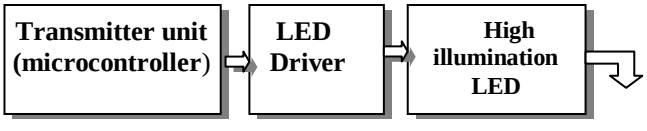

Fig. 1 Transmitter unit installed on street light poles

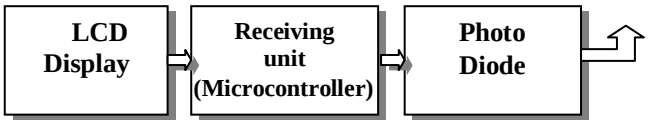

Fig. 2 Receiver unit installed in the vehicle

II. PROJECT WORK

A. Transmitter Unit

For highway routing, transmitting unit has to be erected on the street light poles. It consists of a microcontroller PIC16F876A having 28pins-package. It has EEPROM and 8x16 byte of flash program memory, in which pathway direction is stored by the installer. Binary stored data is transmitted to the LED driver circuit in the form of electronic pulses.

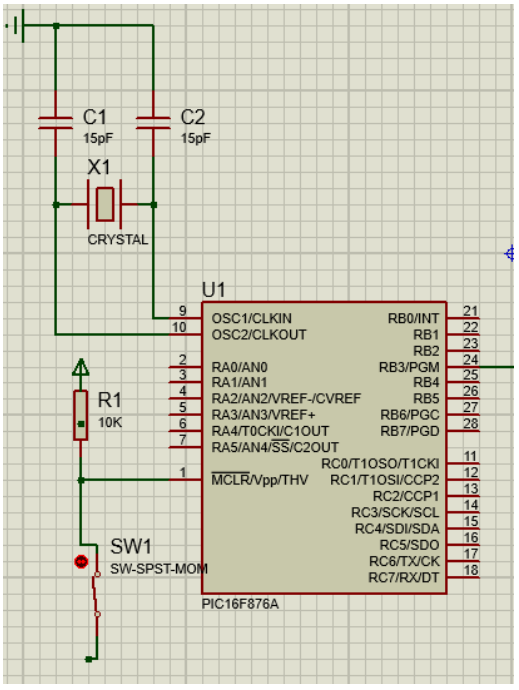

Fig. 3 Transmitter unit PIC16F876A

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B. LED Driver Circuit

Pin no.24 is the port out, sending electronic pulses to the LED. These pulses are amplified by low power high frequency 2N222 NPN transistor. The fast and subtle variations of the current, the optical output can be made to vary at extremely high speeds. Due to the variation in electronic pulses, white light emitted by LED gets modulated. The intensity modulation is imperceptible to the human eye, and thus communication is just as seamless as RF.

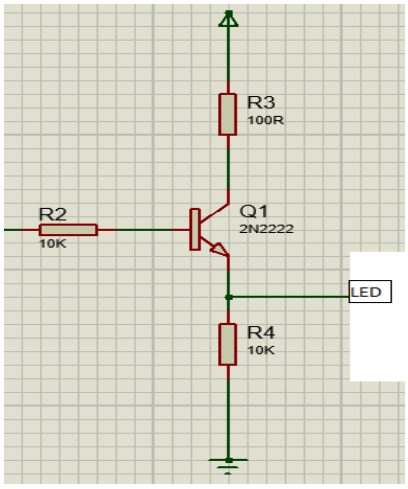

Fig. 4 LED Driver Circuit

C. Photo Diode Receiver Circuit

Photo diode circuit has to be installed in the vehicles. In its Receiver circuit, LM339 is used as a comparator. LM339 had high gain and wide bandwidth. If the light illumination varies photo diode current also changes. In receiver have two stages. First stage photo detector current converts to voltage level. In second stage inverting amplifier inverts once to get original information. The amplified electronic signal is send to the microcontroller PIC16F876A.

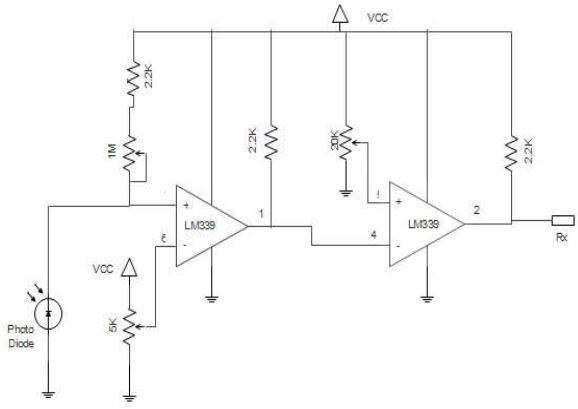

Fig. 5 Photo diode receiver circuit for Li-Fi

D. LCD Display

Electronic signal is again converted back to binary bits. Receiver circuit in vehicle has microcontroller installed. Whenever a signal is received by photodiode it sends the data to microcontroller which let it buzzer to on. Interruption by the buzzer signifies data is received on the 16x2 alphanumeric LCD display.

III. CIRCUIT SIMULATION AND RESULT

For understanding the feasibility and possibility of functioning of Li-Fi for highway routing, we use PROTEUS 8 PROFESSIONAL to simulate above proposed.

A. Transmitter Unit Simulation

Here, a keypad is used to represent poles. Each no. on keypad represents a pole with its own transmitter unit. When a key is pressed, it is supposed that vehicle come in the range of that pole and input data stored on each pole is send to the LED. A reset button is provided to transmitting unit, if in case it becomes non-functioning. In PROTEUS 8, we use a module that has a package of led and its receiver. It transmit the data.

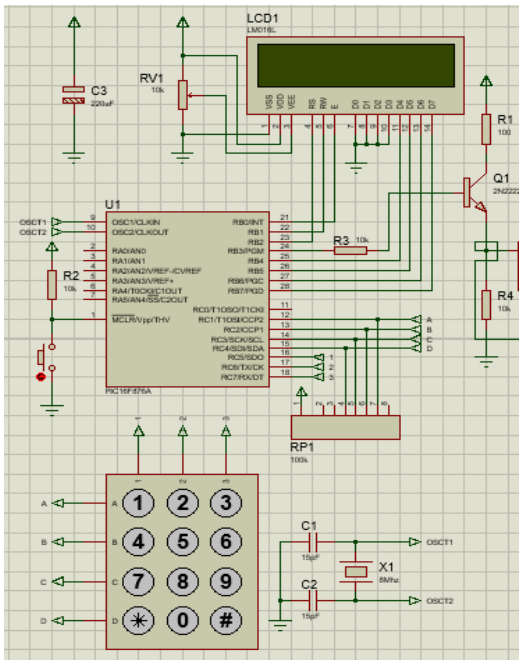

Fig. 6 Transmitter unit simulated circuit

B. Receiver circuit simulation

Module has photodiode in PROTEUS 8. Data received by the receiver circuit is displayed on the LCD as Font- place name, Back-place name, Right- place name and Left-place name.

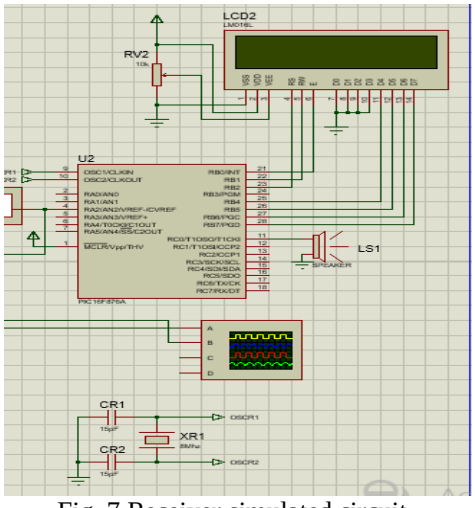

Fig. 7 Receiver simulated circuit.

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C. Output Result

Simulated circuit is run. Its transmitting signal can be analyze from the digital oscilloscope and same output can be seen on receiver LCD2 as it is displayed by transmitter LCD1.

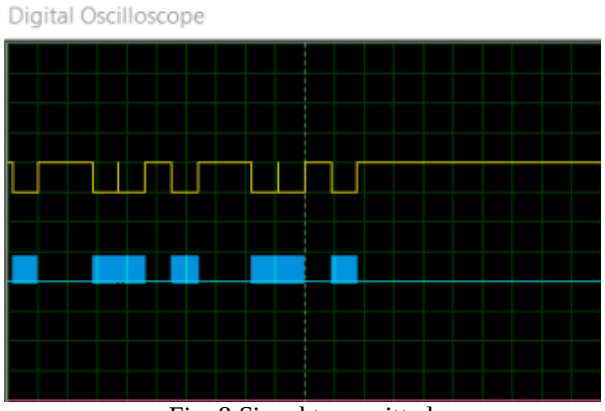

Fig. 8 Signal transmitted

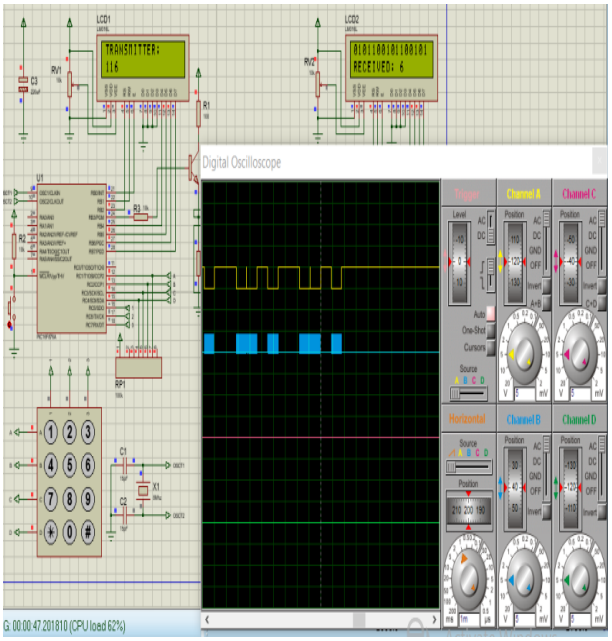

Fig. 9 Output received on LCD

IV. CONCLUSION

This method will help in reducing difficulty faced by the traveller taking long route journey through remote locations on highway. Li-Fi has proved capable of sending data at speeds of up to 1GBps, around 100 times faster than most current Wi-Fi connections. Li-Fi light source enable efficiency, long stable life, and full spectrum intensity that is digitally controlled and easy to use. Most people are thinking of Li-Fi as an alternative to Wi-Fi. However, we think they both are complementary to each other. Wi-Fi has higher range than Li-Fi. However, the latter has much higher connection speed than the former. Li-Fi provides much more secure connection than Wi-Fi. But at same time Li-Fi cannot work on the other side of the wall and among similar barriers. Also Li-Fi doesn't emit any harmful radiation.

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After completing our project on **AN ADVANCE APPROCH TO HIGHWAY ROUTING**, we wish to express our obligations to the college staff. We wish to express our obligations to our fellow project markers.

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