Eco-friendly traffic management using Li-Fi

Eisha Akanksha, Prof. Y.P. Singh
Research scholar of Electronics & communication Engineering, Sunrise University, Alwar, Rajasthan and Assistant Professor CMRIT Bangalore
Director, Somany (P.G.) Institute of Technology and Management, Rewari, Haryana

***Abstract*— Li-Fi provides transmission of data through illumination by sending data through an LED light bulb that varies in intensity faster than a human eye can follow. Li-Fi is a wireless optical networking technology that uses light emitting diodes for transmission of data. Proposed application of VLC includes use of Li Fi technology at traffic signals. The LED's are used at the transmitting end and photodiode at the receiving end. The count of the number of vehicles is transmitted to the sensor installed at traffic light. Depending upon the number of counts the corresponding lane is given green signal.**

Index Terms—OWC (optical wireless communication), Li-Fi (Light fidelity), LED (light emitting diodes), OOK (On Off Keying)

I. INTRODUCTION

IN Modern society, the current wireless networks that connect us to the internet are slow when multiple devices are connected. The idea of Li-If introduced by the German physicist Harald Hass is used for fast eco-friendly and cheap wireless communication system. This OWC technology used LEDs as a medium to deliver networked, mobile, high speed communication. The present application allows traffic management using visible light communication by switching the bulbs on and off with in nanoseconds. Here LED headlights and tail lights are being introduced, which gives the count of the number vehicles in all four lane to the traffic signal. Then depending upon the count the lane with higher number of vehicles are allowed to go first.

II. WORKING

The above technology is cheap and is best for safety and traffic management. The LED headlights acts as the transmitter, sends the data to the photodiodes installed on the tail lights which acts as receiver. As soon as the data is transmitted using Manchester coding the receivers increment the count. This data from the all four lanes are received by the receiver of signal generator which first compares the count received from all lanes and it give the green signal to the lane having largest count. A general model is shown in Fig. 1..

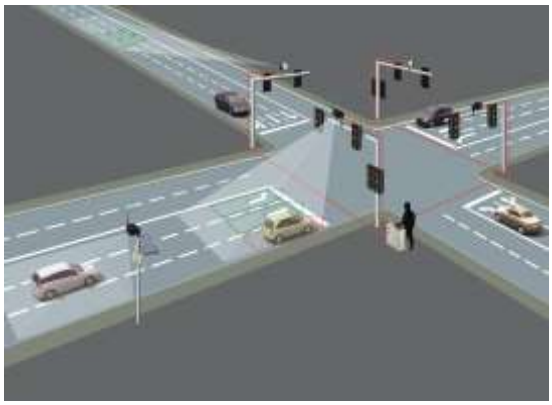


Fig. 1 A general diagram of traffic management

III. TRAFFIC COUNT RECEIVER CODE

First Data received from the entire four lanes. Then the the received data is compared to find the greatest car count. Finally the LED is switched 'ON' corresponding to lane having highest car count by sending the real time data from all lanes using Bluetooth.

IV. TRANSMITTER DATA MECHANISM

Transmitted signal data frame consists of

1. Four bits of 1010 is appended to every data for synchronization.
2. Next four bits comprises of binary data as car count.
3. After synchronization is done, binary data is transmitted using Manchester coding.
4. The final data received by traffic signal indicates the vehicle count.

ON	**OFF**	**ON**	**OFF**	**D**	**A**	**T**	**A**

Logic '0' is represented by OOK symbol '10', with all DC components, which make LED 'OFF'.

Logic '1' is represented by OOK symbol '01', with all DC components, which make LED 'ON'.

OOK uses Manchester coding so that positive pulses is same as that of negative pulse.

Receiver Data Mechanism

The flickered light signal received by photodiode is converted to electrical signal.

Receiver signal data frame consists of

1. Four bits of 1010 is appended to every data for synchronization.
2. Next four bits comprises of integer data as car count
3. After synchronization is done, integer data is extracted from frame.
4. After extraction, four digits are converted to equivalent decimal value.

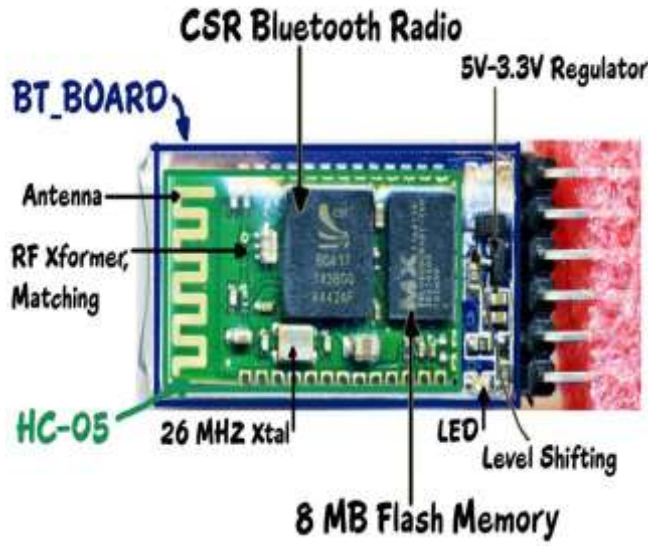
ON	**OFF**	**ON**	**OFF**	**D**	**A**	**T**	**A**

Converted decimal data is stored as:

1	**1*1**	**1**
0	(2)*0	0
1	(2*2)*1	4
1	(2*2*2)*1	8
DATA	SUM	13

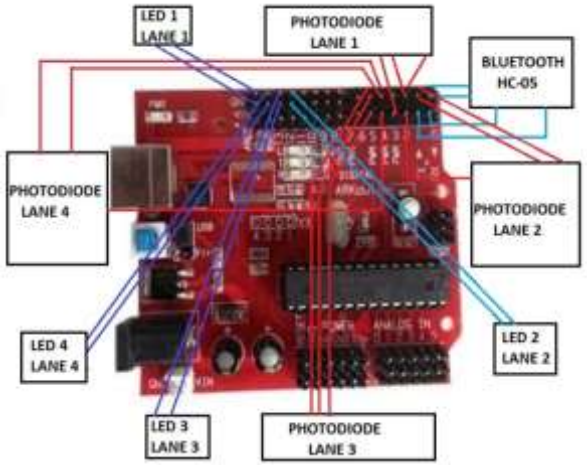
V. BLUETOOTH

1. Connected to main receiver
2. Provides real time data as car count from each lane in mobile for user interface.

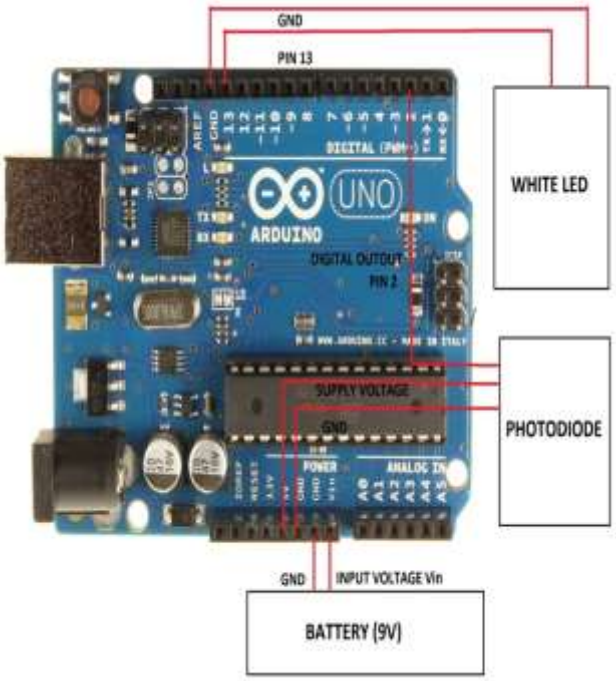


VI. TRAFFIC COUNT RECEIVER

1. Data received from the four lane
2. Comparison between data received
3. Finding the greatest car count.
4. Switch on LED corresponding to lane with highest car density
5. Sending real time data from all the lanes to Bluetooth.



VII. TRANS-RECEIVER



It can be fitted to both front end and rear end.

The data from white LED is transmitted to photodiode which is stored in the data memory of ARDUINO and this count information is further transmitted from one vehicle to another.

VIII. ADVANTAGES

Enhanced Signal Coordination

Helps achieve maximum "green wave" and enhanced flow of traffic

Better Demand Prediction

Centralized analysis of traffic pattern to better determine traffic cycles and trends in movement

Increased Efficiency

Enhanced management of traffic can improve operational efficiencies

Enhanced Safety

Smooth flow of traffic can ensure safety of both commuters and pedestrians.

Improvement in Overall Experience

Seamless traffic movements can help improve traveler experience.

Manage traffic light switch sequence

The microcontroller set/modify the basic switching sequence for signals. It collects all the count information and clear the traffic at each intersection.

IX. CONCLUSION

This type of traffic management system not only clears the congestion effectively but also improves the quality of life and provides a cleaner environment. However, the increased traffic day by day on the roads calls for systems that has the potential to take quick decisions and ensure smoother flow of traffic. The use of embedded devices with "in-built intelligence" can ensure the growing demands of traffic management in cities across the globe.

X. REFERENCES:

[1] http://en.wikipedia.org/wiki/Li-Fi
[2] http://edition.cnn.com/2012/09/28/tech/lifi-haas-Innovation
[3] http://www.dvice.com/archives/2012/08/lifi-ten-ways-i.php
[4] http://www.good.is/posts/forget-wifi-it-s-lifi-Internet-through-light bulbs
[5] http://www.lifi.com/pdfs/techbriefhowlifiworks.pdf
[6] http://www.ispreview.co.uk/index.php/2013/01/tiny-led-lights-set-to-deliver-wifi-style-internetcommunications.html
[7] http://groupivsemi.com/working-lifi-could-be-available-soon
[8] Haas, Harald (July 2011)."Wireless data from every light bulb". TEDD Global .Edinburgh, Scotland.
[9] Tony Smith (24 May 2012)."WTF is... Li-Fi? Optical data transfer's new leading light?".The Register. Retrieved 22 October 2013.
[10] Visilink, Visible Light Communication Technology for Near-Ubiquitous Networking‖ White Paper, January 2012.
[11] Richard P. Gilliard, Marc DeVincentis, AbdeslamHafidi, Daniel O'Hare, and Gregg Hollingsworth, Operation of the LiFi Light Emitting Plasma in Resonant Cavity.
[12] Richard Gilliard, Luxim Corporation, ―The lifi® lamp high efficiency high brightness light emitting plasma with long life and excellent color quality
[13] Jyoti Rani, PrernaChauhan, RitikaTripathi, ―Li-Fi (Light Fidelity)-The future technology In Wireless communication, International Journal of Applied Engineering Research, ISSN 0973 -4562 Vol.7 No.11 (2012)

About the Authors:

1. Mrs. Eisha Akanksha a research scholar is post graduate in Electronics & Communication engineering , working as Assistant Professor In MVJCE Bangalore, She is pursuing her research in the innovative and front line research in Energy efficient communication system (a future wireless internet communication), from the Faculty of Computer Engineering Electronics and communication Engineering, Sunrise University, Alwar, Rajasthan

2. Prof. Y.P. Singh, currently working as Director, Somany (P.G.) Institute of Technology and Management, Rewari, Haryana. He has also worked about 27 years as Lecturer, Dean of academics & Principal in many Engineering institutions and organization. He has also served with Training and Technical Dept. Govt. Of Delhi, almost for 17 years. He has about 76 research paper published in National and 164 papers published in