HIGH SPEED DATA TRANSMISSION USING LIGHT FIDELITY (Li-Fi)

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Abstract: ***People often get frustrated when the internet speed becomes dead slow. When more than one person make access on an internet, the traffic becomes high and the speed gradually decreases, to overcome such difficulty a German physicist Herald Hass has come up with a solution called Data through illumination. 10 megabits per sec data rates will be produced by D-LIGHT which is comparatively faster than the average broadband connection. Hence a future can be envisioned having light as transmitting medium to our laptops, smart phones, and tablets. And security would be a snap- if you away from the light source you cannot access the data.***

Key words: ***Broadband, Data, Internet, LIFI***

1. INTRODUCTION

LiFi uses visible light as a medium for the transmission of data. As a type of VLC system, it requires two components: a photodiode and a light source. The photodiode acts as a transceiver that receives light signals and transmits them back. The light source transmits data using emitted light as the medium. In this case, light emitting diodes (LED) serve as the light source. They are outfitted with a chip that serves as the signal processing unit [1]. LED light bulbs are semiconductors. This means current supplied to the bulb can be modulated, which in turn, modulates the light they emit. This process occurs at extremely high speeds that are unperceivable to the human eye. Data is fed into the light bulb and sends the data at extremely high speeds to the photodiode. It converts the data received into a binary data stream perceivable by humans such as video and audio applications [2]. Li-Fi is a visible light communication (VLC) system that transfers digital signals through light. It combines wireless connectivity with your usual overhead lighting or desk lamps, allowing you to go online while getting the light you need to move around a room. Since it isn't dependent on radio frequencies, Li-Fi can keep you connected when Wi-Fi and cellular connections can't. Plus, it offers other advantages that can revolutionize your internet use. A German physicist Herald Hass has invented the transfer of data through light which is known as Light Fidelity. The invention will be a supplant for Wi-Fi, the data are transmitted at the rate of 500Mbps.This technology uses all kind of light spectrum like white light, infrared, ultraviolet. The HD film can be downloaded within 30 sec. The data are transmitted when the light is in ON state i.e., logic1 is sent and the transmission of data is stopped when the light is in OFF state i.e., logic 0.

The LED light appears to glow continuously but flickering takes place within the bulb more than 100 times which cannot be followed by the naked eyes. As the intensity of the light changes the output appears to be constant throughout the transmission. The researchers from the university of Edinburg and university of oxford worked upon the array of LEDs by parallel transmission, here each LEDs in the array of LED's have different data stream. Research is undergone with colored LEDs like red, blue, green to alter the light frequency encrypting different data channel. In 2011, companies gathered to promote the Li-Fi technology in order to overcome the limited availability of radio based wireless spectrum and believes that it is possible to achieve greater than 10Gbps [3].

2. PROCEDURE

The data are encrypted in the LEDs with the help of a controller and some LEDs. The logical 1 is transmitted when the LED is ON and logical 0 is transmitted when the LED is OFF. The LED flickers enormously so that the data are being transmitted at high speed over 10Gbps on theoretical basis. An array of LEDs is used for parallel data transmission and different colored LEDs to alter the LED frequency so that data are encrypted for different frequency. To encode the information in LED's, the flickering rate of the LED's is varied so that we can obtain different set of 0's and 1's [4].

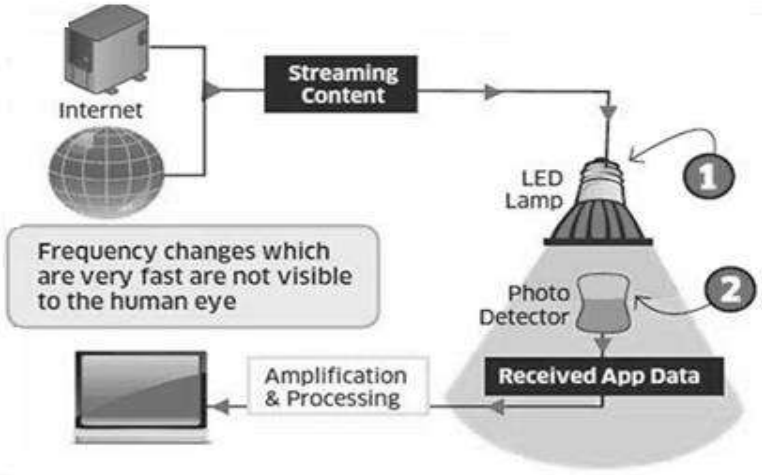

Figure 1: ***Block diagram of the proposed system***

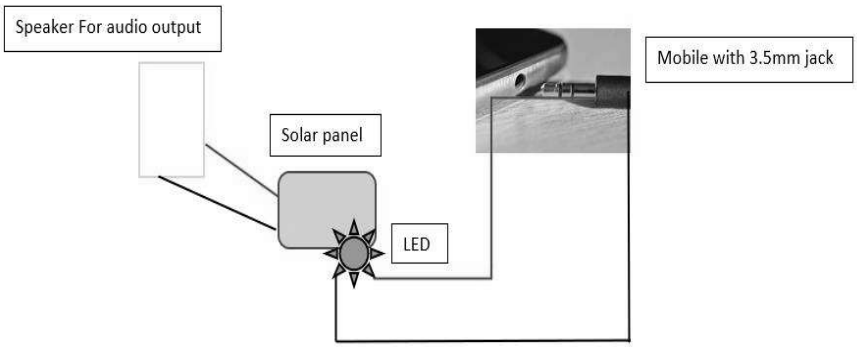

Figure 2: ***Single line diagram***

Name of component	Purpose	Specification
LED	For audio transmission	4v dc, No. of led 12
Speaker	For audio output received in solar panel	5 v input power, aux cable audio input,5-ohm speaker output
Solar Panel	For receiving light audio input	Output of 12v dc
Battery	For powering the LED	Non rechargeable battery of 9v output dc
3.5 mm Audio jack	For input and output receiving data	Gold plated point with proper winding of wire
Connecting wire	For connection of the circuit	A good quality of wire of two different colors.
Mobile	For audio signal	Any mobile with 3.5 mm audio jack output.

3. RESULTS AND DISCUSSIONS

Li-If vs Wi-Fi: The Life is more advantageous than Wi-Fi technology, in case of Wi-Fi the user depends upon the source like routers but in case of Li-Fi it is not so. The Li-Fi technology uses light as a source for data transfer and the user can make use of any kind of light source for data transfer. Wi-Fi uses radio signals which cannot be used underwater data transmission since the radio signals will not be able to pass through water but we know that the light can go through the water and Life is more helpful in underwater data transmission. The security concern in case of Wi-Fi is much compared to Life the radio waves can easily penetrate through the walls and the data can be easily hacked but the light cannot penetrate through the walls therefore the data are more secured. The radio waves are more harmful which are not allowed in hospitals and in airlines but light is very much eco-friendly which can be used in hospitals and, also in airlines. The data rate is greater than 1Gbps in case of Life but the data rate using Wi-Fi is 10Mbps, which finds the user more efficient to surf on the internet.

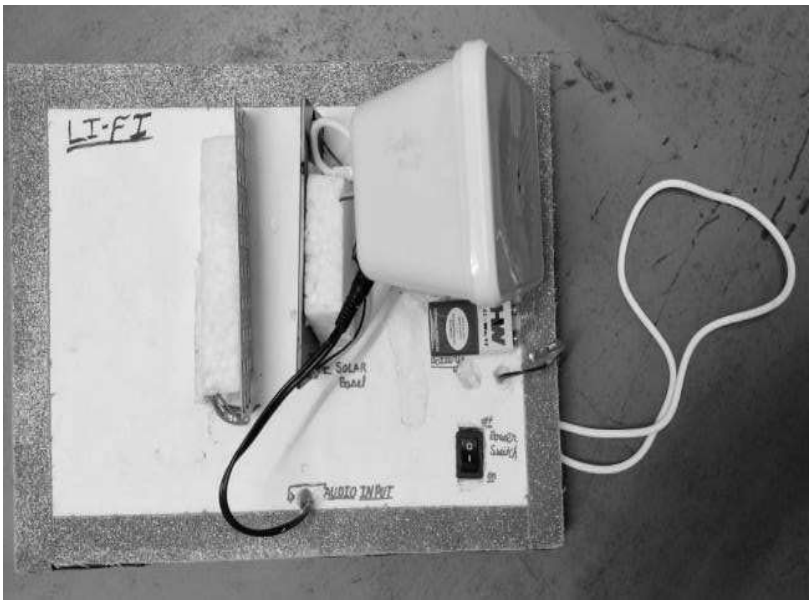

Figure 3: ***Working model of Lifi***

Name of component	Cost of material
LED	4 pic * 10 = 40rs
Speaker	250rs
Solar Panel	200rs
Battery	20rs
3.5 mm Audio jack	80rs
Connecting wire	20rs
Mobile	……
Base for supporting the model	100rs
Usb cable for power supply of speaker	80rs

The LOS channel can be calculated as following:

$$H_{LOS}^{iu} = \frac{(m+1)Apd}{2\pi d_{i.u}^2} \cos^m(\emptyset_{i.u}) g_f \, g_c(\Psi_{i.u}) cos(\Psi_{i.u})$$

Where: $m = \frac{-In(2)}{In(cos\emptyset_{1/2}}$ is the Lambertian emission order;

the optical concentrator gain,which is defined as follows:

$$g_c(\psi_{i,u}) = \begin{cases} \frac{n^2}{sin^2(\psi_{max})}, \psi_{i,u} < \psi_{max} \\ 0, \psi_{i,u} > \psi_{max} \end{cases}$$

Where: n- is a refractive index,

Ψ_{max} - is the semiangle of the field of view (FOV) of the PD.

4. CONCLUSION

The applications of Li-Fi can be explored further, if we started to use LIFI practically then, each and every LED bulb that are available in streets, roads, public places like mall, etc., can be used as hotspot to transmit data The concept of Li-Fi is most welcomed by many people, just because of its data transfer speed. We can observe the speed of Li-Fi in dense population areas like metropolitan cities since many people will access the internet. Radio waves can be eradicated by the Li-Fi so that they can be freely used in hospitals, aircraft, and underground water. If we use Li-Fi We do not want to worry about the bandwidth, channel width of Wi-Fi router. The major drawback of Li-Fi is it can be used only with in the small area as it cannot penetrate through walls it can also be considered as an advantage in terms of security purposes, but overall, it sounds good in the developing field of wireless communication technology. The model on the basics of trail version so this model can only transfer audio but cannot transfer data. My future plane is to upgrade the model so that it can transmit both data and audio in much cheaper cost.

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