Li-Fi Hotspot

Accessing Internet Using Street Lights

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Abstract: The invention relates to Light Fidelity (Li-Fi) Hotspot which refers to techniques whereby internet is provided in the form of a signal embedded in visible light (including for example LED streetlight) emitted by a light source. It will be comprising of a lamp driver (which contains modulation and demodulation device) and a Li-Fi dongle (which contains photo detector and amplification and processing). The lamp driver accesses a signal by means of a network cable and transmits the accessed signal after modulation to the streetlight. The Li-Fi dongle will convert the received visible light signal into a radio frequency signal and then transmit the radio frequency signal to the modulation and demodulation device to demodulate the radio frequency signal to an original signal, thereby carrying Li-Fi communication using streetlights.

*Index Terms* - **Embedded System, IoT, Artificial Intelligence, Visible Light Communication (VLC)**

I. INTRODUCTION

The utility model relates in providing internet to the entire city using Li-Fi (Light Fidelity) with reduced cost, better speed easily accessible and higher bandwidth.

II. BACKGROUND

Visible light wireless communication, also known as "light fidelity technology", English name Light Fidelity (referred to as Li-Fi) is a new wireless transmission technology that uses visible light spectrum (such as light emitted by a light bulb) for data transmission. Li-Fi uses a well-laid device (ubiquitous LED light) to form a device like Access Point (AP) (Wi-Fi hotspot) by implanting a tiny chip on the light bulb, so that the terminal can access the network at any time. Li-Fi uses visible light to achieve wireless communication, that is, the use of electrical signals to control the high-speed flickering signals that are invisible to the naked eye (LEDs) to transmit information.

This "Li-Fi" technology had a huge spectrum of coverage of the Internet, and the width of the visible spectrum reaches 10,000 times that of the RF spectrum. Therefore, visible light communication has higher bandwidth and faster data transmission. Therefore, using this new technology, we can create a huge internet hotspot using Li-fi by providing data to every streetlight of the cities and highways and hence, the user can access fast internet anywhere, anytime, while walking besides the streetlights or driving by the highways having streetlights.
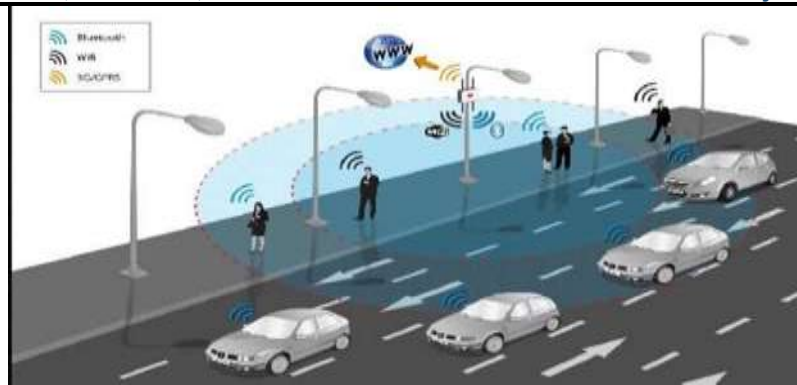
III. DESCRIPTION

The Li-Fi technology is based on the VLC system which uses light for the data transmission. As the velocity as well as the intensity of the light is very high, hence the data transmit with high speed. The working of this technology is very simple. The LED which acts as light emitter is fitted on one end and the photo detector (photo sensor) on another end. When the LED is

ON, the photo detector recognizes the binary 1 and if the LED is OFF, the photo detector recognizes the binary 0. To build up a message, flash the LED numerous times or use an array of LED of perhaps a few different colors to obtain data rules in the range of hundreds of megabits per seconds. The data is received and encoded in the light by varying the flickering rate at which the LED's flicker ON and OFF to generate different strings of 1s or 0s.

In this patent, the modem device can connect to the Ethernet device to access the signal through the network cable, which is well compatible with the current local area network, and the cost is low and easy to implement. The modem device is configured to modulate the accessed original signal into a radio frequency signal, and the modulated radio frequency signal can be transmitted to the lamp driver which will transmit the signal to every LED street lamps.

On the receiving end there is a Li-Fi dongle which composed of photodetector, amplification & processing wherein the photodetector is configured to detect and receive the visible light signal and convert the received visible light signal into the electrical signal and the electrical signal are sequentially converted into a radio frequency signal by an electric amplifier, a low-pass filter, and an up-conversion mixer. The low-pass filter filters out channel noise and other interference and filters out the low-frequency signal. The up-conversion mixer converts the low-frequency signal filtered by the low-pass filter into a high-frequency RF signal, which is then transmitted to the modem to demodulate the original signal. The signal is then converted back into a binary data stream that the user would recognize as web, video and audio applications that run on internet enables devices.
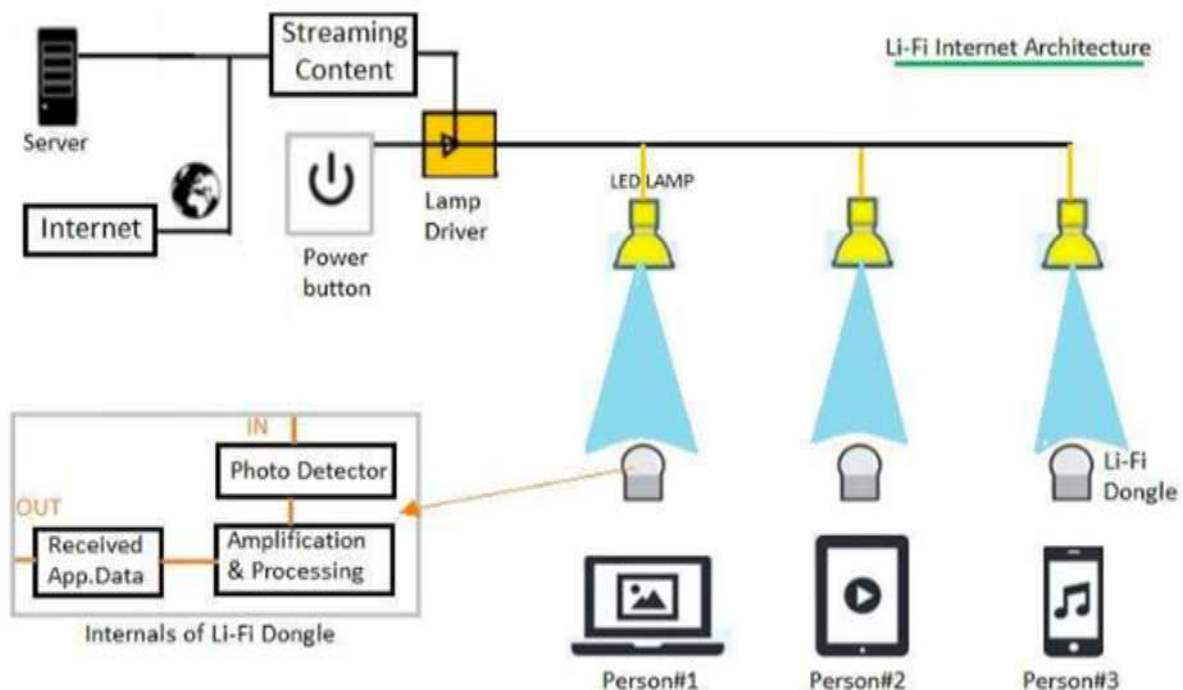
IV. CLAIMS

1. Internet can be provided to the whole city in a much cheaper way, compared to Wi-Fi, it doesn't need many routers to cover a large distance coverage.
2. It will be also beneficial to the tourism department by providing an outlet for local information.
3. Since it does not pollute, it can be called a green technology for device-to-device communication on the Internet of Things (IoT).
4. Li-Fi is very cheap for transmission purpose. LED light consume less energy and are highly efficient.
5. Light has 10000 times wider bandwidth than radio waves. Hence, Li-Fi proves better capacity compared to Wi-Fi.

6. It is possible to get more than 10Gbps, theoretically permit a top-quality motion picture to be downloaded in 30sec. This leads to the fast and easy communication.

V. Limitations

Although Li-Fi can offer many advantages there are some disadvantages as well. For starters, Li-Fi doesn't work under direct sunlight because the sunlight blocks the path of the ray of light given by the LED lamp. Furthermore, it can't go through bricks or walls, so if there is a building or a wall the signal would be obstructed. For this problem we need to used hybrid Li-Fi and Wi-Fi connections to overcome the connection interruption caused by bricks or walls. Another disadvantage is that it doesn't work with the LED lights turned off (the lights need to be on in order to transmit data, they can be dimmed down), this being an issue and also a concern on the power bill and usage. It only works on those devices (tablets, smartphones, etc) that have a Li-Fi receptor.

VI. Summary

This technology is advanced to Wi-Fi as potential for wider bandwidth is high and quicker response time. Every streetlight can be replaced by LED light which acts as photo detector to transfer data. As it is very cheap and faster everyone accesses it easily. If this technology is developed, it will be easier to connect to the internet within a second. If all the light bulbs are replaced by LED's, we could proceed to greener, cleaner, safer, and brighter future. The problem of shortage of radio-frequency bandwidth can be reduced by using this technique. If this technology is developed, this will be great revolution in the field of technology. We just need to hover over streetlight, and we can access internet.

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