REVIEW: INDOOR POSITIONING SYSTEM BASED ON LI-FI

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Abstract— *While visiting new buildings people are generally unaware of a buildings architecture and in large ones, also find themselves lost. The idea of using Li-Fi technology to assist people in finding their exact position in any building is proposed. A prototype is develop based on Light-Fidelity (LiFi) transmitter and receiver and Microcontroller At omega 16 as the microcontroller unit to control these. Finite state machine is used to decode the received sequence. This system is tested under variable ambient light as well as average speed of mobility of possible users. The location update was found to be instant and precise. This system can thus, be handy in getting an exact location update by means of the buildings lighting fixtures inside any building in which it is installed. This can be helpful while visiting places where directions are either not displayed or are illegible to the visitor li- Fi (Light-Fidelity) is transmission of data using visible light by sending data through a LED light bulb that varies in intensity faster than the human eye follow Li- Fi refers to visible light communication (VLC) technology that uses light as a medium to deliver high- speed communication in a manner similar to Wi-Fi. The Wi-Fi is useful for general wireless coverage within buildings while Li-Fi is ideal for high density wireless data coverage in confined areas where there are no obstacles. Since visible light is present everywhere, the main idea of our paper is to create internal navigation systems for the bigger areas to create automatic navigation for the visitors who are visually impaired using Li-Fi technology.*

KEY WORDS: ***Li-fi , Microcontroller ,GPS ,NAVIGATION, WIRELESS.***

1. INTRODUCTION

The Li-Fi technology can transfer the data through LEDs. It is a high speed and low cost wireless communication system, compared to Wi-Fi. It can provide high security, large s bandwidth, and low cost. Li-Fi uses common household LED (light emitting diodes) light bulbs to enable data transfer, boasting speeds of up to 224 gigabits per second. Light Fidelity (Li-Fi) is a bidirectional, high speed and fully networked wireless communication technology similar to Wi-Fi. The term was coined by Harald Haas and is a form of visible light communication and a subset of optical wireless communications (OWC) and could be a complement to RF communication (Wi-Fi or Cellular network), or even a replacement in contexts of data broadcasting Li-Fi can be considered better than Wi-Fi because there are some limitations in Wi-Fi. Wi-Fi uses 2.4 – 5 GHz radio frequencies to deliver wireless internet access and its bandwidth is limited to 50-100 MBPS .This technology has been proposed as a solution to the RF bandwidth limitations. Indoor navigation is convenient to everyone and it is especially indispensable for the visually impaired. Li-Fi makes use of a free, unlicensed spectrum and is not affected by RF noise. Moreover, most indoor locations would have a sufficient amount of light sources and provide additional security since Li-Fi cannot penetrate through walls. The system uses Li-Fi transmitters installed in buildings lighting fixtures as beacons that communicate their location to a portable user-held Li-Fi receiver unit. Due to Li-Fi technologies inherent short range and inability to pass through opaque objects, it can be used conveniently to pin-point exact locations inside a building. This can have tremendous applications in the tourism sector for making

portable tour- guiding systems which can work with Li-Fi receiver chip-containing mobile phones and in assisting blind people in moving about a building when interfaced with a voice-based application. This can also be used to provide a building positioning system in visitors for some reason At the heart of this technology, a new generation of high-brightness light-emitting diodes. Very simply, if the LED is ON, user can transmit a digital string of 1, if it's OFF then user can transmit a string of 0. It can be switched ON and OFF very quickly, which gives instant opportunity for transmitting data. It is possible to encode data in the light by varying the rate at which the LEDs flicker ON and OFF to pass different strings of 1s and 0s. The modulation is so fast that the human eye doesn't notice. There are over 14 billion light bulbs used across the world, which needs to be replaced with LEDs ones that transmit data

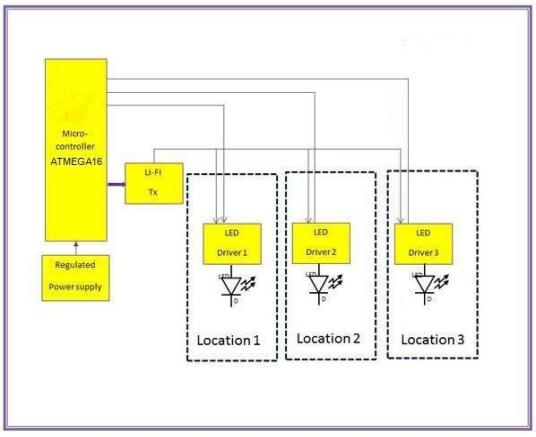

Fig-1

This consists of a Li-Fi based lighting fixture and a portable Li-Fi receiver module and shows how the system will work by establishing a communication link between the receiver and the light transmitters every time receiver enters cone of light and communicates the unique identity of the location.

Today's more sensitive GPS, with the help of multiple satellites helps us in positioning. But its accuracy is not good enough to provide precise locations within a building since its error range is larger than that required inside an indoor space. Some indoor positioning systems exist which work like the GPS like Locate a which sends beacon signals that cover large areas and can penetrate walls, and Nokia, which uses beacons that send out bluetooth signals detectable by any Bluetooth enabled device a cover only a few square meters . Many companies tap in Wireless-Fidelity(Wi-Fi) signals. With a good map of locations of the access points, a Wi-Fi receiver can be located Li-Fi was popularized by Professor Herald Haas of the University of Edinburgh with the vision of providing reliable data connection to people from their nearest light bulb thus, endowing the artificial lighting system with the dual purpose of providing ambient lighting and transmission of data at high speeds at a low cost . This is a technology which is currently under research and promises a lot in terms of its inherently secure data transfer facility and high-speed data transfer capability In this paper a positioning system is proposed based on Li-Fi. Indoor positioning system with Li-Fi is like the satellite tracking system which enables people to know their exact location inside any building which could be very handy for people when visiting new buildings.

2. PROBLEMS STATEMENT

This can be helpful while visiting places where directions are either not displayed or are illegible to he visible for some reason. Since visible light is present everywhere, the main idea of our paper is to create internal navigation systems for the bigger areas to create automatic navigation for the visitors who are visually impaired using LI-FI technology .

3. LITERATURE SURVEY

1) It was July,2011 Dr. Harald Hass, Prof, mobile communication, university of Edinburgh, publicly demonstrated, li-fi for the first time, a method of visible light communication (VLC) technology.

2) Further researcher at Heinrich Hertz Institute in Berlin, Germany have reached data rates of over 500mbps using a standard white light LED, DR. Harald Hass setup a spin of firm to sell a VLC transmitter even more sophisticated an advance techniques are undergoing development at the university of oxford and the university of Edinburgh teams from university of oxford an Edinburgh are focusing on data transmission using arrays of LED, where each LED transmit a different data streams while others groups are mixtures of red green and blue LEDs to alter the light frequency, with each frequency encoding a data channel.

3) Today Researchers working for its feasibility and designing the hardware equipment required for making the technology robust and usable .Li-fi technology has higher potential .it is very much possible to transmit the data via light by changing the flicker rate that provide different string of 1s and 0 and its intensity is modulated to quickly that the human eye cannot notice .there are around 19 billion light emits worldwide. which in terms may be replaced by LED.

4. METHEDOLOGY

a. HARDWARE USED

This consists of a Li-Fi based lighting fixture and aportable Li-Fi receiver module and shows how the system will work by establishing a communication link between the receiver and the light transmitters every time the receiver enters a transmitter's cone of light and communicates the unique identity of the location. block Diagram there are three Sections

1) Transmitter
2) Receiver
3) Android Application for Map

1) Transmitter : In this technology transistor there will be present at the ceiling of the roof . wherever user wants to know the location on the map . This transistor consist of LED Module ,slides switches Microcontroller ATMEGA 16 ,LCD Display , MOSFET Amplifier. This can consist of normal LED lights or IR LEDs that can be installed in the buildings lighting fixtures. Normal LEDs can serve the dual purpose of providing lighting while IR LEDs have better noise performance. Here low power LEDs to provide a proof of concept over a very short range for making a prototype which can be scaled up with bigger & brighter LEDs that are generally installed in rooms to get longer range [7]. These fixtures can be controlled by using micro-controllers or microprocessors in a centralized manner. The modulation of the LEDs is designed to occur in such a way that the flicker of the LEDs is not perceived by naked eyes. The transmission speed was set to 500 bits/s while testing. This enables us to use the same lighting panel to serve dual purpose As discussed earlier, each node/LED is assigned a code corresponding to a unique location. The code sequence used here is of 12 bits. The Atmega16 is used to modulate each node appropriately

2) Receiver : This consists of an LDR that is connected to another microcontroller in a portable board which is capable of detecting the sequence of light falling on it. It could also be implemented with a photodiode or another light detecting device. The microcontroller used in the prototype is also an Arduino Uno, but other microcontrollers or microprocessors can also be used. The microcontroller helps in decoding the received

sequence with the help of a finite-state-machine (FSM). A binary 0 or 1 was differentiated by setting a threshold value exactly between the voltage drop due to background lighting and the voltage drop when the LED was on.

3) Android Application for map : All the data which is received by microcontroller is transferred through Bluetooth to the user phone. this will consist of layout of the area .to generate this layout we use a Basic 4 Android. In this we also get features like text to speech.

b. SOFTWARE USED

a) Embedded c : Embedded C is a set of language extension for the c programming language by the c standard Committee to address commonality issue that exist between c extension for different Embedded system.

b) Basic 4 Android (currently known as **B4A**) is a Rapid Developing Application tool for native Android applications, developed and marketed by Anywhere Software Ltd. B4A is an alternative to programming with Java B4A includes a visual designer that simplifies the process of building user interfaces that target phones and tablets with different screen sizes. Compiled programs can be tested in AVD Manager emulators or on real Android devices using Android Debug Bridge and B4A Bridge. The language itself is similar to Visual Basic and Visual Basic .NET though it is adapted to the native Android environment B4A is an object- based and event-driven language.B4A generates standard signed Android applications which can be uploaded to app stores like Google Play, Samsung Apps and Amazon App store There are no special dependencies or runtime frameworks required

c) BASCOM AVR :The original Windows Basic Complier forthe AVR family. Its designed to run on XP/VISTA/WIN7, WIN8 and WIN10

5. CONCLUSIONS

The LI-FI based indoor positioning system will be designed and implement .The result will be prove the feasibility and effectiveness of the design location updates were obtained in the system instantaneously and with good accuracy..The project will emerge as a promising technology in upcoming era by providing the navigation for visually impaired using li-fi. This consists of a Li-Fi based lighting fixture and a portable Li-Fi receiver module and shows how the system will work by establishing a communication link between the receiver and the light transmitters every time the receiver enters a transmitter's cone of light and communicates the unique identity of the location The effect of the background noise from natural, artificial and stray sources on the systems performance was studied and conclusion reached that adaptive threshold controllers could be installed to enhance the performance of the system in an indoor space in which background light varies tremendously over short distances. It is suggested that this system be refined to enable navigation and guidance within an indoor space which would be very useful in aiding blind people in particular, and visitors in general, to move around in an unknown space.

6. REFERENCES

Book:

[1] C.Rizos, G.Roberts, J. Barnes, and N. Gambale, "Experimental Result Of Locota;A high Accurancy indoor positioning system,"in 2010 International Conference on Indoor Positioining and Indoor Navigation ,sept 2010,pp, 1-7.

Journal Paper:

[2] D.Namiot,"On indoor positioning ,"international Journal of open information Technologies, vol,3, pp.23-26,03 2015 .

Proceeding paper:

[3] L.I.Albraheem,L,H.Alhudaithy,A.A.Aljaser,M.R. Aldhafian, and G.M.Bahliwah,"Toward designing a li-fi based hierarchical iot architecture, "IEEE Acess,vol,6,pp.40 811,2018.