

Challenges and Opportunities of Integration of Wireless Network with IoT

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Abstract- *The never-ending quest for a quicker internet connection, as well as the ever-increasing need for creative technology and methods, both require ongoing innovation. (WiFi) is a wonderful benefit, but it also has certain drawbacks, and as connection expands, both in various locations in the Internet of Things (IoT), these drawbacks are likely to become more pronounced. problems will arise where WiFi is the only option we have. . As a result, a technology called Light Fidelity (LiFi) was developed in 2011, with speeds of over 1 gigabyte per second (Gbps), which is a hundred times faster than the speed of Wi-Fi currently in use . LiFi speeds are also expected to reach 3-5 Gbps , making it ideal for the Internet of Things and removing the limitations and limitations associated with WiFi technology. In this article, we trace the concept of combining IoT and LiFi and identify the potentials and challenges that embedded system presents in the development of innovative and intelligent solutions.*

Indexed Terms- *Internet from things, Internet Of Things, Wireless loyalty, Wireless.*

I. INTRODUCTION

The internet for the purpose of engaging in interaction with other devices. the collecting and dissemination of data using machines. It is generally agreed that Kevin Ashton was the one who first used the word. Both the debate that has surrounded it have been influenced by the work of a sizeable number of researchers, professors, and scientists.. So far, the connection has been established using interoperability on a global scale for wireless microwave access (WiMAX) and wireless fidelity (WiFi). Light Fidelity, sometimes known as LiFi, is intended to accomplish certain speeds. in excess of one gigabit per second, . This is what we are

currently using. This is because the search for a better internet connection is endless and imposes various limitations. LiFi speeds are also expected to reach three to five gigabits per second, making it ideal for the Internet of Things and allowing it to overcome the limits and limitations of WiFi technology.

Dr John O'Sullivan, an Australian radio astronomer, and his colleagues came up with the idea of Wireless Fidelity, now known as WiFi. According to one definition of the term "wifi," the name can be given to any "Institute of Electrical and Electronics Engineers (IEEE) 802.11 standards-based wireless local area network (WLAN) product." This is only one approach to define the term. To put it another way, Wi-Fi is able to establish wireless connections to the internet by employing radio waves and the radio frequency (RF) technology. Connectivity is available for a diverse assortment of systems, devices, and software programmes. Another kind of wireless communication known as WiMAX has been developed. Worldwide Interoperability for Microwave Access is what the abbreviation WiMAX refers to when it's used in a sentence. The IEEE 802.16a standard was used as the basis for the development of WiMAX. WiMAX is a technology that enables wireless communication across extensive distances. It is applicable to both mobile and fixed line connections and may be utilised in any setting. WiMAX may potentially be utilised in the construction of virtual private networks (VPNs)..

OURSto postInsideTHEMPaperI:

- It basically exemplified the concept of combining IoT with LiFi.
- He conceived developed and introduced a system for the automated control of intelligent homes that integrates concepts from the Internet of Things and wireless communication.
- He recognised the difficulties and possibilities

that are coming from the combination of IoT and LiFi, including the advantages, limits, applications, and probable future directions of both technologies.

- **CONCEPTS FROM INTERNET OF THINGS AND LIFI EXTENSION**

Discusses the conditions for using IoT and Lifi both separately and together .[2,3]

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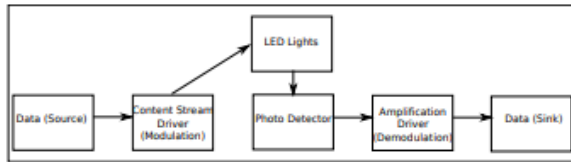


Figure.one.Simple LiFi technology shown as a block diagram .[4]

The term "LiFi" refers to a type of WLAN that uses light instead of radio waves and communicates in the form of visible light, often known as light waves, rather than radio waves. transfers the activation information. Due to the fact that light moves at a quicker speed than radio waves, it is possible to transfer data at a rate about 250 times faster than high-speed broadband. As shown in Figure 1, this invention uses only LED bulbs to achieve its main purpose, which is to transmit data by emitting visible light .

Similar to Wi-Fi, the technology known as Optical Wireless Communication (OWC) uses the light emitted by LEDs as a transmission channel to enable high-speed communication.[5,6] The vast majority of lights can be used for data transmission, which means lights can lead to a Main method that consumes energy to turn it on and off . This is because most lamps use incandescent filaments , which causes a slight delay when the light comes on. Therefore, light emitting diode (LED) lamps are most useful for the transfer of data since they are capable of being turned on and off instantly and easily. Since these lights are electrodes, they can be easily turned off. The main goal is to increase the speed at which data can be sent at high speed while reducing the costs of providing lighting and communications.

The electromagnetic (EM) spectrum consists consisting of gamma, X-ray, ultraviolet (UV), visible, infrared (IR), microwave (MW), and radio (RW) waves., as shown in Figure 2. The use of gamma rays (rays) is quite rare in most environments. X-rays are a common diagnostic tool in hospitals. UV rays have negative effects on the human body .[7] Infrared photons are not used due to eye protection laws . Due to atmospheric conditions, microwaves are subject to attenuation and are also quite expensive.

Not only are radio waves notoriously pricey, but they also have a very restricted availability and can be hazardous. Radio waves that can be seen by the human eye are employed in the transfer of light and data. Visible light is very safe for people to be around and may be found in plenty all over the place. Radio waves have a larger wavelength than gamma rays, but than gamma rays. Because of this, gamma rays have a shorter wavelength than radio waves, but radio waves have a higher frequency. Visible light, on the other hand, possesses longer wavelengths and higher frequencies in comparison to other forms of light, which confers an advantage when it comes to the transfer of data. The term "Visible Light Communication Medium" (VLC) refers to a data communication medium that employs visible light with a frequency ranging from 400 to 800 THz as the optical medium for the transfer of data and the lighting of the surrounding area. This communication method is sometimes referred to as the Visible Light Communication (VLC) system on occasion.[8]

Because it is possible for us to develop an innovation that can be used to transmit data. to reach. This invention will allow us to do this faster and in a far larger quantity than we are now able to handle. Consequently, a signal for the internet can be found anywhere there is an LED lamp; However, the signal is lost when the light is blocked or turned off. These lamps with LED technology and the photo detector are the two most important components of this technological system. "Data over Light" transmission is the basic concept of this wireless communication technology. LED bulbs are used for data transmission , and a photo detector with signal processing technology is used to detect the flash of light emitted by the LEDs. The operating system is characterized by extreme ease of use and simplicity. The LED bulb

will send a binary 1 when it is turned on, but it will send a binary 0 when it is turned off. Because of the ease with which the LEDs may be turned on and off, there is now the potential for data transfer. Because of this, simply LED lights and a controller that is able to encode the data in these LEDs are sufficient. Data can be coded as binary 0s and 1s by varying the blink rate of the LED and according to the data. The photo detector detects these flares as they occur .[9] Binary data is transmitted by the optical detector to undergo further amplification so that the binary digits can be decoded. LEDs that have a high brightness level are essential to the Li-Fi technology. Therefore, the process of turning the LEDs on and off enables some kind of data transfer to take place using binary codes as the mode; however, the human eye is unable to perceive this constant change. The amplitude changes are then translated by a receiver dongle into an electrical signal, which is subsequently turned back into a data stream, and lastly the decoded data is sent to a particular device or system. Thanks to this process, we will be able to understand that there is an internet signal when there is an LED lamp in the future , but this signal disappears when the light is turned off or turned off .[10,11]

• *HEconceptfrominternet of things*

Every Internet of Things application requires hardware, software and connectivity components. Because the Internet of Things has so many faces, it can be difficult to figure out where and how to start. [12] in



Figure2. electromagnetic Ghost[13]

Straight line propagation, often referred to as electromagnetic radiation has several features, and one of these is called line of sight (LOS). With this method of transmission, electromagnetic waves go directly from the source to the receiver. When speaking of the technology known as LiFi , the term "visible light transmission" refers to light emissions that sequentially travel from one point to another. Lightning or lightning can be refracted, reflected, and even absorbed by the atmosphere, depending on how it interacts with the atmosphere .

Figure 3 shows how the location of the source and detectors in a The performance of the LiFi system is a significant factor in determining the overall capability of the system to operate at its full potential. In addition, for LiFi to function appropriately:, there must always be line-of-sight (LOS) between the transmitter and receiver . In any case, we will not be able to connect any devices until we configure the application and its connection functions. , these are the two most important functions. The application is deployed on an integrated CPU and, depending on the option selected, a connectivity module is used to communicate with a user on the local network or to transfer data to a cloud-hosted solution. Raspberry Pi and Arduino are two open source CPU platforms that provide various sensor-based connections when building IoT devices . These links can be used to perform various tasks. The application or function you run will determine the type of connection required .[16]

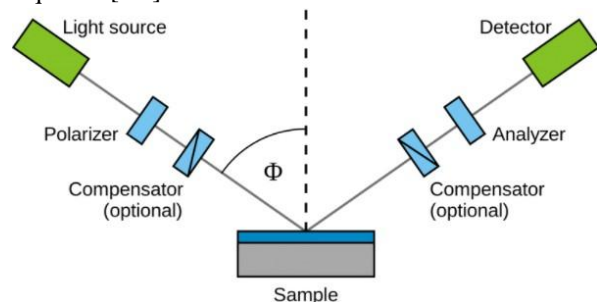


Figure.3.Line of Sight (LOSS) is where we get the idea of Visible Light..[17]

Figure 4 offers a straightforward illustration of the sophisticated home automation that is now within reach. The most important aspects of this model are as follows:

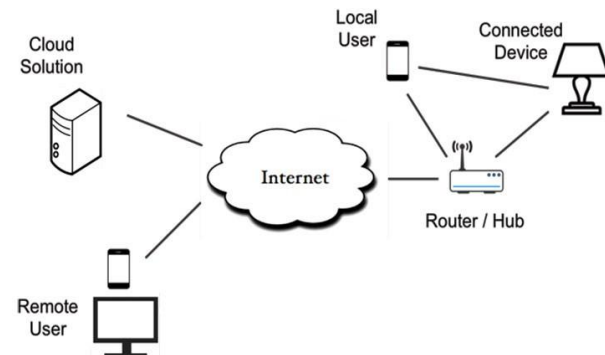


Figure.4.The conceptfrominternet of things Example: Elegant foyer Automation[18]

- 1) *Cloud-based solution*- A cloud solution should contain nothing more complex than a data file sent from a companion device.
- 2) *Internet*-The is already using WLAN and 3/4/5G technologies; these have been implemented..
- 3) *router*- This component establishes a connection between your device and the Internet. We may not have a router or need to provide our own.
- 4) *HELocaluser*- Users are able to engage with the device in a direct manner, which grants them the ability to control or monitor the device, as well as obtain information regarding the device's operation..
- 5) *HERemote controluser*-A person who is not physically close to the device but who wants to use the device remotely or learn about the device.
- 6) *connected device*- real material to be controlled and managed by us. You must be connected to the latest technology, namely Wi-Fi.[19,20]

The latest WiFi technology is used to establish connections for the idea of Internet of Things. As part of our work, we propose to use the most advanced LiFi technology to interconnect different devices, devices and machines .[21]

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High-speed communication is provided by LiFi, which represents a shift to a new way of thinking towards the technology of optical wireless communication (OWC). The increasing need for networks for the Internet of Things (IoT) that have bigger bandwidths, better transfer rates, and more secure data transmission. In the long run, the current configuration of LiFi components and capabilities will not account for the greater impact the technology and capabilities will have. We expect it to start integrating with many other key technologies over the next few years to create a new pervasive computer platform. Because of the combination of these two elements, any apparatus or machine that is substantial enough to include a light-emitting diode (LED) and a light sensor may communicate with and even run on LiFi.. Each device can integrate LiFi, a camera, an amplifier, and a speaker to function similarly to the Amazon Echo, an unobtrusive, universal interface for the Internet of Things. The technology can be implemented quickly, with ease of

use, low cost and very low barriers to market entry. As can be seen in Figure 5, this idea proposes the immediate replacement of WiFi technology with LED bulbs and a system called LiFi, which consists of a modulator, a demodulator, and a photodetector. [22,23]

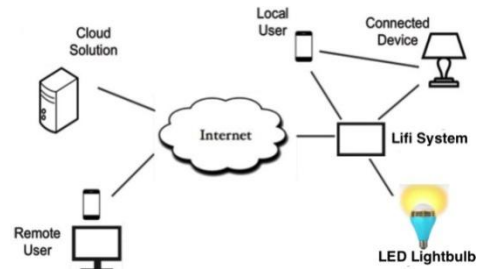


Figure.5.The idea of combining the internet of things with fiber connectivity . Example: smart home automation [24]

• **PROJECTANDAPPLICATION**

The solution that is being suggested for remotely operating and monitoring a house also makes use of the WiFi that is currently accessible. The components of this system are the base station and the satellite stations. This was done in order to gain a deeper comprehension of the hierarchical structure of the constituent parts that constitute the Internet of Things (IoT). In order for it to function as a base station, an Arduino Mega microcontroller board has been attached to a WiFi module. As a direct consequence of this connection, the base station has the capability of being linked to the internet. It is able to interact with satellite stations, which are also referred to as distant nodes, thanks to the presence of an RF transceiver module. The components of a satellite station include a number of Arduino Uno microcontroller boards that have been augmented with a variety of sensors. A gas sensor, a light sensor, a temperature sensor, a capacitive touch sensor, and a motion sensor are all included in these sensors. The RF transceiver module is utilised in order to enhance the quality of the connection between the base station and the satellite stations. These stations are equipped with relays that can be linked to a wide variety of electrical devices; however, in this specific instance, the only electrical devices that can be attached are a light and a fan..[25,26]

Here are the features of the system: The currently planned The home automation system is able to monitor a wide range of the electrical appliances and gadgets found within the home. Due to the fact that the satellite station (shown in Figure 2b) is equipped with appropriate sensors, it can detect ambient temperature, detect motion, detect if there is a gas leak, and determine if someone has touched it. You can also turn on and off various household appliances such as lights, fans and the like. This system's base station and satellite station operate in a master-slave arrangement to communicate with one another.. This means that the base station sends the necessary commands to the satellite stations to perform the actions depending on the user's choice between manual mode or automatic mode, as shown in Figure 6. transmitter and satellite transmitter. Due to the layout, the base station can send basic commands to satellite stations, allowing the above tasks to be performed. The system client is an Android smartphone and data is sent between clients using a programming technique called sockets. The smartphone acts as the main controller of the system. The program provides the user with a dedicated interface for each of the three stations, allowing the user to remotely control and monitor the three stations. The generated flowcharts are attached to this post.[27,28]

• *FOR.WorkfromHESystem*

When the user activates the system, the base station automatically creates a TCP connection with "thingspeak.com" and connects to the selected WiFi access station using its own WiFi module.. This happens as soon as the system boots up .[29]

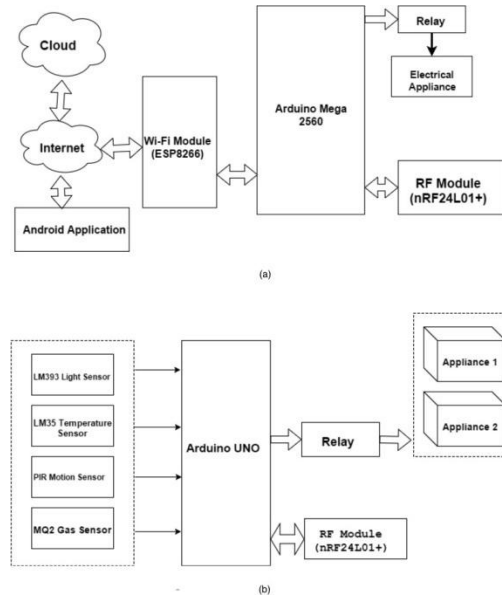


Figure.6.For those unfamiliar with basic block diagrams, the base station and satellite station are the two blocks that make up the diagram. The base station is responsible for controlling a large number of satellite stations [30].

In addition to the existing application for Android. This can be achieved by accepting instructions sent from an application that are operating on an Android smartphone that is connected to the same access point., or by using port forwarding to another point. It also establishes a radio frequency (RF) link with satellite stations via RF modules that use unique addresses for each station . This connection is established with satellite stations. When the user sends a command, the The sensor data and room conditions are collected from each satellite station in turn by the base station via the radio frequency connection. After that, the WiFi module makes use of the "API" key that was supplied. to transmit this data to the ThingSpeak cloud platform every 15 seconds . Readings from each of these sensors are not only available through the mobile app, they can also be viewed on the website and via the mobile app by logging into your ThingSpeak account . [31,32]

Control of electrical equipment can be done in two ways: manually in manual mode or automatically in automatic or sensor-based mode. When a manual control instruction is sent from to the satellite station, the satellite station responds by manually switching the corresponding device on and off. If an AUTO

light control command is received, the light will only. When it receives the AUTO command for the fan, it checks the temperature sensor and starts the fan if it detects that the temperature is above the set threshold; Otherwise, turn off the fan . [33]

The protection and monitoring system consisting of the capacitive touch sensor, the gas sensor, and the PIR motion sensor, all located in the satellite station, contribute to some extent to the monitoring and security features of the system.

PIR and a gas sensor are used for continuous leak detection and motion detection in the room, respectively. Because it is able to detect even the most subtle of touches, the capacitive touch sensor is an excellent choice for use in the area of intrusion detection.. When there is an Internet of Things emergency, the current status of these sensors is sent to the base station and from there to the cloud. The user is then notified of the urgency, which may be in the form of a tweet. In the Android app, the indicator for these alarms appears as 0 indicates that no alarm has been triggered. The base station uploads the data collected by the PIR sensor, LPG sensor and touch sensor to the cloud .[34,35]

HEElegantfoyerAndroidApplication

- The main screen of the application shows a touchable button to access the interfaces of each satellite station and base station. Also , a text field appears on the start screen where you can enter . If port forwarding is configured, the home screen also displays a touch button to access the interfaces of each of the satellite and base station stations.
- In addition, the user can control the satellite station in manual mode by pressing the ON/OFF buttons on the interfaces of the satellite station. There are also AUTO buttons that allow the user to operate the station in an automated mode, in which the device's control is controlled by readings from several sensors.. If the light sensor detects that there is not enough light in the room, the light will turn on automatically when you press the auto light button. If the light sensor does not detect that there is not enough light in the room, the light does not turn on and remains off. When the temperature sensor detects the

temperature above 320 degrees Celsius, pressing the automatic fan button will turn on the fan; The fan will not run if the temperature sensor does not detect a temperature that is higher than 320 degrees Celsius..[36]

- A three-byte, three-digit code is transmitted to the base station whenever you press a command key on any one of the interfaces. This code is enclosed by two "\$" symbols. The base station is the only device that can decipher this code. The first digit identifies the station that is controlling the action, the second digit identifies the device that is controlled by that station, and the third digit identifies the action that is controlled by that station (ON/OFF/AUTO). After receiving this information from the application, the microcontroller of the base station will encrypt it before transferring it over the internet to the Wi-Fi module of the base station.. [40,41] The microcontroller then selects the best course of action, which is transmitted to the satellite station via the RF transceiver module when the microcontroller completes its analysis.
- These readings were recorded on the ThingSpeak Cloud platform . Pressing any of the STATUS parameter keys activates this behavior.
- The app provides information on motion status, LPG leaks, and optional touch detection.[42,43]

IoT and LIFI both present challenges and opportunities [44,45,46]

Documentation has been revised to capture both challenges and expectations.

Advantagefrom usuryfi them Inside HE internet of thingssystem

- LED lamps are found almost everywhere; Since light is the channel through which data is sent, this helps ensure that data transmission is maintained at all times.[38,39]
- LED bulbs are very efficient and use much less energy than traditional incandescent bulbs.
- Achieving high data transfer rates of up to 10 gigabits per second is not difficult. Laser-powered LEDs are said to have data rates of up to 100Gbps .
- The visible light band of the electromagnetic spectrum is a free band, meaning it does not

require a license and can be used free of charge.

- Light Fidelity (LiFi) uses light frequency transmissions, meaning they do not interfere with other electromagnetic signals and therefore cause less interference between devices.
- Signals transmitted by LiFi are safe because light cannot pass through walls. There is less interference, the signal can pass through salty sea water and work in densely populated places or areas.
- Li-Fi networks have low initial setup, ongoing operation and ongoing maintenance costs .
- Light has significantly higher bandwidth which increases the capacity and usability of existing devices.
- If this technology spread all over the world, every lamppost could act as a free access point to the internet.
- Also known as Fi) can be fixed .
- Reduced overall power consumption and simplified system architecture.[47]
- Low environmental impact.[48,49,50]

CONCLUSION

Wi-Fi is currently the best method to connect to the network and the vast majority of people choose it as their primary option. In any case, there are limitations that limit the range of possible outcomes that can be achieved through the Internet of Things. Working with radio waves from a limited source is the main factor in its limitations. The network connection will become increasingly sluggish when an increasing number of devices connect to the internet through WiFi. This is because the data transmission capacity will be split across all of the customers. If you restrict the amount of devices that connect to the internet using Wi-Fi, you won't have to worry about this happening. The greater the number of devices that are linked to the same network at the same time, the much faster the connection will be. There is an immediate and pressing need for internet services that are both quicker and more dependable if we are going to reach our ultimate objective of making the Internet of Things fully functioning. The Li-Fi consortium claims that " speeds of over 10 Gbps are possible ", which, in theory, would make it possible to download a high-definition movie in fewer than 30 seconds. It

would represent a significant step forwards in the development of technologies for wireless networking. According to a professor who works at Fudan University in Shanghai, "Four computers can be connected to the Internet via a one-watt LED lamp." In this configuration, light is employed as the carrier rather than standard radio frequencies like those used by Wi-Fi. During this time, LiFi was working inside the confines of a laboratory that was being closely monitored. It has been demonstrated that it is capable of reaching theoretical top rates of 224 gigabits per second (Gbps) .

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