



Smart Home using Visual Sensor Network and Li-Fi Technology

Devendra Kumar, Upasana Sharma

Abstract: One of the most interest gaining and intellectual applications of the Internet of Things (IoT) is Smart Home. It enhances the quality of human life and brings more comfortability, convenience and savings. In this paper, an intellectual home procedural system is proposed which is based on Li-Fi technology as medium of communication between the connected devices. It uses wireless visual sensor network as video surveillance system. Li-Fi is a bi-directional high speed connected technology that supports sharing (sending and receiving) of data by illuminating the usage of LED bulbs. The usage of such innovation gives a surety of a higher level of security, higher data transmission rate, less consumption of energy and more convenience.

Keywords: IOT, smart home, camera nodes, Li-Fi, base station, radio frequency, visual sensor network.

I. INTRODUCTION

Recent advances in wireless communications, cloud computing and big data, have resulted in a faster development rate of the Internet of Things (IoT). Intelligent home, can also be called as eHome or home automation, is one of the most interesting applications of IoT. It makes human life more comfortable with the help of giving connectivity solutions plus controlling all of the e-devices in home. For example: heating, air cooler, ventilation, lighting plus security systems with no respect to place and time.[1] Smart home results in bringing some of the important benefits to the day to day human life such as:

- Comfortability and convenience: can be achieved with the help of controlling the home at any time and from anywhere. One can also set up the home e-devices to particular needs such as air conditioner according to the preferences of users and adapting rooms heating, or may be with respect to the dynamic weather outside.
- Comprehensibility: by delegating people with severe health situations, or extravagant requirements to live even more freely than before. This can be achieved through utilizing practicable or adaptation methodologies. For example: a blind individual can utilize voice-activated UI to rein his/her interconnected devices.

- Safety Measure: By placing cameras, smoke and fire detectors, motion detectors, locks, etcetera. The operator will be able to detect plus look after his/her house with no respect to where the person is and is able to be notified spontaneously when anything is out of the schedule regarding the situation of the house.
- The contact among home e-devices: through interconnecting the e-devices, sensors and appliances into the particular network, they are able to do the communication among themselves. They are also able to be authorized remotely.
- Energy effectiveness: Through giving the stretch ability for looking out electricity utilization to customers. Also authorizing the system to switch on or off devices when not in requirement in order to save electricity. Otherwise, through expending sustainable power source to make its very own vitality, for example, initiating photovoltaic frameworks on the home rooftop.

Nonetheless, smart home application is confronting a couple of difficulties, which should be conquered. For example, interoperability, cyber security/privacy. The radio waves of Radio Frequency (RF) mechanism are causing interference issue that interfere with other electronic devices in the house, which leads to slowing or even stopping its functionality. Most of the working applications for intelligent home have been predicted like smart appliances, security systems, smart lighting, elderly care and kindergartens. Many of these methodologies utilize standards of communicating. In this paper, a smart home framework that uses Light-Fidelity (Li-Fi) mechanism as medium of communication between all the connected devices and wireless visual sensor network as video surveillance system has been proposed as shown in the figure 1.

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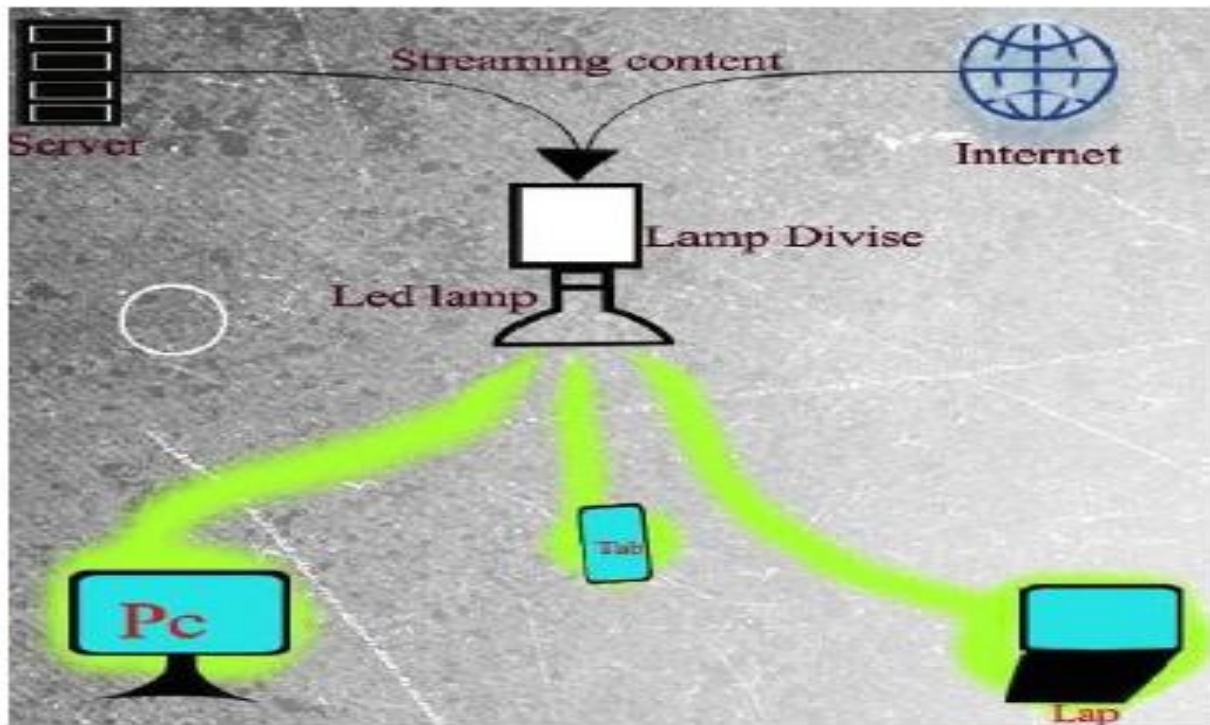


Fig 1. Introduction of Li-Fi Technology [12]

II. VISUAL SENSOR NETWORK & LI-FI TECHNOLOGY

Li-Fi technology provides communication data by luminosity by sending data via LED light bulb that changes faster than the intensity the human eye can follow as shown in figure 1.

III. LITERATURE SURVEY

The study is in the preliminary report stage and till now few papers related to Li-Fi technology have been read and analyzed in order to proceed for the further research work. The complete literature review of the papers have been listed below:

- a. Vitality sparing is an intriguing issue because of the multiplication of atmosphere changes and vitality challenges comprehensively. As it sounds, individuals' recognition about utilizing savvy innovation for vitality sparing is still in the idea arrange. This implies individuals talk about natural mindfulness promptly, yet truly, they acknowledge to pay the given vitality bill. Because of the accessibility of power and its vital job, tweaking purchasers' frames of mind towards vitality reserve funds can be a test. Outstandingly, the hole in the present savvy innovation configuration in smart homes is the comprehension of purchasers' conduct and the coordination of this comprehension into the brilliant innovation.
- b. With the progressing increment in the cell networks, the most up to date innovation of Li-Fi has turned out to be an achievement in intercommunicating systems[2]. It utilizes the noticeable range of light which is far superior to the RF as it is inclined to impedance. With the utilization of LEDs the data can be transmitted at exceptionally high rates with simply the basic turning on and off of the LEDs. This innovation isn't just allowed to

- c. Li-Fi can be appropriately viewed as a light based Wi-fi [3]. The thing that matters is that rather than wi-fi modems, handset fitted LEDs lights are utilized which can light a room just as transmit and get data. The working diagram is shown in the figure 2 This innovation utilizes a piece of the electromagnetic range that is as yet not extraordinarily used, from the infrared through noticeable light and down to the bright range giving a wide scope of frequencies and wavelengths. Light is in actuality a wellspring of life and for all intents and purposes has no evil impacts.

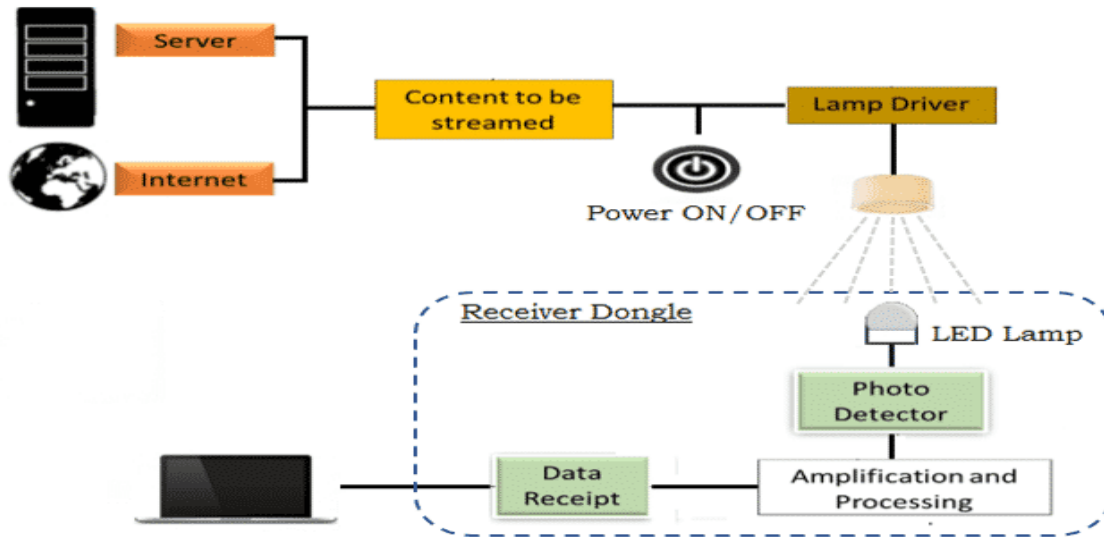


Figure 2. Working of Li-Fi Technology [11]

- d. Visible light correspondence is a conceivably problematic type of remote correspondence. It can enhance radio recurrence correspondence and furthermore particularly empower novel portable remote gadget use cases. High information rate downlink correspondence in homes and workplaces and high exactness indoor situating in retail locations are two of the most convincing use instances of this promising new innovation.
- e. Visible light correspondence, considered as a potential access alternative for 5G remote interchanges, is increasing broad consideration [5]. VLC has qualities in vitality proficiency and ultra wide data transmission. Yet, in addition has shortcoming in transmission range and hindrances in transmission ways. This article expects to give a decisive examination of the most recent advancement in research on VLC, which can be utilized as a major aspect of 5G remote correspondence frameworks [6]. This work features the qualities and shortcomings of VLC in examination with RF-based interchanges, particularly in range, spatial reuse, security and vitality productivity.
- f. Recent advancements in minimal effort CMOS cameras have made the chance of conveying imaging capacities to sensor systems [7]. Different visual sensor stages have been created with the point of coordinating visual information to remote sensor applications. The goal of this article is to review current visual sensor stages as per in- network preparing and compression/coding strategies together with their focused on applications.
- g. In the present situation, reconnaissance is a profoundly wanted administration and most governments are as of now utilizing distinctive kinds of gadgets to give abnormal amounts of security. Wireless Visual Sensor Networks (WVSN) can be utilized to screen all aspects of a city without the expense of running links on top of it [4]. As it sounds, there must be a proficient method to assemble all data gathered by the sensors and cameras, with decreased vitality utilization and normal idleness. This work proposes another calculation to position numerous versatile sinks in WVSN sent along streets and lanes.
- h. Countries on multiple continents are experiencing an aging population. The number of older adults is growing dramatically. With this statistic move, there is a craving to keep more seasoned grown-ups fit, practically capable, and living freely, to a limited extent since this gives a superior personal satisfaction, and to some degree in light of the fact that the aging population will pressure ebb and flow offices and assets intended to think about older folks. Nonetheless, critical difficulties exist in keeping individuals solid and practically capable as they age. A person may fall and sustain injuries that limit mobility or encounter events that may lead to deteriorating health.
- i. World older population is rapidly growing in absolute and relative number. Increased life expectancy of a large percentage of a population has many implications, specifically for older olds and their families, for the public health care system with increasing costs for managements, and for social burden.

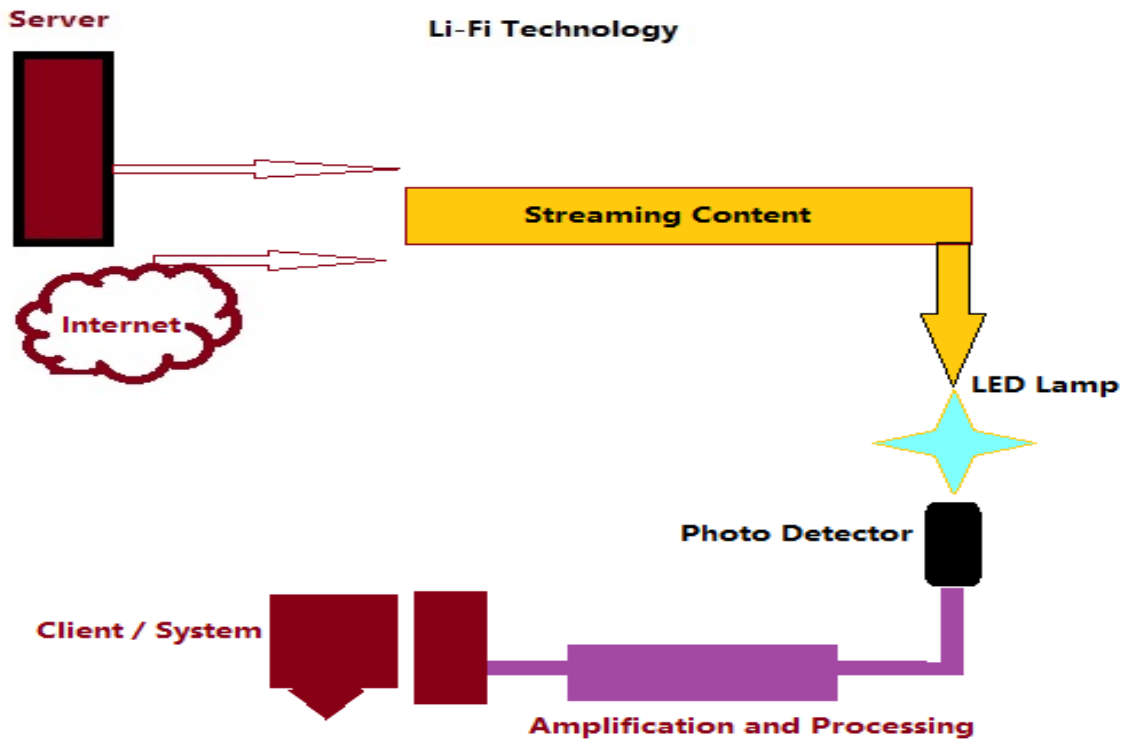


Figure3 Block Diagram of Li-Fi Technology

IV. PROPOSED WORK

In the proposed system, all gadgets are associated with each other and to the web, through Li-Fi utilizing cloud computing. Li-Fi is a rapid bi-directional completely associated Visible Light Communication (VLC) innovation. It utilizes light at wavelength ranged between 380 nm– 750 nm for sending and receiving information with the help of a high switching ON and OFF LED bulb illumination. Li-Fi can get utilized to give both lighting and data at a similar time is one of its major advantages. Li-Fi is additionally portrayed through its higher transfer speed. That makes it more adequate for creating transmission of a wide range of information (audio, giphy, and so forth.) within a brief timeframe. Dissimilar to Wi-Fi innovation, Li-Fi can't go

through non-transparent material. For example, dividers, which will give increasingly verify information trade as it restrains the data transmission to one zone and it doesn't have any obstacle issue. The use of LED light in Li- Fi, makes it continuously sensible for indoor applications as shown in the figure 3. This is because it is more affordable and progressively secure for eyes. As a security system in our proposed shrewd home, we prescribe the usage of a WWSN that involve a broad number of minimal visual sensor center points called camera nodes, which consolidate a picture sensor, an embedded processor, and a remote handset. The above explained hubs can accumulate picture and video data and send the supportive information to the BS after processing diagram shown in figure 4.



Figure 4 Smart home design

V. PROPOSED WORK IMPLEMENTATION

- Consider any individual, either living alone or with family, goes out of his house frequently. Wouldn't it be safer for him and his family when some concerned people of his contact, friends, relatives etc, know when he is

- outside and when he is at home!
- This proposed system of smart home is capable of notifying some selected people of that individual's contact when he is and isn't at home.

- The camera nodes are able to detect all of the changes that happen inside. Whenever any electrical device gets turned on, the notification of such activity will be shared

consequently with the selected people details shown in the figure 5.

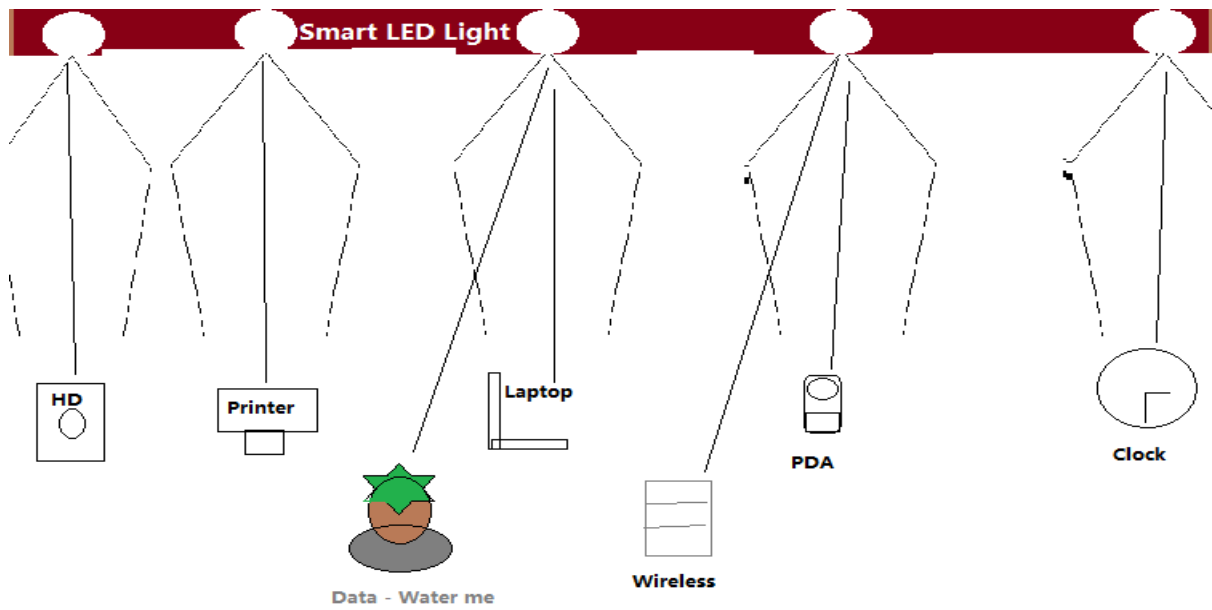


Figure5: Li-Fi System Connecting Devices



Figure 6Proposed Implemented Model

- Different sensing elements and gadgets are able to contact to the camera hubs for encouraging individuals' everyday life. This is done through turning on/off lights or water naturally, altering room temperature as indicated by inclinations of individual, giving him a reminder to do a normal work on the off chance that he overlooks. For instance: taking prescription and so on.
- The intelligent cameras are additionally ready to screen other data. For example, posture, walking speed, balance, so on, and send the gathered information to a vault in the BS. This will going to be stored in the cloud so as to be gotten to by either his family or even his specialist if fundamental.
- In the event that something is strange in regards to the individual's movement, his family will be cautioned. The smart home figure shown in the figure 6.

VI. CONCLUSION

In this research paper, an inexpensive, quick, secure, plus vitality productive smart home framework dependent on Li- Fi methodology is exhibited. The Li-Fi methodology

is presented as mode of collaboration along with remote visual sensor network as video observation framework. This explains how can a person use his resources to a full extent, how he can be reliable on Internet of Things. Implementing the Li-Fi Technology along with the Internet of Things, an individual is safer and more secure than ever before. Also, this implementation results in living in more solace and accommodation. Reason being home is controlled from any placeandwhenever,andthroughadjustingthehousegadgets to explicit requirements. For example, adjusting rooms warming plus climate control system to the inclinations of clients or as indicated by climate changes. By giving the adaptability of checking power utilization to users and allowingthesystemtoturnonoroffmachineswhentheyare not required so as to sparepower.

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