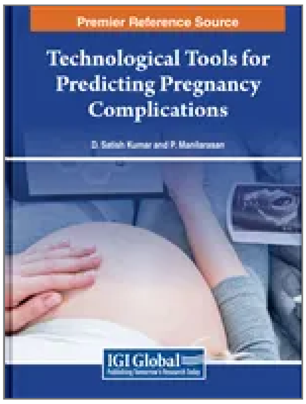

Visible Light Communication-Based Internet of Things for Healthcare

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Abstract

Presently IoT Health care systems utilize Radio Frequency (RF) signal to transmit the data. The capacity, latency and crowded frequency spectrums are the bottle-necks of RF-based communication. Apart from spectral congestion, interference and security issues, electromagnetic RF exposure may result in health issues. This limitation can be besieged by the advanced optical wireless communication technologies, by transmitting binary via optical signal through a technique is known as visible light communication or VLC. Amalgamation of VLC- IoT-based systems opens new era in real time health monitoring, which provides fast data collection, processing and real time communication. It eliminates the interference created by RF based devices in special equipment and complete safety during the exposure of patients. This chapter discusses about the VLC transmitters and receivers, current challenges and future trends of VLC, VLC based IoT for healthcare systems. VLC does not employ electromagnetic-waves and therefore have no side effect on human especially pregnant women.

Chapter Preview

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1. Introduction To Vlc

A broad application of the wireless Radio Frequency(RF) communication, defines quick transmission of biomedical signal in healthcare dimension for the earliest finding of illness. The central health monitoring arrangement such as nursing home, hospital and pharmacy are often equipped with the RF technology appreciating feasibility, mobility and high-speed transfer characteristics that provides biomedical data of the patient with their personal details in real-time remotely. But the supremacy of RF technique is limited in health care industry, owing to the discharge of RF radiation which might disturb the welfare of the patients. The disruption of electro-magnetic interferences (EMI) will endanger the value of biomedical parameters monitoring in addition. This is because the accurateness and capability of the data spreading is crucial for the medical nurses or workers to deliver consequential suggestions on measurement or treatment, according to the biomedical information received. The drawbacks of wireless RF technology are further understood seeing the thorough exclusion of Radio Frequency devices such as mobile phones inside the hospitals' intensive care unit (ICU), emergency room and the like places.

Wireless communication technique has advantages in terms of usability, cost, and simplicity of use, but it also creates a bottleneck issue. Wireless communication has traditionally made extensive use of RF waves in the electromagnetic range below 10 GHz. However, since multiple technologies (Bluetooth, Wi-fi, Cordless phones, cellular phone network) concurrently share the same bandwidth and the prevailing bandwidth could not fulfill the essential speed demands with the capacity, professionals and scientists have concentrated on a new investigation in wireless communications. The interval of operational frequency being moved to the unrestricted 60 GHz band, has been suggested as a potential remedy for this first-meter congestion issue. Widening the bandwidth and achieving higher data rates are the intended outcomes.

Yet, moving to the higher region of the frequency band shortens the wavelength of the electromagnetic waves'. Signals with short wavelengths can only propagate a relatively small distance. As the signal is spread over larger distances, the fault rate raises as the energy fades. WiGig technology is therefore designed to be utilized for high-speed data transfer in smaller spaces. In order to enable supplementary communication channels, it is planned to use electromagnetic waves in the range of mm-length (f > 100 GHz) in relation to these quests. Optical Wireless Communication (OWC) is the term used to describe communication using the mm wavelength optical signals that lie on the right side portion of the Optical Wireless Communication spectrum. The infrared band is previously available for data transfer. Each year, about 100 million electronic devices are produced. Following are some advantages of OWC over Radio Frequency Communication (RFC). A 200 THz bandwidth with no restrictions and wavelengths between 155 and 700 nm is available. Unlike radio waves, optical signals cannot flow through walls. As a result, living in a room that emits signals has substantial benefits in terms of security. Line-of-Sight (LoS), the ability for the receiver to be in vicinity of the sender and vice-versa, is vital for long-range communications. It is simple to identify any obstructions or intervening circumstances. As a result, OWC is often used in government and military systems that demand a high level of information confidentiality and anonymity. The continuation of transmissions in the space eliminates the likelihood of any interference in nearby spaces. In this manner, each room will function as a cell, and productivity will reach the highest levels. When compared to RF devices, Optical equipment are less expensive. Optical transmissions do not have the same negative effects on human health as RF signals. Comparatively speaking, OWC uses less energy than RF systems.

It is now possible to transport data using the infrared region of the spectrum. The most recent research efforts have been concentrated on using LED lighting equipment to achieve data transport and illumination concurrently. It would be ideal to employ these economical and energy-efficient LED devices to convey data over short distances without the usage of RF transmissions. It also aims to achieve wireless communication by employing visible light, in localities and circumstances where the usage of RF waves, is not reliable or safe to use, such as hospitals, airplanes etc.

Key Terms in this Chapter

Wireless Standards (/dictionary/wireless-standards/121095): An established standard of services and procedures that directs how data transmission networks act.

Optical Wireless Communication (/dictionary/optical-wireless-communication/121091): Optical wireless communication (OWC) refers to communication in unguided broadcast medium using optical carriers in the visible, infrared (IR), and ultraviolet (UV) region.

Visible Light Communication (/dictionary/visible-light-communication/121093): It is a subset of optical wireless communications technique in telecommunication, in which light signal with a frequency range of 400–800 THz with a wavelength in the range of 780–375 nm is used as a transmission medium.

Internet of Things (/dictionary/internet-of-things/15436): It describes linkage of physical objects or things, whichare interconnected among each other. The sensors, software, and other technologies are connected together for the purpose of linking and exchanging data over the internet.

Radio Frequency (/dictionary/radio-frequency/121092): It is the frequency where electromagnetic waves are in the range of 3 kilohertz to 300 gigahertz

Wavelength (/dictionary/wavelength/121094): A wavelength is a method of computing the distance covered by a wave's full sequence. It is the distance measured from one particular point on a wave moving to the identical point on the subsequent wave.

Electro-magnetic interferences (EMI) (/dictionary/electro-magnetic-interferences-emi/121089): Electromagnetic interference (EMI) is unwanted disturbance or interference caused by an outside source. Electromagnetic interference (EMI) is an occurrence that might happen when an electronic device is open to an electromagnetic field.

Fetal (/dictionary/fetal/121090): A fetus is an unborn young that grows inside the uterus of women and other mammals to give birth to a child.

Complete Chapter List