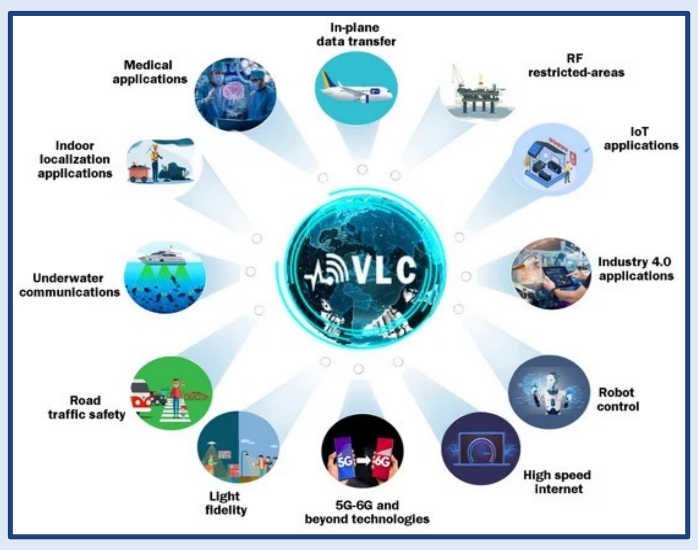
# A Critical Evaluation of Visible Light Communication

Author :

## 1.Introduction

### Background Information



Among optical wireless communications systems VLC constitutes one subset. Information is transmitted through the modification of light sources, such as light-emitting diodes (LEDs) or fluorescent lamps. Infrared communication is one prominent application of VLC. In the context of the burgeoning advancements in the Internet of Things (IoT), smart homes, and related technologies, VLC, with its attributes of efficiency, security, and eco-friendliness, emergs as a pivotal research area. Its applications extend across domains like smart homes, healthcare, and intelligent transportation, lighlighting the importance of VLC research.

### Thesis Statement

This study aims to critically assess the present state of VLC technology. The functional principles will be elucidated, followed by an exploration of the merits and limitations, and ultimately conclusions will be drawn.

## 2. Operating Principles

### General Principles

- Optical communication technology operates through modulating the data intended for transmission onto an optical carrier to generate an optical signal.
- This signal is threafter transmitted through a visible light channel
- An optical receiver is used to demodulate the optical signal into an electrical signal and revert it back to the original data.

### Specific Principles

- LEDs as the carrier for VLC, the modulator modulates the information,
- Transmitted to the LED lamps as a digital signal emitted by the visible lights of the LED lamps.
- The visible light containing the information is received by the receiver via a photoelectric converter (PD) which transforms it into an electrical signal.
- Filtered, shaped, amplified, and demodulated to furnish the pertinent analog information.
- Synchronization identification and detection signals are added when multi-channel or bidirectional transmission is required

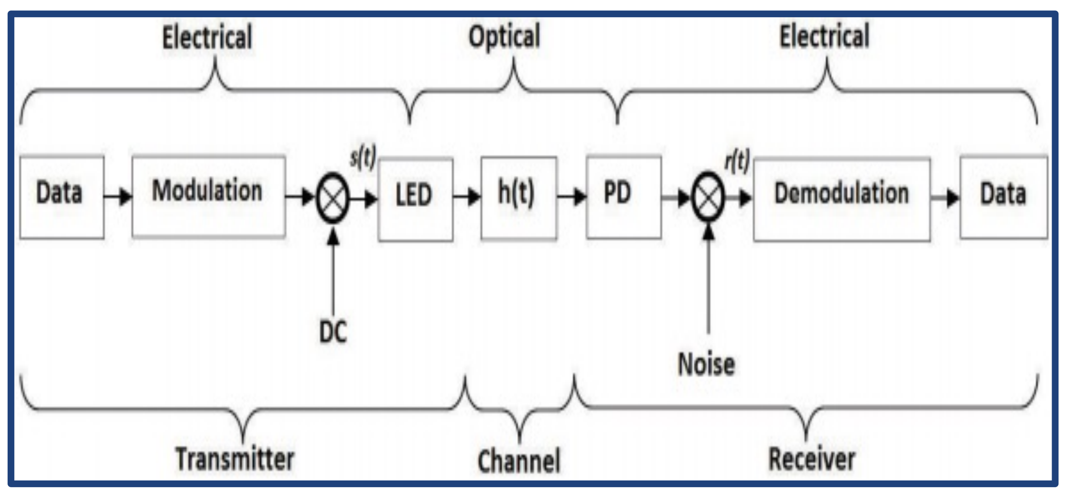



*Fig. 1. Model of VLC communication system.*

## 3. Critical Evaluation

### Evaluation for Security

- Evaluation criterion :A spectrum of security measures carefully assessed since they involve factors including data confidentiality, integrity, and reliability.

**Positive**

- Security pertains to ensuring that during transmission, unauthorized parties cannot access, steal, or manipulate with data.

**Negative**

- High level of secrecy is merely relative. Security risks abound everywhere in public areas.

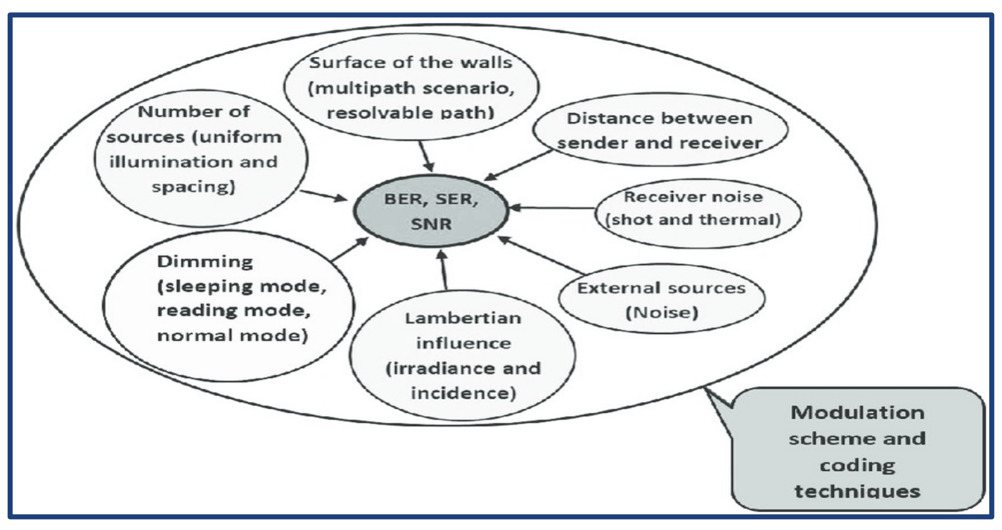



*Fig. 2. Model of VLC communication system.*

### Evaluation for Speed

- The transmission rate when data is communicated via visible light
- Evaluation criterion: increased speed, which opens up new opportunities for secure and fast data transmission.

**Positive**

- Advantage 1: the flexibility in wireless communication and the high speed in optical communication.
- Advantage 2: accomplish Gbps-level high-speed data delivery.

**Negative**

- The application range: constrained by feasible data rate of optical communication technology, decreases when link distance increasing
- Route loss increased: to the inverse ratio of the fourth power
- Data rate reduced: shot noise if the photodiode receiver is exposed to direct sunlight.
- Restriction of high data rate: communication to indoor environments

## 5.Possible Solutions

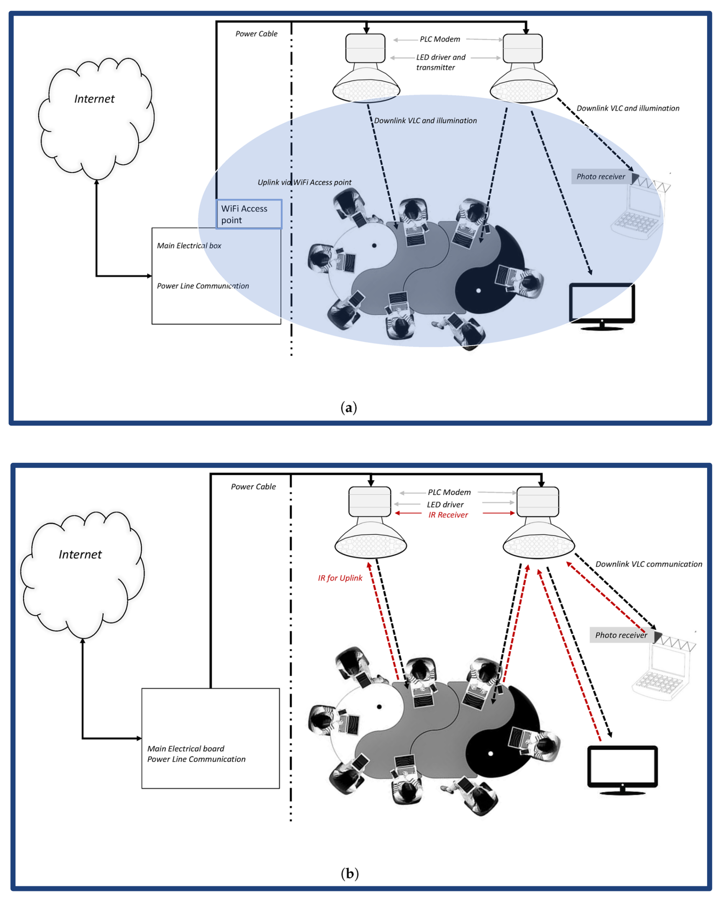


*Fig. 3. VLC downlink and infrared is used for uplink in VLC Hetnet. **(a)** VLC downlink and WiFi for uplink in VLC Hetnet. **(b)** VLC–VLC communication.*

- The visible light in indoor visible optical communication: impervious to walls and other obstructions. Transmitted within the user's line of sight.
- More current and comprehensive research data: underpin the findings and recommendations regarding VLC technology.
- Efforts to address these limitations: enhance the validity and relevance of the study's conclusions.
- Enhanced public environment security features & broaden application scope

## Reference

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