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Optimization of Visible Light Communication (VLC)

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ABSTRACT:-Visible light communication has been identified as well equipped to provide additional bandwidth and system capacity without aggregating the interference in the mobile network. The limited modulation bandwidth and the non-linearity nature of LEDs are the key challenges to visible light communication. In general, one LED lamp consists of multiple LED chips, these LED chips are used for parallel transmission though LED phase-shifted OOK(ON OFF Keying) modulation. For OOK, the bandwidth efficiency is approximate *N* times that of conventional OOK (*N* is the number of LED chips). Thus the developed system exchanges the data through wireless using visible light communication in the light medium. VLC usedin the closed door environment like schools, college, office and hospital with light wave technics.

KEYWORDS*:* ON OFF Keying, LED, Visible Light Communication.

I. INTRODUCTION

Since the introduction of mobile technologies over 30 years ago, wireless communications have evolved into a utility similar to water and electricity, fundamental to the socio-economic growth of modern society. To support the ever growing demand for mobile communications, cellular networks have had to evolve from simple local service providers to massively complex cooperative systems[1]. Indeed, meeting this exponentially growing demand is the main challenge for wireless communications over the next decade(s) is shown in Fig.1.

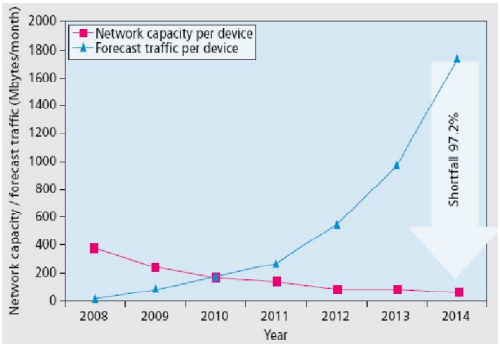

Fig 1.Mobile N/W capacity evolution

Due to the large growth of mobile communications over the past two decades, cellular systems have resorted to fuller and denser reuse of bandwidth to cope with the growing demand. VLC based approach raises the achievable system capacity. On the other hand, however, the increased interference caused by the dense spatial reuse inherently limits the achievable network throughput. Therefore, the spectral efficiency gap between users demand and network capabilities is ever growing.[2] Most recently, visible light communication has been identified as well equipped to provide additional bandwidth and system capacity without aggregating the interference in the mobile network[3]. Furthermore, energy-efficient indoor lighting and the large amount of indoor traffic can be combined inherently VLC is examined as a viable and ready complement to RF indoor communications, and advancement toward future communications. Aoverview of recent VLC commercialization is presented in Fig.2 [3].

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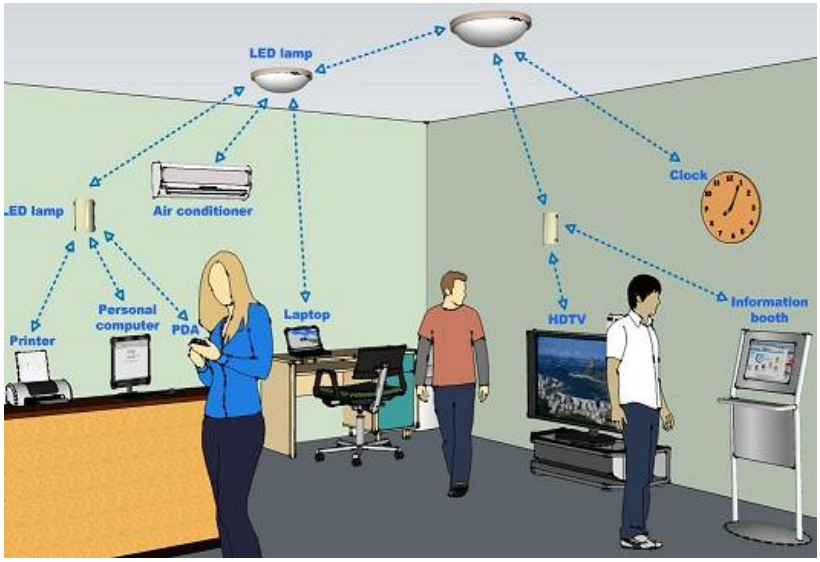

Fig:2 . VLC Communication

II. SYSTEM MODEL

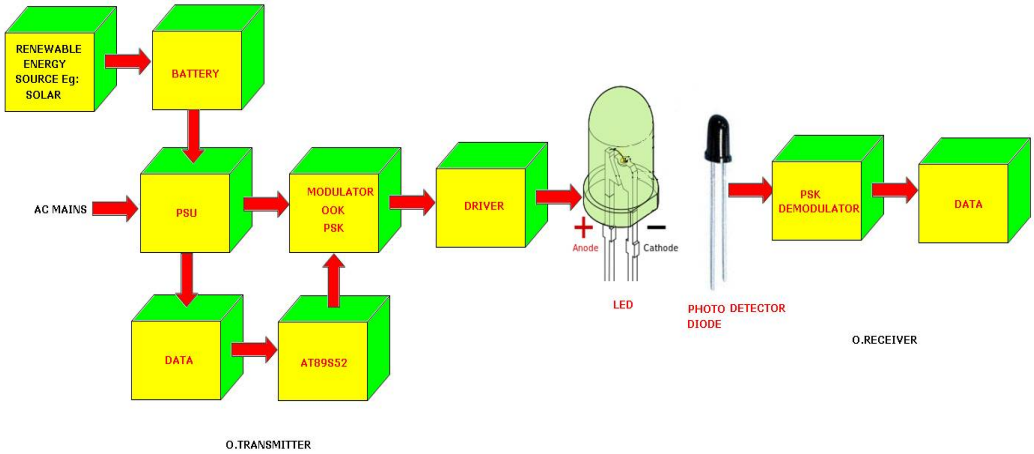

Fig: 3 .System model

In this model consists of two sections one is transmitter and receiver. The transmitter contains data source, AT89S52 microcontroller, on-off Keying PSK modulator, transistor driver and LED. The transmitting information is obtained from data source and it applied to the input of controller which is used to switching the modulator depends upon the time period of the information. The PSK modulator can be used to shifted or modulate the information into two phase level according to their data sign[2] The modulated signals are applied to the input of LED through transistor. The LED is act as a optical transmitter which is used to convert the modulated electrical signal into visual light. The visual light transmits from LED. [3].In receiver side the light signals are fall on photo diode which is used to convert the light signals into electrical signal. This electrical signal is applied to the input of demodulator is shown in Fig.3

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III. FUNCTIONAL BLOCK DIAGRAM

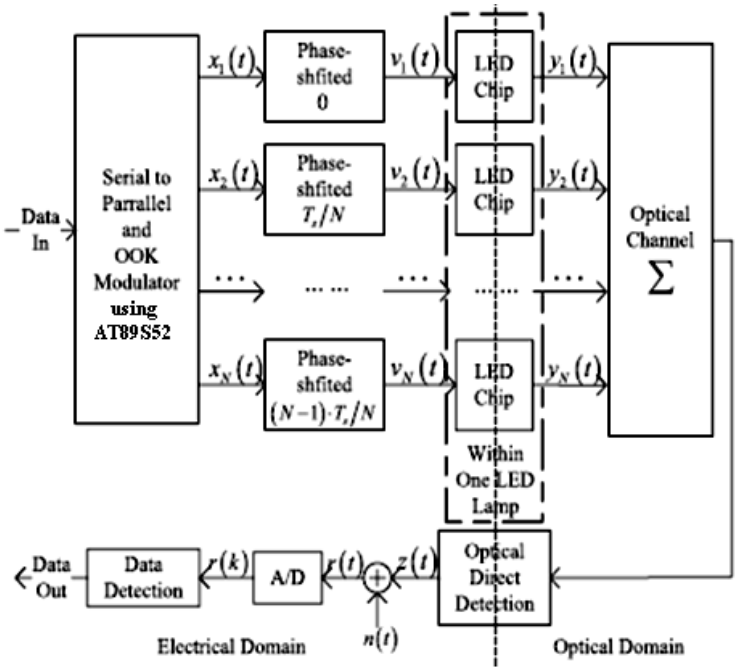

Fig:4. Block diagram of the VLC system based on MP-OOK.

The VLC system model based on MP-OOK is depicted in Fig.4. It is composed of *N* LED chips and OOK Modulator. High speed bit stream is divided into *N* parallel bit streams. Then each bit stream is modulated into OOK signal *xi (t)* and the symbol period of OOK signal is *Ts*. Compared with the *(i*−1*)*th branch, the OOK signal of the *i* th branch has a shifted phase of *Ts/N*. The baseband signal *vi (t)* which is used to modulate the *i* th LED chip can be expressed[4].

A.On-Off keying (**OOK**): OOKdenotes the simplest form of amplitude-shift keying (ASK) modulation that represents digital data as the presence or absence of a carrier wave. In its simplest form, the presence of a carrier for a specific duration represents a binary one, while its absence for the same duration represents a binary zero. Some more sophisticated schemes vary these durations to convey additional information. It is analogous to unipolar encoding line code. On-off keying is most commonly used to transmit Morse code over radio frequencies (referred to as CW (continuous wave) operation), although in principle any digital encoding scheme may be used. OOK has been used in the ISM bands to transfer data between computers, for example.OOK is more spectrally efficient than frequency-shift keying, but more sensitive to noise. [4]. In addition to RF carrier waves, OOK is also used in optical communication.

B. Light-Emitting Diode (**LED**) is a two-lead semiconductor light source. It is a basic PN-junction diode, which emits light when activated. When a fitting voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons.[5] This effect is called electroluminescence, and the color of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor. An LED is often small in area (less than 1 mm^2) and integrated optical components may be used to shape its radiation pattern.

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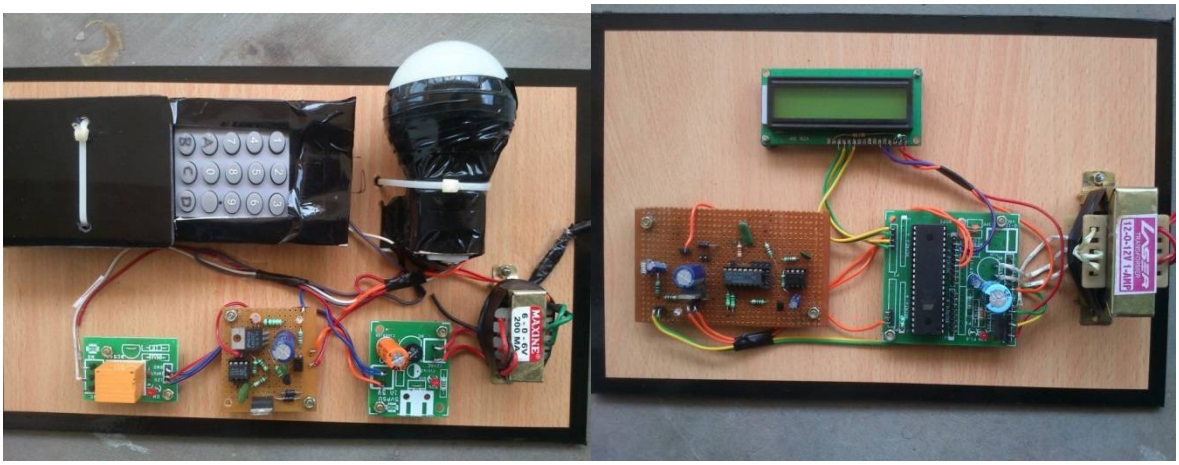
IV. RESULTS AND DISCUSSION

Transmitter module **Receiver module**



Transmitter module:-

The transmitter module consists of matrix keyboard, relay, modulator, transformer, and LED bulbs. The operation of transmitter module starts from the transformer output of the transformer is connected to all the components. Output range of 5-12v.The relay is used to control the over voltage damage of the LED bulb and the components. The matrix keyboard which is used to give a input data, which has the RC5 protocol inbuilt in the keypad. It gives the data signal to modulator. The Modulator which is used for switching the signal by the OOK encryption method. The output of the data is connected to the input of the LED bulb which is used as the transmitter module output.

Receiver module:-

The receiver module consists of transformer, photodiode module, microprocessor, and LCD display. The input of the receiver module is LED light rays. The photodiode which observes and demodulate using the demodulator which is connected to microcontroller. The microcontroller works on RC5 protocol program loaded in the microcontroller. The output of the data is show in the LCD display which connected to Micro controller.

V. CONCLUSION

VLC Wireless Communications is an emerging technology that truly delivers data at very high rate with fibre-like quality, VLC is different from conventional wireless communication and some conventional parallel transmission methods cannot be directly used in VLC.Thus the developed system exchange the data through wireless using visible light communication in the light medium. The system ensures indoor communication of high speed data process.

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