
REAL TIME WATS IN AUDITORIUM USING Li-Fi

Dr. P. Paul Divakar

Head of the Dept., Physics,
Sir C R Reddy College (Autonomous), Eluru, AP, India
Email: putlapaul1965@gmail.com

Ch. Mydhili

Faculty, Dept. of Electronics,
Sir C R Reddy College (Autonomous), Eluru, AP, India
Email: mydhili.chintamaneni91@gmail.com

Dr. A. Veerabhadra Rao

Sr. Faculty, Dept. of Physics,
Sir C R Reddy College (Autonomous), Eluru, AP, India

V S V S Bapuji

Sr. Faculty, Dept. of Physical Education,
Sir C R Reddy College (Autonomous), Eluru, AP, India

Received: Jan. 2020 Accepted: Feb. 2020 Published: Feb. 2020

Abstract: Over the beyond few years there has been a rapid increase in the usage of the Radio frequency region of the EMS. This is due to the huge boom in the range of cellular phones subscriptions in recent times. This has been inflicting a speedy reduction in spectrum (free spectrum) for destiny devices. Light-fidelity (Li-Fi) operates in the visible light region of the EM spectrum i.e. It uses visible light as a transmission medium rather than traditional radio waves. In this paper Live Audio or any Audio from the device (like system, Mobile or direct speech) is amplified and transmitted by using light. At the receiver end photo detectors are used to detect the audio signal (in the form of light) and fed it to the speaker. The advantage of WATS (Wireless Audio Transmission System) is to transmit the audio wireless through light as well as same transmitter is used of lighting the closed rooms such as auditoriums and also faster transmission of audio is achieved.

Keywords: WATS, EMS, Li-Fi, Wireless, Lighting, Li-Fi Tx, Li-Fi Rx

Introduction: Light Fidelity (Li-Fi) is a technology for the transmission of wireless data between devices. light is used as the medium for transmission of data. Optical sources are used for data encoding via switching the light ON and OFF to create a binary code during regular intervals. Encoded code is transmitted to the other end where the receiver receives that code. Li-Fi has a large capacity in transmission of data because it uses light to transmit data.

On July 2011, German physicist Prof. Harald Haas proposed a new technology called Light Fidelity (Li-Fi) at TED (Technology, Entertainment and Design) on Visible Light Communication (VLC) Global Talk. Li-Fi technology uses LEDs for data transmission also known as WON (Wireless Optical Networking). In this technology to deliver data at high-speed light signal is used in a manner similar to Wi-Fi and complies with the **Institute of Electrical and Electronics Engineers** standard IEEE 802.15.7. It is a high-speed and bidirectional fully networked wireless communication technology based standard similar to Wi-Fi's IEEE 802.11.

This paper focuses mainly on one of the application of Li-Fi Technology. This WOCN (Wireless Optical Communication Network) is used to transmit an audio signal in Auditorium. Major use of Wi-Fi is wireless coverage inside building, while for high density wireless data coverage in confined area Li-Fi is ideal and especially beneficial for applications in areas where radio interference issues are of concern, this is the reason that these two technologies can be considered complimentary.

WATS Architecture:

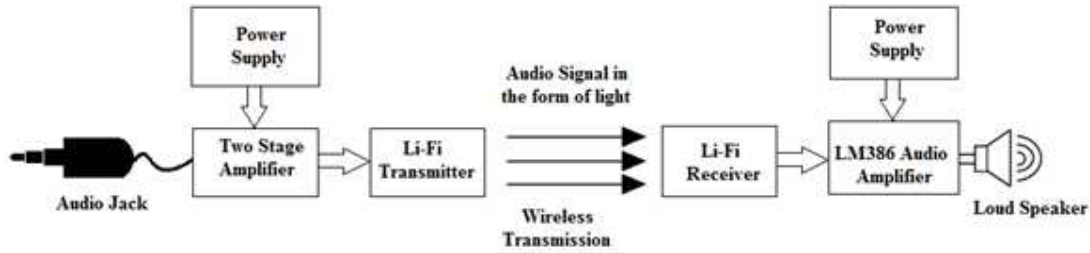


Figure 1.1 WATS Architecture

WATS is a Wireless Audio Transmission System. It consists of Power Supply, Audio Jack, Two Stage Amplifier, Li-Fi Transmitter (LED as light source), Li-Fi Receiver (Solar Panel as photo detector), LM386 Audio Amplifier and Loud Speaker. The photo detector receives the data transmitted by LED. To make LED working properly a Two Stage Amplifier is needed. Signal from Photo Detector is fed to LM386 Audio Amplifier to strengthen the weakest signal received.

Power Supply: As all most all electronic devices need constant DC Power Supply. But the signal from AC Mains is a 230V AC signal with operating Frequency 50Hz. In order to operate the electronic devices a DC power Supply or a battery is required. The DC Power Supply consists of a Step down Transformer, Rectifier, Filter and regulator circuits. The Step down Transformer step downs the large AC signal into small AC signal and it is fed to the Rectifier circuit. Here Bridge Rectifier is used for rectification. The output of the Rectifier consists of both DC components and low frequency AC components. The low frequency AC components are removed by the help of Filter. The output of filter is unregulated DC, it is regulated using a Positive series voltage regulator (78XX). The output of Regulator is constant irrespective of variations in current drawn by load and the AC supply from the Mains.

Audio Jack: Basically an earphone is a closed loop of wire in which current flows through it. This electric current flow in that closed loop interacts with a permanent magnet. This in turn pushes the air, produce the sound. The key thing to remember is that current going through this closed loop of wire will make sound. Here the current comes out of the battery flows through the bulb and then back into the battery which in turn ON the bulb shown in Figure 1.2(a). Now replace the battery with an oscillating source (for music and audio) and the bulb is replaced by the coil shown in the Figure 1.2(b).

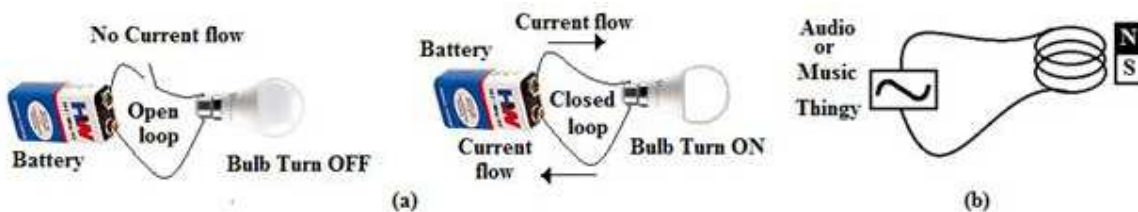


Figure 1.2(a): A Simple circuit with a battery and a Bulb (b) An Oscillating Source and Coil

The plug itself is the main part earphone jack. It allows the Music Source or Audio Source without actually having to connect any wires. Let's see the comparisons of different Head Phone plugs close up.



Figure 1.3: Comparison of different Headphone plugs

Two Stage Amplifier: While dealing with signal strength and quality Amplifiers play a crucial role in any project. In this Two Stage Amplifier the first stage is common emitter amplifier and the second stage is emitter follower. The signal from Audio Source or Music Source is amplified to required level and the fed to drive the Li-Fi Transmitter.

Li-Fi Transmitter: In this paper, the one of the important requirement is light source. Here Light Emitting Diode is used as Li-Fi Transmitter. The Audio signal or Music signal is radiated into free space in the form of light with the help of photo emitter.

Li-Fi Receiver: Another important requirement is photo detector. Here Solar Panel is used for detecting the light transmitted from Li-Fi Transmitter. The signal received by solar panel is fed to the LM386 Audio Amplifier.

LM386 Audio Amplifier: LM386 is a low voltage audio amplifier. Battery powered music devices like guitars, radios, toys etc frequently use LM386 audio amplifier. The range of gain is from 20 to 200, it is internally set to 20 (no external components used) but can be increased up to 200 by using a resistor (R) and a capacitor (C) between pin 1 and pin 8, or simply with a capacitor (C).

Loud Speaker: The speaker acts as anti-transducer. It converts electrical signal into the audible form by using electromagnets present in it. The demodulated audible signal is fed to the speaker, so that the audience can listen to the message transmitted from the source.

Results:

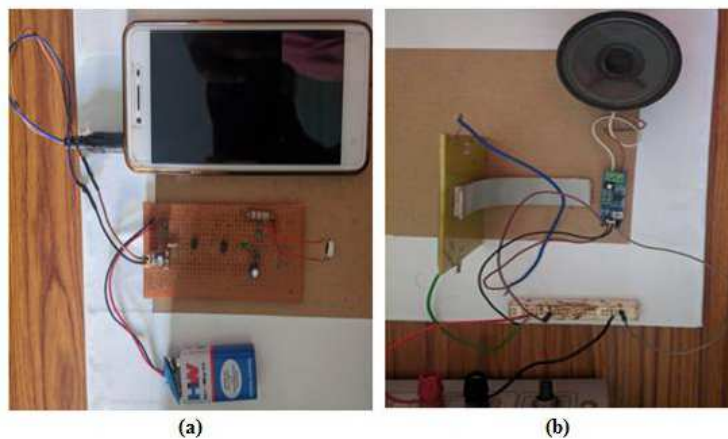


Figure 1.4(a) WATS Transmitter Section (b) WATS Receiver Section

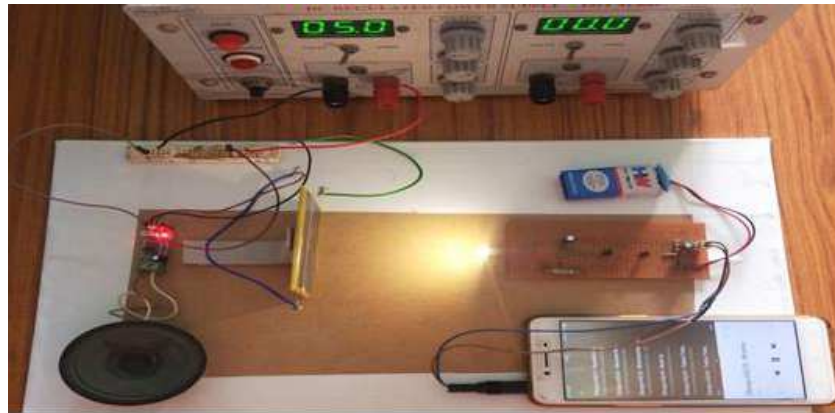


Figure 1.5: WATS While Transmitting Audio

WATS Transmitter Section consists of a Power Supply, Audio Jack, Two Stage Amplifier, Li-Fi Transmitter (LED as light source). WATS Receiver Section consists of a Power Supply, Li-Fi Receiver (Solar Panel as photo detector), LM386 Audio Amplifier and Loud Speaker. In this WATS only single LED (This 5mm white color LED has a small head, it is a very good quality and appropriate for room light) is used, it covers up to 20 to 30cm distance. This single LED is replaced with LED panel so that the distance coverage is increased and also same panel is sufficient for lighting the closed rooms. Only one speaker is used here to demonstrate one of the applications of Li-Fi. Multiple speakers are required to cover the entire auditorium. All the speakers should be placed at equidistance in auditoriums so that audio will be clear without overlapping.

Conclusion: This paper explains the concept of WATS (Wireless Audio Transmission System). This is the brilliant technology for transmission of data wireless without using Radio frequencies. The radiation produced by EM waves causes many unknown health issues. This technology may solve the issues such as the shortage of radio spectrum bandwidth and also allow wireless data transmission and internet where traditional radio based wireless isn't allowed such as in aircraft or in hospitals. The main important point to remember is that it only works in LOS.

Future Scope: As light is free to use everywhere, there is a great scope for the use and evolution of Li-Fi technology. Each LED bulb acts as a wireless transmitter for data. If the Li-Fi technology becomes more and more popular, we enter a new era of technology for high speed data transmission. The possibilities, technology can be put into practical use. Every bulb can be used like a Li-Fi hotspot to transmit data wireless. It will lead to a greener, cleaner, safer Communications and have a bright future. This concept is currently attracting a great deal of interest, because it is very efficient and alternative Technology to radio-based wireless communication. As increase in no. of wireless internet access usage device, the airwaves are becoming increasingly clogged. This pioneering technology is one kind of extraordinary and energy saving parallelism that is believed to deliver data at high speed.

References:

1. Haas H, Yin L, Wang Y and Chen C 2016 What is Li-Fi?J. Light. Technol. 34 PP1533-44.
2. Ayyash M et al 2016 Co-existence of Wi-Fi and Li-Fi toward 5G: Concepts, opportunities and Challenges IEEE Commun, Mag. 54(2) PP 64-71.
3. Pure Li-Fi 2017 Shedding Light on Li-Fi Pure Li-Fi.
4. www.oledcomm.com.
5. <http://en.wikipedia.org/wiki/Li-Fi>.
