

# Implementation of PCM Framing to Improve Data Rate and Audio Quality in Audio Communication Through VLC(Visible Light Communication) on FPGA

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## Abstract :

One of the big problem in wireless communication based on radio frequency is bandwidth or radio frequency spectrum ,to overcome this issue we are going to use wireless communication through Light (LED Light etc). In this communication we have many advantages like low power consumption & no any fear to interference between different-different radio frequency signals and PCM framing is used to improve data rate and signal to noise ratio in audio communication through LED light. In PCM firstly data is converted into digital form after that put preamble and post-amble and guard period in burst frame. Li-Fi gives higher information/data measure, high efficiency, good connectivity, much more secure than Wi-Fi and data rate (speed) is also high about to 10 Gbps according to laboratory experiment. According to nature of LEDs has light weight, cheaper in cost and lightning units, there are innumerable chance to take advantage of this method.

**Keywords:** Audio Transmission Visible Light Communication, PCM Framing , FPGA Kit ,LED, Photodiode.

## 1. INTRODUCTION

Audio Transmission through Visible Light Communication technology utilizes LED light as a method of transmission instead of customary microwaves/radio waves. Along these lines, this can be utilized in sports where radio waves is not allowed.[2][6] Additionally, No one can hack by who is sitting in other room rather than room in which Li-Fi system established. Also, the very appealing component of upcoming technology and innovation which give high speed data rate by which message signal/information will transfer with much more faster than Wi-Fi.[5] Previously ,all the process of audio transmission through VLC was in digital format but not purely digital bit and data rate as well as SNR is quite less than this digital framing system and high probability to add noise in signal .To overcome this problem , I am going to discuss the Audio communication in digital form through pulse code modulation framing in this paper. The working of Visible Light Communication (VLC) is based on changing the current of LEDs works by changing the current to the LEDs and exceptionally rapid, too fast which can't be observed by human eyes, therefore, it doesn't present any glinting. It is additionally noteworthy bottle-neck of the creation when dependent on the light range, as it is limited to the enlightenment reason and not in perfect world changed in accordance with a versatile correspondence reason. Advances that permits as wandering between different Li-Fi cells, otherwise called handover, may permit to consistent change between Li-Fi.

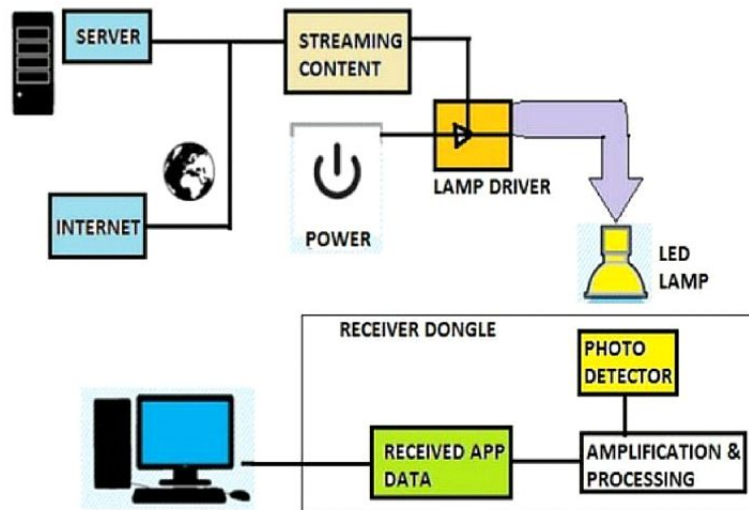


Fig. 1. working of Li-Fi

In this process the received audio signal is firstly converted into digital form analog to digital converter and using pulse code modulation after that put it into FPGA & add the preamble and CRC bit with data bust and then put guard period between frame through verilog coding and then send it to LED at transmitter side.

## 2. PROPOSED SYSTEM

Proposed System consists FPGA Kit, transmitter section & receiver section. Transmitter section consists of ADC, LED, mike & receiver section consists of photodiode, DAC & speaker.

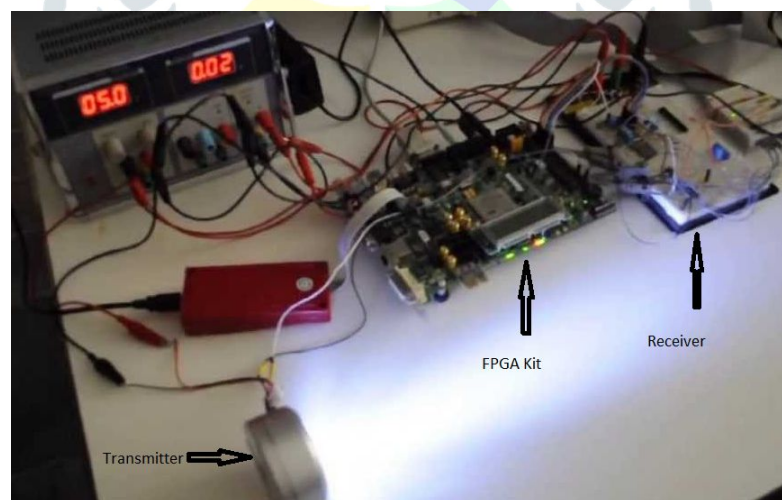


Fig. 2. Setup of proposed system

You should have a LED as transmitter and the other side as receiver side photodiode. When led is start to send the data ,the photodiodes will differentiate the light which contain valid data and a paired '1' and double '0'. As we realize that any information can be transmit or gotten as far as advanced sign (0 or 1).Then we can change over the information into 0 and 1 after that it tends to be transmitted gotten by the Li-Fi Technology effectively. Information transmission rate can be relies on the force of the light of the LED utilized in the framework or power of light relies on the intensity of the electric voltage. It likewise relies on the recurrence of the info or yield signal.

Transmitter :

It consists of mike to receive audio signal which has frequency between 20 to 20 KHz, data processing and framing block consists of 16 Bit stereo analog to digital converter board with Led driver and FPGA kit to do framing to digital bit received from ADC. After that signal is send through led light in the form of binary and serial bit. The working of new Li-Fi creation is simply straightforward.

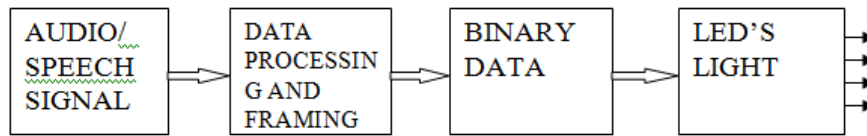


Fig. 3. Transmitter of Audio Communication through Light

ADC:

The IC of ADC PCM1801 is a low-cost, single-chip stereo analog to digital converter with single ended analog voltage input. "The PCM1801 comprises of a band-hole reference, two channels of a solitary to-differential converter, a completely differential fifth request delta-sigma modulator, a pulverization channel (counting computerized high-pass), and a sequential interface circuit.[1]

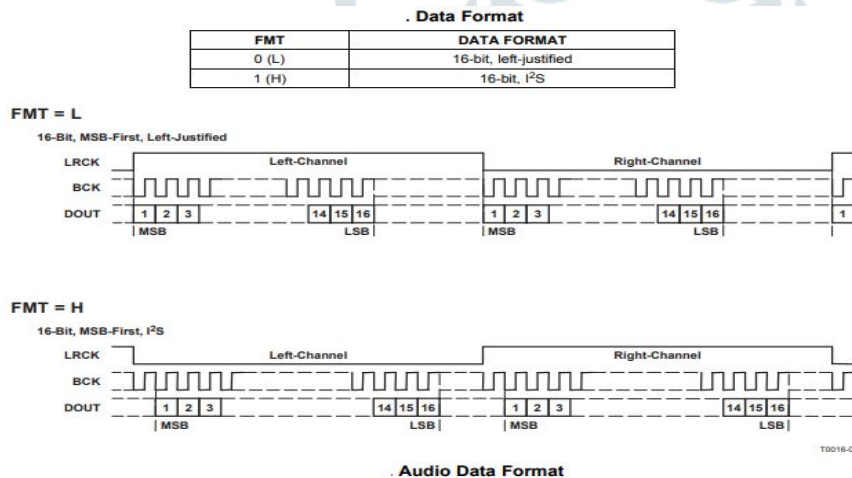


Fig. 4 . Audio Data Format of ADC

Receiver :

At receiver side data is received by photodiodes in the form of digital after that is passed through operational amplifier to increase the power of received signal after that de-framing in the form of stereo bit and digital to analog conversion will be done then received original audio signal through speaker.[7]

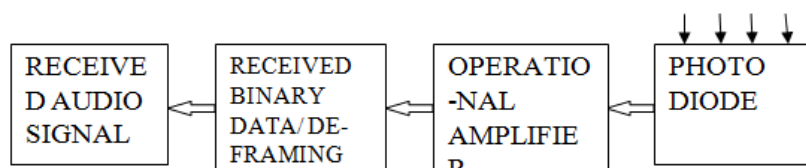


Fig. 5. Receiver Of Audio Communication Through Light

### 3. RESULT

Digital form of audio signal is hold by FIFO and then send the bit one by one or serially to Led light starts blinking but it is not visualized by human eye. This blinking of led shows the transfer of data or audio file is getting transmitted. At receiver side photodiodes will receive the data & line of site matters in this communication but no any loss of data due to framing because when any line of site appears then FPGA controllers stops the transfer or we can say that pause the transfer and then resume from same point after removal of line of site & received audio data in particular manner at receiver side.

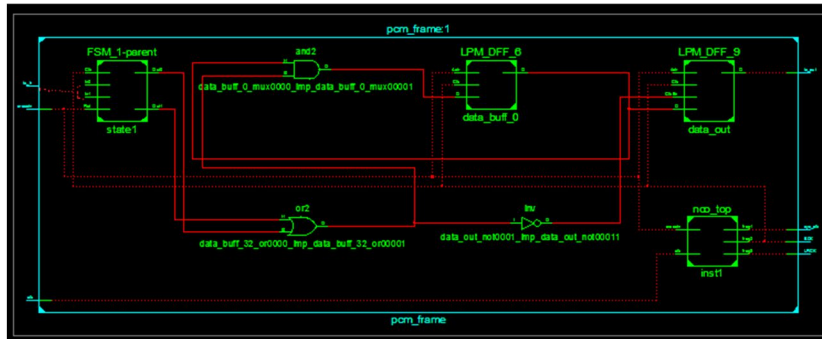


Fig. 6. PCM Frame RTL view

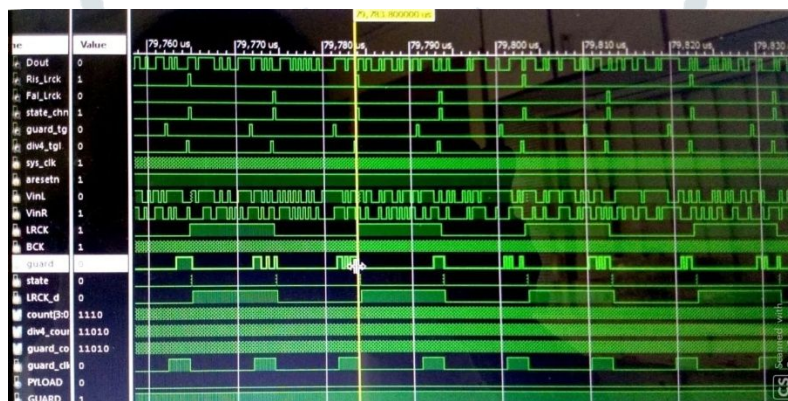


Fig. 7. Output waveform of PCM Frame

### 4. CONCLUSION

Li-Fi has an incredible potential in the field of short run remote correspondences. Unmistakably, we could find in this undertaking how proficiently and successfully sound can be transmitted utilizing VLC & Framing provides high data rate as well high SNR & no fear of data lost during line of sight. Same way it can be utilized to transmit information too. In this way, it a compelling swap for the current innovations like Wi-Fi. In our proposed model we had the option to successfully transmit it to a scope of 15-20 m. It send the data in the form of digital bit so no chances of cross-talk and error so signal to noise ratio will be high or we can say  $98 + 2\%$ . This latest Li-Fi technology will provide us and our lives high technology driven in upcoming few years. With the help of LEDs or we can say its magic of led light to gives our surroundings brighter, greener, safer ,cleaner as well as Eco- friendly & bright place to live. We can implement this technique for live video transmission also but little bit different.

## 5. REFERENCES

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