

# BENCHMARKING OF Li-Fi SYSTEM FOR IOT APPLICATIONS

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## Abstract

*Li - Fi is a label for a wireless communication system which is used to describe visible light technology applied to high speed wireless communication. We are witnessing a revolution in wireless technology where Light Fidelity (Li-Fi) emerges as one potential candidate. In this paper we present a Li-Fi System Benchmarking that allows us to verify the feasibility of deploying this technology. Authors have designed and studied many circuits for the Li-Fi system and benchmarked all the stable system to get the highly efficient system. After around six months of long research and studies, we have come up with stable and efficient system.*

**Keywords**— Light Fidelity (Li-Fi), Internet of Thing (IoT), OPT-101p.

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## 1. INTRODUCTION

In this era of Internet of Things, with increase in IoT device the internet has become a major demand, people in search of Wi-Fi hot spots has increased. Compared to the last few years we can say this demand has doubled now. It is predicted that by 2020 there will be more than 50 million IoT devices in the world and the Internet demand will increase in many fold. Demand for Wireless data is increasing day by day which is escalating the congestion in radio- spectrum. In present scenario the bandwidth capacity which is available is finite and is not capable enough to sustain with the constantly increasing demand of wireless data. To find the alternative for this Light Fidelity (Li-Fi) is the answer. Li-fi or Light Fidelity was invented by Professor Harald Hass of the University of Edinburgh. This is the newest technology in present day communication system that makes the employment of LEDs, Light Emitting Diodes that helps in the transmission of signals a lot quicker and versatile than the signal which will be transmitted through Wi-Fi. It's primarily a 5G technology a visible light communication system that utilizes light emitting diodes as a medium of high speed communication in similar manner as Wi-Fi. By making use of very high switching property of LED which is main advantage of this.

IoT systems are moving towards NB-IoT, LoRaWAN etc. Li-fi is one of these highly useful technology which can be blended very well with the IoT devices in the future. With the insight on this and making it more on practical implementation authors have been working with this technology for quite a long time and are very successful in making IoT device to work with this technology. In this paper authors have described the work done on the communication system of Li-Fi during Implementation stages of a basic Li-Fi system. After a series of test on these systems they saw that results were not up to the mark and implementation of these system on IoT devices will not be reliable. So, to make it more stable and to be compatible

with the IoT devices, different systems were designed and benchmarked to get stable and reliable system to implement on to the IoT devices.

## 2. BENCHMARKING OF SYSTEM

Authors have tested many basic circuits of visible light communication in the beginning and then moved to designing more efficient designs. The major drawback we had with the design was receiving part, where we have used a monolithic photodiode and single supply Transimpedance amplifier (OPT-101p) from Texas Instruments. This is a 0.09x0.09-inch cell operated in the photoconductive mode for excellent linearity and low dark current with maximum responsivity at 650nm. The excitation power supply ranges from +2.7V to +36V is used. We designed an amplifier circuit for the output of the photodiode, as we can see in Fig.1.b the output of OPT is very low and this output was obtained after creating optimal conditions of the test place, restricting other light to fall on the photodiode. When tested in normal conditions the noise was more and after the amplifier design, which here the authors have tested was given the same input as that of output obtained from OPT-101.

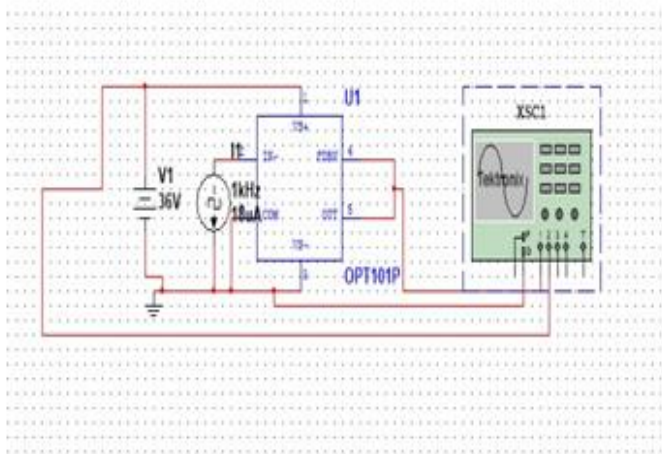


Fig.1.a OPT -101p Test Circuit

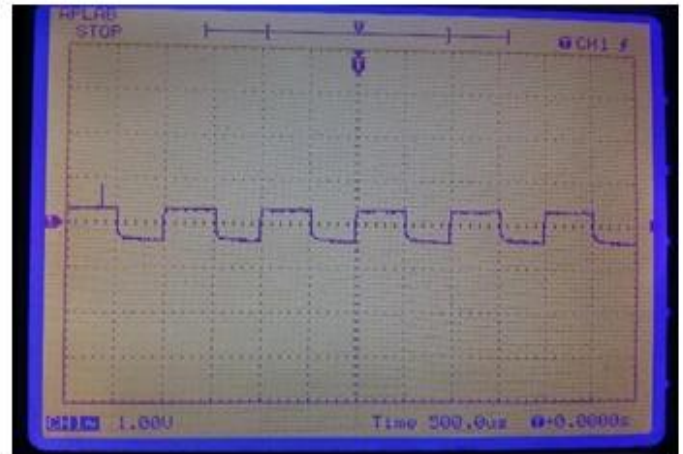


Fig.1.b Output of OPT-101P

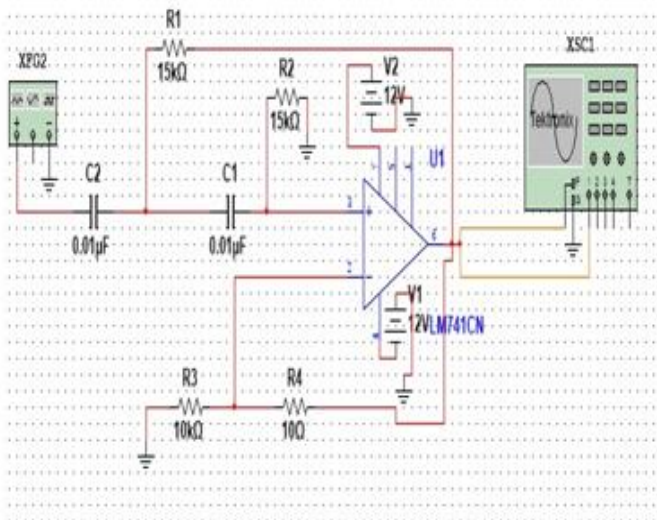


Fig.2.a Amplifier Circuit of OPT-101P

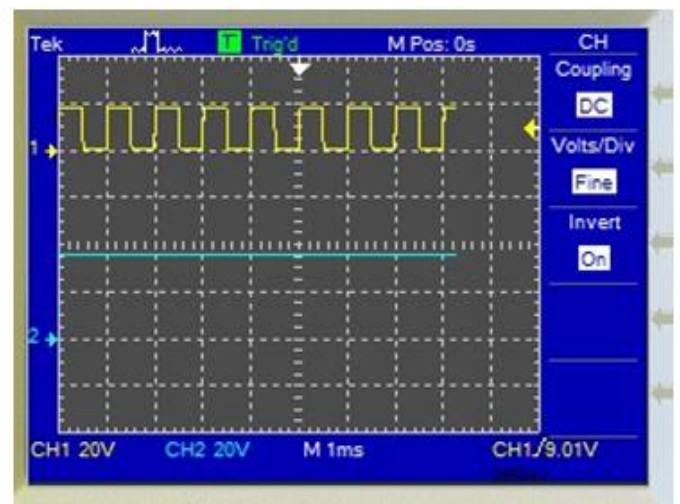


Fig.2.b Output of Amplifier Circuit of OPT-101p

After testing many designs and finally circuit with stable output was obtained, which is shown in Fig.2.a and we can see from figure 2.b that even the output has amplified compared to figure 1. After that stable circuit was tested for very long time for different conditions and parameters, the efficiency rate of this circuit was very high compared to the other circuits tested before.

### 3. TRANSMITTING CIRCUIT

Sending end will have equal weightage as of receiving end. So to convert the data it is sent through the LED driver circuit such that the LED's Switching operation will be based on the input fed to it from LED Driver. To get a very good Driver circuit lot of circuits were designed to check the stability and reliability of it. Even authors have used Darlington transistor Array IC in one of the circuit. After all the design, simulation, implementation and testing, benchmarking is done considering all the parameters. The Circuit shown in figure 3.a is the suitable circuit for the Li-Fi system.

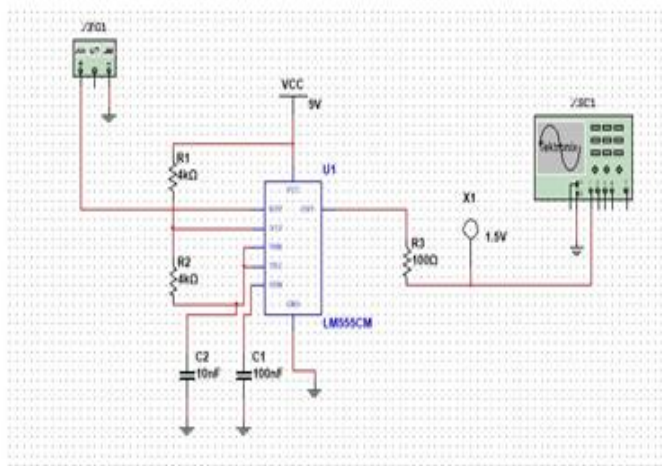


Fig.3.a Transmitting Circuit

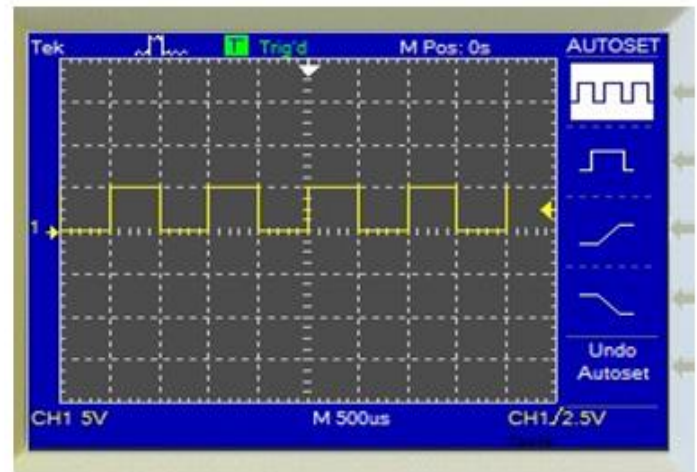


Fig.3.b Output of transmitting Circuit

The complete system is tested for various parameters and different conditions. The proposed system has taken edge over all other designed and tested systems. This system is even taken to the next level to interface with the IoT devices. The system has been very reliable so far in all the situation and application tested on this, even considering the IoT and many other application.

#### 4. CONCLUSION

The idea of Li-Fi technology currently attracting us a great opportunities because of its latest and very efficient alternative to wireless technology. We can see Li-Fi in IoT platform competing with the NB-IoT and LoRaWAN etc. We have described a complete Li-Fi prototype that has been developed to evaluate the feasibility of this technology and tested for many different conditions. In particular, authors are working to integrate an amplifier and some correction codes that will allow a better transmission range. The day is not far from now where authors will be coming-out with IoT device with Li-Fi enabled in it.

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