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Audio Transmission in Visible Light Using Li-Fi Technology

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***Abstract:** In today's world where information security is one of the real concern, it winds up essential to get new strategies for the information transmission. Visible Light Communication (VLC) is rising as new strategy for information transmission in which information is transmitted through LEDs. This is a considerably more secure technique for transmission contrasted with existing innovations. Likewise the information transmission rate is high around few GBps. The utilization of different shaded LEDs can deliver distinctive velocities and information rates. This paper portrays the plan of Li-Fi sound transmission framework and investigating its execution.*
***Keywords:** light fidelity, APR, Visible light, PIC controller*

I. INTRODUCTION

Wi-Fi and Bluetooth are presently the two unmistakable short range remote advancements utilized for different remote applications. However the radio recurrence range utilized by these strategies is rare. There are different downsides of these current advancements like high cost, instability of information, high power utilization. In this way, there is an incredible need of an innovation that could defeat every one of the downsides of existing technologies[1].

Visible Light Communication (VLC) is developing as a decent option. It is additionally named as Li-Fi importance Light constancy. This forthcoming innovation utilizes light as a method of transmission. Li-Fi works in the obvious light range which is 10 thousand times that of the radio wave range. It utilizes unmistakable light as a method of transmission as opposed to the conventional radio waves. In this way, it can be utilized as a part of spots where the utilization of radio waves is denied. In addition, since light stays restricted to a room, the information stays secure and can‟t be hacked by somebody sitting in other room. Furthermore, the most alluring element of this forthcoming innovation is the speed by which information gets transmitted which is 100 times quicker than WiFi[2]. In this innovation information is transmitted utilizing LED knob. The essential thought is to flip the LED quick with the end goal that it isn't detectable to human eye. Information can be transmitted at considerably higher rate contrasted with Wi-Fi or Bluetooth radio recurrence. At the point when LED is „ON‟ consistent "1" is transmitted and when LED is „OFF" sensible "0" is transmitted[3]. In our venture we are recording distinctive sound documents in APR. The voice or sound that must be recorded in APR is recorded with the inbuilt receiver in that IC. Distinctive changes are utilized to store diverse sound documents. APR is controlled by PIC 16F877A microcontroller for sending the sound information document serially to the Li-Fi transmitter module. The sound record gets transmitter when the LED of the transmitter module blinks[4]. The beneficiary part contains a Li-Fi collector module which gets the sound document. The collector module contains a photodiode to distinguish the transmitted audio[6]. This got information is then sent to the speaker.

II. PROPOSED SYSTEM

The proposed system consists of a transmission section and a receiver section. The transmitter section consists of an APR, PIC microcontroller, Li-Fi transmitting module, transformer and the receiver section consists of a Li-Fi receiving module, PIC microcontroller, an amplifier, speaker and a transformer. It integrates a LiFi based wireless sensor node for gathering information from sensors on various environmental conditions. For this purpose, a prototype sensor node is developed to clarify necessary functions through a practical experiment and the hardware configuration of a latest prototype using Visible light communication. Developing practical field experiments to observe temperature, humidity and vibration and send these gathered information to the local Server via light. Using visible light for data transmission entails many advantages and eliminates most drawbacks of transmission via electromagnetic waves outside the visible spectrum

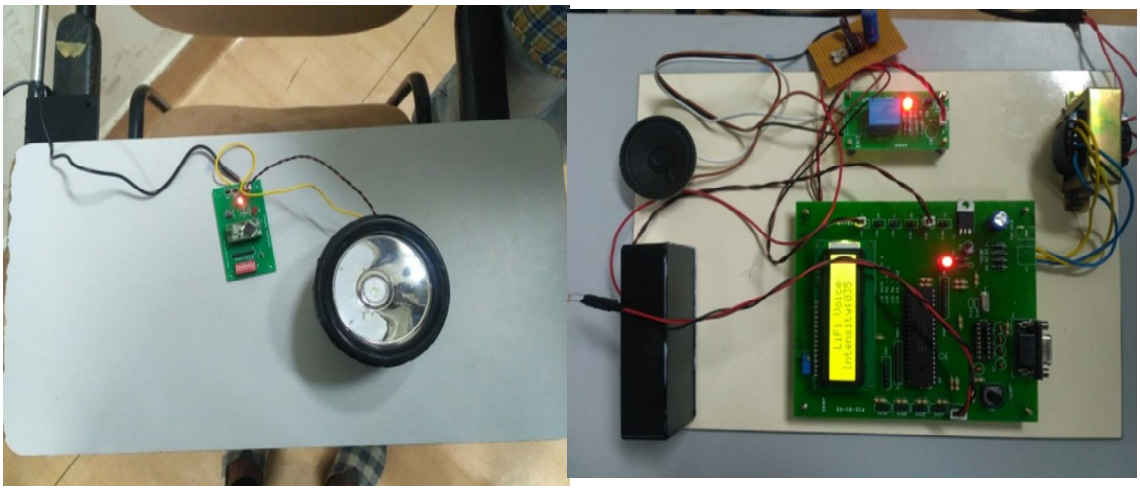

Fig 1: Final output of the proposed system

A. Transmitter Section

The audio is recorded in the transmitter section using APR and is transmitted using Li-Fi audio transmitter via visible light channel. In this project two transmitters are used for better transmission.

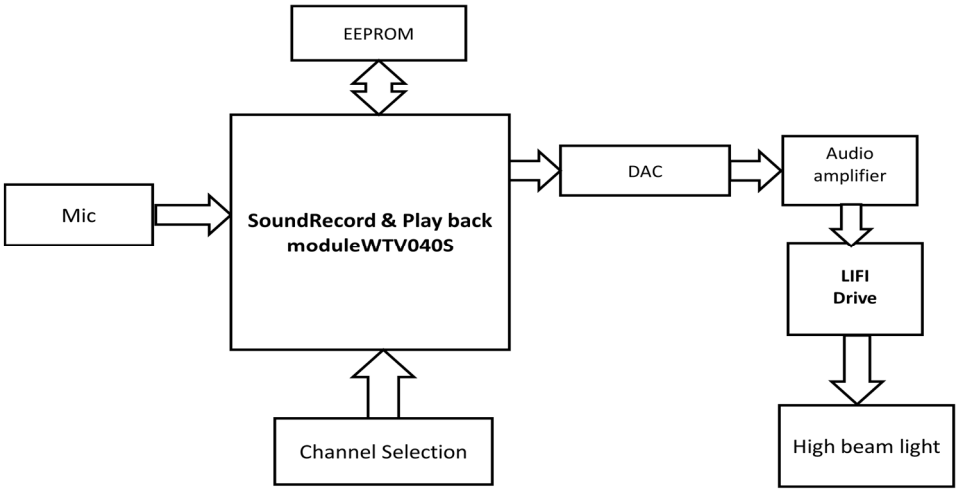

Fig 2: Block diagram of transmitter section

B. Voltage Conversion

The power supply which we are getting is 220V AC and the microcontroller needs is 12V DC. So keeping in mind the end goal to change over we utilize a stage down transformer which change over 220V AC to 12V AC. At that point we utilize an extension rectifier which change over negative portion of the voltage to the positive half cycle. The yield of the rectifier circuit has twofold the recurrence to that of information. At that point this is sustained to channel and controller which changes over the swells to a consistent estimation of 12V. This is the working voltage of PIC microcontroller

C. Pic Microcontroller

The PIC16F877A is a CMOS streak based 8-bit microcontroller, which has working recurrence of 20 MHz. It takes 200 ns to execute a guideline cycle. In our task we have utilized a 40 stick PIC16F877A. Its principle work is to control the APR. It serially send the recorded sound document from APR to the transmitting module. For that it utilizes RS-232 gadget which encourages the microcontroller to send the information serially. For that fifth piece must be set of TXSTA enroll (address 98h). The flag is then send to the transmitting module.

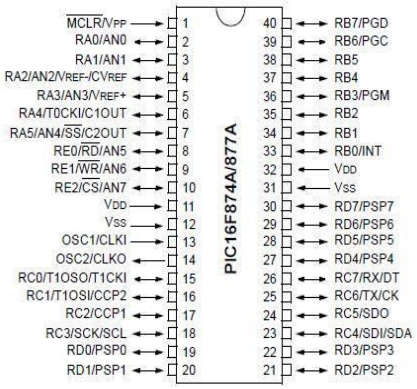

Fig 3: Pin Diagram of PIC 16F877A

D. Audio Playback Recorder

In this task we have utilized APR33A arrangement sound processor. It is a superior which records a decent quality voice. This processor is intended for straightforward key trigger, client can record and playback the recorded document. The one we have utilized comprises of 8 switches. Along these lines we can record 8 sound messages of around 20 sec each. The chip can be kept in shut down mode when client doesn‟t need to utilize it. This can decrease the utilization of electric current by 15uA and thus the time can be expanded in any undertakings that are fueled by batteries

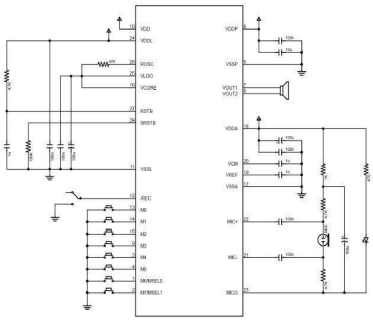

Fig 4: Pin configuration of APR33A

E. Transmitting Module

The Li-Fi transmitting module comprises of a circuit that can adjust light with a low recurrence signals. The beat flag is comparable to an ON/OFF flag that is utilized to control the power of LED. The type of heartbeat wave chooses the way light is discharged from LED to make VLC alive. The information flag controls the squinting of LED. It should occur in nanoseconds with the goal that human eye doesn't recognize it.

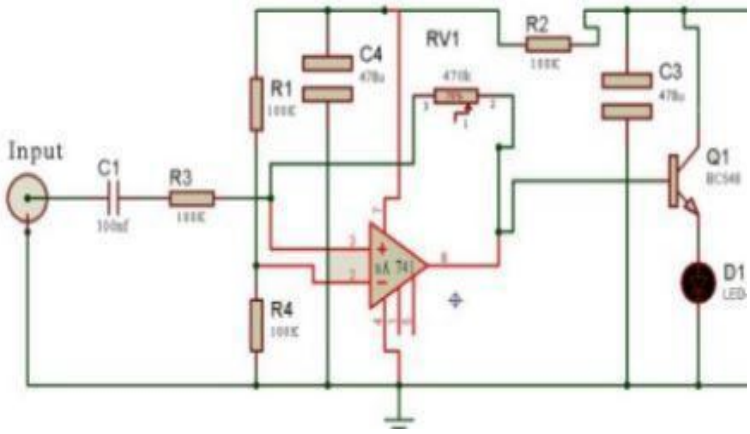

Fig 5: Circuit of Li-Fi transmitter module

F. Receiver Section

The beneficiary area comprises of a getting module, PIC microcontroller, enhancer and a speaker. The accepting module gets the sound signs which are then serially go to the enhancer utilizing microcontroller and after that to speaker

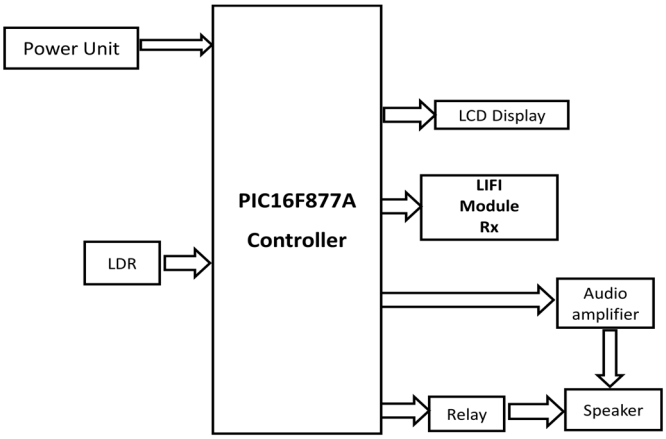

Fig 6: Block diagram of receiver section

G. Receiver Module

The receiver module comprises of a photo detector. At the point when the light falls in it identifies the information that is transmitted by means of light. The getting segment must be kept in observable pathway with the transmitting module. Any adjustments in the situation of any of the modules while transmission can bring about the loss of information and for this situation sound. This recipient gives a sound flag that compares to adjustment envelope.

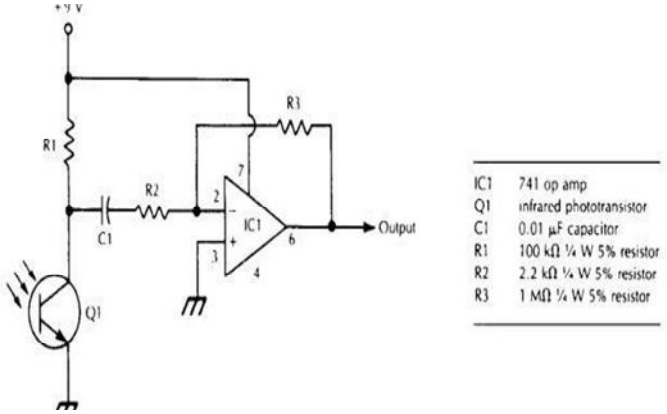

Fig 7: Circuit of Li-Fi receiver module

H. Amplifier

An audio amplifier is an electronic gadget that is utilized to build the quality (plentifulness) of the sound flags that go through it. An audio amplifier increases the low power audio signals to a level which is appropriate for driving speakers. In this undertaking we have utilize a small sound enhancer IC TDA7052 with a pick up of approx. 50 dB.

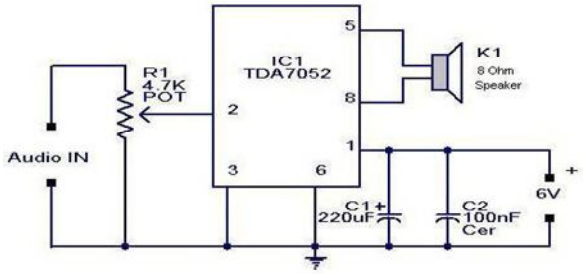

Fig 9: Circuit of audio amplifier

III. RESULT

The sound documents were recorded in APR. At the point when any of the APR switch was squeezed the LED began squinting. This flickering of LED demonstrates that the sound record is getting transmitted. Presently, when the beneficiary module is gotten observable pathway of the transmitter, photodiode gets the sound documents and sends to the speaker with the assistance of PIC microcontroller. The scope of sound transmission was tried to be around 25-40 m. This is so on the grounds that after this separation the light gets scattered and couldn't fall appropriately on the photodiode. The underneath table is a correlation between Wi-Fi and Li-Fi.

Feature	Wi-Fi	Li-Fi
Technology	WLAN 802.11a/b/g/n/ac/ad standard compliant devices	Present IrDA compliant devices
Frequency of operation	2.4GHz, 4.9GHz and 5GHz	10 thousand times frequency spectrum of the radio
Coverage distance	About 32 meters (WLAN 802.11b/11g), vary based on transmit power and antenna type	About 10 meters
Data density	Works in less dense environment	Works in high dense environment
Privacy	RF signal can not be blocked by the walls and thus need to employ techniques to get secure data transfer.	light is blocked by the walls and thus will provide more secure data transfer

IV. CONCLUSION

Li-Fi has an extraordinary potential in the field of short range remote correspondences. Unmistakably, we could find in this undertaking how proficiently and viably sound can be transmitted utilizing VLC. Same way it can be utilized to transmit information also. Consequently, it a viable trade for the existing innovations like Wi-Fi. Not just the nature of sound transmission is great yet in addition the range is great. In our proposed demonstrate we could adequately transmit it to a scope of 15-20 m. In this way, if more research is done in this field and this innovation is put into undeniable down to earth utilization, each LED can be utilized like a Wi-Fi hotspot. Just by utilizing a road light we can give web get to. Also, this Li-Fi innovation can be utilized to conquer different downsides of existing advancements like, bring down transfer speed, less information rates, uncertainty of information and so forth. Likewise this innovation is very useful in places like clinics, planes where utilization of radio waves is disallowed. However, the main disadvantage of this innovation is that it chips away at observable pathway. By one means or another, this can likewise be overwhelmed by utilization of more LED‟s in a steady progression, since it is less expensive than Wi-Fi switches

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