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## Li-Fi BASED SECURITY SYSTEM FOR DEFENSE AND COMMERCIAL PURPOSE

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**Abstract:** This project initialize the digital communication using the visible light and that must be reliable, So it must be secured, less expensive and ecofriendly. The proposed system with following devices in transmitting section using pic16f877a microcontroller along with this a high bright led light is used as the medium of transmission the transistor Bc547 is used along the led light for switching 5v to 12v. when an data is given to the PC micro controller starts to read the data and then it converts the normal data into the binary data that is the data is encrypted then it passes as digital pulse into the led. The led starts flickering the data will transmit on the receiver the photo diode starts to detect the light and generates the electric pulse these pulse will reach the amplifier for processing and then the processed data is reach the Arduino the data is visible on the serial monitor of the Arduino IDE. The line of sight is more important in this transmission, which is more important but there is interference with other light darkroom is better result.

### I. INTRODUCTION

Li-Fi stands for Light Fidelity, Visible light communication is the one of fastest way of communication to the modern world. This system is proposed by the German Physicist Harald Hass in 2011, Li-Fi is the wireless communication technology in which the data transmission is done by the led lamps and on the receiver section is with either a photodiode or a solar panel. It is mainly used in the high security military areas, where RF communication is prone to eaves dropping. In place of Wi-Fi modems, Li-Fi would use transceivers fitted with LED lamps that could light a room as well as transmit and receive information. This system mostly solved the problems like lack of radio spectrum, Space and low internet connection speed and also, we can migrate to greener, cleaner, safer communication networks. In place of Wi-Fi modems, Li-Fi would use transceivers fitted with LED lamps that could light a room as well as transmit and receive information. For better, efficient, secure and a faster connection Li-Fi is used. One of the advantages of using Li-Fi over Wi-Fi is that it avoids radiation produced by Wi-Fi. Li-Fi can play a major role in relieving the heavy loads which the current wireless system is facing.

**KEYWORDS:** PIC Micro Controller, Photo Diode, Arduino Boards.

### 1.1 ADVANTAGES OF Li-Fi

Li-Fi, which uses visible light to transmit signals wirelessly, is an emerging technology poised to compete with Wi-Fi. Also, Li-Fi removes the limitations that have been put on the user by the Radio wave transmission

- **Efficiency:** Energy consumption can be minimised with the use of LED illumination which are already available in the home, offices and Mall etc. for lighting purpose. Hence the transmission of data requiring negligible additional power, which makes it very efficient in terms of costs as well as energy.
- **High speed:** Combination of low interference, high bandwidths and high-intensity output, help Li-Fi provide high data rates 1Gbps or even beyond.
- **Availability:** Availability is not an issue as light sources are present everywhere. Wherever there is a light source, there can be Internet. Light bulbs are present everywhere – in homes, offices, shops, malls and even planes, which can be used as a medium for the data transmission.

- **Cheaper:** Li-Fi not only requires fewer components for its working, but also uses only a negligible additional power for the data transmission.
- **Security:** One main advantage of Li-Fi is security. Since light cannot pass through opaque structures, Li-Fi internet is available only to the users within a confined area and cannot be intercepted and misused, outside the area under operation.
- Li-Fi technology has a great scope in future. The **extensive growth** in the use of LEDs for illumination indeed provides the opportunity to integrate the technology into a plethora of environments and applications.

## CHAPTER II METHODOLOGY

### Block Diagram

#### Li-Fi Transmitter

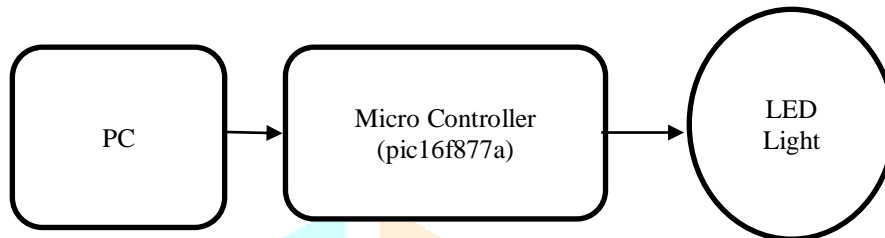


Fig2.1: Transmitter Section (TX)

#### Li-Fi Receiver

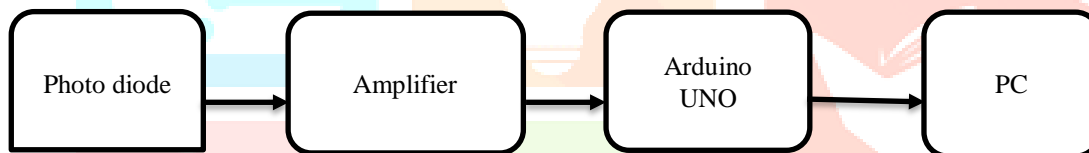


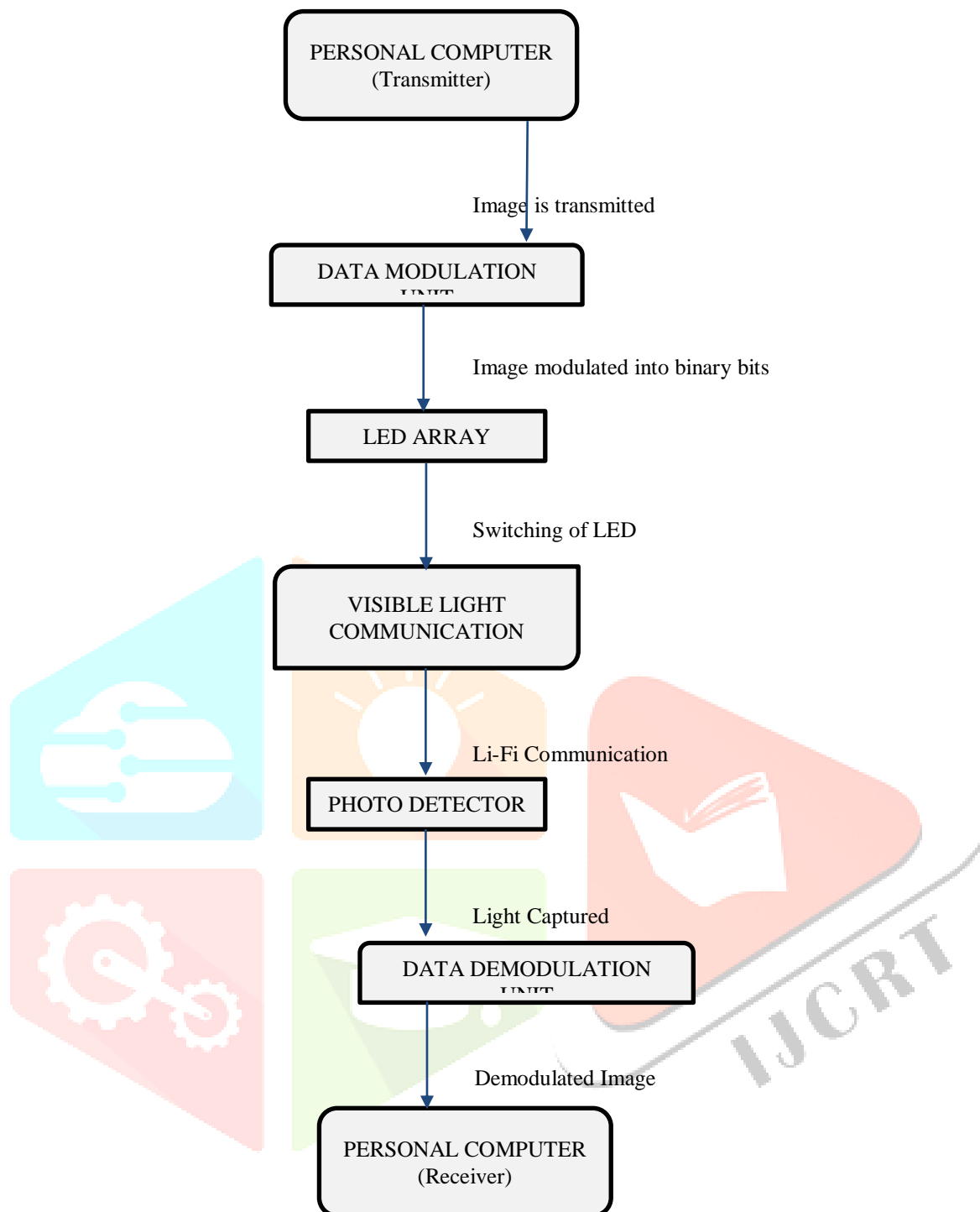
Fig2.2: Receiver Section (RX)

### 2.3Block diagram Description

The above fig 4.1.1 shows the block diagram for the implementation of Li-Fi transmitter, initially the led plays a major role in this radiation less communication and this system proposes the transmitting of data from one PC to another PC. The data from microcontroller is converted into the binary data that's 1's and 0's this digital signal make the led to start switching on/off the data starts transmitting and coming to the receiver section fig 4.1.2 the photo diode detects the transmitted light is illuminated on receiver side which is the photo diode, The information received in the photo diode is converted to electric pulses the comparator circuit using OPAMP reduces the noise data and Then the signal is fed to digital signal modulator which separates data signal and carrier signals. Thus obtained demodulated data signal is given to microcontroller for reframing and then send it to receiver pc serial communication port the data is visible on Arduino IDE serial monitor.

There may be a number of receivers at the receiver side to identify the exact receiver an method is used here is known as steganography, It is the process of embedding a secret message into normal message in the electrical signal carries the integer values of each pixel for image transmission the baud rate is more important on both these section. The image reconstruction from pixel the dimension of the image, the encrypted will reconstructed we will get it correctly if only there is no dispersion and interference from the outside light the data is decoded using the seed value and the private key on the receiver.

## 2.4 FLOW CHART



This proposed system when the data is given in the PC the micro controller starts to read the data and converts it to the binary data (Encrypted data) this is a modulation unit the converted data is transferred through led, The led starts flicker the data has been transferring and on the receiver section the light fall on the photo diode it will send the electric signal to the amplifier to process the data into binary that is decoding the data to its original state which is send to Arduino and the data gets read and see on the serial monitor of the Arduino IDE. The modulation signals is used to switch LED at desired frequencies that contains information to be transmitted. There are several technique of modulation in Li-Fi. Modulation techniques is needed in order the communication is still available even the illumination is not required. Because of that, a modulation technique may support a dimmable illumination.

The variation in intensity of light corresponding to the information in the message signal. There are many typical of modulation in Li-Fi. Single Carrier Modulation (SCM), Multiple Carrier Modulation (MCM), and Color Modulation.

Single Carrier Modulation (SCM) SCM is a modulation multiplexed any number of signal, then modulated individually with different frequency. SCM using a microwave as a subcarrier and an optical carrier. Modulation technique in SCM are on-off keying (OOK), pulse-position modulation (PPM), and pulse-amplitude modulation (PAM). SCM is suitable for low-to- moderate data rates applications.

Multiple Carrier Modulation (MCM) Because of the performance of SCM degrades as their spectral efficiency increase. SCM also require complex equalization process when employed at high data rates. MCM is developed to replace the disadvantage of SCM.

## HARDWARE AND SOFTWARE DESCRIPTION

### 3.1 HARDWARE COMPONENTS

- Pic16f877a Micro controller
- Arduino
- Led light
- OP-AMP IC741
- Photo diode
- Transistor BC547

#### 3.1.1 PIC MICROCONTROLLER

The pic16f877a is a 8 bit Micro Controller and made up of RISC architecture, Which has 7k flash program memory and 20MHz crystal oscillator the operating voltage of 2-5.5v. PIC microcontroller architecture consists of some registers and stack where registers function as Random Access Memory (RAM) and stack saves the return addresses. The main features of PIC microcontrollers are RAM, flash memory, Timers/Counters, EEPROM, I/O Ports, USART, CCP (Capture/Compare/PWM module), SSP, Comparator, ADC (analog to digital converter), PSP (parallel slave port), LCD and ICSP (in circuit serial programming) The 8-bit PIC microcontroller is classified into four types on the basis of internal architecture such as Base Line PIC, Enhanced Mid-Range PIC and PIC18. In this micro controller pin 25 (RC6/TX/CK) is connected to the LED light.

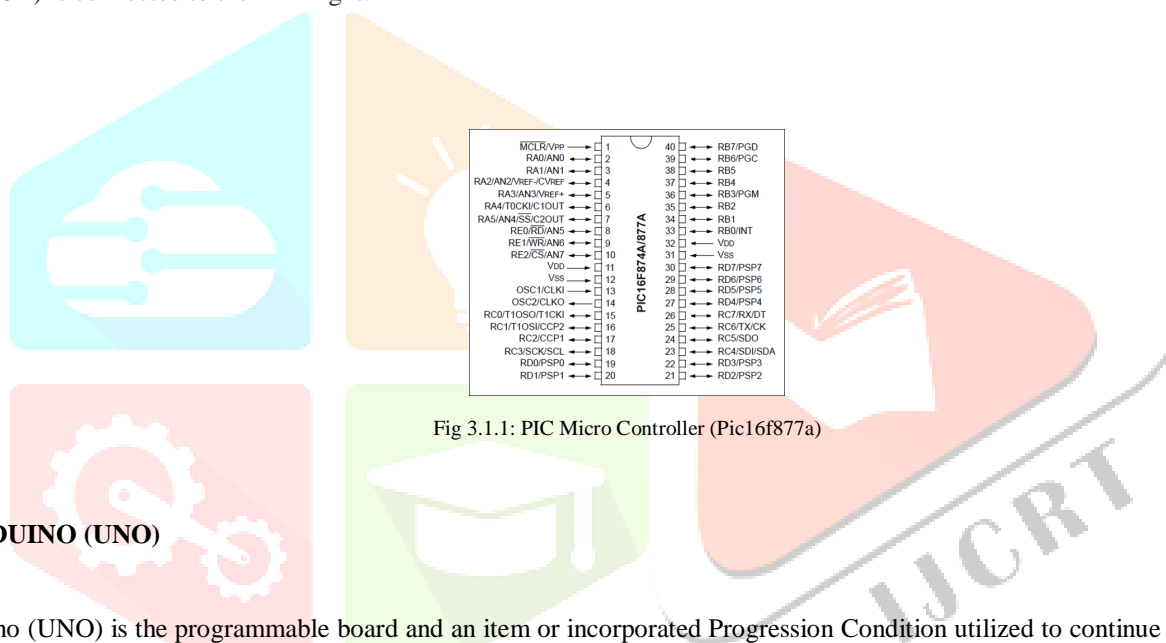


Fig 3.1.1: PIC Micro Controller (Pic16f877a)

#### 3.1.2 ARDUINO (UNO)

Arduino (UNO) is the programmable board and an item or incorporated Progression Condition utilized to continue running on the PC and it is in like manner Arduino (UNO) is a simple board controller unit for building modernized gadgets to compose program (sketches). The main reason why we use Arduino (UNO) is for easy interface of equipment and of low cost. The pin we are using here is the transmitter pin (TX) and the GND pin.



Fig 3.1.2: Arduino (UNO)

### 3.1.3 LED

Light emitting diode emits light when the energy level change in the semiconductor diode. The change in energy generates photons, some of which are emitted as light. The Solid-state design allows LEDs to withstand vibration, shocks, frequent switching and extremes environment without compromising their long useful lives are typically more than 100,000hours. A micro-LED light bulb can transmit 3.5Gbps and data rates of more than 10 GBPS are possible. The potential outcomes are immeasurable and can be investigated facilitate.

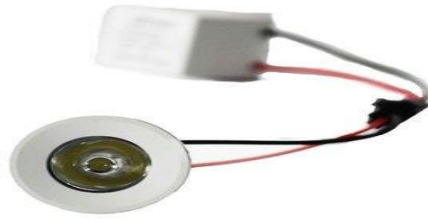
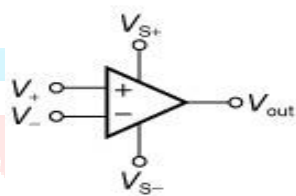


Fig 3.1.3: Led

### 3.1.4 OP-AMP IC741

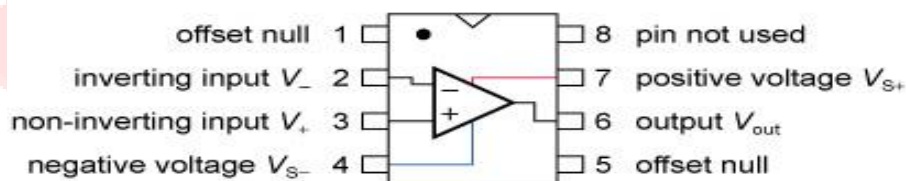
The operational amplifier is a high gain voltage amplifier with single ended output, the operating voltage range is 3v to 5v. Here the amplifier is used as a comparator for converting the received light into bits based on the threshold value.



(a)



(b)



(c)

Fig 3.1.4 OP-AMP IC741

### 3.1.5 PHOTODIODE

The photo diode is a semi-conductor material which produces the electrical energy when the photon of sufficient energy enters into the depletion region of a semiconductor diode it may strike an atom with sufficient energy to release the electron from the atomic structure. The electrons and holes may remain free and pulled away from the depletion region by an external field the photo current will be produced. Photo diode used here is BPW21 and Wavelength of Peak Sensitivity is 550nm.



Fig3.1.5: Photo Diode

### 3.1.6 TRANSISTOR

It is a low power Bipolar NPN transistor the maximum amount of the current flow through the collector pin is 100MA the transistor as a switch circuit is used along with the light emitting diode the transistor used here is Bc547, by using this circuit to step up 5V to 12v. This 12v is fed to the led.



Fig 3.1.6: Transistor Bc547

## 4.2 SOFTWARE DESCRIPTION

### 4.2.1 MPLAB IDE

MPLAB Integrated Development Environment (IDE) is a free, integrated toolset for the development of embedded application employing the microchip. By using this software the embedded C language is used to program the Micro Controller. This also supports assembly language which is consist of simple 35 instruction set. MPLAB IDE run as 32 bit application on micro soft windows, is easy to use and includes a host free software components for fast application development and also a super-charged debugging. MPLAB IDE also serves as single, unified graphical user interface for additional microchip and third-party Software and hardware development tools. Moving between tools is snap and upgrading from the free software simulator to hardware debug and programming tools.

### 4.2.2 ARDUINO IDE

The Arduino integrated development environment (IDE) is across platform application that is written in the programming language java. It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting and provides simple one click mechanism to compile and upload program to an Arduino board. The source code for the IDE is released under the GNU. The Arduino IDE employs the program to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a program in the board's firmware. The Arduino IDE supports C and C++ languages using special rules for code reconstructing.

## V. RESULTS AND DISCUSSION

The Li-Fi based security system for defense and commercial purpose the using the Pic microcontroller and Arduino is tested successfully. Encoding should be done before transmission. So a secret text file is also loaded after setting the baud rate. The transmitter circuit is connected and seed value for encoding should be entered. In order to identify the sender of the information, the MAC address of the sender PC is captured from the sending device. To transmit and encode the text file into the image file. It is possible to encode an image file within an image file. Before the transmission starts, set the receiver ready for reception, the decoder side set the same baud rate and seed value the flickering of the LED light is visible to the human eye. This is due to the transmission of the data from one system to the other and the experimental setup of the transmitter is shown in the Fig 5.1.1 and Receiver is shown in the Fig5.1.2. This flickering effect can be eliminated by using high speed switching LEDs and increasing the baud rate, When the LED stops blinking it is clear that the complete information is transmitted successfully. Where the file which is to be send is accessed. The content of the file is sent to microcontroller from the serial drive through serial communication. The microcontroller converts ASCII to binary and sends the data to the LED for transmission... The transmitted data from LED is received by the photodiode. Then the received data is given to the microcontroller and that has been visible on the PC is shown on the fig 5.1.3.

## 5.1 EXPERIMENTAL SETUP

### 5.1.1 Li-Fi Transmitter



Fig 5.1.1 (Li-Fi Transmitter)

### 5.1.2 Li-Fi Receiver

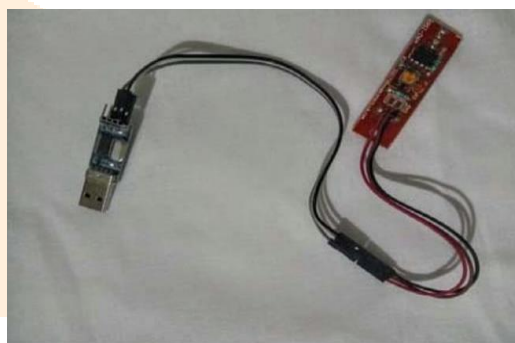


Fig 5.1.2 (Li-Fi Receiver)

### 5.1.3 Pc to Pc data transfer using Li-Fi



Fig 5.1.3 (PC to PC transfer using Li-Fi)

## VI CONCLUSION

The purpose of this project is to develop a potential alternative wireless communication in this the two-sided transmission system can transmit text and pictures successfully with Li-Fi technique. Baud rate possible for this circuitry is limited to certain Kbps. Beyond that limit the photo diode will not detect the incoming signals. Transmission of black and white images is not possible since we use random encoding in 3 layers. The baud rate of transmitter and receiver should be the same and the improvements can be made by adding focusing lens between the transmitter and the receiver. In the event that this innovation can be put into down to earth utilize, each bulb can be utilized as a light source alongside VLC based Wi-Fi hotspots Hence it is only used for broadcast purposes. The limitations of this work can be removed by using higher end device

This project conclude is to overcome the effect of radiation by using RF wave communication, The Li-Fi made the more secure way of communication, cost effective and no effect in humans health, Being a short range communication the data traffic is less and more convenient way to send and receive .By using the high end devices we can get the maximum transmission speed.

### 6.1 LIMITATIONS

- Internet cannot be accessed without a light source. This could limit the locations and situations in which Li-Fi could be used.
- It requires a near or perfect line-of-sight to transmit data.
- Opaque obstacles on pathways can affect data transmission.
- Natural light, sunlight, and normal electric light can affect the data transmission speed.
- Light waves don't penetrate through walls and so Li-Fi has a much shorter range than Wi-Fi.
- High initial installation cost, if used to set up a full-fledged data network.
- Yet to be developed for mass scale adoption.

### 6.2 FUTURESCOPE

This method of data transmission can be applied where optic fibers and radiation prohibited areas such as chemical plants. This method can be used for wireless communication such as communication between space shuttles etc. This analytic study can be used for the future development of visible light communication systems. This can be applied at the chemical plants where the RF waves and OFC cannot be used. This system you can used into the school, college, lab, hospital, aircraft, air plane, to commanding the robot, mobile to mobile communication, etc. where the RF is ban on some areas and RF is strictly unused on that range like petrol pump which is RF is cause the explosion on this areas.

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