A VLC Enabled Indoor Navigation System for Visually Impaired People

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***Abstract*-The WHO committee broadly estimated that about 10% of the world population is disabled. India is now been a home to the world's largest number of blind people. In an entire world there are 37 million people across the globe who are blind over 15 million are from India. In order to help blind people, Nowadays as our modern technology is developing people use a huge number of data to accomplish their work through wire or wireless network. In order to make easy transmission of data a new technology, Li-Fi has been evolved, where it transmits a data through LED lights in such a way that it is undetectable to human eyes. Li-Fi is a unique technology which is used in progression with WIFI (wireless fidelity) technology.**

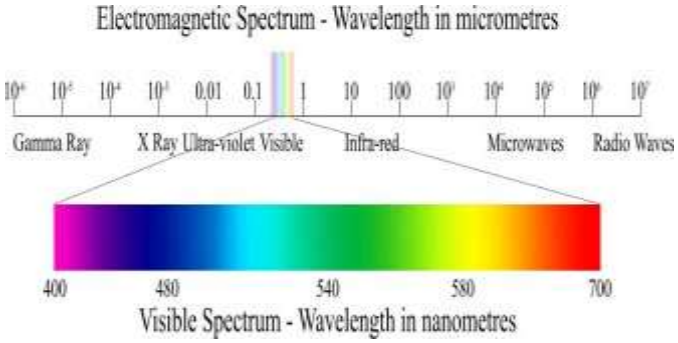
***Keywords*:--Wireless communication, Li-Fi, Led lights, Wi-fi.**

I. INTRODUCTION

Localization is one of key techniques that gain the increasing attention of researchers recent years. The location information, especially the indoor location, is important for navigation systems, heating and air conditioning systems, illumination adjustment, humidity control, robot service, and so on. Although the outdoor localization has already been well-developed using Global Positioning System (GPS), using GPS for indoor location sensing is difficult due to the poor coverage of satellites in indoor environments. To determine the indoor locations of mobile users, a number of techniques have been proposed and studied, most based on triangulation, fingerprinting, scene analysis, and proximity.

The goal of this work is to allow the visually impaired persons navigate independently in the indoor environment. Conventional navigational systems in the indoor environment are expensive and its manufacturing is time consuming. The visually impaired are at considerable disadvantage as they often lack the information needed while passing obstacles and hazards. They have relatively little information about land marks, heading and self-velocity information that is essential to navigate them successfully through unfamiliar environments. In this modern world providing security to each and every human being in life gains a major consideration. Everyone has realized the need to secure themselves against hazards and unauthorized dealings. This work aims at providing the navigation for the visually impaired persons, by designing a cost – effective and more flexible navigation system. It is our belief that the recent advances in technologies could help and facilitate in day – day operations of visually impaired persons.

Visible light communication (VLC) is a modern method of wireless communication using naked light. Typical transmitters are visible light LEDs and receivers are photodiodes and sensors. Location-based services are preferred for visible light communication applications. An indoor visible data transmission system using LEDs is proposed. In this system, devices are used for illuminating rooms and also for optical wireless communication system



Visible Light Communication (VLC) using Light Emitting Diodes (LEDs) comprises Optical Wireless Communication (OWC) links using visible light spectrum, in which LEDs are used with two functions, illumination and communication, simultaneously. In VLC, communication takes place by modulating the intensity of the LED light. VLC is a category of OWC, which also includes Infrared (IR) and Ultra Violet (UV) Communications, yet VLC is particularly of interest because the same visible light used for lighting is also used for communication.

VLC is the energy saving of LED technology. Nineteen per cent of the worldwide electricity is used for lighting. Thirty billion light bulbs are in use worldwide. Assuming that all the light bulbs are exchanged with LEDs, one billion barrels of oil could be saved every year, which again translates into energy production of 250 nuclear power plants. Driven by the progress of LED technology, visible light communication is gaining attention in research and development.

II. SYSTEM IMPLEMENTATION

Working of Li-fi

LIGHT FIDELITY (Li-FI) is invented by, a German physicist professor Harald Haas at University of Edinburgh. The term Li-fi was coined by Hass when he astonished people by the movement of high transmission video from a LED lamp, at TED Global Talk on July 2011.

Dr. Hass gave an idea, about "data through illumination" where the fiber optics transforming data through a LED light bulb that varies intensity. Li-fi is typically implemented using white LED light bulbs these gadgets are generally used for illumination by applying a constant current through LED. The optical output can be made to vary at extremely high speeds which are unseen to the human eyes. Nearly around 600TB of data will be transmitted by cell phones, However there are more than 5 billion mobile phones, accordingly have 1.4 million cellular mast radio wave base stations which have been deployed. Prof. Haas also introduced the idea of "Wireless data from every light".

In Present scenario wireless communication uses radio waves. Spectrum is necessary for wireless communication. With the modern technology and the number of users, the existing radio wave spectrum fails to resolve the issues of durability, availability, scalability and security, we have come up with new technology of transmitting data wirelessly through LEDs, which is called as Li-Fi.

Li-Fi is a modern technology which helps in the transmission of data much more faster and flexible than Wi-Fi technology. At the heart of this technology, a new generation of high-brightness light-emitting diodes. Very simply, if the LED is ON, user can transmit a digital string of 1, if it's OFF then user can transmit a string of 0. It can be switched ON and OFF very quickly, which gives instant opportunity for transmitting data. It is possible to encode data in the light by varying the rate at which the LEDs flicker ON and OFF to pass different strings of 1s and 0s. The modulation is so fast that the human eye doesn't notice. There are over 14 billion light bulbs used across the world, which needs to be replaced with LEDs ones that transmit data.

III. BLOCK DIAGRAM

In order to augment a visually impaired person's pedestrian experience and help them travel comfortably in known and unknown environments, the navigation system should provide enough information to give him a whole picture of the environment and deliver the information along the visually impaired person's path in real time through auditory cues.

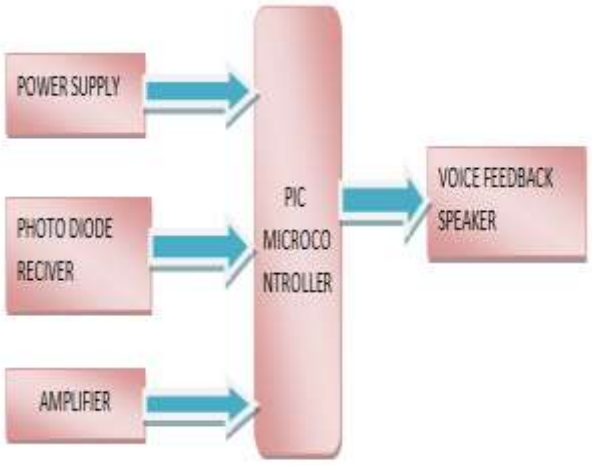


Fig: Block Diagram of Receiver

The environment may include various scenarios such as crowded walkways, infrastructures, daily routine usable things etc. In sample indoor environment it consists of a kitchen, a living room, a bedroom and a bathroom. The proposed system shows how to use voice command to switch

from one navigation to indoor navigation when the visually impaired person first enters the smart house and illustrates the sample communication between the user and the system. The system introduces the indoor facility to give the user a broad picture of the indoor environment. While the user is walking, he may request the current location and ask for the optimal route to get to a destination. With the user's current position a step-by-step guidance is provided with the orientation and angles the user should turn.

Transmitter Module – generates the corresponding on-off pattern for the LEDs.

Receiver Module – has a photo diode to detect the on and off states of the LEDs. It captures this sequence and generates the binary sequence of the received signal. A typical optical receiver's front end consists of a photo detector (PD) followed by an amplifier and a limiting amplifier (LA). The rest of a basic software-defined-radio (SDR) receiver includes an analogue-to-digital converter and a digital signal processing unit.

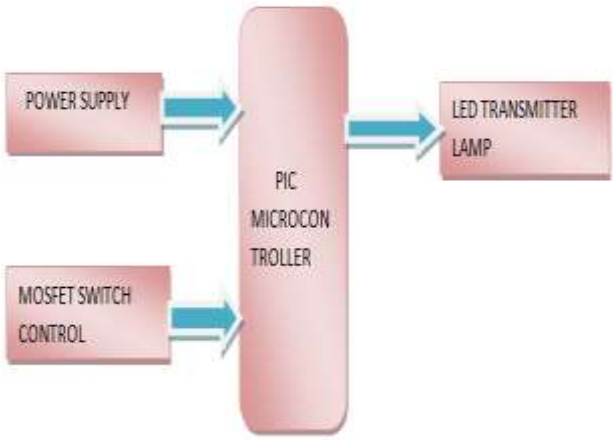
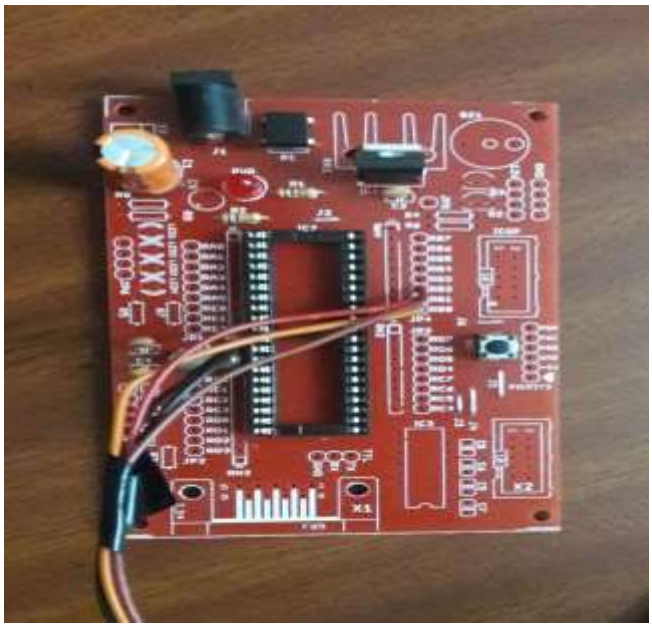


Fig: Block Diagram of Transmitter

A. Components required

1. PIC Microcontroller

PIC16F877 is one of the most advanced microcontrollers from Microchip. This controller is widely used for experimental and modern applications because of its low price, wide range of applications, high quality, and ease of availability. It is ideal for applications such as machine control applications, measurement devices, study purpose, and so on. The PIC 16F877 features all the components which modern microcontrollers normally have. The figure of a PIC16F877 chip is shown below.



2. Crystal Oscillator 2MHz

A crystal oscillator is an electronic oscillator circuit that uses the mechanical resonance of a vibrating crystal of piezoelectric material to create an electrical signal with a precise frequency. This frequency is commonly used to keep track of time, as in quartz wristwatches, to provide a stable clock signal for digital integrated circuits, and to stabilize frequencies for radio transmitters and receivers. The most common type of piezoelectric resonator used is the quartz crystal, so oscillator circuits incorporating them became known as crystal oscillator, but other piezoelectric materials including polycrystalline ceramics are used in similar circuits.

3. AC to Dc Converter

230V AC power is converted into 12V AC (12V RMS value wherein the peak value is around 17V), but the required power is 5V DC; for this purpose, 17V AC power must be primarily converted into DC power then it can be stepped down to the 5V DC. But first and foremost, we must know how to convert AC to DC, AC power can be converted into DC using one of the power electronic converters called as Rectifier. There are different types of rectifiers, such as half-wave rectifier, full wave rectifier and bridge rectifier. Due to the advantages of the bridge rectifier over the half and full wave rectifier, the bridge rectifier is frequently used for converting AC to DC.

4. Voltage Regulator LM 7805

The LM7805 is a monolithic 3-terminal positive voltage regulators employ internal current-limiting, thermal shutdown and safe-area compensation, making them essentially indestructible. If adequate heat sinking is provided, they can

deliver over 1.5-A output current. They are intended as fixed voltage regulators in a wide range of applications including local (on-card) regulation for elimination of noise and distribution problems associated with single-point regulation. In addition to use as fixed voltage regulators, these devices can be used with external components to obtain adjustable output voltages and currents.

5. Photo diode

Silicon photodiodes are semiconductor devices responsive to high-energy particles and photons. Photodiodes operate by absorption of photons or charged particles and generate a flow of current in an external circuit, proportional to the incident power. Photodiodes can be used to detect the presence or absence of minute quantities of light and can be calibrated for extremely accurate measurements from intensities below 1 pW/cm2 to intensities above 100mW/cm^2. Silicon photodiodes are utilized in such diverse applications as spectroscopy, photography, analytical instrumentation, optical position sensors, beam alignment, surface characterization, laser range finders, optical communications, and medical imaging instruments.

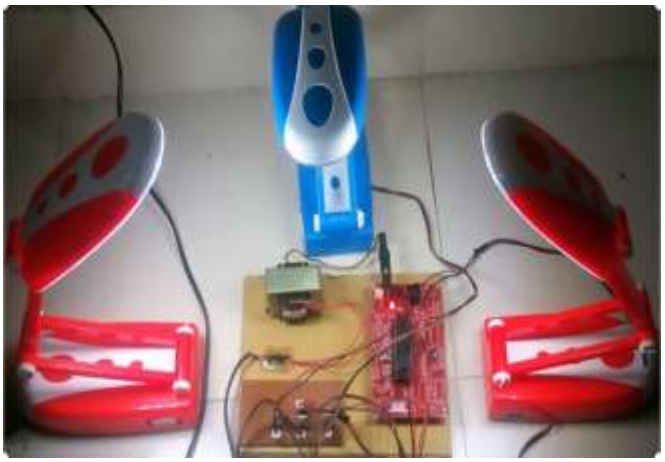
IV. CONTROL SOFTWARE

After the text edit has been completed, the paper is ready for the template. Duplicate the template file by using the Save As command, and use the naming convention prescribed by your conference for the name of your paper. In this newly created file, highlight all of the contents and import your prepared text file. You are now ready to style your paper; use the scroll down window on the left of the MS Word Formatting toolbar.

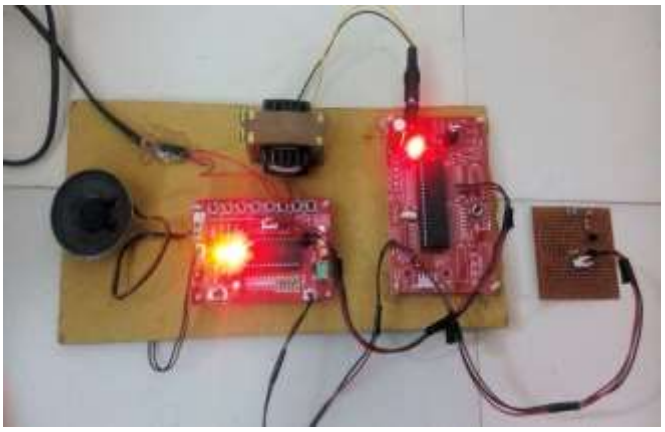
V. RESULTS

The transmitter part consists of PIC16877A microcontroller, LED lights, Transformer, Mosfet Driver circuit. The MOSFET driver circuit specifies the three locations which has to be identified. As power supply is given to the module the LED lights on. As the blind person comes in contact with the LED light of a particular room a voice message is to the person intimating the person about his location through the voice playback kit.

The receiver part consists of voice play back system, transformer, microcontroller and MOSFET driving system with photo diode and speaker. In this the location information will be differentiated with respect to different partition of the indoor system. And in the voice kit the particular location voice will be recorded .As photodiode comes in contact with the transmitter led light the voice is transmitted and it is received by photodiode and the voice is sent to the blind person regarding his/her location. In this way a blind person can come to know about his/her whereabouts.



Transmitter Section of Proposed System



Receiver Section of Proposed System

VI. CONCLUSION

The use of Li-fi technology gives a golden opportunity to replace or to give alternative to the radio based wireless technologies For future short range applications and VLC present a viable and promising supplemental technology to radio wireless systems. Although there are many challenging issues, VLC remains one of the most promising technologies in the future. The blind person navigation system helps blind person by indicating them with a voice message whenever a person enters the room. This will inform the blind people about the person who has entered into the room. In existing system, the reliability is poor, data can be easily hacked. This method provides a cheap and highly reliable way transmit data securely. Hence this method can be implemented to transfer data. The proposed method can be integrated into medical devices and in hospitals as it can easily used in navigation beacons.

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