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LI-FI BASED BLIND INDOOR NAVIGATION SYSTEM

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ABSTRACT

LIGHT FIDELITY is popularly known as Li-Fi. Li-fi that is based on the visible light spectrum is being designed. This project uses a 12 V LED and a solar panel to transmit and receive data respectively. Li-fi can be compared with the existing wireless technology i.e. Wi-Fi in terms of speed and security which the former provides better. The aim of this project is to support visually impaired people who travel indoors.This project mainly deals with the transmission of audio, automatic switching of fan and also obstacle detection using a setup of PIC microcontrollers, 12 V LED, Ultrasonic sensor and Solar Panel. The 16*2 LCD Display is used to monitor about the status of the data.

KEYWORDS: Li-Fi, Wi-Fi, LED,LCD Display, PIC Microcontroller, Ultrasonic sensor.

INTRODUCTION

Nowadays Wi-Fi is widely used in all the public areas like home, cafes, hotels, airports. Due to this radio frequency is getting blocked day by day, at the same time usage of wireless data is increasing exponentially every year .Transfer of data from one place to another is one of the most important day-to-day activities. The current wireless networks that connect us to the internet are very slow when multiple devices are connected. 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. LED's are the mediators to transfer the data for Li-Fi technology. when

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compared to Wi-Fi, It has high speed and low cost. Main attractions are high security, large bandwidth. Li-Fi uses common household LED light bulbs (used for illumination) to enable data transfer.
The light reaches everywhere and if certain information is to be passed using light as a medium, not only will the communication get fast but also the possibilities coming with it. Such a technique of using Light as a medium is named as the Li-Fi.Visible Light Communication has been broadly studied as a promising Technology, predominantly in the indoor environments.In today's world we use various technologies for navigation like GPS, voice navigation, guide dogs etc. Most of these can also be used by the visually impaired people for navigating outdoors.

OBJECTIVES

The main objective of this project is to create internal navigation system for the blind people using light source.

LITERATURE SURVEY

SandipJadhav, AniketRathod, VikramShinde, Mrs.PriyankaPatil," Li-Fi based blind indoor navigation system", International Research Journal of Engineering and Technology, Volume:05 Issu:04|Apr-2018.The main aim of this paper is to create internal navigation system, using Arduino software and Arduino hardware. The transmission of data can act as transceiver, where LED and photodiode were in same line of sight. The light from the LED is detected by using photodiode and the data is send to the Arduino. Therefore, by using this system, we can obtain a better speeds than WI-FI. The radio band crisis problem can also be solve by employing the further existing system with this technology. It is for visually impaired using Li-Fi technology.

Isabella A. Mariya, Angelina G. Ettiyil, Amalu George, Sri Nisha, Iwin Thankakumar Joseph,"Li-Fi Based Blind Indoor Navigation System"published in 2019 5th International Conference on Advanced Computing & Communication Systems (ICACCS).Usage of LED lights reduces 50% of total energy consumption. This can facilitate a future that is in front of us i.e. Li-Fi. This technology is used for transmitting data through VLC Communication. Visually challenged persons can be benefited by using this technology as it can guide them in an indoor system. The data transmission occurs only when a person has entered the room. It guides the person inside the room to walk confidently with the knowledge of each and every obstacle with the help of audio feedback. Comparatively, Li-Fi offers much higher speed of communication than Wi-Fi.

S,Subhashreddy, Y.BhaskarRao, "Indoor navigation system for blind people using VLC',International Journal of Engineering & Technology.They proposed an indoor navigation system that utilizes visible light communication technology, which employs LED lights and a geomagnetic correction method, aimed at supporting visually impaired people who travel indoors. To verify the effectiveness of this system, we conducted an experiment targeting visually impaired people. Although acquiring accurate positional information and detecting directions indoors is difficult, we confirmed that

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using this system, accurate positional information and travel direction can be obtained utilizing visible light communication technology, which employs LED lights, and correcting the values of the geomagnetic sensor integrated in a Smartphone.

Bing Li, Juan Pablo Muñoz, Xuejian Rong, Qingtian Chen, Jizhong Xiao, Yingli Tian, Aries Arditi, Mohammed Y, "Vision-Based Mobile Indoor Assistive Navigation Aid for Blind People",published in: IEEE Transactions on Mobile Computing ,Volume: 18, Issue: 3, March 1 2019.This paper presents a new holistic vision-based mobile assistive navigation system to help blind and visually impaired people with indoor independent travel. The system detects dynamic obstacles and adjusts path planning in real-time to improve navigation safety. First, we develop an indoor map editor to parse geometric information from architectural models and generate a semantic map consisting of a global 2D traversable grid map layer and context-aware layers. By leveraging the visual positioning service (VPS) within the Google Tango device, we design a map alignment algorithm to bridge the visual area description file (ADF) and semantic map to achieve semantic localization. Using the on-board RGB-D camera, we develop an efficient obstacle detection and avoidance approach based on a time-stamped map Kalman filter (TSM-KF) algorithm. A multi-modal human-machine interface (HMI) is designed with speech-audio interaction and robust haptic interaction through an electronic SmartCane. Finally, field experiments by blindfolded and blind subjects demonstrate that the proposed system provides an effective tool to help blind individuals with indoor navigation and wayfinding.

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Mounir Bousbia Salah, Redjati Abdelghani, Mohamed Fezari**, "**An Ultrasonic Navigation System for Blind People**",** published in2007 IEEE International Conference on Signal Processing and Communications (ICSPC 2007), 24-27 November 2007, Dubai, United Arab Emirates. The aim of this paper is to investigate the development of a navigation aid for blind and visually impaired People. It is based on a microcontroller with synthetic speech output. This aid is portable and gives information to the user about urban walking routes to point out what decisions to make. On the other hand, and in order to reduce navigation difficulties of the blind, an obstacle detection system using ultrasounds and vibrators is added to this device. The proposed system detects the nearest obstacle via streoscopic sonar system and sends back vibro-tactile feedback to inform the blind about its localization.

Deepika D Pai, "Advantages and Limitations of Li-Fi over Wi-Fi and iBeacon Technologies",International Journal of Innovative Research in Electrical, Electronics, Instrumentation and control engineering, vo. 4, issue 11, November 2016.Light is inherently safe and can be used in places where radio frequency communication is often deemed problematic. The visible light spectrum is unused; it's not regulated and can be used for communication at very high speed. This paper compares the LI-Fi technology with Wi-Fi.

EXISTING SYSTEM

The existing system provide an assistive technology for blind and visually impaired individuals by exploiting the power of smart phones, which are existing, popular, and often used by blind individuals.

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Our proposed system provides a novel navigation system that operates on smart phones and provides a route to any destination in a building from the user's current position[4].

The navigation system enables users to imagine the map of the rooms (dimensions, relative position of points of interest). This information is stored in RFID tags in WAP Binary extensible Markup Language (WBXML) format. The system allows leaving audio messages that are recorded in RFID tags in Adaptive Multi Rate (AMR) format. Voice enabled navigation, that is familiar to users with visual disabilities, is used.

Another researchers propose an RFID-based system for navigation in a building for blind people or visually impaired. The system relies on the location information on the tag, a user's destination, and a routing server where the shortest route from the user's current location to the destination. The navigation device communicates with the routing server using GPRS networks[5]. We build a prototype based on our design and show some results. We found that there are some delay problems in the devices which are the communication delay due to the cold start cycle of a GPRS modem and the voice delay due to the file transfer delay from a MMC module.

Drawbacks of the existing systems

1. The systems are bulky and are not portable where in these cannot be carried easily anywhere, any time.
2. Requires more hardware, which in turn increases the implementation cost.
3. The systems did not provide a complete kit solution to the existing problem.
4. As we can see above the entire systems are separated with each other and lack the feature of one stop solution to the problems faced by the blind person.

MERITS AND DEMERITS

Merits

- The data transfer rate for internet application is higher.
- It provides high amount of security as data communication is line of sight (LOS). Moreover lifi signal covers low region does not pass through the walls. This will avoid unwanted access of lifi signal by unauthorized persons.
- The lifi devices consume low power for operation and hence used in IoT applications.
- It uses optical spectrum and hence avoids already crowded RF spectrum.
- The speed of data provide by these LEDs is 100 times faster than the WiFi speed.
- It is very efficient in terms of cost and energy.
- Unimpeded by radio interference.

Demerits

- Internet cannot be used without a light source.
- A whole new infrastructure for Li-Fi would need to be constructed.

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- Internet can be used only where light of source device is available. Moreover light can not penetrate from walls and it works only in line of sight path. This limits access of internet whereever one requires. Moreover its range is limited.

METHODOLOGY

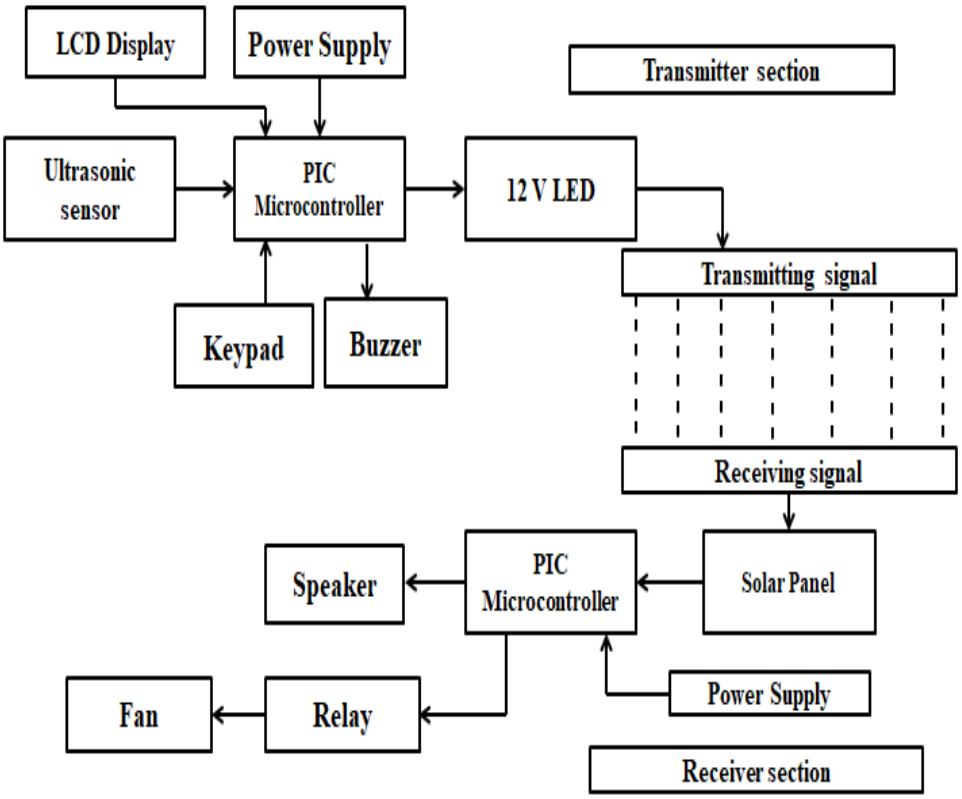
Transmitter section

- In this section, we are using PIC microcontroller which is interfaced with Keypad, LCD Display and Ultrasonic sensor.
- Keypad is having control on the fan which is in the receiver section and Ultrasonic sensor which detects the obstacles.
- Here 12 V LED acts as a transmitter.

Receiver section

- Here solar panel acts as a receiver.
- Another PIC microcontroller is connected with the speaker and fan.
- When microcontroller receives the signal from the transmitter section, the speaker will play the audio and the fan will be automatically switched on.

BLOCK DIAGRAM



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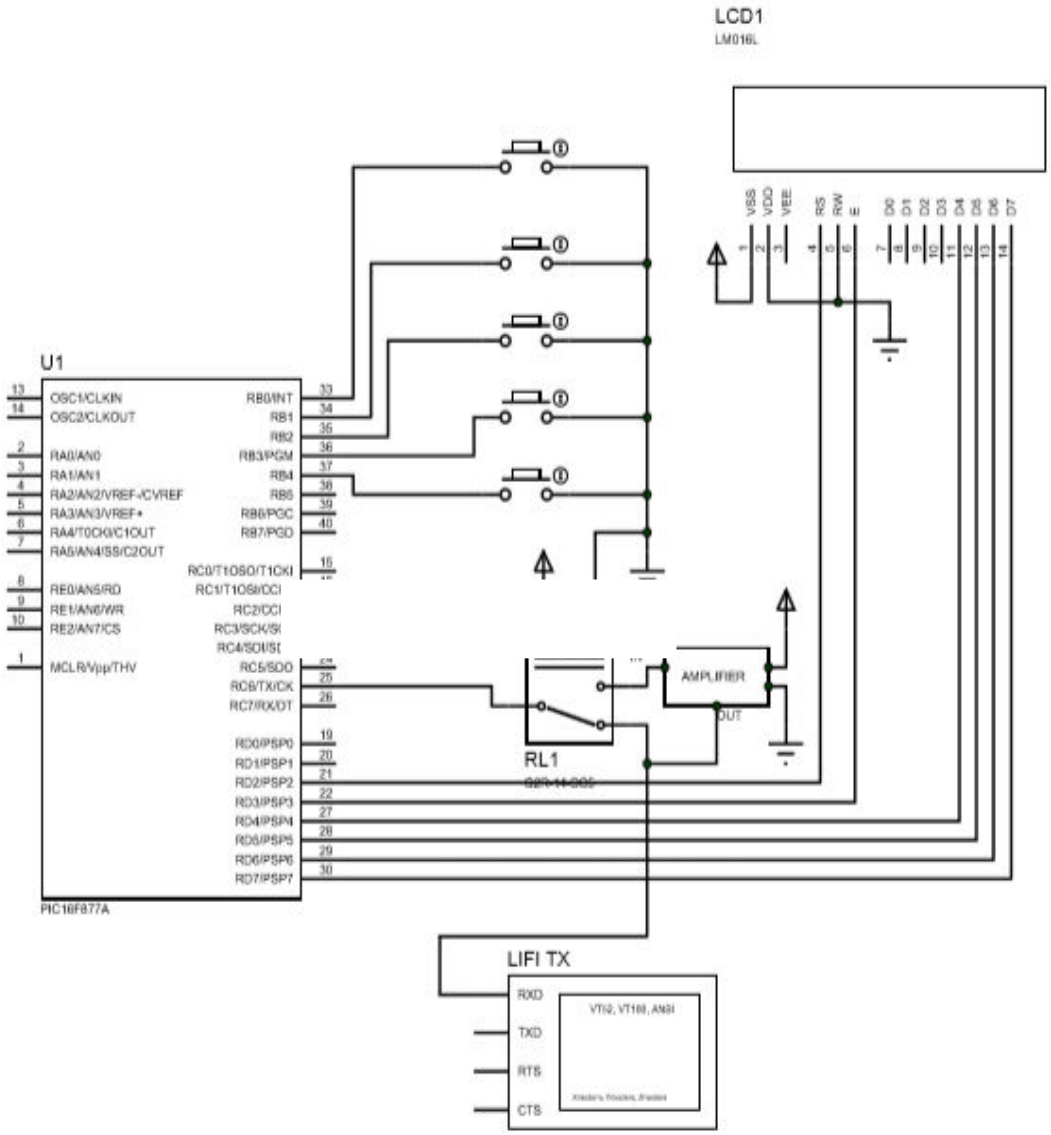
CIRCUIT DIAGRAM



Transmitter Section

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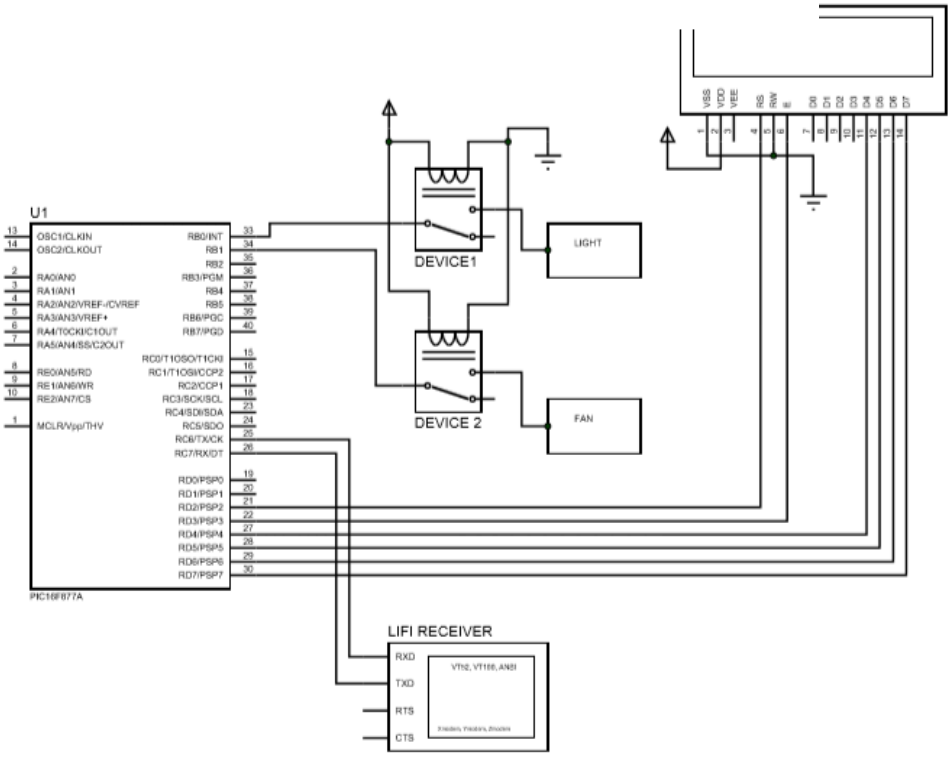

Receiver Section

WORKING AND APPLICATIONS

Working

The working is as follows:

- Power supply is given to the PIC Microcontroller.
- In transmitter section PIC Microcontroller is interfaced with Ultrasonic sensor, Keypad and the LCD display.
- Ultrasonic Sensor is used to detect the obstacles in front of the blind person.
- If there is any obstacles in front of blind person, it will give a buzzer sound.
- LCD display is used to monitor whether the data is received or not.
- The text displayed in the LCD will be like “Waiting for data”, “Data Sent”, “Data Received”.
- When the blind person presses the button in the keypad, the fan which is in the receiver section will be automatically switched on.
- The data will be sent from the PIC Microcontroller to the 12V LED Lamp.
- Using this light source the data will be transmitted, and the data will be received by the solar panel.
- In receiver section another PIC Microcontroller is used. Power supply is given to it.
- This PIC Microcontroller is connected with the fan and the speaker.

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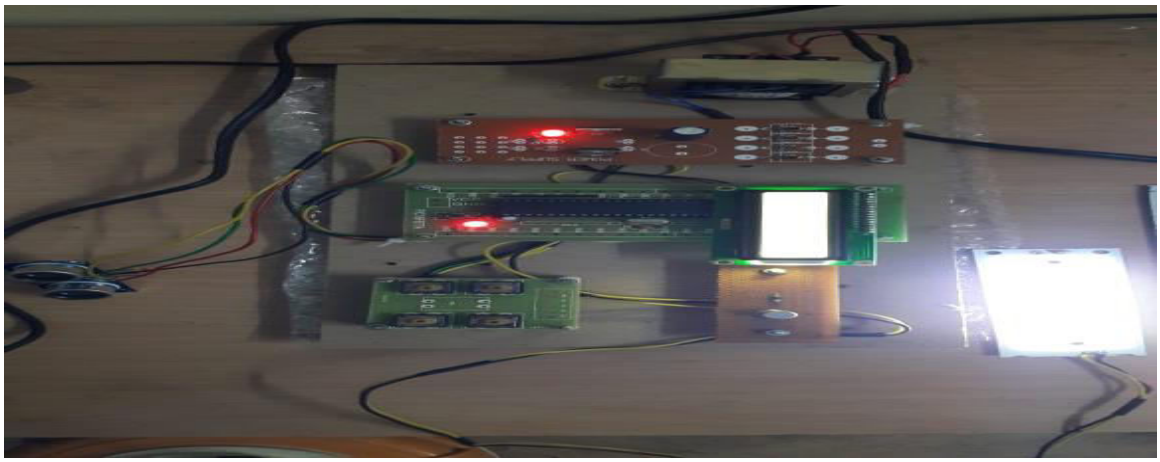
- The purpose of the speaker is to guide the blind person. For example if the blind person enters any of the room like if he/she enters living room the audio will be like "This is Living Room".

Applications

- Security. In a meeting room environment, the access area of each channel is the width of the light pool, and can be accessed by multiple users.
- Dense urban environments.
- Cellular communication.
- EMI sensitive environments.
- Augmented reality.
- Localized advertising.
- Underwater communication.
- Safety environments.

RESULTS



Transmittersection

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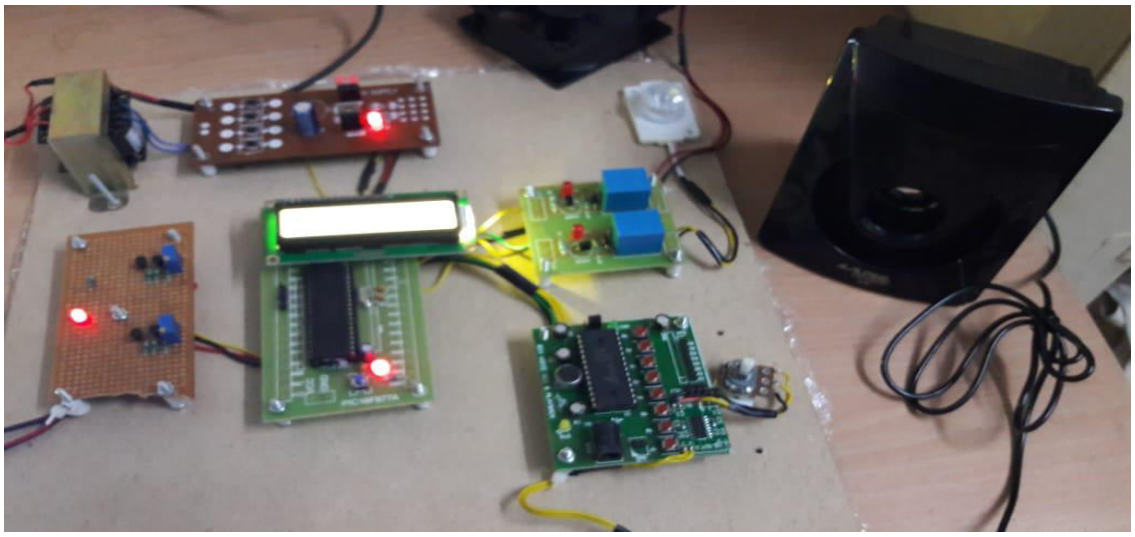
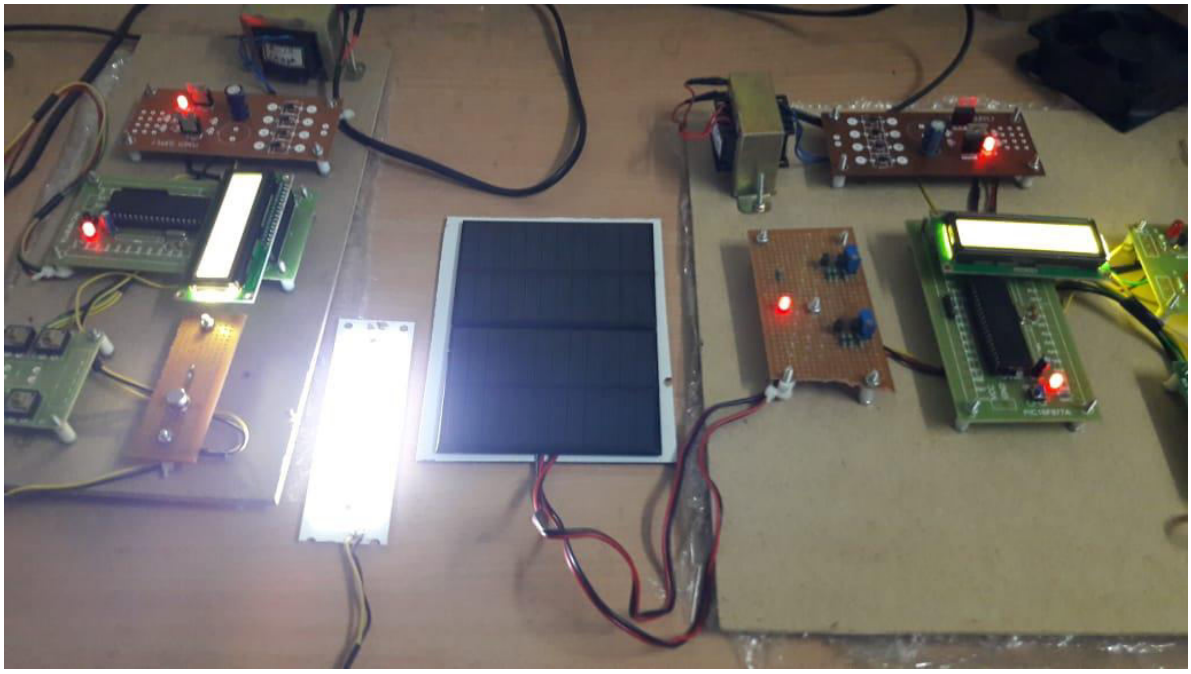


Receiver section



Hardware connection

CONCLUSION AND FUTURE SCOPE

Conclusion

The use of li-fi technology stretches a golden opportunity to swap or to give alternate to the radio based wireless technologies for future short range applications and VLC present a viable and promising extra technology to radio wireless systems.Although there are many thought-provoking issues, VLC remains one of the most capable technologies in the future. In existing system, the reliability is poor, data can be easily hacked. This method provides a cheap and highly reliable way transmit data securely. Wi-Fi

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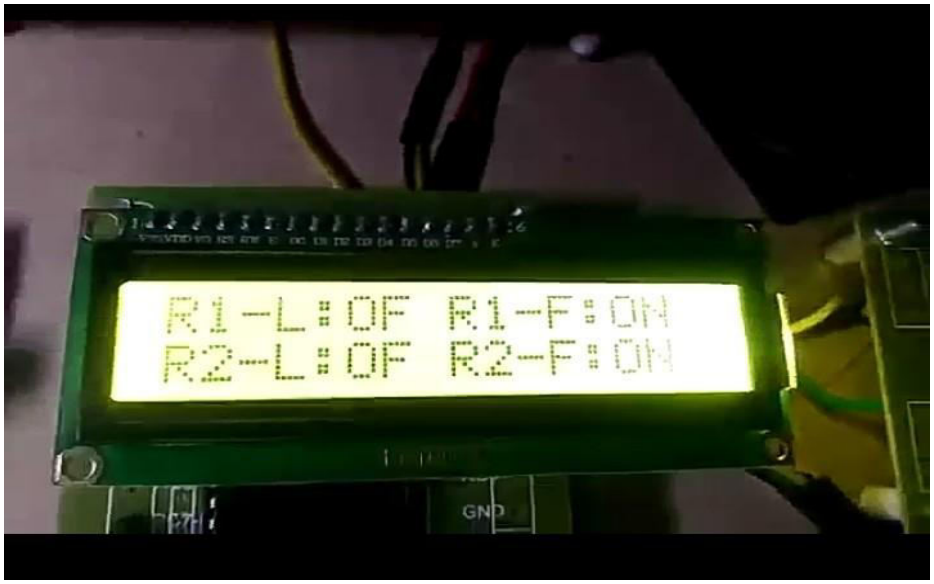
hotspot to transmit information wirelessly. The idea of Li-Fi is pulling in a considerable measure of eye-balls since it offers a honest to goodness what's more, extremely effective other option to radio based remote. It has a brilliant opportunity to supplant the customary Wi-Fi on the grounds that as a constantly expanding populace is utilizing remote web, the wireless transmissions are ending up plainly progressively stopped up, making it more hard to get a solid, high speed flag. The deficiency of radio-recurrence transmission capacity also, boot out the impediments of Wi-Fi. Li-Fi is the up and coming and on developing innovation going about as equipped for different other creating and as of now imagined advancements. Henceforth the future uses of the Li-Fi can be anticipated and reached out to various stages and different strolls of human life.

Future Scope

The use of li-fi technology stretches a golden opportunity to swap or to give alternate to the radio based wireless technologies for future short range applications and VLC present a viable and promising extra technology to radio wireless systems.Although there are many thought-provoking issues, VLC remains one of the most capable technologies in the future. In existing system, the reliability is poor, data can be easily hacked. This method provides a cheap and highly reliable way transmit data securely.

Snapshot of the Project

The below picture shows Fan and light is in “on” and “off” conditions.



Here the light and fan is under on condition.

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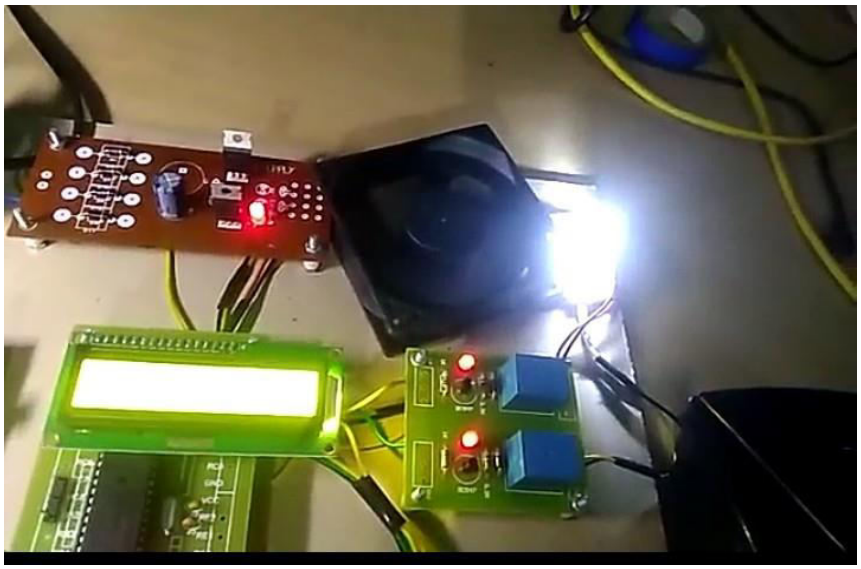

Appendices

PIC Microcontroller

- It has 35 instructions set.
- It can operate up to 20MHz frequency**.**
- The operating voltage is between 4.2 volts to 5.5 volts. If you provide it voltage more than 5.5 volts, it may get damaged permanently.
- It does not have an internal oscillator like other PIC18F46K22, PIC18F4550.
- The maximum current each PORT can sink or source is around 100mA. Therefore, the current limit for each GPIO pin of PIC16F877A is 10MA.

It is available in four IC packaging such as 40-pin PDIP 44-pin PLCC, 44-pin TQFP, 44-pin QFN

LCD Display

- Operating Voltage is 4.7V to 5.3V.
- Current consumption is 1mA without backlight.
- Alphanumeric LCD display module, meaning can display alphabets and numbers.
- Consists of two rows and each row can print 16 characters.
- Each character is build by a 5×8 pixel box.
- Can work on both 8-bit and 4-bit mode.
- It can also display any custom generated characters.
- Available in Green and Blue Backlight

Ultrasonic sensor

- Input Voltage: 5V
- Current Draw: 20mA (Max)

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- Digital Output: 5V
- Digital Output: 0V (Low)
- Working Temperature: -15°C to 70°C
- Sensing Angle: 30° Cone
- Angle of Effect: 15° Cone
- Ultrasonic Frequency: 40kHz
- Range: 2cm - 400cm

Dimensions:

- Length: 43mm
- Width: 20mm
- Height (with transmitters): 15mm
- Centre screw hole distance: 40mm x 15mm
- Screw hole diameter: 1mm (M1)
- Transmitter diameter: 8mm

Solar Panel

Size and Weight

- 17.5 x 22.1 x 0.5 cm.
- 255 grams.

Output

- Open Circuit Voltage: 7.7V.
- Peak Voltage: 6.5V.
- Peak Current: 930mA.
- Peak Power: 6.0W.
- Power Tolerance: +/-10%.
- For maximum power output, orient the panel towards the sun.

Construction

- Urethane coating.
- 3mm aluminum-plastic composite substrate.

Mounting

- Four embedded screws: 4-40 thread, 0.46 cm long.
- Attach to a vertical pole using Universal Panel Bracket.
- Attach to a metal surface using magnet mounts.

Output Cable

- Cable Length: 26 cm.
- Cable Color: Red PU Coated.
- Plug: Waterproof Male 3.5x1.1mm.
- Extend the cable length using 1 foot, 4 foot, and 10 foot extension cables.

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- Solder directly to a PCB using extension with exposed leads.

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