BLIND ASSISTANCE IN SHOPPING MALL USING LI-FI

Sandeep Salvankar[1], Shradha Shetty[2], Vishal Anand Bhat[3], Vishruthi V Kotian[4], Nagaraj Rao[5]
[12345] Dept of Electronics and Communication Shri MadhwaVadiraja Institute of Technology and Management, Bantakal, Udupi, India

Abstract—Navigation in indoor environments is highly challenging for the several visually impaired, particularly in spaces visited for the first time. Several solutions have been proposed to deal with this challenge. So, the Technology used to overcome this problem isLI-FI (Light-Fidelity). The term LI-FI refers to visible light communication (VLC) technology that uses light as a medium to deliver high-speed communication, which employs LED lights, and correcting the values of the geomagnetic sensor integrated in a Smartphone. Since visible light is present everywhere. The main idea is to create automatic indoor navigation systems for the visually impaired people using LI-FI Technology. The indoor positioning glasses for blind based on the LI-FI technology. The design of indoor positioning glasses for the blind will propose new ideas of three-dimensional indoor positioning problems for the blind.

Index Terms—Data base, LED, Li-Fi model, Obstacle detection,Path, Raspberry Pi,Text to voice, Vice to text

INTRODUCTION

Navigating large, unfamiliar environments in the real-world is a challenging task for people with visual impairments. To facilitate independent mobility for people with visual impairments, many assistive navigation systems have been proposed. Transfer of data from one place to another is one of the most important day-to-day activities. The radiation released by Wi-Fi is very harmful for species, and is difficult to accurate the location, In order to avoid this problem we used a technology known as Li-Fi. The term Li-Fi refers to visible light communication (VLC) technology that uses light as a medium to deliver high-speed communication, which employs LED lights, since visible light is present everywhere; the main idea is to create automatic indoor navigation systems for the visually impaired people using Li-Fi Technology.This Li-Fi technology helps the visually impaired to move within indoor environments. The main objective of the system is to provide, in real–time, useful navigation information that enables a user to make appropriate and timely decisions on which route to follow in an indoor space

I. PROJECT OBJECTIVES

- To design Li-Fi module for indoor navigation.
- To design a prototype to avoid obstacles while shopping.
- To design a system to locate the position of the rack to get the required product for customers.
- Conversion of text-to-speech and speech-to-text.

II. METHODOLOGY

In this project, we are using Li-Fi technology for indoor navigation. First, the input will be given in the form of voice, the input voice will be converted to text. We create a database for the racks name, for example, vegetable rack, fruit rack, etc., when the voice input matches one of the names initialized in the database, the shortest path to reach the destination will be calculated. In each row, we keep a light source attached to the roof, and each light source will be assigned with the name of the rack

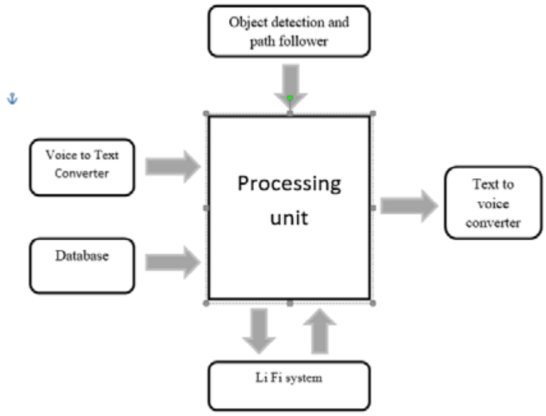

Fig.1 Block diagram of the proposed system

Fig.1 shows the block diagram of Indoor Navigation Using Li-Fi. When the distance dispatched each light will be given the direction of the next source, the information given by the light source will be received by the solar panel and the information will be converted into a voice which will be given to earphone or speaker. To maintain the center path, we have provided a cart with 4 ultrasonic sensors, in which 2 sensors will be fixed in the front portion and the other 2 on both sides. The front sensors are used for object detection and the side sensors are used to maintain the center path. If the sensor value varies, the corresponding signal will be given so that the person maintains the path without any disturbance. When he crosses each light source, the corresponding information will be given. As he reaches his destination, the device asks him to give voice input to search for the particular. The voice input is converted to text and which will be fed to raspberry pi. When his shopping completes the processor will find the shortest path to the starting point.

III. LI-FI MODEL

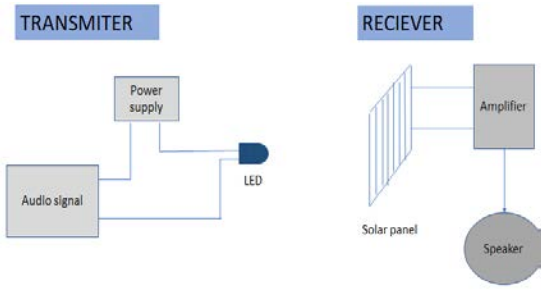

Fig. 2 Li-Fi model

Li-Fi stands for Light Fidelity. Li-Fi technology provides transmission of data through illumination by sending data through LED that varies in intensity faster than the human eye can follow. This product focus on developing a Li-Fi based system and analyse its performance with respect to existing technology. The heart of this technology is a new generation of high brightness LEDs. The product consisting of a transmitter which includes a light source and the receiver circuit which receives the data transmitted via light waves. The same system can be employed in industries making industrial automation using the existing light source a reality.

IV. FINDING SHORTEST PATH

Dijkstra's algorithm (or **Dijkstra's Shortest Path First algorithm**, **SPF algorithm**) is an algorithm for finding the shortest paths between nodes in a graph as shown in Fig. 3 , which may represent, for example, networks. The algorithm exists in many variants. Dijkstra's original algorithm found the shortest path between two given nodes, but a more common variant fixes a single node as the "source" node and finds shortest paths from the source to all other nodes in the graph, producing a shortest-path tree. For a given source node in the graph, the algorithm finds the shortest path between that node and every other. It can also be used for finding the shortest paths from a single node to a single destination node by stopping the algorithm once the shortest path to the destination node has been determined.

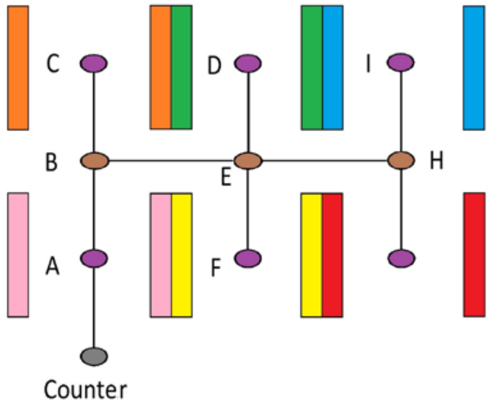

Fig. 3 Path Flow

V. DATABASE

In simple words data can be facts related to any object in consideration. For example, your name, age, height, weight etc. are some data related to you. A picture, image, file, pdf etc. can also be considered data. Database is a systematic collection of data. Databases support storage and manipulation of data. Here we are using database to store the path details as well as to the location of the items. This can be done using SQL platform.

VI. VOICE TO TEXT CONVERSION

Voice to text conversion is the process of converting spoken words into written texts. This process is also often called speech recognition. Although these terms are almost synonymous, speech recognition is sometimes used to describe the wider process of extracting meaning from speech, i.e. speech understanding. The term speech recognition should be avoided as it is often associated to the process of identifying a person from their voice, i.e. speech recognition All voice-to-text systems rely on at least two models: an acoustic model and a language model. In addition, large vocabulary systems use a pronunciation model. It is important to understand that there is no such thing as a universal speech recognizer. To get the best transcription quality, all of these models can be specialized for a given language, dialect, application domain, type of speech, and communication channel.

Like any other pattern recognition technology, speech recognition cannot be error free. The speech transcript accuracy is highly dependent on the speaker, the style of speech and the environmental conditions. Voice recognition is a harder process than what people commonly think, even for a human being. Humans are used to understanding speech, not to transcribing it and only speech that is well formulated can be transcribed without ambiguity.

From the user's point of view, a voice-to-text system can be categorized based in its use: command and control, dialog system, text dictation, audio document transcription, etc. Each use has specific requirements in terms of latency, memory constraints, vocabulary size, and adaptive features.

VII. TEXT TO VOICE CONVERSION

Text-to-speech (TTS) is a type of speech synthesis application that is used to create a spoken sound version of the text in a computer document. To make the Raspberry Pi speak and read some text aloud, we need a software interface to convert text to speech on the speakers. For this we need a Text to Speech engine.

The TTS engine we are using in this tutorial is e-Speak. The voice may be a little robotic, however Like other modules the process has got its own relevance on being interfaced with, where Raspberry Pi finds its own operations based on image processing schemes. So once image get converted to text and thereby it could be converted from text to speech. Character recognition process ends with the conversion of text to speech and it could be applied at anywhere. it runs offline which is an added plus.

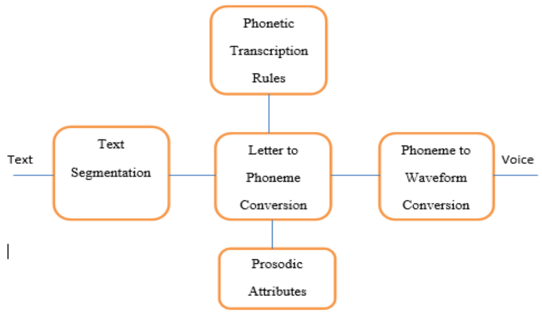

Fig. 4. Text to Voice Conversion

VIII. OBJECT OBSTACLE AVOIDANCE

The ultrasonic sensor transmits sound waves and receives sound reflected from an object. When ultrasonic waves are incident on an object, diffused reflection of the energy takes place over a wide solid angle which might be as high as 180 degrees. Thus some fraction of the incident energy is reflected back to the transducer in the form of echoes. If the object is very close to the sensor, the sound waves returns quickly, but if the object is far away from the sensor, the sound waves takes longer to return. But if objects are too far away from the sensor, the signal takes so long to come back (or is very weak when it comes back) that the receiver cannot detect it.To maintain the center path, we have provided a cart with 4 ultrasonic sensors, in which 2 sensors will be fixed in the front portion and the other 2 on both sides. The front sensors are used for object detection and the side sensors are used to maintain the center path. If the sensor value varies, the corresponding signal will be given so that the person maintains the path without any disturbance. When he crosses each light source, the corresponding information will be given.

Fig 5 obstacle detection

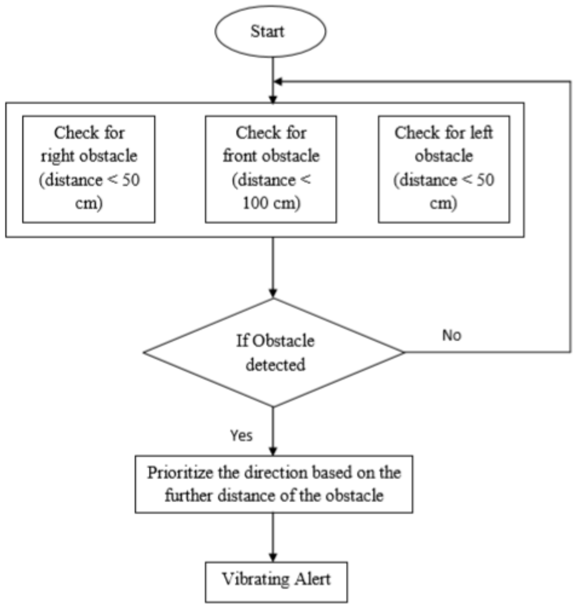

Fig 7 Flowchart of Obstacle Detection

The system design flow is explained in this section. The flow chart of the obstacle detection process is shown in Fig 4.6. When the system is made ON, the Arduino regularly sends the triggering pulse signal to the three ultrasonic sensors. The ultrasonic sensors scan the three directional sides namely right, left and front, checking for the presence of any obstacle. The obstacle detection range can be programmed using microcontroller. The distance of the obstacle can be measured and the nearest obstacle can be prioritized first, so that vibrating motor gives the alert to the user.

EXPERIMENTAL RESULTS

1) Li-Fi Model

The Li-Fi module consists of transmitter and receiver. Transmitter of Li-Fi is connected with audio signal and LED; Receiver part of Li-Fi is connected to solar panel. From this we observed that input audio signal has been converted into light that is fallen to solar panel. The output of solar panel is connected to speaker in which we get original audio signal.

Fig. 5.1 Li-Fi model

2) Obstacle Detection

By connecting ultrasonic sensors in the trolley and programing in such a way that the obstacle has to be avoided with specification of particular distance, If the obstacle is arriving from left side it indicates to move towards right, in order to indicate the obstacle here we used vibrating motor, Similarly if the obstacle is arriving from right it vibrates towards left indicating that the person should move towards left, Meanwhile for the Centre. By this visually impaired can avoid inconvenience during shopping.

Ultrasonic Name	Obstacle detection condition	Right Vibration Motor 1 state	Left Vibration Motor 2 state
Left	Distance < 50 cm	ON	OFF
Right	Distance < 50 cm	OFF	ON
Front	Distance < 100 cm	ON	ON

Table 1 Unit test

3) Shortest Path Finding

Here we have taken 9 nodes as shown in Fig. 4.3, where alternate node represents racks. We have given id to each node, based on the user input the shortest path created using Dijkstra's Algorithm. Below tables shows ids of the racks.We have programed in a such a way that the direction is feed to a user through voice signal when is cross each node. After shopping is done path is created automatically to the counter.

Items	Node id
Diary	A
Grocery	C
Vegetable	D
Fruit	F
Soap	I
Snacks	G

Table 2 Dataset of item

CONCLUSION

The Li-Fi module consists of a transmitter and receiver. The transmitter of LiFi is connected with an audio signal and LED. the Receiver part of Li-Fi is connected to the solar panel. From this, we observed that the input audio signal has been converted into light, which is fallen to the solar panel. The output of the solar panel is connected to the speaker in which we get the original audio signal. By connecting ultrasonic sensors in the trolley and programed in such a way that the obstacle has to be avoided with the specification of a particular distance. By this visually impaired can avoid inconvenience during shopping. By connecting ultrasonic sensors in the trolley and programming in such a way that the obstacle has to be avoided with the specification of particular distance, If the obstacle is arriving from the left side it indicates to move towards right, in order to indicate the obstacle here we used vibrating motor Similarly if the obstacle is arriving from right it vibrates towards left indicating that the person should move towards left, Meanwhile for the Centre. By this visually impaired can avoid inconvenience during shopping. In order to locate the position of the rack, visually impaired people need the shortest path. Here we used Dijkstra's algorithm for finding the shortest paths between nodes in a graph as shown in Fig1.2, initially, here we have taken 9 nodes, alternative nodes consist of the database. A visually impaired person needs to feed his data in the initial, according to the data it will find the shortest path, in this way Dijkstra's algorithm works.

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