International Journal of Computer Applications (0975 – 8887)
International Conference and Workshop on Emerging Trends in Technology 2013

Nav Drishti

Saylee Gharge, Ph.D.
VESIT
Collector's colony
Chembur, Mumbai-74

Kshama S, Priya R
VESIT
Collector's colony
Chembur, Mumbai-74

Sailesh D, Karan G
VESIT
Collector's colony
Chembur, Mumbai-74

ABSTRACT

To date, there are increasing complexities for the visually impaired person who totally depends upon the white canes which escorts them through the roads or there is always a sense of helplessness which makes them dependent on friends and relatives. This paper presents an effective navigation system for the blind people which will increase their mobility thereby creating a friendly environment for them to live in. "Nav Drishti" is a portable unit consisting of ultrasonic sensors, Android based cell phone, PIC 18 microcontroller chip, Bluetooth module and vibration sensors. Obstacles on the path will be detected by Ultrasonic sensors. Information about these obstacles will be conveyed to the users through vocal prompts. In addition to this directions will be provided to them enabling them follow the right path to reach the destination step-by-step. This assistive technology is cost effective and will greatly facilitate the blind person in their day to day life making them self-reliant. Future work will be done to develop the system for face recognition as well as for detecting different types of obstacles.

General Terms

Blind, Ultrasonic Sensor, Microcontroller, Staircase indication, Android App., GPS, Vibration Sensors, Face recognition using Android device with built in camera, Bluetooth Module .

Keywords

Blind, Ultrasonic Sensor, Microcontroller, Staircase indication, Android App., GPS, Vibration Sensors, Face recognition using Android device with built in camera, Bluetooth Module .

1. INTRODUCTION

Blind or visually impaired people are somewhat limited in day-to-day activities. One of the major difficulties they suffer is full sensory access to information. Work is being carried out on aids to improve their general standards of living. Many inventors and researchers see the need to find ways of improving the quality of life of blind people. Although the vast size of India and the fact that up to now only the fringe of the problem of blindness are touched. The problems of prevention of blindness is then a more pressing one; which might, by its very immensity, paralyze effort, unless there were another side to the picture [1].

They face a lot of problem in their life and they have to depend on others for satisfying their needs. One percent in the world goes blind every second, one child every minute. There are 135 million visually handicapped people in the World and increasing as we speak. One fourth of them are here in India [1].

To varying degrees under various circumstances, blind people face significant challenges in accessing the world in the following three areas:

1. The physical world - refers to interaction with the physical environment.

2. Navigation – refers to identifying direction of the destination place where the blind person wants to reach.

3. The symbolic world - refers to reading of the standard prints and to identify the person in his front [2].

During the last decades, several research efforts have been directed toward providing better accessibility and navigation to blind individuals in their living environment by developing new devices and information technology scientific methodologies [2-16].

A range of adaptive technologies and devices has evolved since the 1960s to assist people who are blind in dealing with a variety of situations. The primary drawbacks included inconsistencies in feedback depending on various conditions (such as weather), possible disorientation caused by overuse of the sound space, and the fact that the information such devices provided was redundant to what the individuals could discern on their own in a more efficient manner using a cane or guide dog. The main drawbacks of existing assistive devices are the cumbersome hardware, the level of technical expertise required to operate the devices, and the lack of portability [3]. These technological advances do not facilitate unobtrusive indoor navigation and learning from the environment. This limits employment and social opportunities for blind and visually impaired individuals. In summary, these technological advances target specific functional deficits but largely neglect social aspects and do not provide an integrated, multifunctional, transparent, and extensible solution that addresses the variety of challenges (such as independence) encountered in lives of blind people everyday .In order to cope up with their problems we came up with this project.

The Section-2 describes about the origin of the idea and working with the Block Diagram. Section-3 focuses on the details of components used in project. Section-4 throughs light on the acknowledgments. Section-5 gives a brief conclusion and future ideas.

2. Nav Drishti

2.1 Origin of idea

People with complete blindness or low vision often have a difficult time self-navigating outside well-known environments. In fact, physical movement is one of the biggest challenges for blind people, explains World Access for the Blind. Traveling or simply walking down a crowded street may pose great difficulty. Because of this, many people with low vision will bring a sighted friend or family member to help navigate unknown environments. Moreover, blind people have to learn every detail about the home environment. Large obstacles such as tables and chairs must remain in one location to prevent injury [4]. If a blind person lives with others, each member of the household must also diligently keep walkways clear and all items in designated locations, this makes them dependent on all biotic and abiotic things in their surroundings. So idea of "Nav Drishti" emerged. This module will be portable and will give information to the user about urban walking routes to point out what decisions to make to reach the destination place. For this the module finds proper path to the destination address and conveys it to the user through vibrators. On the other hand, in order to detect obstacles on the path, an obstacle detection system using ultrasonic sensor and vibrators is added to this device. This idea portrays ultrasonic sensor as the eye and microcontroller as an interfacing device between the eyes and the hearing aid(speakers).Ultrasonic sensor detects the obstacle in its front and also gives the distance in time domain, PIC18 µC detects this signal as interrupts and calculates the distance of the obstacle from the sensor and according to that distance it sends the signal to the speakers that act as hearing device for blind persons. Thus the project helps blind persons to get the directions to their destination place, detect the obstacles, staircases, persons in their front, which makes them feel more independent.

2.2 Working

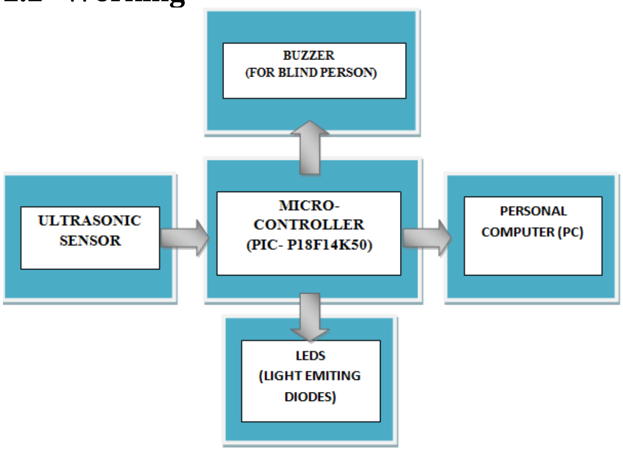

Fig 1. Block Diagram of Obstacle Detection

Block diagram of project idea is shown in Fig 1. The project consist of PIC micro-controller as an interfacing device to Ultrasonic sensor and output device to blind person.The Ultrasonic sensor helps in calculating the distance between the ground(or obstacle) and the sensor. This signal is passed to controller, then it calculates the distance according to the formulae and provides the output signal accordingly.

The project works in three stages based on the distance between the obstacle and the sensor:

- If the distance calculated comes out be in the range of 5cm – 15cm(ht of a normal staircase) than one beep alarm is heard from the speaker.
- If the distance calculated comes out be in the range of 15cm – 30cm than two beep alarm is heard from the speaker.
- If the distance calculated comes out be greater than 30cm than three beep alarm(danger alarm) is heard from the speaker.

The project has voices of two different frequencies in order to dishtinguish between the elevation step or downward step. It gives output in 3 different forms i.e Buzzer sound , LED for reference and in the Computer as a written command.

The second problem faced by blind people as per NAB, they need assistance while they travel or walk to show them the path and the distance to be covered. This problem is solved by developing an Android application. Pictorial representation of iinterfacing vibrators with android device is shown below.

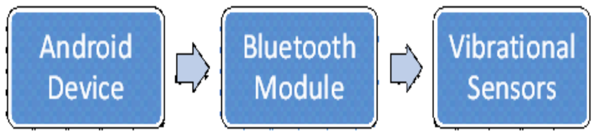

Fig 2. Interfacing of Android device to vibrators via Bluetooth

The android application will take the input from the blind person orally in terms of destination place where the person has to reach. The app will continuously check the person's current location and will find the path to the destination place using Google maps and built-in navigation compass. The application will use real time location given by Google maps. The vibrational Sensors are fabricated on sole of shoes which is connected to android device via Bluetooth. Whenever a "turn" comes, vibrators on shoes are made to vibrate to indicate the correct direction in which the person has to move. The intensity of the vibration varies directly to the distance left between the source and destination, thus aiding blind to navigate through the roads. The following figure describes the placement of vibrators on the sole.

Fig 3. Shoe sole with vibrators

Depending upon whether right or left turn is to be taken, those particular vibrators on shoe will vibrate. Initially LED's were used instead of vibrators for testing. If the input given by blind person is not detected by the device it will again ask for input and continue the procedure. Fig 4. expains the working of the Android app.

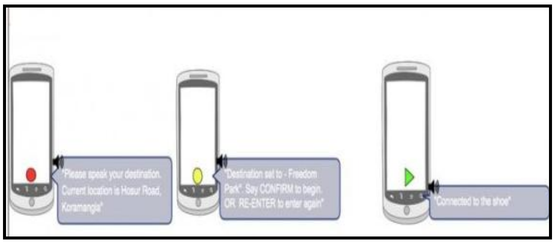

Fig 4. Android application steps [5]

3. Product Features

3.1 Ultrasonic Ranging Module HC - SR04

3.1.1 Features

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work:

(1) Using IO trigger for at least l0us high level signal,

(2) The Module automatically sends eight 40 kHz pulse signal and detect whether there is a pulse signal back.

(3) If the signal is back, through high level, time of high output IO duration is the time from sending ultrasonic to returning.

Test distance = [high level time X velocity of sound (340m/s) / 2]

- 5V Supply
- Trigger Pulse Input
- Echo Pulse Output
- 0V Ground

3.1.2 Electric Parameter

Table 1.Specification of ultrasonic sensor

Sr.No.	Specifications	
1	Working Voltage	DC 5V
2	Working Current	15mA
3	Working frequency	40Khz max
4	Range	4m max
5	Range	2cm max
6	Measuring angle	15 Degree
7	Trigger Input signal	10us TTL Pulse
8	Echo Output signal	Input TTL level signal

3.1.3 Timing diagram

The Timing diagram is shown below. You only need to supply a short 10uS pulse to the trigger input to start the ranging, and then the module will send out an 8 cycle burst of ultrasound at 40 kHz and raise its echo. The Echo is from a distant object that has its pulse width in proportion to the range of the object. One can calculate the range through the time interval between sending trigger signal and receiving echo signal as follows:

usec /58= centimeters or usec /148 = inch; or: the range =high level time * velocity (340:m/s) /2;

The optimum time duration should be over 60ms measurement cycle, in order to prevent trigger signal to the echo signal.

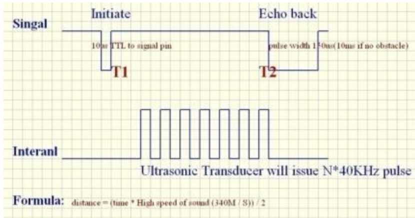

Fig 5. Internal Working Waveforms of Ultrasonic sensor

Fig 6. Ultrasonic Sensor

3.2 PIC18 MICROCONTROLLER

Table 2. Specifications of PIC18f14k50

Sr. No.	Parameter Name	Value
1	Program Memory type	Flash
2	Program Memory (KB)	16
3	CPU Speed (MIPS)	12
4	RAM Bytes	768
5	Data EEPROM (bytes)	256
6	Digital Comm. Peripherals	1-A/E/USART, 1-MSSP(SPI/I2C)
7	Capture/Compare/PWM Peripherals	1 ECCP
8	Timers	1*8-bit,3*16 bit
9	ADC	9ch. ,10 bit
10	Comparators	2
11	USB (Ch., Speed, Compliance)	1.Full Speed USB 2.0
12	Temperature Range (C)	-40 to 125
13	Operating Voltage Range (V)	1.8 to 5.5
14	Pin Count	20

4. ACKNOWLEDGEMENT

We are thankful to NAB Organization and it's Assist. Director Mrs.Shayya Dasai for helping in testing our project on blind person and also suggesting the practical problems faced by them. We also thank Dr. (Mrs.) Saylee Gharge for her continuous support, guidance and encouragement throughout the project.

Fig 7. Practical Implementation image

5. CONCLUSION

The suggestions made by the NAB helped in the further getting the idea of Android app as they needed the direction sensing information too. Now the work for identifying and differentiating types of obstacle is in progress. It can be done through IR sensors which can be connected on the Cap or can be attached to the goggle wore by them. Also we are working on face recognition technique using camera of same android phone. Whenever a person will come in front of camera his face will be stored and again if that person comes near the blind person his face will be detected and name will be conveyed to blind person through speakers [17].

6. REFERENCE

[1]http://www.languageinindia.com/dec2008/sheelavisuallychallenged.html

[2] http://www.worldaccessfortheblind.org/node/103

[3] G. Dagnelie and R. Massof, ''Toward an artificial eye,'' IEEE Spectrum, vol. 33, pp. 20–29, May 1996.

[4]http:/www.livestrong.com/article/241936-challenges-that-blind-peopele-face/

[5]http://www.pixelonomics.com/shoe-for-visually-impaired-le-chal/

[2] N. G. Bourbakis and D. Kavraki, ''Tyflos—An intelligent assistant for naviga-tion of visually impaired people,'' in Proc. IEEE Symp. BIBE-01, Bethesda, MD, Nov. 2001, pp. 230–235.

[3] M. Maas and N. Bourbakis, ''A methodology for the fusion of laser and image data for 3-D modeling of an unknown space,'' TR-1993, AAAI Research Lab, EE, Binghamton University.

[4] G. Dagnelie and R. Massof, ''Toward an artificial eye,'' IEEE Spectrum, vol. 33, pp. 20–29, May 1996.

[5] N. Bourbakis and S. Tzafestas, ''Robotics and bioengineering for people with disabilities,'' IEEE Robot. Autom. Mag., vol. 10, no. 1, p. 3, 2003.

[6] Riegl Laser Measurement SystemsRiegl USA Inc.4419 Parkbreeze Court, Orlando, FL, 1993.

[7] M. Asada, ''Building a 3D world model for mobile robots from sensing data,'' in Proc. IEEE Conf. Robotics and Automation, 1988, pp. 918–923.

[8] M. Adjouadi, ''A man-machine vision interface for sensing the environment,'' J. Rehabil. Res. Dev., vol. 29, no. 2, pp. 57–76, 1992.

[9] S. K. Park and I. S. Kweon, ''Robust and direct estimation of 3D motion and scene depth from stereo image sequences,'' Pattern Recogn., vol. 34, no. 9, pp. 1713–1728, 2001.

[10] R. N. Pal and K. S. Pal, ''A review on image segmentation techniques,'' Pat-tern Recogn., vol. 26, no. 9, pp. 1277–1294, 1993.

[11] A. Moghddamzadeh and N. G. Bourbakis, ''Segmentation of color images with highlights and shadows using fuzzy reasoning,'' in Proc. SPIE, vol. 2411, pp. 300–310, 1995.

[12] N. Bourbakis, "Motion analysis and associations for guiding visual impaired"-presented at IEEE Workshop on Assistive Technologies for Disabled and Elderly, Greece, July 2007.

[13] NIST, ''AIR blind navigation system,'' 2002.

[14] ''TORRES, the Spanish project for blind navigation,'' ESA, Spain, 2003.

[15] C. Jacquet, Y. Bellik, and Y. Bourda, ''A context-aware locomotion assis-tance device for the blind,'' in Proc. ICCHP-04 Conf., France, July 2004.

[16]D. Kavraki and N. Bourbakis, ''Intelligent assistants for disable peoples' independence: A case study,'' in Proc. IEEE Symp. Intelligent Systems, Baltimore, MD, Nov. 1996, pp. 337–344.

[17] http://en.wikipedia.org/wiki/Facial_recognition_system