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Design and Implementation of Ultrasonic Walking Stick for Visually Impaired People

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Abstract: God endowed the human being with sense of vision is an important aspect of our life. But there are some unfortunate individuals who lack the ability to imagine items. During their everyday life the visually impaired have to face many obstacles. The problem gets worse when an obstacle stands in front of them. Blind stick is a revolutionary stick designed to improve mobility for visually disabled people. The paper introduces a description of a theoretical framework to provide blind people with smart ultrasonic assistance. The program aims to provide overall indicators–artificial vision and identification of artifacts. The overall system aims at providing low cost and effective navigation assistance to a visually impaired person. Ultrasonic sensors are used to calculate distance of the obstacles around the blind person to guide the user towards the available path. Output is in the form of sequence of beep sound which the blind person can hear.

Keywords: Keil software, Microcontroller, RFID, Ultrasonic sensors, Visually impaired person.

INTRODUCTION

There are approximately 37 million people across the globe that are blind and over 15 million are from India. Even for the non-visually impaired the congestion of obstacles is sometimes problematic however it's even worse for the visually impaired. People with visual disabilities are often dependent on external assistance which can be provided by humans, trained dogs or special electronic devices as support systems for decision making. Existing devices are able to detect and recognize objects that emerge on the floor but a considerable risk also includes the objects that are at a sudden depth or obstacles above waist level or stairs. Thus a motivation arises to develop a smart white cane to overcome these limitations.

Fig. 1: Person with Cane

The most common tool that the blind currently use to navigate is the standard white cane [1]. It was necessary to change and develop the walking cane, since blind can only identify objects by touch or cane. The consumer moves the cane toward them back and forth. The consumer is conscious of the hazard when

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the cane strikes an object or slips off the edge of a stairway, sometimes too late. We achieved this aim by adding ultrasonic sensors to the cane at specific positions which provided user information about the environment through audio feedback. The main component of this device is the Radio-Frequency module used to locate the stick if it is lost around it.

BACKGROUND

Sight is the most essential part of human biology because 83 per cent of human knowledge from the world is through sight. World Health Organization (WHO) figures for 2011 indicate that there are 285 million visually impaired people [2] in the world, 39 billion of whom are blind, and 246 with poor vision. Walking cane also called white cane or stick and guide dogs are the common and oldest mobility aids for people with visual impairments. The most critical limitations of these aids are the skills needed and the process of preparation, the range of motion and very little information transmitted. With the rapid advances in modern technology, both hardware and software are brewing.

LITERATURE SURVEY

Numerous attempts have been made in the society to help the blind. "Project Prakash" is a humanitarian mission to help the blind children especially by training them to utilize their brains to learn a set of objects around them. The stick has a ping sonar sensor to sense the distant objects. It also has a wet detector to detect the water. The micro-controller used is PIC microcontroller. The microcontroller circuit is on the outside of the stick but is protected with a code so its security cannot be breached. The only feedback given to the user is through the vibration motor. Three sensors are used like ultrasonic, pit sensor and water sensor. Even this is a PIC based system. The feedback given is through the vibration as well as the speaker or headphones. There is a GPS system [3] where-in the user has to feed his location. Also they haven't mentioned anything about the size and shape of their cane and neither about the placement of their circuitry. There is a detachable unit consisting of an ultrasonic sensor and a vibration motor. It can be fit on any stick and detects obstacles up to 3m. The vibration feedback varies in the intensity as the obstacles come nearer. Many different approaches have been taken with the primary purpose of creating a technology to aid the visually impaired. The priorities set by different authors are different leaving a scope of improvement in every application.

S.Gangwar (2011) designed a smart stick for blind which can give early warning of an obstacle using Infrared (IR) sensors. After identifying the obstacles, the stick alerts the visually impaired people using vibration signals. However the smart stick focused only for obstacle detection but it is not assisting for emergency purposes needed by the blind. Moreover, the IR sensors are not really efficient enough because it can detect only the nearest obstacle in short distance.

S.Chew (2012) proposed the smart white cane, called Blind spot that combines GPS technology, social networking and ultrasonic sensors to help visually impaired people to navigate public spaces. The GPS detects the location of the obstacle and alerts the blind about not hitting the obstacle using ultra-sonic sensors; however, GPS did not show the efficiency in tracing the location of the obstacles since ultra-sonic tells the distance of the obstacle.

Benjamin et al. (2011) had developed a smart stick using laser sensors to detect the obstacles and down curbs. Obstacle detection was signalized by a high pitch beep signal using a microphone. The design of the laser cane is very simple. The stick can only detect obstacle, but cannot provide cognitive and psychological support. There exists only beep sound that triggers any obstacle and there is not any assistance to direct people.

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DESCRIPTION OF ULTRASONIC STICK

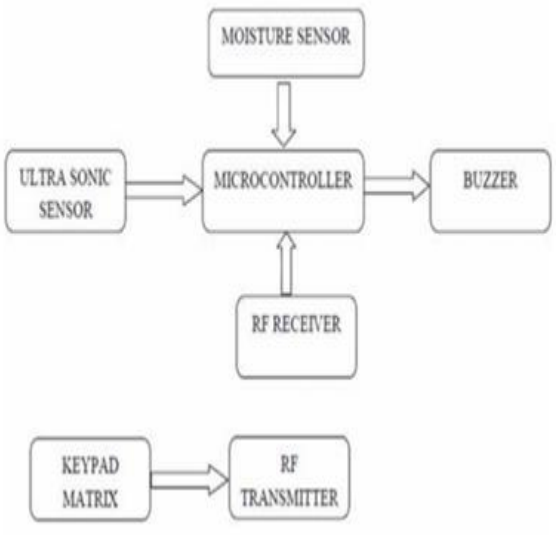

Fig. 2: Block Diagram of System

In this system the ultrasonic sensor is used to sense the object or obstacle. The signal is then send to microcontroller to operate a buzzer. There is one more advantage of this system. Sometimes when the blind loose there sticks or forgot where have they put it, they can find it by using the wireless remote.

COMPONENT DETAILS

Ultrasonic Sensor:

Ultrasonic sensors also known as transceivers when they both send and receive operate on radar or sonar like concept that measures target attributes by reading the echoes from radio or sound waves, respectively [4]. Ultrasonic sensors produce sound waves of high frequency and determine the echo which the sensor receives back. To evaluate the distance to an object, the sensors measure the time interval between transmitting the signal and receiving the echo. This device can be used for measuring: wind speed and direction, tank fullness and air or water velocity. A device uses several detectors for measuring speed or direction and calculates the speed from it. Ultrasonic range, above 18,000 hertz, by turning electrical energy into sound, then upon receiving the echo turn the sound waves into electrical energy which can be measured and displayed. The technology is limited by the shapes of surfaces and the density or consistency of the material.

Microcontroller:

A microcontroller is a small computer containing a processor core, memory and programmable input or output peripherals on a single integrated circuit [5]. Often commonly included on chip is program memory in the form of Ferroelectric RAM, NOR flash or OTP ROM as well as a typically small amount of RAM. In comparison to the microprocessors used in personal computers or other general purpose applications, microcontrollers are designed for embedded applications. Microcontrollers are used in products and devices that are automatically controlled, such as automobile engine control systems, medical devices, remote controls, office machines, appliances, power tools, toys, and other integrated systems. Through reducing the size and cost compared to a system using a separate microprocessor, memory, and input / output devices, microcontrollers make digital control of even more devices and processes cost-effectively. Mixed signal microcontrollers are popular, integrating the analog components required to control electronic non-digital systems.

RF Module:

An RF module (radio frequency module) is a small electronic unit used to transmit radio signals between two devices and/or receive them [6]. Wireless connectivity with another computer is often desirable in an embedded system. This wireless communication can be achieved by optical communication or by communicating with radio frequency. The medium of choice for many applications is RF since it needs no line of sight. RF communications incorporate a transmitter or receiver.

Micro switch:

A micro switch also known as a snap-action switch, is a generic term used by using a tipping point device

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to refer to an electrical switch that is operated by very little physical force [7]. These are very popular for heavy duty models due to their low cost and reliability, greater than 1 million cycles and up to 10 million cycles. The durability is a natural result of the design. A rigid metal strip must be bent internally to turn the switch on. It produces a very distinctive clicking tone and an incredibly smooth feeling. Once pressure is removed the metal strip flows back to its original state [8]. Popular applications of micro switches include the door interlock on a microwave oven, elevator leveling and safety switches, vending machines and the detection of paper jams or other photocopier faults. Micro switches are typically used in gate valve tamper switches on fire sprinkler systems and other water pipe systems, where it is necessary to know whether a valve has been opened or shut down [9][10]. The defining feature of micro switches is that a relatively small movement at the button of the actuator creates a relatively large movement at high-speed electrical contacts.

LIST OF REQUIREMENTS

Hardware Requirement:
1. Microcontroller
2. Ultrasonic module
3. RF module
4. LDR
5. LED
6. Buzzer
7. Push button
8. GPS module
9. GSM modem

Software Requirements:
1. Keil micro vision (IDE)
2. Compiler

Advantages:

The system can be used both indoor and outdoor navigation.
Blind person's location can be tracked whenever needed which will ensure additional safety.
Detects obstacles and alerts the blind person through vibration alert and speech output.

Disadvantages:

The system developed is a moderate budget navigational aid for visually impaired people.
Minimization in cost leads to compensation in performance.

APPLICATIONS

Some more applications like vehicle detection, slippery floor, on-coming vehicle detection and smoke alarm can also be included.
One more application is for the family members to gain access to the blind person's location through the server whenever needed.
Also, use of RFID tags will transmit the location information automatically to the PCB unit when the intelligent stick is in its range.

CONCLUSION

All the studies examined indicate that for blind people, there are a range of techniques to create an ultrasonic blind walking stick. The system's benefit is that it can prove a very low cost solution for millions of blind people around the world. The smart white cane is a device that is actually possible and is convenient to carry around like any other tool. This could also be thought of as a blunt way to give the blind a sense of vision. This device can be combined with real GPS module used in vehicles and we can provide the partially deaf person with a vibrator. The use of VLSI technology to design the PCB device can further improve this. That further makes the system more compact. In an indoor environment, a wall-following feature may also be added so that the user can walk straight along a hallway.

REFERENCES

[1] G. Gayathri, M. Vishnupriya, R. Nandhini, and M. Banupriya, "Smart walking stick for visually impaired," IJECS, 2014.
[2] S. Chaurasia and K. V. N. Kavitha, "An electronic walking stick for blinds," in 2014 International Conference on Information

Communication and Embedded Systems, ICICES 2014, 2015, doi: 10.1109/ICICES.2014.7033988.

[3] R. Khlaikhayai, C. Pavaganun, B. Mangalabruks, and P. Yupapin, "An intelligent walking stick for elderly and blind safety protection," in Procedia Engineering, 2011, doi: 10.1016/j.proeng.2011.03.058.

[4] L. Kleeman, "Ultrasonic sensors," in Control and Mechatronics, 2016.

[5] T. S. Ng, "Microcontroller," in Studies in Systems, Decision and Control, 2016.

[6] S. Cheng and Z. Wu, "Microfluidic stretchable RF electronics," Lab Chip, 2010, doi: 10.1039/c005159d.

[7] L. Roche, J. Sigafoos, G. E. Lancioni, M. F. Oreilly, and V. A. Green, "Microswitch Technology for Enabling Self-Determined Responding in Children with Profound and Multiple Disabilities: A Systematic Review," AAC: Augmentative and Alternative Communication. 2015, doi: 10.3109/07434618.2015.1024888.

[8] O. Ben Belghith and L. Sbita, "Remote GSM module monitoring and Photovoltaic system control," in 2014 1st International Conference on Green Energy, ICGE 2014, 2014, doi: 10.1109/ICGE.2014.6835420.

[9] A. F, A. NADA, M. A, and S. MASHALI, "Effective Fast Response Smart Stick for Blind People," 2015, doi: 10.15224/978-1-63248-043-9-29.

[10] D. Sekar, S. Sivakumar, P. Thiyagarajan, R. Premkumar, and M. V. Kumar, "Ultrasonic and Voice Based Walking Stick for Blind People," Int. J. Innov. Res. Electr. Electron. Instrum. Control Eng., 2016, doi: 10.17148/IJIREEICE.2016.4359.

[11] Vishal Jain, Mahesh Kumar Madan, "Information Retrieval through Multi-Agent System with Data Mining in Cloud Computing", International Journal of Computer Technology and Applications (IJCTA) Volume 3 Issue 1, January-February 2012, page no. 62-66, having ISSN 2229-6093 .

[12] Vishal Jain, Mahesh Kumar Madan, "Multi Agent Driven Data Mining for Knowledge Discovery in Cloud Computing", International Journal of Computer Science & Information Technology Research Excellence Vol. 2, Issue 1, Jan-Feb 2012, page no. 65-69, having ISSN 2250-2734.

[13] V.M. Prabhakaran, Prof S.Balamurgan ,A.Brindha ,S.Gayathri ,Dr.Gokul Kruba Shanker,Duruvak kumar V.S, "NGCC: Certain Investigations on Next Generation 2020 Cloud Computing-Issues, Challenges and Open Problems," Australian Journal of Basic and Applied Sciences (2015)