AUSTRALIAN JOURNAL OF BASIC AND APPLIED SCIENCES

ISSN:1991-8178 EISSN: 2309-8414
Journal home page: www.ajbasweb.com

An Intelligent sensor based stick for Blind and Deaf

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ARTICLE INFO

Article history:
Received 18 February 2017
Accepted 15 May 2017
Available online 18 May 2017

Keywords:
Intelligent Stick, Blind, Deaf.

ABSTRACT

Background: Among all the disabilities, blindness and deafness are the most common disabilities across the world. According to latest statistics of World Health Organization, 285 million people are visually impaired whereas 360 million people have disabling hearing loss. The majority of people with these disabilities live in developing and middle income countries.**. Objective:** This paper discusses the design of intelligent stick for blind and deaf that will not only detect any kind of obstacle including water but will also contain vibratory mechanism to aware the person holding stick. **Results:** The white cane is the most widely used travel aid for blind persons but it is not suitable for detecting potentially dangerous obstacles. The deaf persons can see the obstacles but they cannot hear the sounds such as car horns, which can be really dangerous. Moreover, intelligent GPS/GPRS based system has been included in the design that will send the exact location of the person if some mishap occurs. **Conclusion:** The proposed solution for blind persons is tested and it works effectively.

INTRODUCTION

The visually impaired have to face many challenges in their daily life. The problem gets worse when they travel to an unfamiliar location. Only few of the navigation systems available for visually impaired people can provide dynamic navigation through speech output. None of these systems works perfectly for both indoor and outdoor applications. In this project, a navigation device for the visually impaired has been proposed which is focused on providing voice output for obstacle prevention and navigation using proximity sensor, short circuit sensor, vibration sensor, GPS module and dual feedback system- auditory as well as vibrational. The aim of the overall system is to provide a low cost and efficient navigation aid for blind which gives a sense of artificial vision by providing information about the environmental scenario of static and dynamic objects around them. The blind traveler is dependent on other guides like white cane, information given by the people, trained dogs etc. in this an approach has been made to explain the novel design of that stick that will serve as a magic to blind and deaf for enjoying their life despite cursing the life (Kher Chaitrali, S., *et al*., 2015).

Literature Review:

Many research articles and papers were reviewed before finalizing the Objectives for this project. Some of the main papers reviewed are discussed below:

Kher Chaitrali S., Dabhade Yogita A., Kadam Snehal K., Dhamdhere Swati D., Deshpande Aarti V. have discussed the importance of walking stick for blind and deaf with modifications in paper titled "An Intelligent Walking Stick for the Blind". In this paper, device proposed is used to guide partially sighted or blind

To Cite This Article: Gaurav Sareen, Parminder Kaur, Komal Marwah, Hitesh Vohra., An Intelligent sensor based stick for Blind and Deaf. ***Aust. J. Basic & Appl. Sci.,*** *11(8): 34-38, 2017*

individuals. This helps the partially sighted to interact with same ease and comfort level to their surroundings. The device has different features like proximity sensor, voice guided navigation system. RFID tags are installed in buildings and also integrated in blind person's stick. RFID tags based Android application is built which provides Bluetooth connectivity of stick and mobile, voice navigation and location of blind person via android smart phone.

Shruti Dambhare, Prof. A. Sakhare has proposed a theoretical concept of guiding stick for blind in paper "Smart Stick for Blind: Obstacle Detection, Artificial vision and Real-time assistance via GPS". In this concept blind person is assisted via global positioning system(GPS).The system consist of proximity sensors, ultrasonic sensors, GPS module, stereo cameras and dual feedback system- auditory as well as vibratory circuit. This aims at providing artificial vision by providing information regarding ongoing environmental scenario. This proposed theory will help the blind people to overcome the problems which blind person faces in his/her life.

Abdel Ilah Nour Alshbatat discussed that blind people make use of traditional cane for directing them to move from one place to another. In this paper "Automated Mobility and Orientation System for Blind or Partially Sighted People" new intelligent system is proposed to provide same ease and confidence to blind as sighted people. This system GSM-GPS is provided to pin-point the location of blind person and ultrasonic sensor is provide to detect any obstacle in path. With this system blinds can move independently and safely.

A.Sangami, M.Kavithra, K.Rubina, S.Sivaprakasam proposed a concept of smart stick for blind person in this paper "Obstacle Detection and Location Finding For Blind People". Vision is god gifted sense which plays a very important in our lives. When moving to public places visually challenged person have to face many difficulties to overcome this problem intelligent stick is proposed. Navigation system for visually impaired system is provided for dynamic interactions. GPS is provided to identify the location of blind person. An emergency button is also provided to contact with personal or emergency contact.

G.Prasanthi, P.Tejaswitha in their paper "Sensor assisted stick for the blind people" have discussed the new advancement in sensors and the application of ultrasonic ranging scheme for producing electronic walking stick. The sensors mentioned will help the person in detecting the obstacle and that too in up, down & front direction and detecting the pits in the way.

Mohit Saraf, Mohd Shehzad and Neeraj Jadhav in their paper "An IVR Based Intelligent Guidance Stick for Blind" in which they have proposed an IVR Based Intelligent Guidance Stick. The stick consists of two circuits embedded on it. First circuit will be having an Arduino Uno board interfaced with three ultrasonic sensors which will be used to detect obstacles andwill check for the obstacle in all three directions all the time and a speaker which will provide an audio output. The second circuit will be having an 8051 microcontroller technology and has one ultrasonic sensor interfaced with it to detect the potholes in the path.

Objective:

The project of developing an Intelligent Stick for Blind and Deaf was undertaken with the following objectives in mind:

- To provide walking aid to blind & deaf persons that makes them aware about upcoming obstacles.
- Helps them make emergency calls with the help of buttons.
- Providing exact marked location on map to saved contacts in emergency.
- Vibratory mechanism i.e. increasing vibration with respect to proximity of obstacle.
- Detection of high voltage AC mains nearby.

Block Diagram:

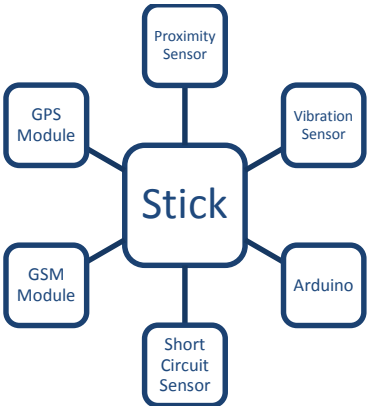

Fig. 1: Block Diagram of Intelligent Stick

Various sensors have been used in the stick to enhance the features of obstacle detection (Prasanthi, G., P. Tejaswitha, 2015). The functionality of each of the sensors has been discussed below:

- A proximity sensor is a sensor able to detect the presence of nearby objects without any physical contact. The maximum distance that this sensor can detect is defined "nominal range". Some sensors have adjustments of the nominal range or means to report a graduated detection distance. Proximity sensors can have a high reliability and long functional life because of the absence of mechanical parts and lack of physical contact between sensor and the sensed object. Capacitive sensors respond to any substance with a high dielectric constant (water, oil, fuel, sugar, paper) without necessarily making physical contact.

Fig. 2: Proximity Sensor. (Source: http://www.nskelectronics.com)

- The Vibration sensor has been used to produce Vibratory output that will aid the deaf person about the presence of potential obstacles whereas the blind persons will be intimated by an obstacle by the buzzer output.

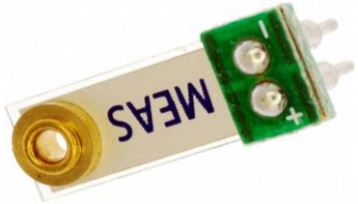

Fig. 3: Vibration Sensor. (Source: www.digikey.com)

- The Short Circuit sensor is used to detect the water under the stick. The two probes will be used to detect the water whenever the water comes in contact with the probes the circuit will be completed and vibrations are produced in the stick to aware the blind.

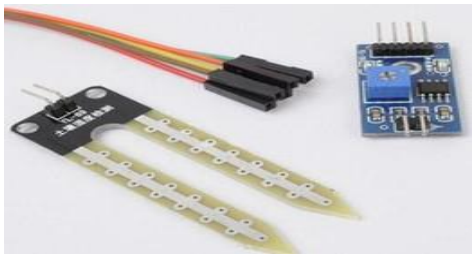

Fig. 4: Short Circuit Sensor. (Source: www.dhgate.com)

- GSM module is used to establish communication between a computer and a GSM system. Global System for Mobile communication (GSM) is an architecture used for mobile communication in most of the countries. GSM enables higher data transmission rate. GSM module consists of a GSM modem assembled together with power supply circuit and communication interfaces (like RS-232, USB, etc) for computer. A GSM MODEM can perform the following operations:

  - Receive, send or delete SMS messages in a SIM.
  - Read, add, search phonebook entries of the SIM.
  - Make, Receive, or reject a voice call.

Fig. 5: GSM Module. (Source: www.circuitstoday.com)

- The Global Positioning System (GPS) is a space-based navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites (Shruti Dambhare, A. Sakhare, 2011). The system provides critical capabilities to military, civil, and commercial users around the world. GPS devices may have capabilities such as:
- maps, including street maps, displayed in human readable format via text or in a graphical format.
- turn-by-turn navigation directions to a human in charge of a vehicle or vessel via text or speech.
- directions fed directly to an autonomous vehicle such as a robotic probe.
- traffic congestion maps (depicting either historical or real time data) and suggested alternative directions.
- information on nearby amenities such as restaurants, fuelling stations, and tourist attractions

Fig. 6: GPS Module. (Source: www.bhphotovideo.com)

Working Methodology:

It is an Arduino based automated walking stick with very low power consumption and easy operation. This intelligent walking stick is an electronic interface which has been designed for visually impaired people to help them in walking by providing the indication about the presence of obstacles (Abdel Ilah Nour Alshbatat, 2013; Mohit Saraf, *et al*., 2014).

The intelligent stick involves obstacle detector and location tracker (Sangami, A., *et al*., 2015). The proposed design includes short circuit sensor, vibration sensor, proximity sensor and GSM and GPS enabled switches in case of any emergency. It can be operated in buzzer, vibration and voice play back modes (Pankaj Patil, *et al*., 2015). Vibrator circuit can serve the same purpose as buzzer mode for blind as well as deaf. Thus, the user is free to use any of the modes.

The micro-controller used, is Arduino ATmega. All sensors' data are taken by the micro-controller and it produces different Pulse Width Modulation (PWM) based on the sensors output to operate motor. In case of any emergency, the deaf or blind person can press any of the four switches installed on the stick. These switches are GSM and GPS enabled. As soon as any of the switch is pressed, a pre-stored message will be sent to the saved emergency contacts along with the location of person. The saved contacts can find the exact location of the person in trouble with the help of an android application linked to the GPS of stick.

Gps/gprs based advanced system:

There are four buttons on the stick that operate with the GSM/GPS module. The function of each of these buttons is:

By By pressing button 1: - Call and text message will be sent to the 4 assigned contacts in the stick. If first person doesn't pick the call, the call will be forwarded to the next assigned number automatically.

By pressing button 2: - GPS location of the person in the form of latitude and longitude coordinates will be sent to the assigned number along with marked location on the map.

By pressing button 3: - Beep and buzzer will be activated to make the nearby people aware and can also be done by itself if needed.

By pressing button 4: - Call will be received by the blind person with the use of head phones (Rohit Sheth, *et al*., 2014).

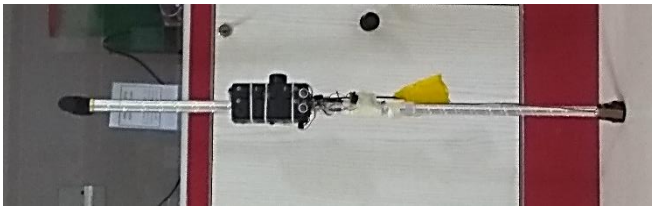

Fig. 7: Intelligent Blind Stick.

Main Features:

- ***Distance Estimation****:*

Making Blind/Deaf person aware of upcoming obstacle by increasing the vibration as the obstacle comes near.

- ***Exact Tracking of Blind/Deaf Persons****:*

GPS based mapping.
Emergency call/message facility.
Detection of high AC mains nearby.

Conclusion:

This paper proposes a design for an intelligent stick that aids blind as well as deaf people for any kind of obstacle detection including water, potholes, AC mains. It has an added functionality of GPS and GSM module that will enable immediate provision of help to the person in case of an emergency. The objective is to provide an aid to visually impaired and deaf people which will assist them everywhere they go.

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