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Ultrasonic Stick for Blind

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Abstract
Today technology is improving daily in different aspects in order to provide flexible and safe movement for the people. Currently the most widespread and used mean by the visually impaired people are the white stick, however it has limitations. With the latest technology, it is possible to extend the support give to people with visual impairment during their mobility; this paper proposes an economical ultrasonic stick for visually challenged people, so as to gain a personal independence and free from the external help. A portable user friendly device is developed that can identify the obstacles in the path using ultrasonic sensors and Camera. Ultrasonic sensors can scan three different directions (at 180º). Camera can be used as an alternative tool in the places that surrounds with the low signal coverage, a microcontroller, buzzer and vibrating motor. The buzzer and vibration motor is activated when any obstacle is detected. GPS system provides the information regarding to his current location. SMS system is used by the blind to send SMS message to the saved numbers in the microcontroller in case of emergency.

Keywords – Ultra sonic sensors, GPS-L10 modem, GSM SIM 900D modem.

I. INTRODUCTION

The statistics by the World Health Organization (WHO) in 2011 estimates that there are 285 billion people in world with visual impairment, 39 billion of people are blind and 246 billion are with low vision, and around 15 million people are blind in India, The World Health Organization expects this number to increase in the coming years. This paper proposes the design and develops a portable unit (stick) for the blind people for easy use and navigation in public places. The most widely used stick is the long cane because it can feel the nature of the path and detect obstacles in the path of the blind person. Being an emerging area of research, a review of the most recent literature has been carried out and presented in Section II. The methodological framework and the system design are presented in Section III. Results are given in section IV and conclusion in section V.

II. LITERATURE REVIEW

- Voice operated outdoor navigation system for visually impaired persons done by **Somnath and Ravi (2012) [1].** Uses a stick equipped with ultra-sonic sensors, GPS and audio output system. The stick contains GPS which will have SD memory card which used to store different locations. The user can set the location by voice and the GPS will guide the person to his/her distention. This system will also provide the speed and the remaining distance to reach the distention. When the ultra-sonic sensors detect any obstacle directly the voice system will activate the caution voice. This system can be classified as a low cost system affordable by the user. In addition to that, it can provide a voice guide for the user with greatest possible accuracy. **The system uses the ARM processor which has more memory space, so that the operating speed is high. However, this system cannot operate indoors because there will be no signal for the GPS system. The accuracy of the GPS signal need to be improved because it only can be controlled within 5 meters radios.** Finally, the blind person needs to be trained on the system so that he or she can use it effectively.
- **Shruit and Prof. A (2011) [2]** system done for using smart stick for blind people: obstacles detections, artificial vision and real time assistance via GPS. This system operates by using GPS, artificial vision system, obstacle detection and voice circuit. This system works by fitting a camera on the persons head, the camera will be use an algorithm to identify the highs

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and obstacles in front the blind person. This system also contains ultra-sonic sensors to detect the obstacles. Furthermore, this system includes GPS system is to reach the required destination. The accuracy of the artificial vision unit provides a high accuracy output for the user. **However, the designing complexity of the system makes it difficult to design and understand.**

- Another study in the same field to help blind people uses the pulse echo technique in order to provide a warning sound when detecting the obstacles. This technique is used by the United States military for locating the submarines. They used pulse of ultrasound range from 21 KHz to 50 KHz which hit the hard surface to generate echo pulses. By calculating the difference between signals transmit time and signal receiving time we can predict the distance between the user and the obstacles. This system is very sensitive in terms of detecting the obstacles. It has a detection range up to 3 meters and a detection angle 0 to 45 degree. **However, this system requires more power to operate because of the transmitter and receiver circuits. So, this system needs to be re-designed to operate with less power consumption (Anon., n.d.) [3].**

- Another study done by (Jayant, Pratik and Mita, 2012) [5] proposed a smart cane assisted mobility for the visually impaired. The system is based on normal ultrasonic sensors and ATMEL microcontroller. It operates with two rechargeable battery (7.4v) it can be recharged using USB cable or AC adaptor. The control unit is programed using ATMEL AVR microcontroller ATMEGA328P microcontroller. Once any obstacles are detected vibration and buzzer will start in order to warn the user. This system is a non-complex system to use. It has the ability to cover a distance up to 3 meters and has the rechargeable feature of the battery. Also, this system can be folded in small piece so that the user can carry it easily. **However, this system has only one direction detection coverage and it is inaccurate in detecting the obstacles.**
- All the studies which had been reviewed show that, there are many techniques of making a smart sticks for blind people. However, the study conclusion shows that, using the ultra-sonic sensors would be an efficient solution to detect the obstacles with maximum range of 7 meters and 45 degree coverage

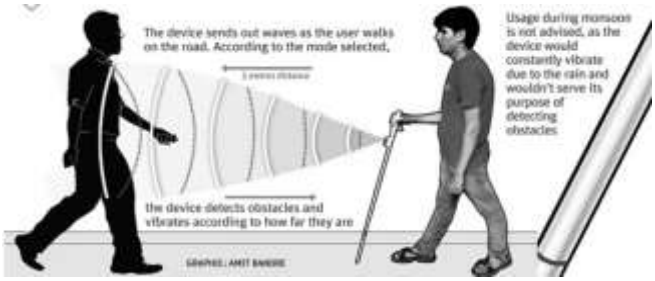

Fig1:- Working of Stick [11]

and using a noncomplex microcontroller will help the blind person to use the devise friendly and without any problems. Finally, the device should work for a long time with minimum power and it could be recharged so it operates with two rechargeable batteries (7.4v) and further can be recharged using USB cable or AC adaptor. This system proposes a stick which uses ultrasonic sensors for detection and a microcontroller that controls the system without complexity. The detection angle is 180 degree. In our initial study we face many problem with the low signal in many areas like indoors so for that we make use of camera on the persons head, the camera will be use an algorithm to identify the highs and obstacles in front .It is low cost and light weight system.

UTTRASONIC SYSTEM –

The main part in the system is the microcontroller that controls the other components of the system.

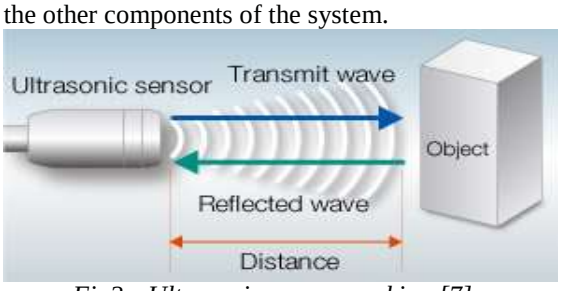

Fig2:- Ultrasonic sensor working [7]

When the ultrasonic sensors detect any objects or obstacles in 180 degree horizontal and 60 degree vertical, it will activate the buzzer and the vibration motor automatically. If any of the three sensors detect any obstacles with in a range of 100 cm the buzzer will be activated with 1000Hz and 2000 m/s delay. If the obstacles within range of 100 cm and 50 cm the buzzer will activate with 1000Hz and 1000 m/s delay. Finally, if the detection is below 50 cm the buzzer will activate with 1000Hz, 500 m/s delay and the vibration motor will activate.

Ultrasonic Sensors– Ultrasonic sensors or ultra-motion detectors are an electronic kit that contains many sub electronic

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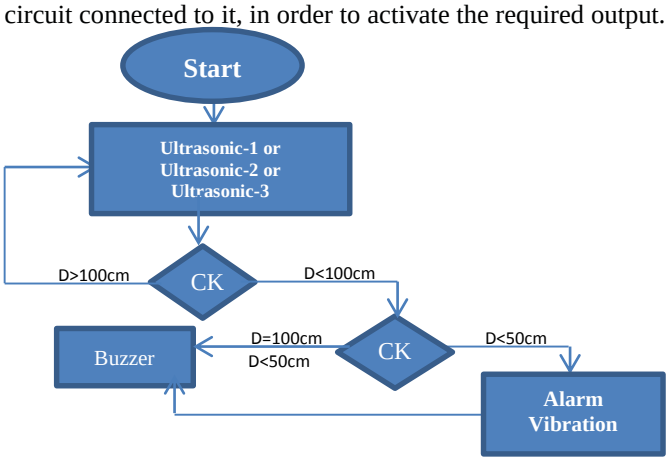
Volume 4 Issue 4 April 2015, Page No. 11375-11378

circuit in it and has many applications. When signals from the sensors of sound circuit, playback circuit or vibrator circuit have been detected, it will be transmitted to an additional circuit connected to it, in order to activate the required output.



Fiq2:-Detection Flow Chart

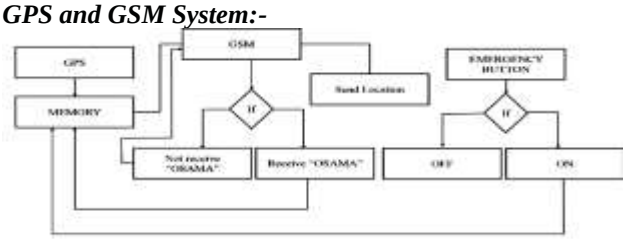
The ultrasonic sensors contain complete ultrasonic crystal control transmitted 40 KHz and a very sensitive receiver measure 1 to 0.5 by 3 inches. Usually ultrasonic sensors can detect with the range of 3 meters to 7 meters.

It is an 8 bit 18 pins microcontroller that provides 200 nanosecond instruction executions. It has a flash program memory of 3.5 KB and CPU speed up to 5 MPS. Also, it has 4 MHz internal oscillator, 224 Bytes RAM and 128 bytes EEPROM. Addition to that, it has two comparator and operating voltage 2 V to 5.5 V with temperature range - 40 C to 125 C.

Vibration Motor

This is the type of DC vibration motors used in mobile phones. It requires a voltage supply of 1.3v to 3v with current around 125 mA. This type of motors can be programed to control the speed of it by using the PWM (Pulse Width Modulation) method. The speed of the motor is 13500 rpm and the diameters of the motor are 4 mm to 10 mm and the length is 2mm to 15 mm.

GPS and GSM System:-



Fiq:-3 GPS and GSM Modems Flow Chart [4]

When GSM modem receives a message the microcontroller will process the message with the keyword saved in it. Then, it will get the location of the stick from the GPS modem and transmit the location to the GSM modem in order to respond to the sender. In case of an emergency, the user of the stick can press the emergency button the microcontroller access the location from the GPS modem and transmit the location to the GSM modem which will send a SMS messages to the all saved numbers in the microcontroller

The GPS will update the location of the stick and automatically save the location in PIC18F45K22 EEPROM memory. If the microcontroller receives the word “OSAMA” from the GSM modem, the microcontroller will track the last location from the EPROM and transmit it to the GSM modem which will send an SMS message that states the location for the person to the required number. Addition to that, if the emergency button is pressed the directly the microcontroller will transmit the last location saved in the EEPROM to the GSM modem to send it to all saved number in the microcontroller.

Figure 6 shows the connection of the GPS modem and GSM modem with PIC18F45K22 microcontroller.

PIC18F45K22 Microcontroller–

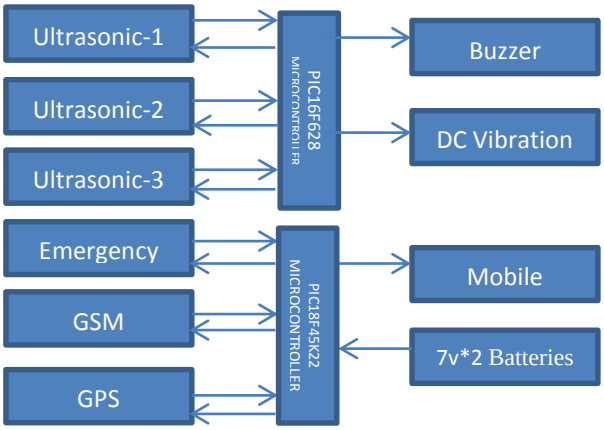


Fig3:- System Block Diagram

It is a 40 pin microcontroller flash programmable memory with 32KB program memory, CPU speed MISP, RAM 1536 bytes and data EEPROM 256 bytes. It equipped with 2 UART, 2 SPI, 2 I2C2 and 2 Comparator. Addition to that, it has 28 channel 10 bit ADC and require 1.8v to 5.5v to operate with temperature range from -40C to 125C. *C.*

Working Principle–

The main part in the system is the microcontroller that controls the other components in the system. When the ultrasonic

sensors detect any objects or obstacle in 180 degree path it will activate the buzzer and the vibration motor.

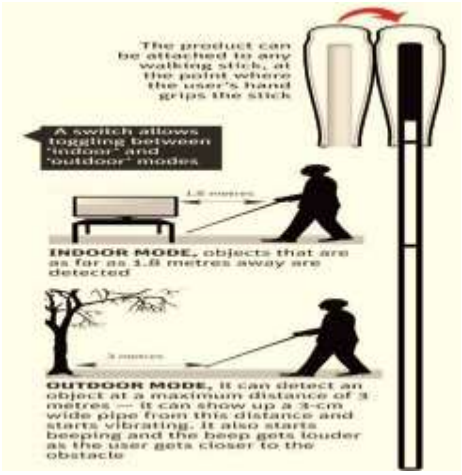


Fig6:- Working Principle Indoor and Outdoor

In addition to that, when the GSM modem receive a message it will be sent to the microcontroller which will get the location of the stick from the GPS modem and transmit the location to the GSM modem in response to the sender. In the areas with low signals cameras can be use, this system works by fitting a camera on the persons head, it will use certain algorithm to identify the highs and obstacles in front the blind person. In case of an emergency, the user of the stick will press the emergency button and the signal from the button will go to the microcontroller which will get the location from the GPS modem and transmit the location to the GSM modem which will send a SMS messages to the all saved numbers in the system.

CONCLUSION

The paper analyzed the existing electronic aids for blind people and does not discuss any implementation results. Based on the limitations in existing aids, this paper proposes an enhanced assisting electronic aid using latest technology like Ultrasonic waves, Camera, GPS, GSM for the visually impaired people, In addition to that, where GPS system cannot be used we make us of the camera with some algorithm for to identify the obstacles. Also, this paper aims to develop emergency trigger alert system along with design.

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