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Navigating the Unseen: Ultrasonic Technology for Blind Navigation

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ABSTRACT

Navigation for the visually impaired is a critical aspect of ensuring independence and safety. This project introduces an "Ultrasonic Navigation System for the Blind" using ultrasonic sensors and a buzzer. The system aims to assist individuals with visual impairments by detecting obstacles in their path using ultrasonic sensors and providing feedback through a buzzer. This integration of sensors and an audible alert system offers an intelligent solution for enhancing mobility and reducing obstacles for the blind.On the other hand, and in order to reduce navigation difficulties of the blind, an obstacle detection system using ultrasounds and vibrators is added to this device. The proposed system detects the nearest obstacle via streoscopic sonar system and sends back vibro-tactile feedback to inform the blind about its localization.The system has one more advanced feature integrated to help the blind find their stick if they forgot where they kept it. Pressing the remote button sounds a buzzer on the stick which helps the blind person to find their stick. Thus this system allows obstacle detection as well as finding stick if misplaced by visually disabled people. This goal has been realized through the use of an ultrasonic sensor to determine the range of obstacles and also a microcontroller to act accordingly. The life of blind people is very difficult and challenging, This stick will be embedded by sensor to senses any object or human in front of them.

Keywords: Ultrasonic Sensors, Buzzer

1. INTRODUCTION

The motivation of this project was to develop a portable navigation aid for blind pedestrians. The most widely used primary mobility aid today is the long cane. This has several limitations such as a range limited to the length of the cane, typically one pace ahead of the user, difficulties detecting overhanging obstacles, and difficulties storing in public places. It is a self contained portable electronic unit. It can supply the blind person with assistance about walking routes by using spoken words to point out what decisions to make. On the other hand, and in order to overcome the imperfections of existing electronic travel aids, the proposed method of measuring distance travelled in this system, is to use the acceleration of a moving body which in this case is the blind person. An accelerometer, followed by two integrators is used to measure a distance travelled by the blind. This technique is considered in inertial navigation

systems and suffers from drift problems caused by the double integration and offset of the accelerometer which are overcome by the footswitch . When this footswitch is closed, the acceleration and the velocity are known to be equal to zero and this can be used to apply a correction. In addition, to help blind or visually impaired travellers to navigate safely and quickly among obstacles and other hazards faced by blind pedestrians, an obstacle detection system using ultrasonic sensors and vibrators has been added to this aid. The proposed obstacle detection system consists then in sensing the surrounding environment via sonar sensors and sending vibro-tactile feedback to the user of the position of the closest obstacles in range.

2. LITERATURE REVIEW

Blind people are individuals with vision problems. Blind people can be classified into two groups, namely: Blind and low vision. Definition of Blindness according to Somantri (2006) are individuals who have weak vision or accuracy of vision less than 6/60 after being corrected or no longer have the vision. Persons with visual impairments are individuals whose senses of vision (both) do not function as a channel for receiving information in daily activities as well as sighted people Because blind people have limitations in their sense of sight, the learning process emphasizes other sensory devices, namely the sense of touch and sense of hearing. Therefore, the principle that one must consider in teaching the blind individuals is that the media to be used must be tactual and sound, for example the use of braille writing, embossed drawings, model objects and real objects, whereas the voiced media are tape recorders and JAWS software. Blind people have several limitations, namely:Unable to see hand movements at less than 1 (one) meter.

1. Visibility of 20/200 feet is sharpness that can see an object at a distance of 20feet.
2. The field of vision is not more extensive than 200 (Somantri, 2006).

Blind sticks are a long, straight stick that is the most useful tool for mobility for the visually impaired.

Sounds are stimuli that vibrate the ear organ (hearing) of humans, so that humans hear stimuli or vibrations caused by these stimuli. Sound waves are longitudinal mechanical waves. These sound waves can be transmitted inside solid objects, liquids and gases. The material particles that transmit a wave oscillate in the direction of propagation of the wave itself. These sound waves are vibrations of molecular substances and collide with each other, but these substances are coordinated to produce waves and transmit energy even without particle displacement. When sound waves propagate to the surface boundary, the sound waves will experience transmission and reflection. Basically, ultrasonic is a sound wave that has a frequency above the human hearing limit. The frequency of human hearing limits varies for each person. But in general, the frequency of human hearing is from 20 Hz - 20 kHz. And ultrasonic waves have a frequency of more than 20 kHz. Until now, the ultrasonic wave frequency hasreached 1 GHz and if it exceeds the frequency of 1 GHz it is called hypersonic — spectrum of ultrasonic waves. At a frequency of 10 kHz - 150 kHz, ultrasonic is used for communication of several animals such as bats and dolphins. If at this frequency the power is increased, then ultrasonic can be used to assist the cleaning process (cleaner) of some materials such as jewelry. For medical imaging applications a frequency of 1 MHz up to 20 MHz is needed, for example as used for ultrasonography (USG). Likewise for other applications it requires its own frequency range.

3. PROPOSED METHOD OFDCNN-NFS FOR MTD

Blind stick is an innovative stick designed for visually disabled people for improved navigation. We here propose an advanced blind stick that allows visually challenged people to navigate with ease using advanced technology. The blind stick is integrated with ultrasonic sensor along with light and water sensing. Our proposed project first uses ultrasonic sensors to detect obstacles ahead using ultrasonic waves. On sensing obstacles the sensor passes this data to the microcontroller. The microcontroller then processes this data and calculates if the obstacle is close enough. If theobstacle is not that close the circuit does nothing. If the obstacle is close the microcontroller sends a signal to sound a buzzer. It also detects and sounds a different buzzer if it detects water and alerts the blind. It is embedded as part of a complete device often including hardware and mechanical parts. Embedded systems control many devices in common use

today.98 percent of all microprocessors are manufactured as components

Figure 1: Smart Blind Attack

Of embedded systems. with general-purpose counterparts are low power consumption, small size, rugged operating ranges, and low per-unit cost. This comes at the price of limited processing resources, which make them significantly more difficult to program and to interface with. However, by building intelligence mechanisms on the top of the hardware, taking advantage of possible existing sensors and the existence of a network of embedded units, one can both optimally manage available resources at the unit and network levels as well as provide augmented functionalities, well beyond those available.

3.1 ARDUINO NANO

Arduino can control the environment by receiving input signals (Digital/Analog) and can effects its surroundings by controlling lights, relays and other devices. 'The microcontroller on the board is programmed using Arduino software.On sensing obstacles the sensor passes this data to the microcontroller.

3.2 ULTRASONIC SENSOR

Generating, detecting & processing ultrasonic signals Ultrasonic is the production of sound waves above the frequency of human hearing and can be used in a variety of applications such as, sonic rulers, proximity detectors, movement detectors, liquid level measurement. Ultrasonic Ranging Module HC - SR04.

Figure 2: ULTRASONIC SENSOR

When GSM modem receivea 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.

3.2 BUZZER

A transducer (converts electrical energy into mechanical energy)that typically operates A buzzer is in the lower portion of the audible frequency range of 20 Hz to 20 kHz. This is closeness in different formats of vibrations. an electric, oscillating signal in the audible range, into mechanical energy, in the form of audible waves. Buzzer is used in this research to accomplished by converting warn the blind person against obstacle by generating sound proportional to distance from obstacle. VIBRATE MOTOR. A vibrator motor is included to enhance the overall feedback for the person who receives the warning against obstacles

Figure 3: BUZZER

4. RESEARCH METHODOLOGY:

The research method used in the construction of this system is the SDLC (System Development Life Cycle) method. System Development Life Cycle (SDLC) is the process of creating and changing systems and the models and methodologies used to develop an application. SDLC is also a pattern taken to develop software, which consists of the following steps:

1. Implementation : At this stage implementation is carried out from the system planning to the real situation that is by selecting the components to be used andthe preparation of the software (coding / coding)
2. Testing: At this stage testing is carried out to see whether the system created is in accordance with the

needs of the user or not, if not, the next process is iterative, i.e. returning to the previous stages. And the purpose of the test itself
is to eliminate or minimize defects so that the system developed will really helpthe users when they carry out their activities.

3. Maintenance: At this stage the process of operating the system begins and ifnecessary small repairs can be done

4. Planning: In the planning phase, things that are related to studies of needs, feasibility studies, both technically and technologically, and scheduling are alsocarried out in this study.

5. Analysis: In the analysis phase direct observation is carried out by looking at the problems that arise and are realized regarding the components and software and hardware.

6. Design: At this stage the application will be described in detail about the design process of each component in the prototype according to the needs in the prototype discussed earlier.

5. RESULTS & DISCUSSION

In this section, the tests carried out with the Acoustic Prototype are described. The experiments, which were developed during two months, involved twenty blind users. The tests were performed in controlled environments under the supervision of instructors and engineers. During the first month, each individual was trained to perceive and localize the sounds heard through the headphones, to learn that these sounds were representing objects of the surrounding environment and to relate them to corresponding obstacles. In other words, they learned that the sound meant 'danger' and that they should avoid it. This initial learning period was implemented through different exercises with increasing complexity: from simple object detection to localization of several objects and navigation through these objects whilst avoiding them. Initially users were complementing the use of the Acoustic Prototype with the white cane. The use of the white cane enabled the users to relate the distance perceived with the white cane with the sounds heard via headphones. The aim of these experiments was to validate the Acoustic Prototype as object detector and mobility device for blind people.

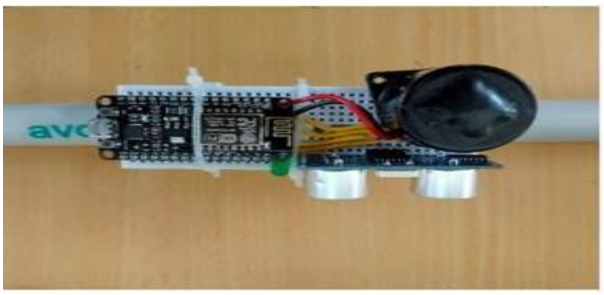

Figure 4: object detector and mobility device for blind people.

Figure 5: localize the sounds heard through the headphones, for blind people.

6. CONCLUSION:

This research has produced a design prototype of sticks for blind people using sensor technology to assist the alertness and movement of the blind who are able to detect objects at a minimum distance of 10 meters with output in the form of sound and vibration. The resulting stick has a frame consisting of 0.5-inch PVC material consisting of two parts, the stick rod and thesensor unit.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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