A Survey Paper on Ultrasonic Navigation System for Blind People

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Abstract— This paper represents is an investigation of the development of navigation aid for blind and visually impaired people. It based on a microcontroller AVR Atmega328 with having synthetic speech output. This project is built to use the blind as well as they may walk easily in rural areas as well as avoid obstacles using special detection sensors. The paper shows an innovative project design and implementation of Ultrasonic sensors fitted with the system provides obstacle data to the blind person through voice message so that he/she may avoid them. As well as, to reduce the navigation difficulties of the blind, and obstacle detection system using ultrasounds and vibrators is added to this device. The proposed system detects the nearest obstacle via an ultrasonic sensor and sends back vibrator tactile feedback to inform the blind about its location. In this project, the system is designed in such a way that it gathers data about the environment via ultrasonic sensors and extracts the visual information that data. The information is to transform the audio signal and the blind person can recognize the environmental information through binaural sound generated by the system.

Keywords: Handicapped aids, Navigation, Sonar, Ultrasonic

I. INTRODUCTION

The development and application for the technology for orientation and moving has a long history. A walking stick and guide dogs are used blind persons for surviving in day to day life. By technology, some electronic devices are made for blind persons. Most of the commonly used electronic travel aids use ultrasound. All such devices use the principle of reflection of the high-frequency ultrasonic beam and are available in different models. Sonic Pathfinder, Moswat-Sensor, and Guide-Cane are called clear path indicators or obstacle detectors since the blind can only know whether there is an obstacle in the path ahead. These devices are used to search for obstacles in front of the blind person, and they operate like a flashlight, which has very narrow directivity. Ultrasonic and navigation is the environment sensor since it has searched for several obstacles at the same time. The motive of this project is the develop navigation use for blind people. It is used for the primary use for today is the long cane. Some limitations are present such as a range limited to the length of the cane, typically pace ahead of the blind person, difficulties detecting overhanging obstacles, and also the difficulties storing in public places. In this paper, the recommendation for the navigation system involves a microcontroller with speech output It is a self-contained portable electronic unit. It can supply the blind person with assistance about walking routes by using instructions to point out what decisions to make. On the other hand, and to overcome the imperfections of existing electronic travel use the proposed method of measuring the distance traveled in this system, is to use the acceleration of a moving body which this case is the blind person. An accelerometer, follow by the two integrators is used to measure a distance traveled by the blind.

A. Existing System

The system is straightforward and it's easy to use. The system is attached to the belt of the user's waist. They are provided for the test to ascertain that the blind person step is detected by the accelerometer receiver. Then the user is selected the route number and direction and the appropriate.

A repeat key is considered to enable a blind person to make the use repeat the word indicating decision.

On the other way, when an obstacle is detected and the output occurs in the pulses at a rate inversely related to the distance from the user.

B. Proposed System

Proteus is the essential software for circuit implementation and simulation. The ARES is used for the PCB designing and ISIS has used for the circuit designing with simulation. Including required components with corresponding information from its library, it is simulated after building the circuit. AVR microcontroller needs to include the hex file for the implementation of the project. The proteus combines circuit simulation and co-simulation of complete to based microcontroller design.

The equipment used for the design as well as the implementation of the circuit is AVR microcontroller, voltage regulator, diode, crystal oscillator, capacitor, variable resistor, transistor, ultrasonic sensor, and the SD card.

The three reflective signals they produced: front obstacle sensor, right obstacle sensor, left obstacle sensor. All signal are inputs for ADC on the microcontroller these signals are used as well as the input to a specific program implementation on the real-time within microcontroller then according to internal instruction it will produce the output which transferred from the microcontroller to the SD card then it aware the blind pedestrian about the barriers blocking his way.
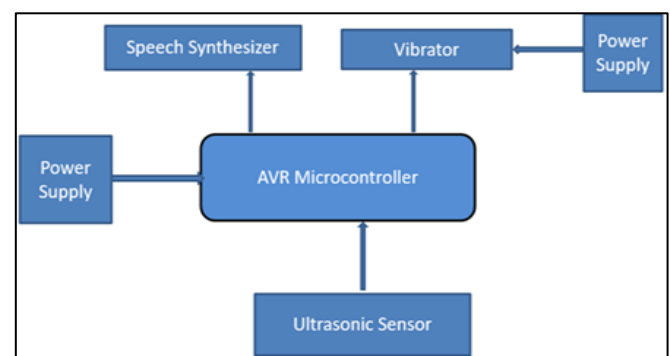
II. SYSTEM BLOCK DIAGRAM

Fig. 1: Block Diagram

A. Modules

- Power supply
- Vibrator
- Speech synthesizer
- SD card
- Ultrasonic sensor
- AVR microcontroller
- Battery

B. Module Description

1) Power Supply

For getting +5 volts supply, the + 12 volts supply from power supply output is taken. And it is given to 7805. The minimum input to 7805 is +7 Vdc and the Maximum input is + 35 Vdc as well as + 12 Vdc as input to the 7805. There is the output of the 7805 is constant regulated +5 Vdc.

2) Vibrators

In this system, the vibrator is used. those devices are small and light enough to be fixed on the cloth without any obstruction.

3) Speech Synthesizer

The speech synthesizer device chosen is the ISD 5216[16] from 'Chip Coder' and is used as an audio output. This chip is a single-chip in the storage capacity and up to 16 minutes of good quality, playback functionality, and audio system. On the other hand, the speech synthesizer is activated by pulses from the microcontroller. This output represents the different actions like (e.g. road right turn, left turn...)

4) SD Card

The module (Micro SD Card Adapter) is a Micro SD card reader module for reading and writing through the file system and the SPI interface driver, SCM system can be completed within a file Micro SD card.

5) Ultrasonic Sensors

In this system is based on three ultrasonic sensors mounted together. It emits the ultrasonic wave measures the echo. By different the input and output signals, the PIC 16F876 computes the distance to the nearest obstacle. The information is transmitted as a Pulse Wide Modulation (PWM) signal to the receiver.

6) AVR Microcontroller

The AVR has modified Harvard architecture 8 bit RISC single-chip microcontrollers. AVR microcontroller is the first microcontroller families to use on-chip flash memory for program storage, as opposed to one-time programmable ROM, EPROM, or EEPROM used by other microcontrollers at the time. AVR microcontrollers find many applications as embedded systems. AVR microcontroller has a 28 pin is present.

7) Battery

It gives 12 volts and 5 Amps current for quick charging of the battery. If the battery is partially discharged, the full charge will be attained in one hour if the Battery level is below 12VDC then the charging circuit is triggered ON. The voltage will be sense IC senses the voltage level to trigger the charging events. Battery: It gives 12 volts and 5 Amps current for quick charging of the battery. If the battery is partially discharged, the full charge will be attained in one hour if the Battery level is below 12VDC then the charging circuit is triggered ON. The voltage will be sense IC senses the voltage level to trigger the charging events.

III. CONCLUSION

The proposed navigation aid has been developed to enhance the independent mobility of blind individuals. This technique well known in aircraft navigation used in this study has reduced errors caused by the accelerometer and double integration. Also, the use of the footswitch is highly advantageous because, without it, drift errors due to the accelerometer and double integration would be considerably greater in magnitude and would reduce the effective range of the electronic travel use. The system detects the nearest obstacle, it cannot solve the blind people's ultimate problem of the environment perception. It has limits due to the characteristics of the ultrasound reflections such that many objects can barely be detected, which have very small or soft surfaces. The results obtained are encouraging and further testing on more blind people shall be implemented shortly.

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