AN ULTRASONIC NAVIGATION SYSTEM FOR BLIND PEOPLE

A Minor Project Report Submitted By

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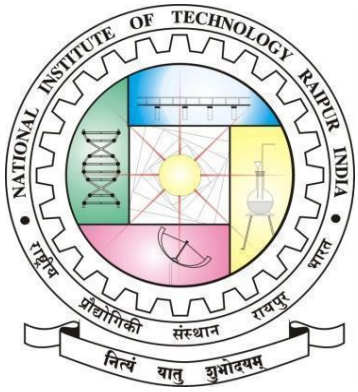

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NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR

CERTIFICATE

This is to certify that the Minor Project work entitled **"An Ultrasonic Navigation System for Blind People"** is the bona-fide work done by **Bhupendra Nishad (16116018)**, **Nitish Kumar (16116058)**, and **Tejprakash Sahu (16116085)**, under our guidance and supervision. This report is submitted following the completion of major project during the academic session of July-November 2019.

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CERTIFICATE BY THE EXAMINER

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Date:

Examiner 2

Name:

Date:

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Abstract

The aim of this project is to investigate the development of a navigation aid for blind and visually impaired People. It is based on a microcontroller with synthetic speech output. This aid is portable and gives information to the user about urban walking routes to point out what decisions to make. 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 stereoscopic sonar system and sends back vibro-tactile feedback to inform the blind about its localization.

Table of Contents

List of Figures

1. Introduction

Blindness is a condition of lacking the visual perception due to physiological or neurological factors partially or fully. The main concept of the paper is to provide an electronic aid as guidance to overcome the lacking of their visualization power by proposing a simple, efficient, configurable electronic guidance system for blind and visually impaired pedestrians.

Ultrasonic Sensor is the proposed electronic aid which senses the obstacles in its path by continuously transmitting the ultrasonic waves. When an obstacle appears in its vicinity then the ultrasonic waves gets reflected to the system immediately. And then ultrasonic receiver senses these ultrasonic waves. This method supports the microcontroller to obtain the information from ultrasonic waves and then it alerts the blind pedestrians through voice message. The advantage of our proposed system is its voice based announcement for easy navigation which can assist a blind pedestrian to pass through a busy road. Moreover, this system is an auditory guidance system for the visually impaired pedestrians using ultrasonic-to-audio signal transformation.

2. Motivation

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.

3. Literature Survey

Technology is being developed day by day which can be used for betterment or to increase the comfort of people using those technologies. People who become blind either by accident or by birth will face many problems in their day to day life. Technology is paving way to provide aiding devices for the visually impaired people. Various papers have brought out the innovations used to betterment of visually impaired.

Mobility of visually impaired people is restricted by their incapability to recognize their surroundings. According to the World Health Organization (WHO) in 2012, out of 7 billion global population there were over 285 million visually impaired people and 39 million were totally blind out of which 19 million are children (below 15 years). This means that someone in our world goes blind in every five seconds and a child in every minute. Over 90 percent blind children obtain no schooling. Recent survey source India is now becoming the world's large number of blind people. The population of India has reached 120 Cr. Of those 8.90 Cr. people are visually impaired. 90%of those cannot travel independently. In this paper, we present a survey of navigation system of visually impaired people highlighting various technologies with their practical usefulness, design and working challenges and requirements of blind people. The aim of this paper is to provide a better understanding to identify important research directions in this increasingly important social area for future research.

Various assistive devices have been developed intensively in order to help and guide blind people. One of such mechanism is that the blind people are able to "sense" the environment by one of these devices which are called Tongue- Placed Electrolyte Display (TED). It plays a key role as a man-machine interface that brings the environment information to the brain in place of the deceased sense organ. Here, a proposed design of the TED which is located within the human mouth is introduced. Then the performance of the TED is validated via tests with ordinary people at the safety intensity of electrical voltage and current. The results show that such device can totally function inside the mouth and can be a potential wearable aid device. This research shows a promise of a new prosthetic which may result in the improvement in the living quality for the disabled community.

4. Technical Description

In this section, the components of the proposed navigation aid are described in some detail.

4.1 Arduino UNO

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

Fig:-1 Arduino UNO

4.2 HC-SR04 Ultrasonic Sensor

HC-SR04 Ultrasonic (US) sensor is a 4 pin module, whose pin names are Vcc, Trigger, Echo and Ground respectively. This sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver. The sensor works with the simple high school formula that

$$\text{Distance} = \text{Speed} \times \text{Time}$$

The Ultrasonic transmitter transmits an ultrasonic wave, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor this reflected wave is observed by the Ultrasonic receiver module as shown in the picture below.

Fig:-2. Ultrasonic Sensor

4.3 Vibrator

This Flat 1034 Mobile Phone Vibration Motor is a shaft less vibration motor is fully-enclosed with no exposed moving parts. Its small size (10 mm diameter, 3.4 mm height) and shaft less design mean you can mount it on a PCB or even place it in a pocket to add quiet, hepatic feedback to your project. The motor has a 3M adhesive backing on it for easy mounting and 1.5″ leads for making quick connections. Polarity is not important; the motor can run CW or CCW. This tiny, button-type, vibrating motor shakes with a vibration amplitude of 0.75g and draws approximately 60 mA when 3 V is applied to its leads**.**

Fig:-3 Vibrator

4.4 Buzzer

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

Fig:-4 Buzzer

5. System in Use

The system is straightforward to use. It is attached to a hand glove which is fastened around the user's palm. The user then selects the route number, and the appropriate mode and direction. A repeat key has been considered to enable the blind person to make the aid repeat the word indicating a decision. This is to ensure that the user can be certain of the decision, in case it is obscured the first time by, for example, traffic noise. On the other hand, the blind should know from which direction the obstacles are coming from. Localization on the horizontal plane is done by appropriate combination of vibration between the left and the right side. If the user feels a vibration on its right it means that the obstacle is on his right and vice versa. If the vibration is on both sides the obstacle is in front of him.

5.1 Flow Chart

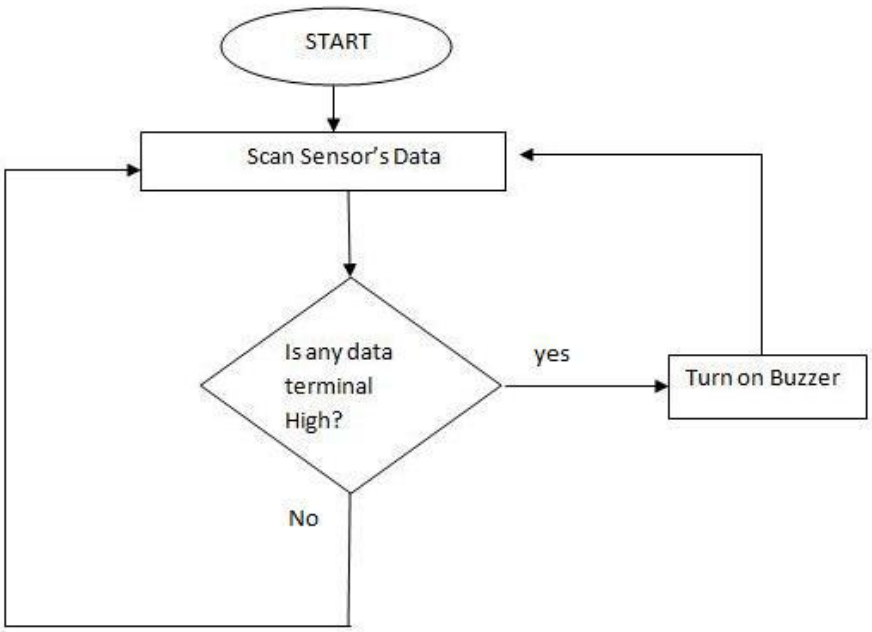

Fig:-5 Flow Chart

5.2 Circuit Schematic

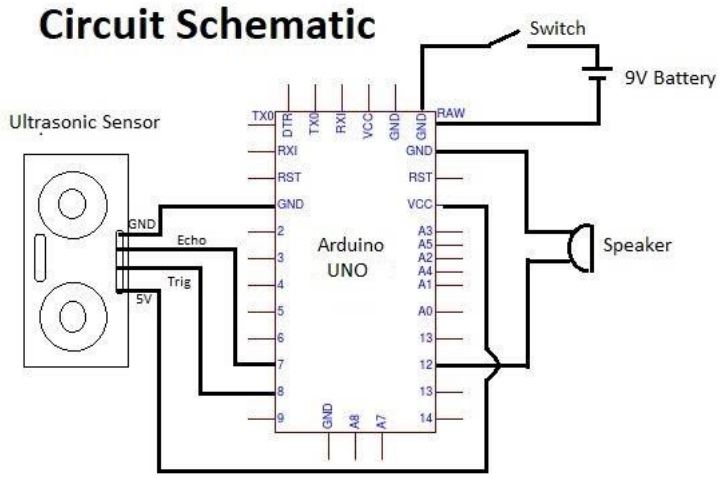

Fig:-6 Circuit Schematic

6. Test and Results

The final circuit is the integration of the Arduino, ultrasonic sensor, a buzzer for output and a battery to support power supply. In this circuit, the Arduino micro controller is connected to the driver. And ultrasonic sensor are connected to the Arduino micro controller. The circuit works on the transmission and reception of ultrasonic sound. When circuit is completes means ultrasonic rays are reflected by any obstacle which helps to routing in path.

Multiple test conducted on basis of practical use of project and it finds very useful to recognize obstacle nearby 5 meters.

The future work is to extend the range of obstacle recognition and improvement of obstacle category identification.

7. Conclusion

The proposed navigation aid has been developed in order to enhance the independent mobility of blind individuals. Although the system detects the nearest obstacle, it cannot solve the blinds' ultimate problem of the environment perception. It has limits due to the characteristics of the ultrasound reflections such that many object 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 in the near future. However, the problem of estimation of the blind position, based on information from different sources, will be solved by using the approach known as particle filtering. The particle clustering and convex region mapping techniques will be used to guarantee that at all times the position estimates are feasible, i.e. that they comply with the constraints imposed by the digital map of the traversed area.

We hope that this aid will be an effective, low-cost solution for reducing navigation problems for blind users.

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