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Echologication Based Guidance System for the Blind

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Abstract
Significant changes have taken place in the last decade in the position of disabled people in our societies and communities. A combination of factors has led to new legislation, regulations and standards in many countries to attempt to remove existing discrimination against differently abled people and enable them to participate fully in education, employment and the community. These factors include increasing awareness of the benefits to society as a whole of increasing the involvement and independence of disabled people and increasingly assertiveness and activity by organization of disabled people.

Equal accessibility to public and services is now required by law in many countries. It is often the use of specialized technology which can provide the visually impaired with a fuller enjoyment of all the facilities of society.

In this work, we have created an automated system to assist the blind in understanding and navigating their immediate environment through their sense of hearing and sense of feeling. We have implemented an obstacle detection system ultrasound technology and vibration motors. The proposed system detects the nearest obstacle via a sonar system and sends back vibro- tactile feedback to inform the user about its localization. This system will benefit the visually – impaired people in more ways than one. In addition to making them more independent, it also boosts their self- esteem and morale.
Keywords: *Blind, Obstacle detection, Sonar system, vibro-tactile feedback.*

1. Introduction

Persons with severe visual impairment face significant obstacles in achieving independent mobility that is safe and robust in terms of possible emergencies and unfamiliar destinations. Widely used mobility aids such as a guide dog and / or white cane offer only limits solutions to this problem. Proposed retrofits of buildings with fixed – points enunciators (to assist with the way finding indoors) are inflexible and costly. The personal navigational aid envisioned below attempt to address many of the problems faced by the visually impaired.

The system is based on the principle of echolocation – the technique used by bats to virtually map their immediate environment. Bats send out high frequency waves that are inaudible to the human ear. This wave bounces off any object it comes across. The bat listens carefully to the echoes that return, the bat's brain figures out how far away an object is. This biological sonar is known as echolocation.

In our project, we aim to give information about the surroundings by employing an ultrasonic ranging module. Ultrasonic ranging modules are designed to emit ultrasonic waves, and receive the waves that bounce back from obstacles. Based on the time taken to receive the reflected wave, the distance of the obstacle from the transmitter can be approximately determined. Once the distance of the obstacle has been determined, the information is conveyed to the user using audio and haptic feedback.

Perhaps the most commonly used mobility aid is the long cane. We believe that this primary aid would form an effective and familiar basis for the introduction of new technology to create an electronic guide cane. This could augment the simple features of the white cane to increase its effectiveness as a primary mobility aid and also enhance its safety. A self – imposed limiting requirement was that an electronic cane must not monopolize the user's hearing faculties. In order to deliver information from an electronic cane equipped with ultrasonic sensors to its user, without the need to commandeer hearing faculties, a tactile user interface was selected for our project.

We believe that our project is a small step in a long journey to make differently abled people as

independent as possible. Our project focuses on helping the blind people the blind people navigate their way with minimal assistant from others.

2. Implementation

The Timing diagram of the HC – SR04 ultrasonic ranging module is as shown in the Fig. 1.

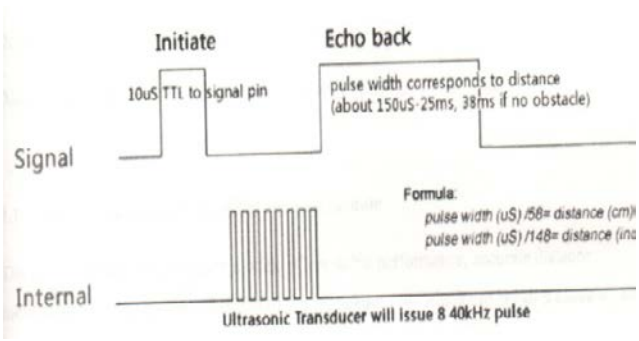

Fig. 1 Timing analysis of HC-SR04.

To start measurement, the TRIG pin of the module must receive a TTL high pulse for at least 10 microseconds. This will trigger the module to transmit out 8 cycle of ultrasonic busts at a frequency of 40 kHz. The module then waits for the reflected ultrasonic bursts. Once the receiver detects the ultrasonic bursts, the module will set the ECHO pin to high (5V) and then set it low after a definite period, the period being proportional the distance of the object from the module.

2.1 Calculation of distance from duration of echo pulse

Let the duration of the echo pulse be 'd' microseconds. This corresponds to the round –trip time of the ultrasonic wave. Therefore, the distance covered is twice the actual distance between the object and the module. Thus, the distance between the module and the object is given by the following relation. Here, we assume speed of sound in air to be 340 m/s.

3. Conclusion

Traditionally, not enough attention has been given to people with disabilities and they were even considered a burden on our society. However, over the last couple of decades, there even concerted efforts by various organizations, both governmental and nongovernmental to ensure that differently – abled people are made an inclusive part of our society. Electronics has helped transform so many aspects of this planet, and surely it is our best bet to help and transform the lives of people with disabilities.

Our project is as small –step in this direction to ensure utmost independence to visually impaired people. This would lead to an increase in self-confidence and lesser reliance on others, and we believe this is highly necessary for them to become an integral part of our society.

Considering all this, we believe that our project, the echolocation based guidance system for the blind, is a simple yet effective solution to help the visually impaired become more independent. This solution is extremely cost effective and can be easily modularized for implementation into existing guide-canes.

4. Future Enhancement

The following features can be added to this system to increase its effectiveness and versatility.

- Adding multiple ultrasonic ranging modules at different heights and in different directions to give a more informed decision about the obstacles in the path of the visually – impaired person.
- Adding a button, which when pressed, sends out an SOS message to pre-defined people. A GPS module can also be included to transmit the location of the person, in case of emergency.

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