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THIRD EYE FOR THE BLIND: AN INNOVATIVE WEARABLE TECHNOLOGY USING NI MYRIO

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ABSTRACT: Visually impaired people usually rely on outside help by Humans, well-trained dogs, special electronic system. The issue with blinds is how to navigate the way where they want to move. Humans with proper eyesight help blind people. According to the World Health Organization (WHO), 10% of visually disabled people don't have enough eyesight to walk around without human help. This current project is designed to help the blinds to overcome by the hurdles using other senses like sound and touch. The device uses NI myRIO controller, which is a Xilinx Field Programmable Gate Arrays, and a dual-core ARM (Advanced RISC Machine) Cortex-A9 processor. HCSR04 ultrasonic distance sensor module is used to determine the distance. The sensor module is used to find the distance according to the principles of sound navigation and ranging or Radio detection and ranging, in which ultrasound is used to find the distance to the object. It includes a buzzer that generates a buzzer sound and a motor that generates a vibration signal. The device uses sound signals and vibration signals to alert users of impending complications. As the gap between the sensor and the obstacle decreases, the frequency of the buzzer and vibration signals increases, so the system provides navigation for those who need it, with short and clear response time.

Keywords: HCSR04 Ultrasonic sensor, NI myRIO, Buzzer, Visually impaired, FPGA.

I. INTRODUCTION

The third eye for the blind is a portable device that helps the visually impaired to walk independently. This reduces the workload of people helping the blind. Furthermore, it also gives an opportunity to move independently from one place to another. Today, people are showing interest in new technologies that are constantly being used. This device is especially useful when you want to walk around the house or some indoor areas by yourself. This device can be used to determine the distance to obstacles through the ultrasonic module and NI myRIO. The controller is a Xilinx FPGA (Field programmable logic array) and dual-core Cortex-A9 ARM (advanced RISC machine) processor. The distance to the obstacle is determined and reported to the visually disabled in the form of buzzer and vibration. Turn to other directions to avoid accidents during use. If no obstacle is detected, it means that if it is not within the distance range used by the program code, the user will not be able to feel any output, the vibrator motor does not vibrate, and the buzzer does not buzz.

II. LITERATURE SURVEY

To make the system more effective, there are several systems related to the development of projects related to the blind. This literature review has helped us overcome several design and software improvements. Describes a better navigation tool for the visually impaired [2].

The smart stick could be a device that avoids various obstacles in the way. Blind people cannot exercise every day, walk on the street, spend time with colleagues or family members, or perform daily activities. Therefore, the plan can help individuals to participate to confirm the willingness to solve this important issue.to be safe without having the excitement in his head that someone or something might meet him on his way [3].

A smart cane: Visually impaired walking stick that can detect knee-high obstacles and provide better GPS navigation for the user. The sensors are mounted on the holding place of the user [6].

A wearable ultrasonic obstacle sensor to assist the blind and visually impaired develops a method of developing electronic gloves that enable deaf and blind people to easily interact. They used sign language to communicate with others, but it is very difficult to use and understand this sign language because it contains around 6000 gestures. The model uses 26 hand gestures to convey the alphabet and another 10 more gestures to convey the numbers. This will help the deaf people to connect with others by waving their hand and writing text on the Liquid Crystal Display (LCD) screen. The text becomes language so that the blind can listen and communicate [4].

III. PROPOSED SYSTEM

The purpose of the project is to develop a product that is useful for blind people and people who often rely on others. Visually impaired people move around and Learn about nearby objects by using the portable armband holder emit ultrasound, buzz when obstacles are detected. The aim of the project is therefore to develop a cost-effective and efficient way to navigate more comfortably, faster and safer. The main disadvantage is consumption a lot of time and effort. Figure 1 shows the block diagram of the current system, since the blind person want to know that there is a hurdle in front of them, an ultrasonic sensor is used to detect the obstacle. This a detection device works according to the SONAR principle (Sound Navigation and Ranging). Innovative wearable technology with NI myRIO Sends a high-frequency ultrasound signal every 10 µs. This signal hits the obstacle and reflect back. During this period, the echo signal rises from the echo pin of the ultrasonic sensor, which is connected to the NI myRIO. The controller used here is NI myRIO, a Xilinx FPGA (Field Programmable Gate Array) and a dual-core ARM (Advanced RISC Machine) Controller Cortex Processor - A9, which is used to evaluate the distance in centimeters through the received duration echo pulse.

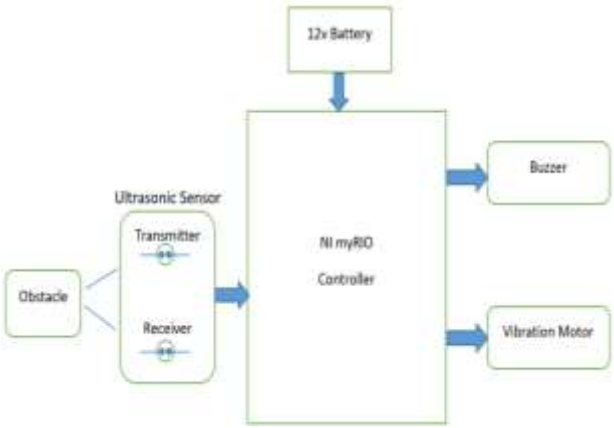

Figure 1: Block Diagram of Third Eye for the Blind: An Innovative Wearable Technology using NI myRIO.

IV. IMPLEMENTATION

Following Hardware are Used to implement this project.

A. MyRIO:

NI (National Instruments) MyRIO1900 is a reconfigurable portable I/O device. RIO is an integrated real-time evaluation board from National Instruments. It is used to develop applications with embedded FPGAs and microprocessors, LabVIEW is used. The figure 2 shows the NI MyRIO. NI myRIO1900 provides analog I/O, digital I/O, audio output, and power in a compact embedded device. The NI myRIO1900 connects to the host through a USB controller and an 802.11b wireless connection.

Figure 2: NI MyRIO

B. Ultrasonic Sensor HC-SR04:

Ultrasonic sensors are very popular for range detection. This sensing technique is a SONAR (Sound Navigation and Ranging) technique which can also be seen in some animals like dolphins and bats. The sensor provides very high measurement accuracy. Also, the fastness of the reading is high. They are effective in finding hard and soft materials.

Figure 3: Ultrasonic sensor

The HC-SR04 has four pins, VCC, GND, TRIG and ECHO which are shown in figure 3. All have different functions listed below.

1) The VCC and GND pins are the simplest: they supply power to HC¬SR04.This pin connects to +5 V and ground.

2) There is only one control contact: TRIG contact. The TRIG pin is responsible for sending ultrasonic signals. This pin should be set to high level for ten microseconds. Then HCSR04 sends 8 frames of 40 kHz audio data packets, as shown in Figure 4.

3) The ECHO contact is a data contact used for distance measurement.

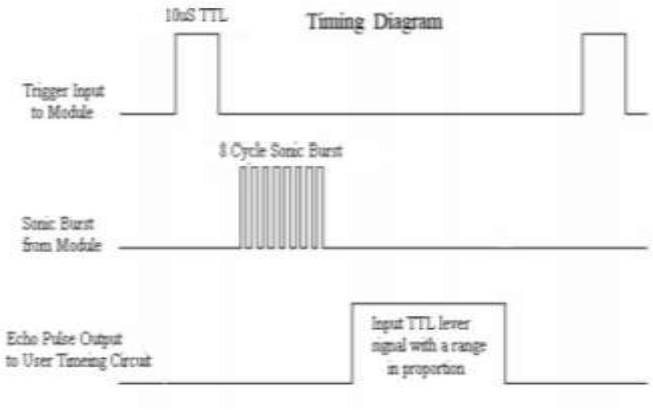

Figure 4: Timing diagram for ultrasonic sensor

The below equation 1 can be used to easily calculate the distance in centimetres.

$$Distance = \frac{time}{58} = \frac{\mu s}{\mu s/cm} = cm \text{----------(1)}$$

C. Vibration Motor:

Eccentric Rotating Mass Vibration Motor or ERM, also known as pager motor, is a Direct Current motor whose balance weight is connected to the shaft. When the Eccentric Rotating Mass Vibration Motor rotates, the centripetal force of the moving mass is asymmetric, generating pure centrifugal force and restarting the motor. Due to its high speed, the motor is constantly moved and driven by these asymmetric forces. This repetitive movement that is perceived as vibration. "Controlled harmonic vibration" is an example of vibration produced by Eccentric Rotating Mass Vibration Motor. It means there is some additional driving force that makes the system vibrate. The Eccentric Rotating Mass Vibration Motor is shown in figure 5.

The term "harmonic" means that the system is forced to oscillate with the excitation frequency. Note that with the Eccentric Rotating Mass Vibration Motor, the drive input is not the Direct Current voltage fed to the motor, but the rotation of the mass around the central axis motor shaft.

Figure 5: Eccentric Rotating Mass Vibration Motor.

D. Buzzer:

Buzzers are electric sounding devices that generate sounds. Typically powered by DC voltage, they can be categorized as Piezo buzzer and magnetic buzzer. They come in different designs and uses as well, and based on that, they can produce different sounds. Figure 6 shows the Buzzer.

Figure 6: Buzzer

V. RESULTS

Third eye for the blind: An innovative wearable technology using NI MyRIO is developed with NI MyRIO, the ultrasonic sensor module (HC SR04), buzzer, vibrator motor and voltage regulator. The ultrasonic sensor module detects the obstacle. When people move forward, they point obstacles and send ultrasonic waves in the indicated direction. The ultrasound module calculates the distance from the obstacle to the person and if the obstacle is not detected, i.e., if it is not within the distance as used in the program code, the user cannot feel any of the outputs. The vibrator motor does not vibrate and the buzzer does not sound. If the gap between the user and the object is smaller when the object is detected, then the person can feel the output. When the module is within range obstacle can be detected, the vibrator motor vibrates and the buzzer sounds. The length of time the buzzer sounds depends on the gap from the sensor and the obstacle, the delay is greater when the space is greater and less when the space is shorter. The buzzer sounds faster when the user is close to the obstacle.

VI. CONCLUSION

The third eye for the blind is a useful device that allows the blind to work freely. Its goal is to help blind people overcome vision loss by using other senses such as sound and touch. A blend of an NI myRIO and an HCSR04 ultrasonic sensor is used as an input to calculate the obstacle distance. An efficient and accurate way of signaling the user about obstacle is by using vibration motor and a buzzer. Xilinx FPGA is used to process the duration received from the ultrasonic sensor and finally the output is received through two devices, buzzer and vibrator motor, to provide sound and touch. In this way, a simple, inexpensive, efficient, easy to transport, configurable, easy to use electronic guidance system for constructive assistance for the blind is developed.

FUTURE SCOPE

In the future, the equipment can be improved as follows

- The size of the device may be reduced with MEMS controllers.
- Object identification can be included.
- The Haptic feedback can be improved with custom vibrations.
- Location tracker can be included.

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