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Smart Guiding Blind Stick

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Abstract

Blind stick is used for visually disabled people to improved navigation. The present work is 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 temperature and water sensing. On sensing obstacles the sensor passes this data to the microcontroller. The microcontroller then processes this data and calculates the obstacle is close or far and also if water is there in the path the microcontroller sends a signal to sound a buzzer. Thus this system allows for obstacle detection as well as finding stick if misplaced by visually disabled people. The main aim of this stick is to alert the visually impaired about an obstacle in his way.

Key words: Blind stick, navigation, ultrasonic sensors, water sensor and temperature sensor.

I. INTRODUCTION

There are approximately 37 million people across the globe who are blind, over 15 million are from India. Even for the non-visually impaired the congestion of obstacles is sometimes problematic, it's even worse for the visually impaired. People with visual disabilities are often dependent on external assistance which can be provided by humans, trained dogs, or special electronic devices as support systems for decision making. Existing devices are able to detect and recognize objects that emerge on the floor, but a considerable risk is also includes the objects that are at a sudden depth, or obstacles above waist level or stairs. Thus we were motivated to develop a smart white cane to overcome these limitations. The most common tool that the blind currently use to navigate is the standard white cane [1].

Walking to unknown environment is real challenge because an obstacles usually produce noise while moving, blind people develop their sense of hearing to identify them. A white cane is the most common mobility aid for the visually challenged. However, it does not give information about the obstacles above knee level and those which are at near distance. Walking sticks with adjustable length, elbow canes, were developed in the market to guide the visually challenged. However, these attempts were not completely successful in assisting the user. To improve these issues the Smart electronic aid is designed in such a way that it includes an Ultrasonic sensor for Obstacle detection, supported with water detection. In this system, Vibratory motors are used to inform about the moving obstacles. The intensity of vibration depends on the speed of the moving obstacles [2].

II. HARDWARE SPECIFICATIONS

1. Walking stick
2. Ultrasonic sensor
3. Water sensors

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4. Temperature sensor
5. Buzzer
6. Arduino

The block diagram for the smart guiding stick for blind people is shown in figure 1.

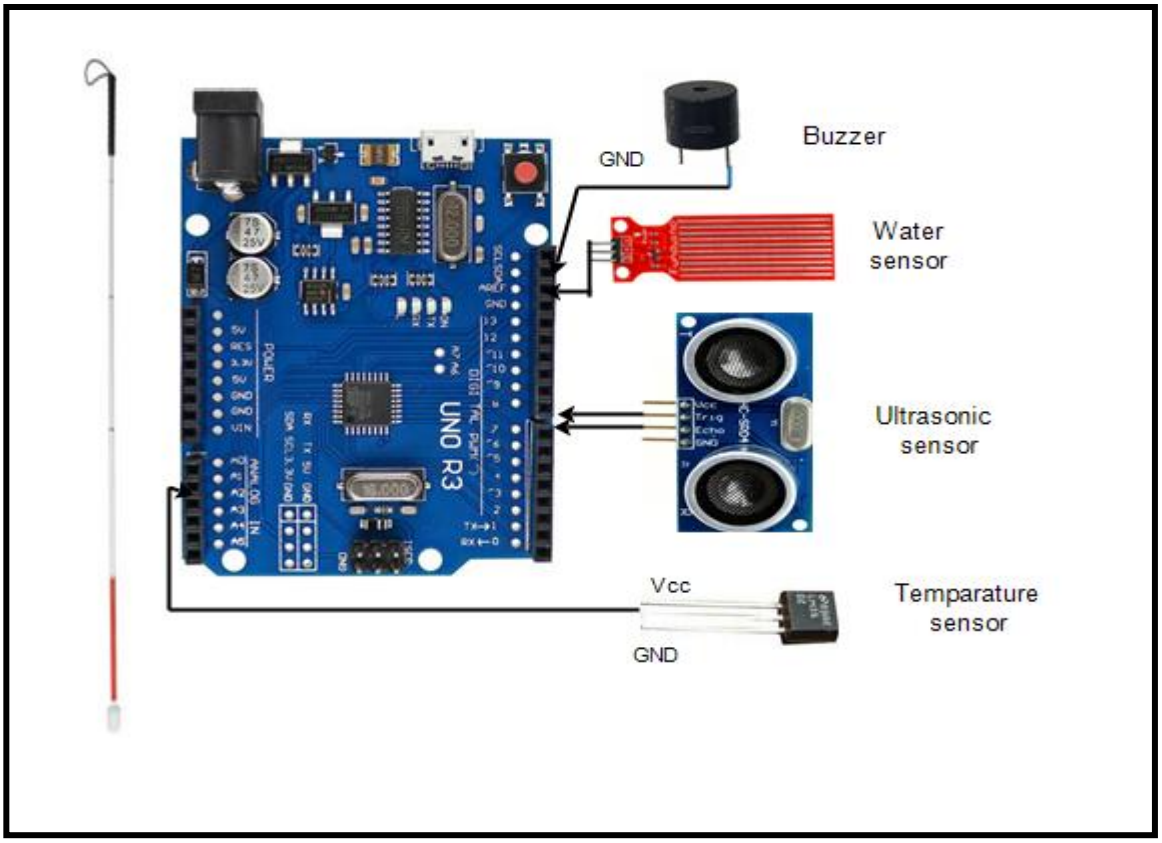

Figure 1: Block diagram of smart guiding blind stick.

The detail description of each block is given below.

2.1. Walking stick:

The stick is designed in such a way that each time the obstacle moves a motor vibrates. The intensity of vibration depends on the speed of the moving obstacle. A **white cane** is used by many people who are visually impaired. Primarily it aids its user to scan his surroundings for obstacles or orientation marks, but is also helpful for other traffic participants in identifying the user as visually impaired and taking appropriate care [3]. The latter is the reason for the cane's prominent white colour, which in many jurisdictions is mandatory.

2.2. Ultrasonic sensors:

As the name indicates, ultrasonic sensors measure distance by using ultrasonic waves. The sensor head emits an ultrasonic wave and receives the wave reflected back from the target. Ultrasonic Sensors measure the distance to the target by measuring the time between the emission and reception. The

obstacle detection is carried out using dual transducer Ultrasonic Sensor. Once triggered, the ranger produces an eight cycle sonic burst at 40 kHz frequency. Simultaneously the echo pulse is raised high until the last sonic pulse sends back the reflected wave. Once the duration of this echo pulse is found, distance can be easily calculated using this time and the speed of sound. The module is also incorporated with motor vibration intended for moving objects. As the obstacle approaches the user and reaches close proximity, the intensity of vibration increases [4].

A continuous stream of pulses is sent out through the Trigger terminal of the Ultra sonic Sensor. The pulses Reflected from the obstacle are received at the echo terminal. The time duration for which the echo pulse remains low gives the time takes by the ultrasonic pulse to travel twice the distance. Thus relating the time taken (t) and distance between the obstacle (d), 2d=s*t; where s=340 m/s (speed of sound).If the distance d is less than 50cm, low intensity vibration is provided. If the distance d is greater than 50cm, the intensity of vibration is high. The distance received from the Ultrasonic Sensor for that particular obstacle is measured 5 times. Each reading is subtracted from the previous reading and the absolute value is taken. If the measured value is within 55 cm which is equal to the average footstep of the user implies that the obstacle hasn't moved and vibration given to the motor is zero. If the difference increases and lies between 55 cm and 150 cm, it means that the obstacle is moving at a faster rate and medium vibration is given. Finally, if the difference measured is greater than 150 cm, it gives an idea that the obstacle is moving at a greater rate and maximum vibration is given [5].

2.3.Water Detection:

Two electrodes are provided in circuit, which are fitted at the bottom of stick for sensing water depths in the travelling path. Information about water depths are indicated through buzzer. Indication to the blind people is conveyed through different sound intensities. This is used to indicate any liquid. The two electrodes are connected to Arduino analog pins the differential voltage produced by this will be identify the depth of water.

2.4.Temperature sensor:

A temperature sensor is exactly what it sounds like – a sensor used to measure ambient temperature. This particular sensor has three pins – a positive, a ground, and a signal. LM35 is a linear temperature sensor. A change in temperature of one degree centigrade is equal to a change of 10 millivolts at the sensor output. The microcontroller on the board is programmed using the Arduino programming language". Using the Arduino I will show you how to get the analog input from the LM35 temperature sensor and display the information in the serial window as raw data, Celsius and Fahrenheit. In program the limit of temperature is placed while exceeding this value the system will give alert signal through the buzzer.

2.5.Buzzer:

A buzzer or piezo speaker which can be found in alarm devices, computers, timers and confirmation of user input such as a mouse click or keystroke. It's not like a regular speaker that you might think of. It uses a material that's piezoelectric, it actually changes shape when you apply electricity to it. By adhering a piezo-

electric disc to a thin metal plate, and then applying electricity, we can bend the metal back and forth, which in turn creates noise. The faster you bend the material, the higher the pitch of the noise that's produced. This rate is called frequency. Again, the higher the frequency, the higher the pitch of the noise we hear.

2.6.Arduino:

Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators. Arduino is an open source electronics platform based on easy to use hardware and software. Arduino boards are able to read inputs light on a sensor, a finger on a button, or a Twitter message and turn it into an output activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board.

III. CONCLUSION

The proposed work the designed and developed of a new concept of Smart Guiding Stick for
Blind people. The advantage of the system lies in the fact that it can prove to be very low cost solution to millions of blind person worldwide. It finds distance along with temperature and water identification sensors. The proposed combination of various working units makes a real time system that provides feedback making navigation more safe and secure.

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