"SMART BLIND STICK"

SHUBHANGI NALAGE [1], KIRAN NALAWADE[2],
Dr. Prof. V. R. PAWAR[3]
ELECTRONICS AND TELECOMMUNICATION,
BHARTI VIDYAPEETH'S COLLEGE OF ENGINEEARING FOR WOMEN, PUNE
nalageshubhangee@gmail.com, kirannalawade1201@gmail.com, pawar.vijaya40@gmail.com

Abstract - This paper presents approach to staircase detection and obstacle detection. The presented solution can detect a staircase and calculate its height and width. Blind people face several problems in their life; the most important one is detection of the obstacles when they are walking. Visual loss or blindness can cause by many diseases which are being reduced, but there are many people who are causing age-related visual impairment and blindness. Visual information is the support for most navigational tasks, so visually impaired people are facing difficulties because of lack of necessary information about the surrounding environment and atmosphere. Due to recent advances in all technology it is possible to extend the support to the people with blind stick when they are travelling. So, in the present work a new technique is invented which can detect size of a stair case and obstacle if any. ATMega328 microcontroller is used to detect the staircase and Bluetooth is interfaced to transfer the data between android App and microcontroller. System attains 90% generalized accuracy.

Keywords- Ultrasonic sensor, Bluetooth, Android App, Smart Stick, Microcontroller, Staircase Detection

1. Introduction

Blind person has trouble to maintain daily activity, lots of difficulties get raised while they are travelling from one place to another place. The most widely and traditionally used stick is the long cane because it detects the nature of the path and obstacles in the path [4]. Blindness or visual impairment is a condition that affects many people around the world. This condition leads to the loss of the valuable sense of vision Worldwide more than 160 million people are visually impaired with 37 million to be blind [1]. The need for assistive device is rigorous. There are wide number of navigation systems and tools existing for visually impaired people. The blind person truly required for identifying objects. The blind stick takes the blind person to the destination location by direction identification, obstacle detection and stair case detection.

Blind stick is an intelligently designed for visually impaired people for improved navigation and safety. We here propose a smart blind stick that allows visually impairment and blind people to travel safely using advanced technology. The blind stick is integrated with 4 ultrasonic sensors for height, width and obstacle. Our proposed project uses first ultrasonic sensor to detect the obstacle and then it calculates how much distance between obstacle and stick. Blind stick also counts the height and width of staircase using ultrasonic waves. On sensing obstacles, the sensor passes receiving data to the microcontroller ATMega328. The microcontroller ATMega328 then processes the data and detect the obstacle is ahead or not. If the obstacle is not close to the circuit then circuit does not perform any activity. If the obstacle is close to the stick, then microcontroller sends a signal through Bluetooth to the Android App and it gives sound voice alert. A wireless Bluetooth is used for this purpose to sends the data to android app. Then android app gives the output in the form of speech in headphones. Thus this system allows for obstacle as well as staircase detection by visually impaired people. So the project is designed a system that tries to remove the problems of blindness and make them self-dependent to do their daily activities.

2. Background

Many researchers at national and international level contributed for staircase and obstacle detection few of the surveyed methodologies are presented here:

Ayat A. Nada et.al [1] paper presents a light weight, cheap, user friendly, fast response and low power consumption smart stick based on infrared technology. A pair of infrared sensors can detect stair cases and other obstacle presence in the user path. Connected to an earphone to alert the blind with speech warning message about the detected obstacle. The experimental results achieve good accuracy and the stick is able to detect all obstacle.

J.F.Elleuch et.al [2] paper presents a new method of ground segmentation for obstacle detection using possibility theory. Indeed, several features extracted from reference zone were modelled in order to build possibility map. Each problem can be solved using specific features. Data provided by reference area is extracted & modelled separately using possibility theory.

Gaorishankar kasilingam et.al [3] paper presents a GSM & GPS based stick so that it has extra feature of the GSM network such as the popularity and less price. Also GPS module has been used in many location of human activity, such as the direction finder to guide visually impairment people enabling them to avoid obstacles from the path and reach safely at their destination.

Stair case detection accuracy reported at international and national level is less so in the present system focus on staircase detection in the form of height and width using ultrasonic sensors and Bluetooth to be used to communicate through the Android App.

3. Present System

Detail block diagram is as shown in figure 1.

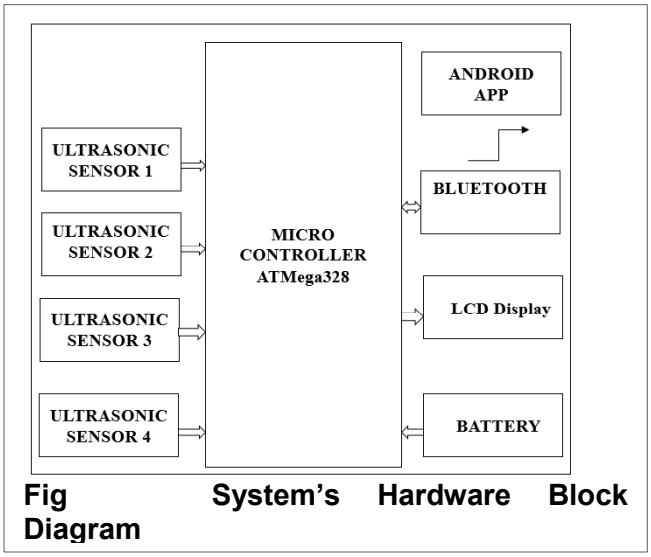

Fig System's Hardware Block Diagram

- Ultrasonic sensors, Bluetooth and LCD are interfaced with PIC microcontroller.
- HC-SR04 sensor is ultrasonic sensor. This sensor is used to detect the object. It calculates the distance of the obstacle from the stick and also calculate the height, width of the obstacle and stairs.
- Present system is fitted on the stick.
- Ultrasonic sensor senses the corresponding present values and display it on the LCD.
- After detecting obstacle, the values are displayed on the LCD.
- Bluetooth module HC05 is interfaced with ATMega-328 and Android App.
- Displayed values on the LCD are send through the Bluetooth to the Android App.
- Talking display shield android app is used to listen the detected values.

4. Methodologies Used for System Design

Present system is mainly divided into two parts

I. Detection
II. Communication

A. Detection:

The system designed using the ultrasonic sensor and Bluetooth module. Ultrasonic sensor is mounted on stick like left side, right side, front end and back end. Front ultrasonic sensors are used to detect the distance between stair and blind stick. Left ultrasonic sensor count the left width and right ultrasonic sensor count right width of a stair. Back ultrasonic sensor counts the height of stair in centimeters. The detected real time values in centimeters are given to the Bluetooth through microcontroller ATMega328. These values are display on LCD screen (16*2).

B. Communication:

Bluetooth module is used for communicate between ATMega328 and android app. Bluetooth receives data from the ATMega328 which is displayed on the LCD and received values will be send to the android app. Through the android app the values will be displayed on the app and it converts the displayed values in speech form which is audible to blind people. So the blind peoples will understand the steps are ahead and they walk safely and confidentially.

Table 1. Specification of Parameters

Name	Specification
Ultrasonic Sensor Range	2-400cm
Bluetooth Range	10m
LCD display size	16*2
Battery Voltage	5V

Characteristics of the system are:
1. Less accident will be occurred from the blind people.
2.High detection accuracy in detection
3. Speech message will help blind & physical disable to recognize the destination

5. Experimental Result

Table 2. Stair at different places are tested with respect to the parameters height & width.

Name of the parameter	Height	Left width	Right Width	Remark
Stair 1	19 cm	52 cm	51 Cm	Obstacle is near to 33cm
Stair 1	4	47	53	Alert - Alert obstacle is near
Stair 2	20	55	47	Obstacle is near to 27
Stair 2	4	49	50	Alert- Alert obstacle is near

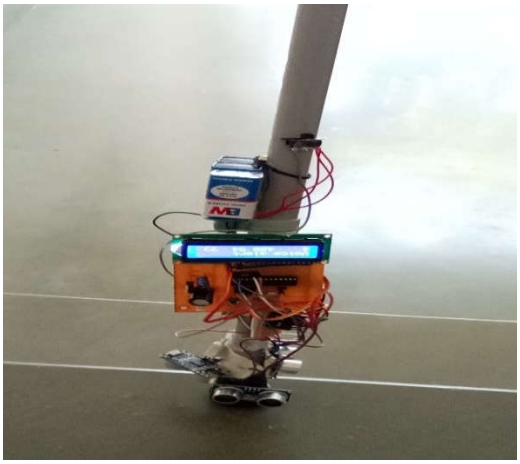

Figure 2. Staircase Detection

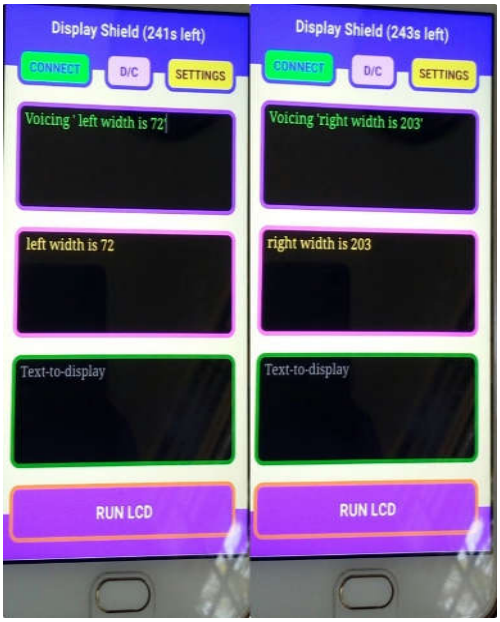

Figure 3. Detected stair left and right width

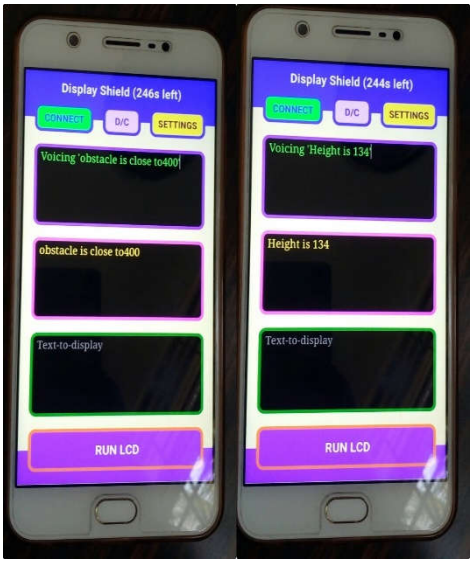

Figure 4. Detected obstacle distance and height

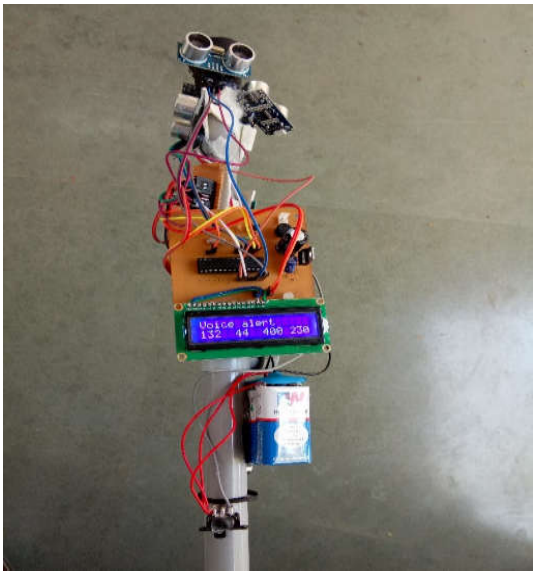

Figure 5. Hardware of system

6. Conclusion

In this paper a staircase detection and obstacle detection is developed in alert form for blind people. Accurate detection of obstacle and size of staircase in height & width form is successfully achieved. It suggests the right path to the blind people. For Generalized staircase 19 cm is safer height and 52 cm is safer width.

7. References

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