Smart Cane for Blind People using Raspberry PI and Arduino

Prutha G, Smitha B M, Kruthi S, Sahana D P

Abstract: ***In this paper we are introducing a stick to guide blind people to move independently. It consists of raspberry pi and Arduino for monitoring the stick. Three pairs of ultrasonic sensors are used to detect obstacle in front of the users in the range of 15cm, and water sensors are used for water detection & puddles. The above sensors are interfaced in the stick. The stick can take robotic decision to move forward, backward, left and right as per obstruction detection using dc motor. Users will get alert from buzzer and vibration. Flashlight is interfaced on stick which can be noticed by others to let him pass way. Finger ring is used to give navigation using GPS. The user can maintain easily with fast response & low power consumption The main purpose of this paper is to help visually impaired people for navigating independently***

Keyword: Raspberry pi, Arduino, HC SR04 ultrasonic sensor, water sensor, L289N motor drive, dc motor, GPS.

I. INTRODUCTION

Visual debilitation also known as blindness is the condition which is affecting many individuals around globe. This leads to loss of vision. Blind individuals must recognize objects. So, these people require some aiding equipment. Almost all blinds cannot walk around independently and require dependent on someone to travel. The preferred walking aid for blind is the traditional white cane. White cane is one such tool which are used by blind or who have imperfect vision to be independent. The cane helps blind to find obstacles and to overcome them safely. It was recognized as the standard gear for the visually impaired. Therefore, various technologies are used as solution to assist the blind people.

Some researchers have developed walking stick for visually impaired people for safe navigation. In work [1], walking stick consists of a camera, earphone for output and four ultrasonic sensors. This system gives the result for all 360 degree from the position of the cane. The camera is used for text and object recognition. In [2], authors have developed walking stick with an ultrasonic sensor for detecting obstructions using various buzzer sound for each type of obstruction. This system includes wireless RF remote control which alarm buzzer uniquely when pressed and also for locating the blind stick when it is misplaced.

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Another work [3], authors have introduced system which includes crutch and bracelet. So that crutch will detect obstacles in front of them with sensors. The other invention [4] by authors is smart cane which can detect all obstacles in range of 4m during 39ms and output is through audio-based frequency clips for announcing obstacles detection. In [5], the authors have developed portable device for blind peoples that will provide direction to new locations and alert them about obstacles in their path during outdoor navigation. Using a ST microelectronic, this system has MEMS digital compass module which will allow to give more accurate direction for the blind person.

We have proposed a system for blind people to navigate in safe path by alerting presence of obstacles.

II. METHODOLOGY

Figure 1 shows the block diagram of the system procedure. It has three pairs of ultrasonic sensors, water sensor, motor drive with dc motor, raspberry pi, Arduino, buzzer and vibrator. The ultrasonic sensor and water sensor detect the obstacles and water.

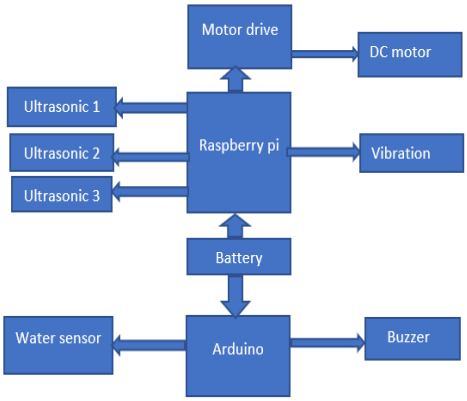


Fig. 1. Block diagram of the system

It consists of:

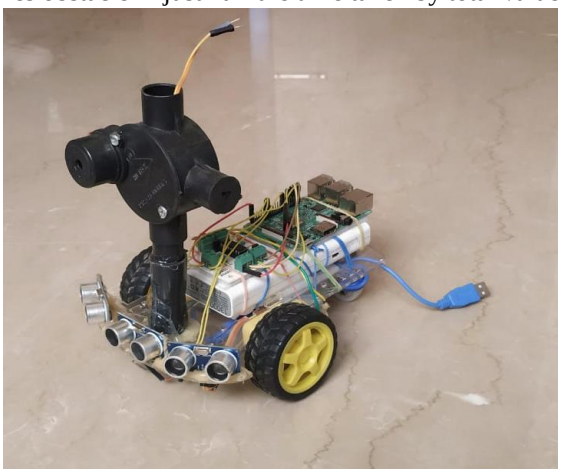
A. Obstacle detection

There are three pairs of ultrasonic sensors placed in front of the system for detecting obstacles. HCSR04 ultrasonic uses 3.3v input voltage. It detects obstacles in the range of 15cm covering front position of the user [4]. A simple page motor vibrator is used to alert user for obstacle detection by ultrasonic sensor.

We have calculated the range of object detection which is depended on waves of ultrasonic sensor to return back to it by using following formulae.

Distance= (Time x Speed of Sound in Air (343 m/s))/2.

Since wave moves in both forward and backward direction, the formula is divided by two. Thus, the wave reaches obstacle in just half the time taken by total value.



B. Water detection

For detecting water content, a water sensor is placed at bottom of the system [2]. In this paper, water sensing circuit is used for water detection. Figure 2 shows the circuit connection of water sensor. It consists of two 330ohm resistor, 1microFarad capacitor and 1kohm variable resistor. When water comes in contact with two open ends of variable resistor, it will complete circuit and outcome is given through buzzer.

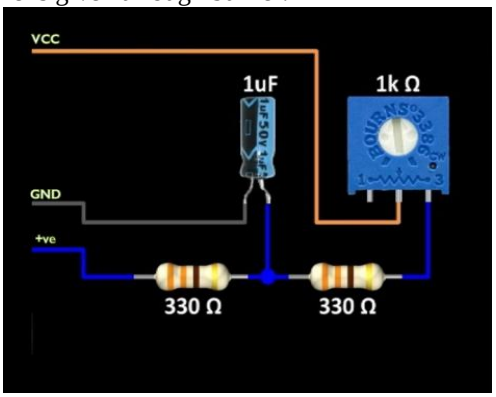


Fig. 2

C. Battery

A 5 volt, 11000 mAh, Lithium ion cell type battery is used. It can rechargeable which feed required power supply to entire system.

D. Controller

In this model, we make use of Arduino and raspberry pi for controlling system. Raspberry pi is programmed using python language. Based on various signal obtained from different sensors, pi work as decision making controller [1]. Pi 3 model B has 1GB RAM which suitable for operation which is used in this system.

E. Motor drive

L298N motor drive with 5-volt dc motor is used to control speed and direction of two dc motors at same time.

F. GPS

We have proposed a finger ring which is interfaced with GPS for safe navigation [3].

III. RESULT

To evaluate the accuracy & performance of the designed project, few experiments were conducted. The results in this paper show implementation of our efforts to build a cost effective and accurate travelling tool that allows the visually challenged to face the everyday environment. As previously mentioned, the sensors embedded detect information about the surrounding. The design is such that it detects and changes the direction after encountering an object with a predefined accuracy. Also, a GPS module is used as safety feature.

Raspberry Pi have programmed to take decision in the range of 45cm long. Whenever pi detects object less than 15cm, it stops the stick and moves the stick backward and then turn the stick in left or right direction. Again, it moves forward if there is no presence of object within the range of 15 cm. If the stick detect object again, it repeats the same process, else continue to move forward until it detects any obstruction again.

Ultrasonic Sensor has calculated the distance by initial read time between forward and backward signal. Here we have made the process to repeat for 5 times which has given better accuracy.

IV. CONCLUSION

With above terms, the blind people can move from one place to another independently, with more accuracy. Various types of sensors are used, with the help of this system in which the blind person can receive any signs of danger with the alarm system. It is a real boon for blind people, because good results can be obtained. The system can give most accuracy of obstacle detection for range of 0.3cm. Further aspects of this system can be improved via wireless connectivity between system components. Thus, can increase range of obstruction detection speed by upgrading components. Flashlight is used as at night time which can be noticed by others to let him pass way.

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Prutha. G, completed her education in M Tech in the field of Power Electronics at RVCE, Bengaluru, Karnataka. Presently, she is working as Assistant Professor in the department of Electrical and Electronic Engineering at Rajarajeswari College of Engineering, Bangalore. She has presented paper in National conference on Advance Techniques in EEE competition on January 2016 as author at SJBIT College, Bengaluru, Karnataka. She has presented paper in National Conference on Advancement in Science, Engineering & Technology competition on February 2016, as an author at RRIT College, Bengaluru, Karnataka. She has presented a paper in IEEE explore on MPP Tracking using is Controller with Sepic Converter in International Conference on Computing Methodologies and Communication (ICCMC2018) on February 2018 as author at Surya Engineering College at Erode, Tamilnadu state. She has presented paper in an IEEE explore on Power to Grid with Different Uses of Controllers for Solar Energy in International Conference on Electronics, Communication, and Aerospace Technology (ICOECA2018) on March 2018 as an author at RVS technical campus in Coimbatore, Tamilnadu. She has also presented paper in National Conference on Design and Implementation of Power Supply and Position Sensor for Robotics Application in Knowledge Dissimentation of PG Projects and Research Works in RVCE, Bengaluru on May 2018. She has presented a paper in SPRINGER SCOPUS on Smart Automation to Robotics in 7th International Conference on Innovation in Electronics and Communication Engineering (ICIECE) on July 2018 as an author in Hyderabad, Andhra Pradesh state, India. She had presented a paper in IEEE explore on Converter for Hybrid Vehicle Using Renewable Resource in International Conference on New Trends in Engineering and Technology (ICNTET2018) on September 2018 as an author at Chennai, Tamilnadu state, India.

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