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Use of Arduino and Ultrasonic Sensors to Design Smart Walking Stick for Visually Impaired People

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Abstract -This paper suggests a smart blind stick that detects obstacle in front of a blind man on street. Arduino and ultrasonic sensor is used to detect the depth below or obstacles in between LED, Buzzer,9V Battery, Jumper wires, a stick. As per the statistics of World Health Organisation (WHO), currently there are 45 million blind people all around the globe. The visually impaired people are very much dependent on external assistance such as humans, trained dogs, or special electronic devices as decision making support systems. Thus, developing a smart stick may overcome these limitations. Ultrasonic sensor is being incorporated at specific position of cane to provide information regarding the environment with the help of buzzer sound. The proposed system is low cost and light weight designed with the help of microcontroller to processes signal and alerts for the visually impaired person over any obstacle, water or dark areas through beeping sounds Obstacle and moisture detection sensors are used for receiving, processing and sending signals to the alarm system and finally alert the user for prompt action. The system was designed, programmed using C language and tested for accuracy and can detect obstacles within the distance of about 2m from the user.

Key Words: Arduino UNO, Ultrasonic sensor, Walking stick, Visually Impaired, RF Receiver.

1. INTRODUCTION

People suffering from blindness cannot be corrected with conventional means such as refractive correction or medication. Visually Impaired persons have difficulty to interact and sense their environment. Total blindness is the complete lack of form and visual light perception and is clinically recorded as NLP, an abbreviation as “no light perception”. Physical movement is a challenge for visually impaired persons, because it can become tricky to distinguish obstacles appearing in front of them, and they are not able to move from one place to another [1]. They are fully dependent on others for mobility and financial support. Due to lack of mobility they cannot interact with people and social activities. In the early days, the systems are designed without a solid understanding of the no visual perception. In the last few decades, researchers developed an intelligent and smart stick to assist and alert visually impaired persons from obstacles and give information about their location. Smart walking stick helps in detecting obstacles which may help the blind to navigate care-free. The audio messages will alert the user alert reduce accidents. The proposed system is composed of ultrasonic sensor, water sensor, voice play back board and speaker. The indoor and outdoor obstacles are detected by the system with the help of a camera. The buzzer helps in identifying any foreign object or obstacle. The blind person can get a sense of vision by getting the information about the surroundings. In case the stick is lost around him, a rf transmitter is there and when he presses the button the stick produces beep so he can find the stick.

2. LITERATURE SURVEY

A Smart Walking Stick is proposed which is an Electronic Approach to Assist Visually Disabled persons. The device is a microcontroller based automated hardware that can assist a blind to detect obstacles in front of him/her promptly. The hardware consists of a microcontroller PIC16F690 incorporated with ping sonar sensor, proximity sensor, wet detector, a GH311 Ultrasonic obstacle sensor, a micro pager motor and additional equipment. The simplicity of the proposed design makes it easy to use by any person and at the same time the cost of manufacturing such sticks is kept low. It is also very cheap compared to the conventional ones. Obstacle and hole can be determined easily by sensor readings. Wet, muddy or possibly slippery terrain can be detected by a pair of electrodes. The use of solar panels for instance, will be more advantageous in order to get recharged. The proposed stick is not bendable therefore keeping it might be challenging. This cost effective and light weight device can be designed to take the pattern of a plastic and portable device which can be completely fixed on the familiar white cane or blind stick [2].

An Intelligent Walking Stick for the Blind was proposed. The proposed navigation device for the visually impaired is focused on providing voice output for obstacle navigation using infrared sensors, RFID technology, and android devices. The device has proximity infrared sensors; RFID tags are installed into public building and also integrated into blind person’s walking stick. The device is connected to an android phone through Bluetooth. An android application is designed which gives voice navigation based on RFID tag read and also updates person’s location information on the server. Another application is designed for family members to access the blind person’s location through the server whenever needed. The system can be used both indoor and outdoor navigation. Blind

person's location can be tracked whenever needed which will ensure additional safety. The drawback of their approach is that it is not compact. The whole device is designed to be small and used in conjunction with the white cane [3].

A system contains the ultrasonic sensor, water sensor, voice play back board, raspberry pi and speaker is proposed. The system detects the obstacle images which are present in outdoor and indoor with the help of a camera. The Stick measures the distance between the objects and smart walking stick by using an ultrasonic sensor. When any International objects or obstacles come in range of an ultrasonic sensor then the buzzer tell the name of obstacle which is in front of the stick. The smart walking stick is a simple and purely mechanical device to detect the obstacles on the ground. The main aim of the system is to provide a efficient navigation aid for the blind persons which gives a sense of vision by providing the information about their surroundings and objects around them [1].

An ultra-sonic stick is required powered with GPS. The stick has GPS which has a SD memory card and holds different locations. The person sets the path by means of GPS to guide the individual to his / her destination [4].

Two ultrasonic sensors are mounted on the stick having range from 20- 350cms (set to different ranges). Two Infrared sensors are also implemented on the lower side of stick for avoiding small obstacles ranging from 2-10cms. A switch that can be operated with the thumb (in worst condition) that allows the blind user to send a general message (I am in trouble, help me) on a saved mobile no. for help. Vibrating sensors along with a buzzer used for beep and vibration if stick is about to hit with any obstacle. Circuit box contain combination of GSM300/900 module and microcontroller circuitry. The co-operation between the Ultrasonic and IR sensors are utilized to create a complementary system that is able to give reliable distance measurement [5].

3. CONFIGURATION OF THE SYSTEM

The block diagram of the system is given in Fig -1.

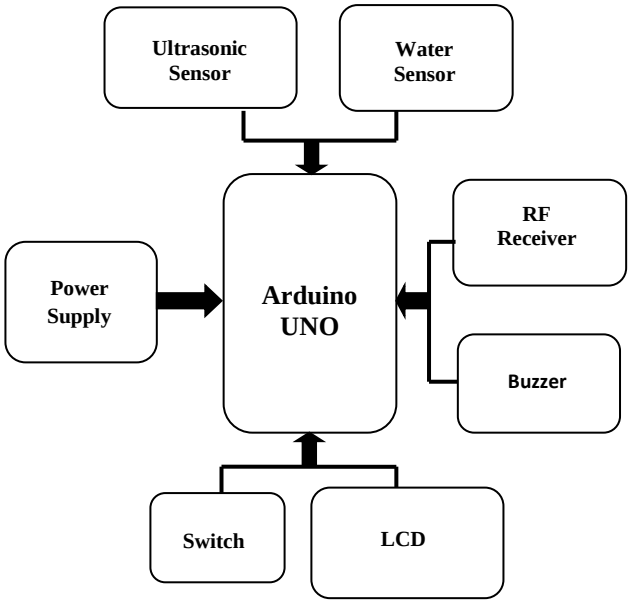

Fig -1: Block Diagram of Proposed Smart Walking Stick

In this paper, an advanced blind stick is proposed with advanced technology that enables visually challenged people to navigate with ease using. Ultrasonic sensor along with light and water sensing are incorporated into the blind stick. The proposed system first uses ultrasonic sensors to detect obstacles ahead using ultrasonic waves. When obstacles are sensed, the data is passed to the arduino Uno with the help of the sensor. The data is then processed by the arduino uno and calculates if the obstacle is close enough. In case the obstacle is not that close the circuit does nothing. If the obstacle is close the arduino Uno sends a warning in the form of voice. A different buzzer sounds in case water is detected. The stick also includes the vibrator. Vibrator help in case the obstacle is nearby. Water sensor is there for water detection. One advanced feature is integrated to find out the stick if the person forgot where s(he) kept the stick. A wireless RF based remote is used for this purpose. Pressing the remote button sounds a buzzer on the stick which helps the blind person in walking.

4. FLOW CHART

The flow chart of the proposed system is given below.

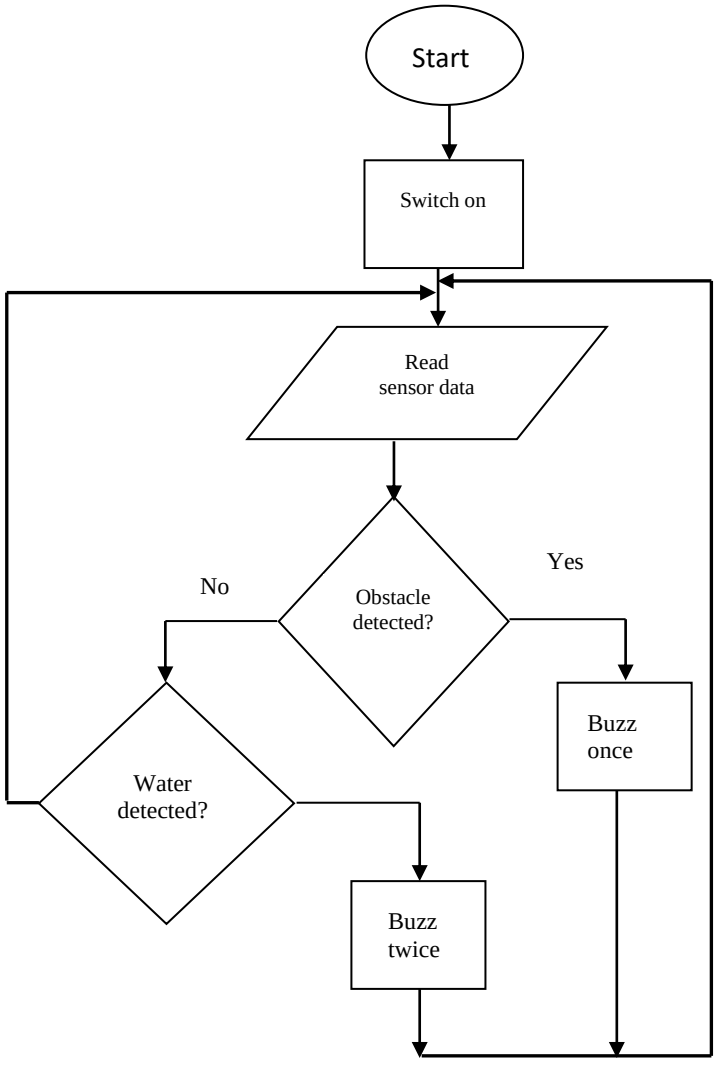

Fig -2: Flow Chart of Proposed System

4. HARDWARE COMPONENTS

4.1 Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs), a 16 MHz resonator, a USB connection, a power jack, an in circuit system programming (ICSP) header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started [6].

Fig -3: Arduino Uno [7]

4.2 Ultrasonic Sensor

An ultrasonic sensor is an instrument which measures the distance to an object using ultrasonic sound waves. An ultrasonic sensor sends and receives ultrasonic pulses that relay back information about an object's proximity using a transducer. Ultrasonic sensors and water sensors collect the data and send it in real time to the microcontroller. The microcontroller triggers the buzzer after processing certain details. The water sensor detects water on the earth, and the circuits are operated by batteries.

Fig -4: Ultrasonic Sensor [8]

4.3 RF Transmitter and Receiver

The blind stick is fitted with RF transmitter and receiver. Transimitter sends the signal to the receiver and, using this, we will put a buzzer that helps the blind person to easily detect their stick by tracking the echo from where it comes from.

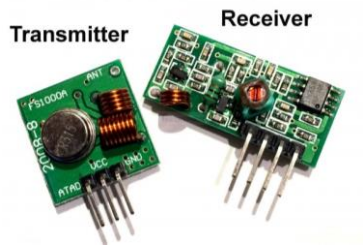

Fig -5: RF Transmitter and Receiver [9]

5. PROGRAM CODE FOR THE ARDUINO UNO

sketch_may19a.ino

```
// defines pins numbers
const int trigPin = 9;
const int echoPin = 10;
const int buzzer = 11;
const int ledPin = 13;

// defines variables
long duration;
int distance;
int safetyDistance;


void setup() {
pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
pinMode(echoPin, INPUT); // Sets the echoPin as an Input
pinMode(buzzer, OUTPUT);
pinMode(ledPin, OUTPUT);
Serial.begin(9600); // Starts the serial communication
}


void loop() {
// Clears the trigPin
digitalWrite(trigPin, LOW);
delayMicroseconds(2);

// Sets the trigPin on HIGH state for 10 micro seconds
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);

// Reads the echoPin, returns the sound wave travel time in microseconds
duration = pulseIn(echoPin, HIGH);

// Calculating the distance


distance= duration*0.034/2;

safetyDistance = distance;
if (safetyDistance <= 5){
  digitalWrite(buzzer, HIGH);
  digitalWrite(ledPin, HIGH);
}
else{
  digitalWrite(buzzer, LOW);
  digitalWrite(ledPin, LOW);
}

// Prints the distance on the Serial Monitor
Serial.print("Distance: ");
Serial.println(distance);
}
```

6. PROPOSED WALKING STICK

The implanted smart walking stick scheme has numerous subsystems, as was already mentioned. These components are mostly sensor-based. the whole

Scheme is created using the PIC16F90 microcontroller's foundational circuitry. This microcontroller controls the whole system by keeping the subsystems in working order and connecting them together.

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Fig -6: Proposed Smart Walking Stick

7. ADVANTAGES

1. The Smart Stick may act as a basic platform in future to help the visually impaired people to navigate both indoor and outdoor.
2. In a developing country like India, there is need of cost effective system which people can afford and the proposed stick can solve this.
3. Water detecting sensor is integrated to reduce the problem of blind people.

8. CONCLUSION AND FUTURE SCOPE

The Smart Stick serves as a foundation for the next wave of assistive technologies that will allow the blind to securely navigate both indoor and outdoor environments. Both cost-effective and efficient. It provides good results in identifying obstructions in the user's path within a three-meter range. This work has been meticulously completed in order to create and execute an articulate walking bolt for the blind, it should be highlighted at this point. In the upcoming phase of more helpful apps, the Smart Stick serves as a flexible interface for simple and comfortable internal and outdoor mobility for visually impaired persons. The inclusion of wireless connectivity between the device's components will improve its extra functions, extend the range of its ultrasonic sensors, and incorporate technology to gauge how difficult the hurdles ahead are. Future improvements includes global system for locating the person using GPS and GSM technology so that the caretaker can be reached. Also motion sensor may be incorporated to detect object even in a motion.

10. REFERENCE

1. Srinivas, G., Raju, G.M., Ramesh, D. and Sivaram, S.: Smart Blind Stick Connected System Using Arduino. Int. J. Research and Analytical Reviews (2019) 934-939.

2. Mahmud, M.H., Saha, R. and Islam, S.: Smart Walking Stick – An Electronic Approach to Assist Visually Disabled Persons. Int. J Scientific and Engineering Research (2013) 111-114.

3. Kher, C.S., Dabhade, Y.A., Kadam, S.K., Dhamdhere, S.D. and Deshpande, A.V.: An Intelligent Walking Stick for the Blind. Int. J. of Engineering Research and General Science (2015) 1057-1062.

4. Jose, A., George, G., Nair, M.R., Shilpa, M.J. and Mathai, M.B.: Voice Enabled Smart Walking Stick for Visually Impaired. Int. J Advanced Research in Electrical, Electronics and Instrumentation Engineering (2016) 80-85.

5. Belea, S., Ghuleb, S., Gunjalc, A. and N.D. Anwatd, N.D.: Design and Implementation of Smart Blind Stick. International Conference on Communication and Information Processing (ICCIP-2020) Available on: Elsevier-SSRN, https://ssrn.com/abstract=3645413.

6. https://docs.arduino.cc/hardware/uno-rev3

7. https://en.wikipedia.org/wiki/Arduino_Uno

8. https://robonest.co.in/index.php/product/ultrasonic-sensor/

9.https://www.deltakit.net/product/rf-transmitter-receiver-module-315mhz-wireless-link-kit-for-arduino/