Team ID:
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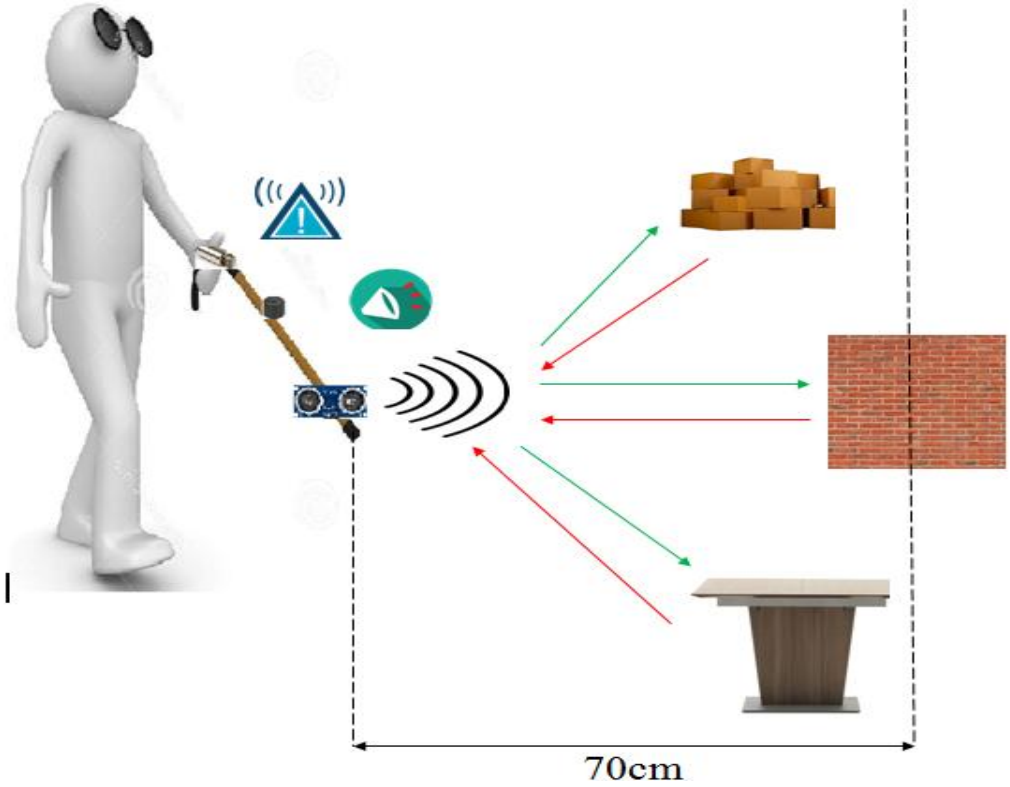
Smart Stick for blindman assistance system



Submited as part of CSE322 Embedded System Project Based Learning Assesement

To

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By

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Index

Chapter 1
ABSTRACT

Eyes are the one of most crucial sense organ in human body, whose loss due to a genetic disorder by birth or due to an unfortunate accident can be a major setback in anyone's life. Although other senses and intelligence can help overcome this shortcoming the transition can be difficult. Therefore we are creating a smart sensor enabled walking stick for blind people so that they can walk confidently using a stick with increased range of detection. The incorporation of Ultrasonic Module will detect the presence of any object in the specified distance and combining its output data as the input for our piezo buzzer will create a dynamic alert system depending on the direction of the walking stick. The existing tool meant to support in walking for blind people is just a simple stick which acts as a extension, but is restricted by its fixed range and lack of alert system in case something is missed or to help others realize they are in path of a blind person which will be dealt with our smart stick along with increasing range. The implementation will be done on a stick so a way is to be designed such that the sensors along with the arduino unit can be accommodated in a compact manner. Also another issue would be to ideally place the sensor so as to reduce the amount of stick movement required to find obstacles in path. Once dealt with these issues the product will help blind people to navigate and get used to walking using a stick providing increased range and alert system.

Keywords:

Arduino, embedded system, ultrasonic sensor, blind, assistance, eyes, piezo buzzer, walking stick, alert system, obstacle detection, range of detection, helping new users.

CHAPTER 2
OBJECTIVES

1 To study interfacing of arduino microcontroller with sensors like ultrasonic distance module and piezo buzzer.

2 To study arduino programming and utilizing sensor data in this case ultrasonic sensor along with arduino's computation abilities to carry out programmable actions using other components like piezo buzzer.

3 To create a smart sensor enabled walking stick for assistance system of blind person.

4 The smart stick will have increased range for detecting obstructions while walking also detecting depth upto an increased range and alert system.

5 To provide a more comfortable transition for blind people to walk using a stick by providing sensors and reducing chances of collision.

CHAPTER 3
LITERATURE REVIEW

3.1. National Status

- Technology based laboratory to improve science learning
  Avinash Kumar Shudhanshu, Raj Kumar, Sadashiv Raj Bharadwaj, Gaurav Singh, Amit Garg *corresponding author* Acharya Narendra Dev College, University of Delhi, Govinduri, Kalaji, New Delhi (India)

- An Intelligent Walking Stick for the Blind Kher Chaitrali S., Dabhade Yogita A., Kadam Snehal K., Dhamdhere Swati D., Deshpande Aarti V. JSPM's Jayawantrao Sawant College of Engineering

- Ultrasonic Stick for Blind Ankit Agarwal1 , Deepak Kumar2 , Abhishek Bhardwaj3 1 IP University, Sirifort College of Computer Technology and Management 8, Institutional Area, Rohini Sector-25, New Delhi

- Blind Assist System Deepak Gaikwad1 , Chaitalee Baje2 , Vaishnavi Kapale3 , Tejas Ladage4 Assistant Professor, E&TC Department, NBN Sinhgad School of Engineering, Pune Student,E&TC Department, NBN Sinhgad School of Engineering, Pune

- Smart stick for Blind: Obstacle Detection, Artificial vision and Real-time assistance via GPS. Shruti Dambhare, ME 3rd SEM(ESC) GHRCE nagpur, Prof A.Sakhare.M.tech(ESC), GHRCE nagpur

- ULTRASONIC SENSORS FOR THE ELDERLY AND CAREGIVERS IN A NURSING HOME Toshio Hori Digital Human Research Center, National Institute of Advanced Industrial Science

- Distance Measurement of an Object or Obstacle by Ultrasound Sensors using P89C51RD2 A. K. Shrivastava, A. Verma, and S. P. Singh

3.2. International Status

The origin of the Arduino project started at the Interaction Design Institute Ivrea (IDII) in Ivrea, Italy.[2] At that time, the students used a BASIC Stamp microcontroller at a cost of $100, a considerable expense for many students. In 2003 Hernando Barragán created the development platform *Wiring* as a Master's thesis project at IDII, under the supervision of Massimo Banzi and Casey Reas, who are known for work on the Processing language.

- The project goal was to create simple, low cost tools for creating digital projects by non-engineers. The Wiring platform consisted of a printed circuit board (PCB) with an ATmega168 microcontroller, an IDE based on Processing and library functions to easily program the microcontroller.

- In 2003, Massimo Banzi, with David Mellis, another IDII student, and David Cuartielles, added support for the cheaper ATmega8 microcontroller to Wiring. But instead of continuing the work on Wiring, they forked the project and renamed it *Arduino*.

- The initial Arduino core team consisted of Massimo Banzi, David Cuartielles, Tom Igoe, Gianluca Martino, and David Mellis, but Barragán was not invited to participate.

- Following the completion of the Wiring platform, lighter and less expensive versions were distributed in the open-source community.

- Adafruit Industries, a New York City supplier of Arduino boards, parts, and assemblies, estimated in mid-2011 that over 300,000 official Arduinos had been commercially produced,and in 2013 that 700,000 official boards were in users' hands.

- In early **2008**, the five cofounders of the Arduino project created a company, Arduino LLC,[8] to hold the trademarks associated with Arduino. The manufacture and sale of the boards was to be done by external companies, and Arduino LLC would get a royalty from them. The founding bylaws of Arduino LLC specified that each of the five founders transfer ownership of the Arduino brand to the newly formed company.

CHAPTER 4
REQUIREMENTS

4.1. Hardware Requirements

S.No	Item	Model	Spec	Vendor	Price	Description	Reference
1	Arduino Uno Microcontroller	Arduino Uno R3	Operating Voltage 5V, Digital & analogue pins, flash memory	REES52	Rs. 451	Used for running C/C++ sketch to compute sensor data in order to carryout an action.	https://www.amazon.in/Arduino-Uno-R3-USB-Cable/dp/B014YUY3RC?tag=googinhydr18418-21&tag=googinkenshoo-21&ascsubtag=d1ce6ac3-a875-4bc2-96e6-dc967b5d0419
2	Ultrasonic Sensor	HC-SR04	Sensor angle 15 degrees, range 2cm to 450cm,precision 2mm	REES52	Rs.166	The ultrasonic range finder module is used to calculate the distance of any object in front of it using time duration.	https://www.amazon.in/REES52-Ultrasonic-Distance-Measuring-Transducer/dp/B00MYYE6XM/ref=sr_1_2?s=industrial&ie=UTF8&qid=1505631922&sr=1-2&keywords=ultrasonic+sensor+hc-sr04
3	Vibration Motor	Non-flat	1100rpm, 0.2 amp i/p	Robu.in	Rs. 95	The vibration motor has a ground and trigger wires and vibrates by rotating fast rpm motor to alert	

4	Piezo Buzzer	Buzzer PCB Mount	5v operating voltage, continous beep sound	OLatus	Rs. 35	The piezo buzzer creates a beep noise till its trigger pin is kept by arduino logic running in its code	
5	Switch	CNB-1032	2 modes ON/OFF	TPS	Rs. 30	The switch is meant to complete and break the circuit at users demand in order to control the device usage	

4.2. Software Requirements

S.No	Item	versions	Spec	Vendor	Price	Description	Reference
1	Arduino IDE	Version: 1.6.7	Runs on windows OS	arduino.cc	Open-source	The Auduino IDE is an open-source tool created with the purpose of programming arduino actions and sensor system using c/c++ along with a rich support of libraries.	

CHAPTER 5
INVENTION DETAILS

5.1. Objects of the Invention

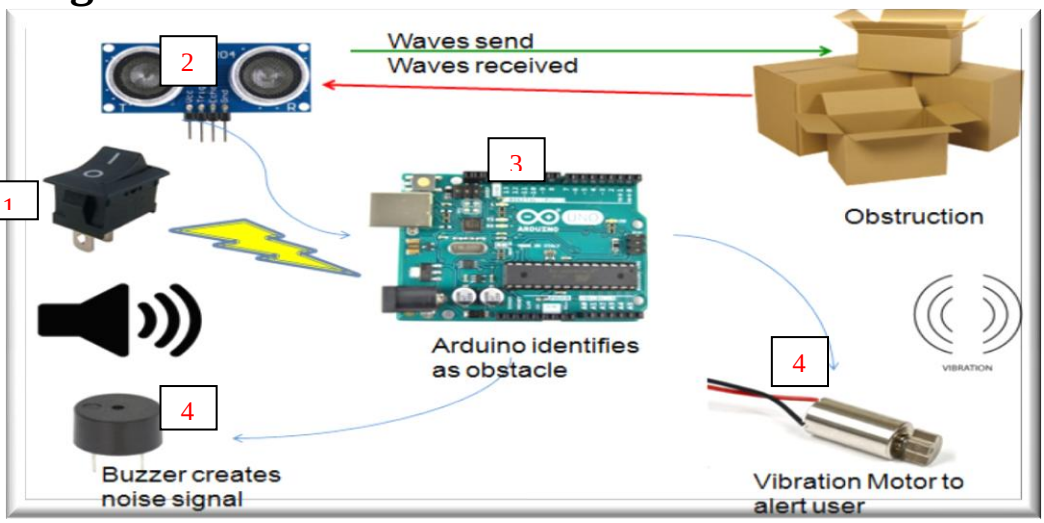
1. To study interfacing of arduino with various sensors.
2. To study arduino programming for carrying out action based on sensor output.
3. To develop a smart stick for people who are visually impaired that offers increased range and alert for obstruction.
4. To provide a tool for smooth transitioning to people who are new to walking by stick.

5.2. Summary of Invention

Eyes are the one of most crucial sense organ in human body, whose loss due to a genetic disorder by birth or due to an unfortunate accident can be a major setback in anyone's life. Although other senses and intelligence can help overcome this shortcoming the transition can be difficult. Therefore we are creating a smart sensor enabled walking stick for blind people so that they can walk confidently using a stick with increased range of detection. The incorporation of Ultrasonic Module will detect the presence of any object in the specified distance and combining its output data as the input for our piezo buzzer will create a dynamic alert system depending on the direction of the walking stick. The existing tool meant to support in walking for blind people is just a simple stick which acts as a extension, but is restricted by its fixed range and lack of alert system in case something is missed or to help others realize they are in path of a blind person which will be dealt with our smart stick along with increasing range. The implementation will be done on a stick so a way is to be designed such that the sensors along with the arduino unit can be accommodated in a compact manner. Also another issue would be to ideally place the sensor so as to reduce the amount of stick movement required to find obstacles in path. Once dealt with these issues the product will help blind people to navigate and get used to walking using a stick providing increased range and alert system.

5.3 Brief Description of the Drawings

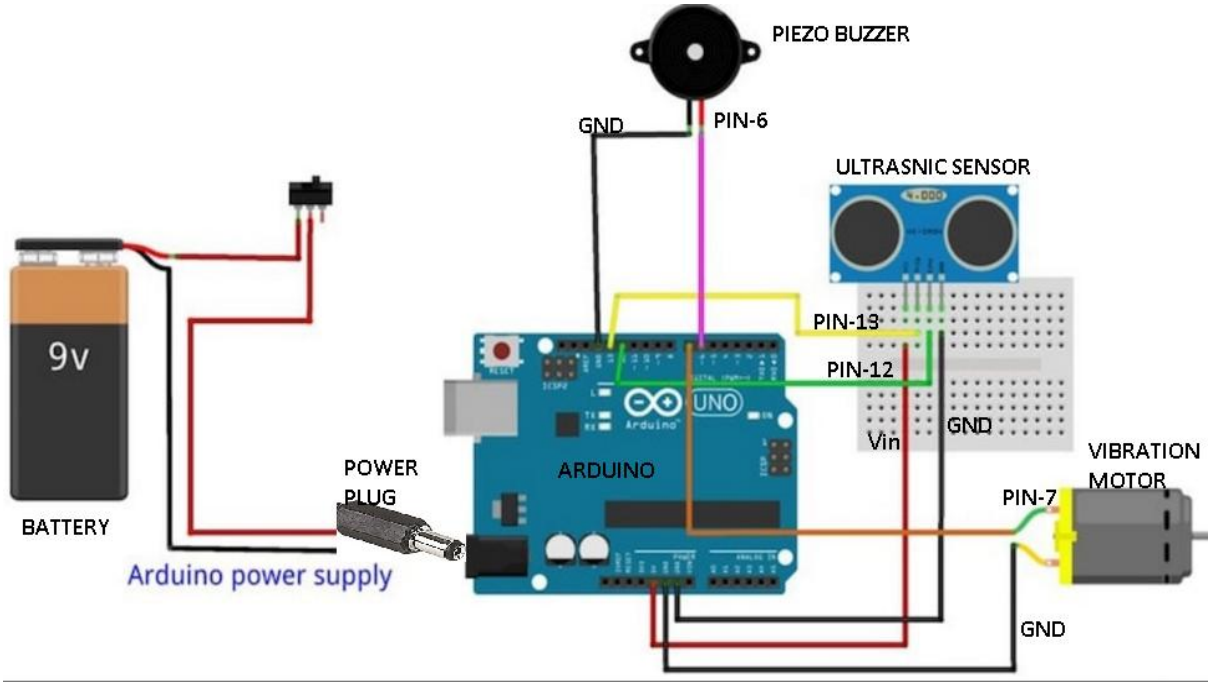
Drawing – 1



The system model as showed in the above photo describes the working principle of the project smart stick.

1. The power button is used to enable ON mode to utilize sensor functionality.
2. As depicted in the diagram the ultrasonic sensor used sends and receives waves and its reflection respectively using the pair of transmitter and receiver present on the sensor. The ultrasonic sensor then calculates the duration of time taken by the reflected wave to come back.
3. This duration is then sent to arduino which uses the programmed arduino logic to calculate the distance of the object from the sensor. If the calculated distance comes less than 70 cm programmed pins are triggered.
4. The arduino's signal activates the actuators and the vibration motor and piezo buzzer starts their functioning.

5.4. Detailed Description of the Invention



The above figure depicts the systematic connections of the project. The components are connected to the arduino with the respective pins mentioned in the diagram. The battery power the arduino to remotely operate on the stick using a power plug. The Vcc pin of the ultrasonic sensor is connected to the Vin pin of the arduino and trigger pin to pin 13 and echo to 12. Pin 7 is connected to the activation pin of vibration motor and pin 6 to piezo buzzer. Rest pins are connected to the ground of arduino.

5.5. Working Examples

5.5.1 Working Example 1

In OFF mode the stick can be used as normal stick.

5.5.2 Working Example 2

In this example we will demonstrate the ability to alert user and surroundings using actuator piezo buzzer.

5.5.3 Working Example 3

In this example we will demonstrate the ability to alert user using actuator vibration motor.

CHAPTER 6
IMPLEMENTATION

6.1. Pseudo Code

1. Declare variable names for i/p, o/p pins to be used for echo, trigger of ultasonic sensor and activating buzzer and motor.

2. Create function setup and declare mode of each pin as i/p or o/p as:-

{ pinMode(trigPin, OUTPUT); pinMode(echoPin, INPUT); pinMode(motor, OUTPUT);

pinMode(buzzer,OUTPUT);}

3. Declare long duration, distance variables for storing reflection time sent by ultrasonic sensor and calculated distance respectively.

4. Create function to read data from sensor and convert to distance as:-

digitalWrite(trigPin, LOW);

delayMicroseconds(1);

digitalWrite(trigPin, HIGH);

delayMicroseconds(1);

digitalWrite(trigPin, LOW);

duration = pulseIn(echoPin, HIGH);

distance = (duration/2) / 29.1;

5. Create a loop for checking condition to set the actuators :-

if (distance < 70) // Checking the distance, you can change the value

{

digitalWrite(motor,HIGH); // When the the distance below 70cm

digitalWrite(buzzer,HIGH);

} else

{

digitalWrite(motor,LOW);// when greater than 70cm

digitalWrite(buzzer,LOW);

} delay(500);}

CHAPTER 7
RESULTS

Snap shots

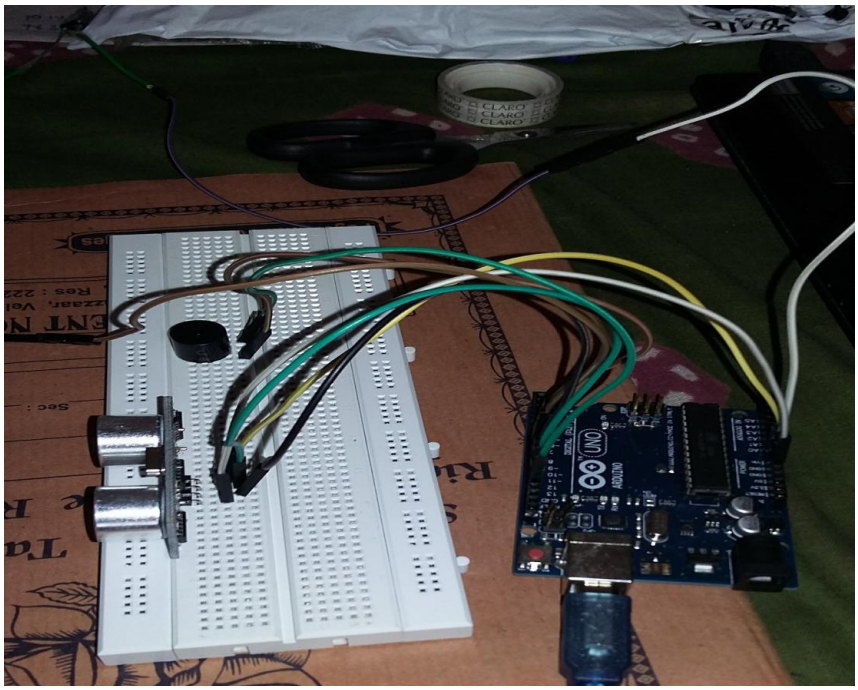


Fig.1
The circuit arrangement of arduino,
sensor and actuators

Observations:-

The above snapshot is depecting the circuit arrangement of arduino with the ultrasonic sensor, the piezo buzzer and the vibration motor.

This is the first arrangement which was working according to requirements and based on this arrangement the code was designed.

Fig.2
The Piezo buzzer

Observations:-
The above snapshot is depecting the positioning of the Piezo buzzer on the smart stick. The buzzer is placed beaneth the control box and is kept in open so that the buzzer sound is not muffled.

Fig.3
The Ultrasonic sensor

Observations:-

The above snapshot is depecting the positioning of the Ultrasonic sensor at the foot of the smart stick so as to get as closest as possible to the obstruction in path and provide maximum range. The connection between arduino and ultrasonic sensor are done using jumper wires that run inside the PVC pipe used.

Fig.4
The Connections

Observations:-

The above snapshot is depecting the positioning of the vibration motor at the top of the smart stick so that the user can feel the vibration in case of n obstruction in front of him.

The user controls the mode of operatio as ON/OFF using the switch which is placed at the control box that has arduino and all the connections going inside.

Fig.5
The Connections

Observations:-

The above snapshot is depecting the final form of our prototype for smartstick. The user will readily be able to use this stick in this form without the requirements of adapting or aquiring to anything new. The components present in the smatrt stick are self sufficient for its working.

CHAPTER 8
Conclusions

- **Results**

1. The range of detection set as 70cm for ultrasonic sensor.

2. The formula used to convert duration of wave transmission and reflection is distance = (duration/2) / 29.1 as, sound travels at 343 meters per second, which means it needs 29.155 microseconds per centimetre, then divide by 2, because the sound has to travel the distance twice.

3. The placement of ultrasonic sensor on stick should be based on user as the sensor should be parallel to the ground.

- **Improvements:-**

1. 1. A smart-stick is created implementing features of ultrasonic sensor.

2. Distance is calculated by arduino in real time to alert user using actuator vibration motor and piezo buzzer also to alert nearby people

3. The functionality of smart stick can be used on demand using the ON/OFF switch

Chapter 9
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5. Paul McWhorter: https://www.youtube.com/user/mcwhorpj