

A Project Report On
”Object Detector For Blind Person”
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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
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BY
Nagpure Latika C.
Ranshoor Pratibha S.
Tupke Gayatri A.
Ujainkar Shraddha D.
Under Guidance of
Mrs. S. S. Gawali



DEPARTMENT OF COMPUTER TECHNOLOGY
SANJIVANI RURAL EDUCATION SOCIETY'
S.K.B.P. POLYTECHNIC, KOPARGAON
DIST. AHMEDNAGAR - 423603
(2018-19)
Department of Computer Technology

S.K.B.P. POLYTECHNIC, KOPARGAON



CERTIFICATE

THIS IS TO CERTIFY THAT PROJECT ENTITLED

“Object Detector for Blind Person”

Submitted by

Nagpure Latika C.

Ranshoor Pratibha S.

Tupke Gayatri A.

Ujainkar Shraddha D.

Is a bona fide work carried out by above students under the supervision of Prof. S. S. Gawali and it is submitted towards the partial fulfilment of the requirement of MSBTE, Mumbai for the award of Diploma in Computer Technology.

(Prof. S. S. Gawali)
Project Guide

(Prof. V. A. Parjane)
Project Co-ordinator

(Prof. G. N. Jorvekar)
HOD, Computer Department

(Prof. A. R. Mirikar)
Principal

**MAHARASHTRA STATE BOARD OF TECHNICAL
EDUCATION, MUMBAI**



**EXAMINERS CERTIFICATE
“Object Detector for Blind Person”**

Submitted by
**Nagpure Latika C.
Ranshoor Pratibha S.
Tupke Gayatri A.
Ujainkar Shraddha D.**

For the partial fulfilment of the requirement of Diploma in Computer Technology examined & certified.

Internal Examiner

External Examiner

Date: / /

Place: Kopergaon.

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Nagpure Latika
Ranshoor Pratibha
Tupke Gayatri
Ujainkar Shraddha

Diploma in Computer Technology,
Sanjivani K.B.P.Polytechnic,
Kopargaon

ABSTRACT

Independence is the building methodology in achieving dreams, goals and objectives in life. Visually impaired persons find themselves challenging to go out independently. There are millions of visually impaired or blind people in this world who are always in need of helping hands. For many years the white cane became a well-known attribute to blind person's navigation and later efforts have been made to improve the cane by adding remote sensor. Blind people have big problem when they walk on the street or stairs using white cane, but they have sharp haptic sensitivity.

The main aim of this paper is to contribute our knowledge and services to the people of blind and disable society. The Object detector comes as a proposed solution to enable visually impaired people to find difficulties in detecting obstacles and dangers in front of them during walking and to identify the world around. It will help the blind person by providing more convenient means of life.

The system consists of an ultrasonic sensor, a buzzer and microcontroller (Arduino Uno R3) to receive the sensor signals and process them to short pulses to the Arduino pins where buzzer is connected.

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1 Introduction

1.1 Project Title :

Object Detector for Blind Person

1.2 Internal Guide :

Mrs. S. S. Gawali

1.3 Overview :

Blind people face several problems in their life, one of these problems that is the most important one is detection of obstacles when they are walking. In this research, we suggested a system with ultrasonic sensor placed on blind person's stick that its duty is detecting the object in front of the blind person.

Blindness is a state of lacking the visual perception due to neurological or physiological factors. The partial blindness represents the lack of integration in the growth of the optic visual or nerve centre of the eye, and total blindness is the full absence of the visual light perception. In this work, object detector is designed and implemented to improve the mobility of both blind and visually impaired people in a specific area. The proposed work includes a wearable equipment consists of light weight blind stick and sensor based obstacle detection circuit is developed to help the blind person to navigate alone safely and to avoid any obstacles that may be encountered or to prevent any possible accident. The main component of this system is the ultrasonic sensor which is used to detect the object in front of the blind person by measuring the distance between the object and the stick.

Major Components used in the system are :

1) Ultrasonic Sensor : Ultrasonic sensor is used for generating, detecting and processing ultrasonic signals. Ultrasonic is the production of sound waves above the frequency of human hearing and can be used in a variety of applications such as, sonic rulers, proximity detectors, movement detectors, liquid level measurement.



Figure 1: Ultrasonic Sensor

2) Buzzer :

A buzzer is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric. It consists of two an outside case with two pins to attach it to power and ground.



Figure 2: Buzzer

3)Arduino Uno :

Arduino is a microcontroller which can control the environment by receiving input signals (Digital/Analog) and can effects its surroundings by controlling lights, relays and other devices. The microcontroller on the board is programmed using Arduino software (Arduino IDE).

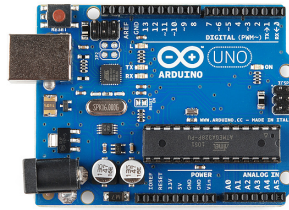


Figure 3: Arduino Uno

1.4 Motivation :

Walking safely and confidently without any human assistance in urban or unknown environments is a difficult task for blind people. Blind people face several problems in their life, one of these issues that is the most vital one is identification the hindrances when they are walking. When moving from one place to another, they need help of other people around. Their independency in strolling is lost. Sticks can be usable but are not that reliable nor does everyone have it. A visually impaired person needs absolution to help him overcome problems in navigation due to his disability.90 % of the world's blind people are in developing countries, so our goal is to make the device useful but still affordable in the 3rd world. It's designed to help people in need, rather than to buy me a Ferrari, so the whole project is non-profit and is open-source hardware and software.

1.5 Objective :

The main objective is that to develop a system for blind person to detect object in front of them in low cost. Object detector is mainly proposed for people who are visually impaired to detect obstacles using ultrasonic sonic sensor.

2 System Requirements

2.1 Hardware Requirements :

1. Arduino Uno R3
2. Ultrasonic sensor HC-SR04
3. 5V Buzzer
4. 9V Battery
5. Jumper cables (4 male to female)
6. Jumper cables (2 male to male)
7. Data cable of Arduino Uno R3

2.2 Software Requirements :

1. Arduino IDE(Beta Version)
2. Operating System(Windows 10)

3 System Analysis

3.1 Block Diagram :

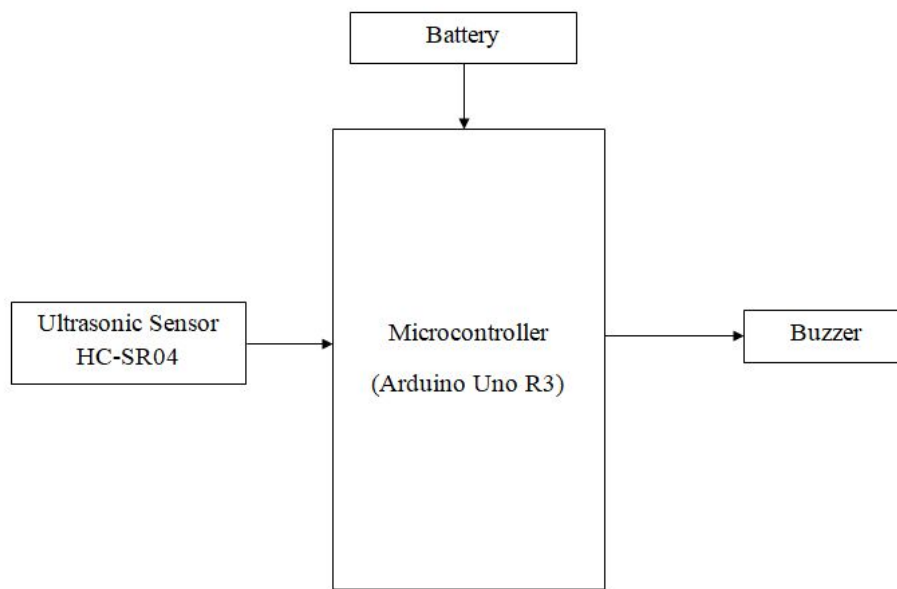


Figure 4: Block Diagram

3.2 Circuit Diagram :

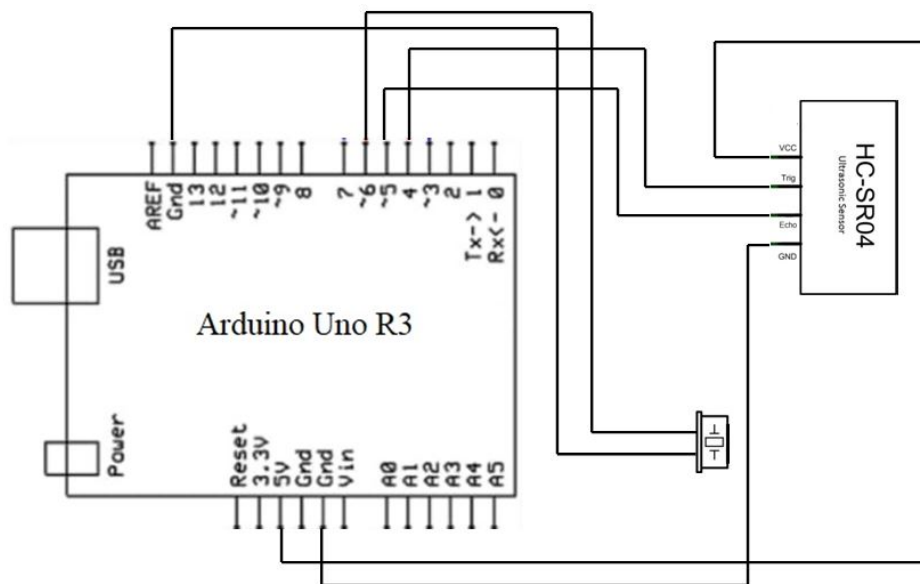


Figure 5: Circuit Diagram

3.3 Use-case Diagram :

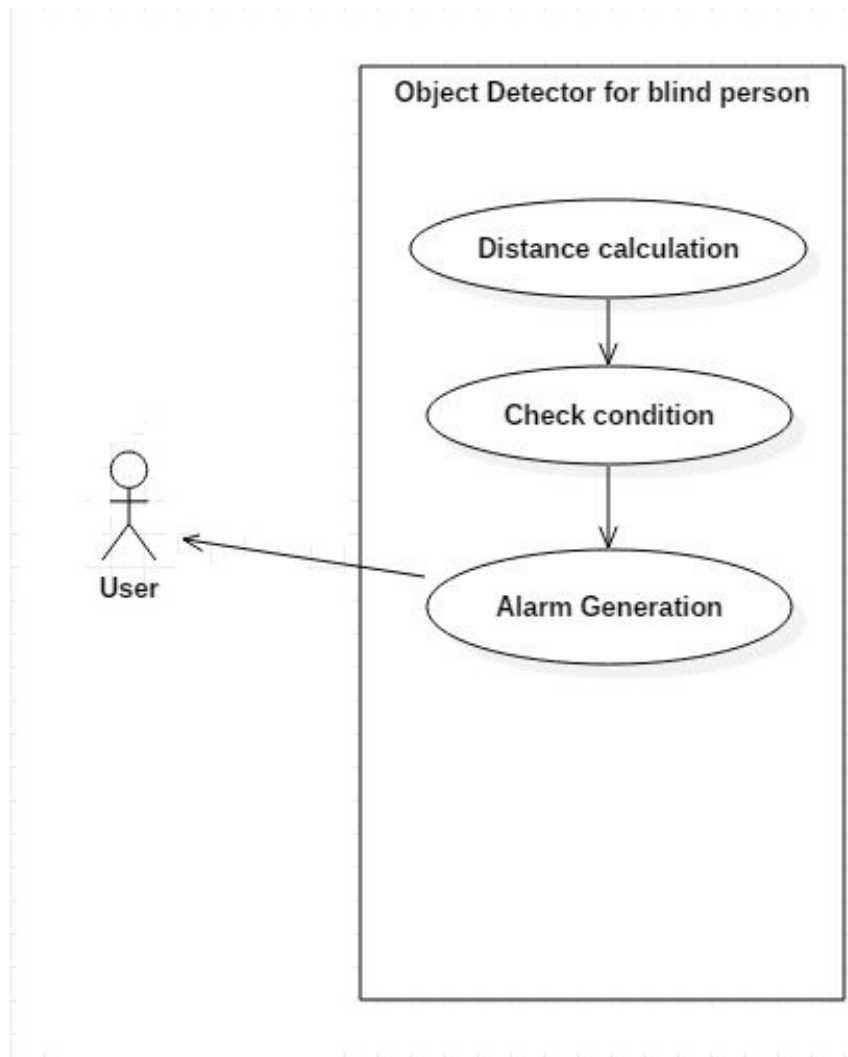


Figure 6: Use-case Diagram

3.4 Data Flow Diagram :

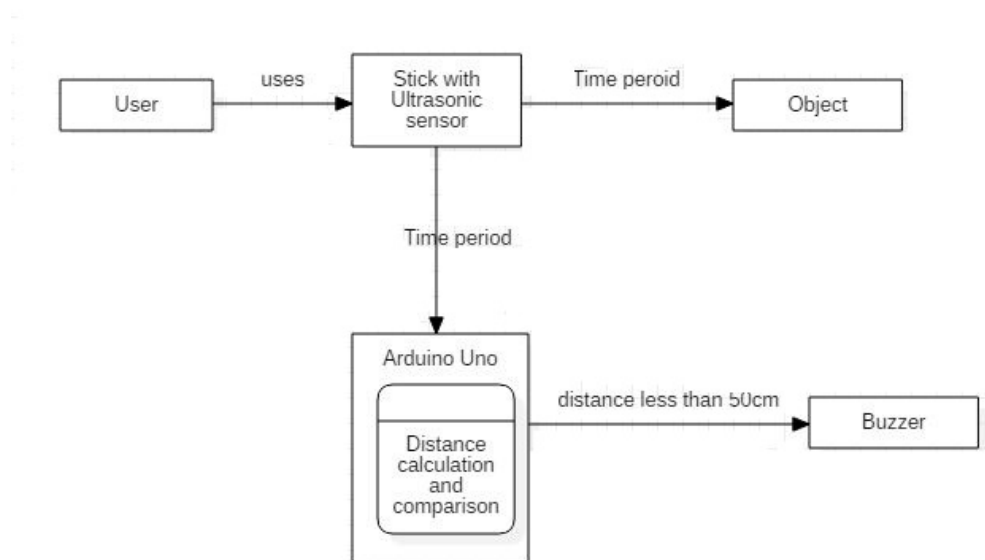


Figure 7: Data Flow Diagram

4 Implementation Details

4.1 Methodology :

1. Arduino Uno R3, Ultrasonic Sensor HC-SR04 and buzzer are collected first.
2. Ultrasonic sensor is connected to the arduino board in that way the vcc pin is connected to the 5v, echo pin is connected to 5th digital pin, trigger pin is connected to 6th digital pin and GND is connected to GND of arduino board. And positive pin of buzzer is connected to the 6th digital pin of arduino board and another pin is connected to the GND pin of arduino board.
3. Arduino board is programmed with the java code in which distance is calculated using `pulseIn()` function with the signal received from an ultrasonic sensor and the corresponding code is executed.
4. If the distance between object and the blind person is less than 50 cm then it generate an alarm (i.e. it sets Buzzer to HIGH mode) otherwise it set buzzer to LOW mode.
5. After uploading code, the components are attached to the stick and the project is developed.

4.2 Modules :

1. Distance Measurement :

Ultrasonic sensor is used to measure distance between the object and the blind people. The Arduino `pulseIn()` function measures the time period of high pulse input signal by

which the distance is calculated as :

$$\text{Distance} = \text{duration}(\text{time period}) * 0.034 / 2$$

2. **Comparison :**

The distance calculated by using the signals of an ultrasonic sensor is compared in an arduino code using if condition. If the distance between the object and the stick is less than 50cm then alarm is generated using buzzer otherwise it takes next input signals from the ultrasonic sensor and check the condition.

3. **Alarm Generation :**

If the condition given in arduino code is true then the alarm is generated (i.e. buzzer is set to HIGH mode using digitalWrite() function) otherwise it takes next input signals from ultrasonic sensor and check the condition again.

4.3 **Algorithm :**

1. Initialize the variables trigPin, echoPin, buzzer to 4, 5 and 6 pin respectively.
2. Set buzzer and trigPin to OUTPUT and echoPin to INPUT using pinMode() function.
3. For retrieving time period we have use pulseIn() function.
4. Now for distance calculation, distance= (duration*0.034)/2.
5. Conditions are checked, if distance is less than 50 buzzer is set to high mode and if it is greater than 50 it is set to low mode.

4.4 Pseudo Code :

```
int trigPin = 4;
int echoPin = 5;
int buzzer = 6;
long duration;
int distance;
void setup() {
    pinMode(buzzer, OUTPUT);
    pinMode(trigPin, OUTPUT);
    pinMode(echoPin, INPUT);
    Serial.begin(9600);
}
void loop() {
    digitalWrite(trigPin, LOW);
    delayMicroseconds(2);
    digitalWrite(trigPin, HIGH);
    delayMicroseconds(10);
    digitalWrite(trigPin, LOW);
    duration=pulseIn(echoPin, HIGH);
    distance=duration*0.034/2;
    Serial.print("Distance : ");
    Serial.println(distance);
    if(distance < 50){
        digitalWrite(buzzer, HIGH);
    }
    else{
        digitalWrite(buzzer, LOW);
    }
}
```

5 Testing, Results and Analysis

5.1 Introduction :

Software Testing is an investigation conducted to provide stakeholders with information about the quality of the product or service under test. Software testing can also provide an objective, independent view of the software to allow the business to appreciate and understand the risk of software implementation. Test techniques include, but are not limited to, the process of executing a program or application with the intent of finding software bugs. Software testing can be stated as the process of validating and verifying that a computer program/application/product.

5.1.1 White-Box Testing :

White-box testing also called as clear box testing, glass box testing, transparent box testing and structural testing, tests internal structures or working of the program, as opposed to the functionality exposed to the end user, In white box testing an internal perspective of the system, as well as Programming skills, are used to design test cases. The tester chooses input to exercise path through the code and determine the appropriate output. This is analogous to testing nodes in a circuit. Though, this method of test design can uncover many errors or problems.

5.1.2 Black-Box Testing :

Black box testing treats the software as a black box, examining functionality without any knowledge of internal implementation. The tester is only aware of what the software is supposed to do, not how it does it. Black-box testing methods include :

equivalence partitioning, boundary value analysis, all pairs testing, state transition tables, decision table testing, fuzz testing, model-based testing, use case testing, exploratory testing and specification-based testing. Specification-based testing aims to test the functionality of software according to the applicable requirements.

5.1.3 Unit Testing :

Unit testing, also known as component testing refers to tests that verify the functionality of a specific section of code, usually at the functional level. In an object oriented environment, this is usually at the class level and the minimum unit tests include the constructors and destructor. This type of testing is usually written by developers as they work on code. Unit testing alone cannot verify the functionality of a piece of software, but rather is used to assure that the building blocks the software uses work independently of each.

5.1.4 Integration Testing :

Integration testing is any type of software testing that seeks to verify the interface between components against a software design. Software components may be integrated in an interactive way or all together. A system is implemented as components cooperating with each other. Thus, components comprise of hardware and software. The process of integrating the components and implementing the interaction between them is called integration. The verification and testing of integration is called integration testing.

5.2 Test Cases :

Test case no:	Name of Test case	Description	Expected Output	Actual Output	Pass/Fail status
1	Ultrasonic sensor	Check whether the ultrasonic sensor is sending appropriate signal to the arduino board or not.	Echo pin must send signal to arduino when the object is in front of ultrasonic sensor.	Echo pin is sending signal to the arduino if any object is in front of ultrasonic sensor.	Pass
2	Buzzer	Check whether the buzzer is giving audio signal or not.	Buzzer must give an audio signal when arduino gives signal.	Buzzer is giving arduino signal.	Pass

3	Arduino Uno	Check whether the arduino board is giving correct output signal as per the input signal	Arduino must give output signal to the ultrasonic sensor and buzzer as per the input signal received.	Arduino gives output signal to the ultrasonic sensor and buzzer.	Pass
4	Distance Calculation	Check that whenever the distance between the object and stick goes less than 50 cm, alarm generates or not.	If the distance is less than 50 cm, the alarm must generate.	Whenever the distance goes less than 50 cm, alarm is generated.	Pass

5	Power Supply	Check whether the power supply is given to the arduino board or not.	When power supply is given to the arduino board, the arduino must indicate that the power supply is given (by blowing the LED signal on it).	Arduino indicates that the battery is connected to it by blowing the LED on it.	Pass
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Table 1: Test Cases

6 Applications and Future Scope

6.1 Applications :

1. Person protector
2. Object identifier
3. Buzzer Alert
4. Distance calculation between two objects.

6.2 Future Scope :

A variety of future scope are available that can be used of with the stick such as usage of Global positioning System can help the blind person to source to destination route information.

GPS can help to find the shortest and best path as accordingly to Google (Bing map based on real time coordinates).

GSM attachment can help in future for any immediate casualty help. It can also contain special arrangement to connect the walking stick to aadhar card of blinds, helping the government serve the physically disable even better.

Water sensor sense any kind of water allowing the safe walk of the blind people in order to avoid slipping. Using water sensor we can avoid the minor accident which is happen with blind peoples.

7 Conclusion and References

7.1 Conclusions :

The project started with the motivation and the idea to solve the problems of visually impaired people. Object detector is used to solve one of the most problem for blind person that is, to detect the object in front of them. Arduino Uno, ultrasonic sensor and a buzzer is used to develop a system which generates alarm whenever there is any object found between the 50 cm from the blind person. The system is useful for the blind people to move safely without taking help of anyone.

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