

Artificial Vision Stick for Blinds in IoT Environment

Anuradha T

Department of Computer Science, PDA College of Engineering, Kalaburagi

-----ABSTRACT-----

Nowadays there are many blind assistive systems but there is no such kind of stick that will navigate to a blind person and also to guide him each & every movement that can help to rescue him/her in any panic situation. In this paper, we have presented a artificial vision stick with hurdle recognition, that is voice based via GPS along with panic alert system. In this system blind person is navigated through a spectacle interfaced with an android application. The blind person is guided using three languages such as Hindi, Kannada, and English voice commands generated by the application according to the obstacle position that helps the blind person to go anywhere in the world. With the help of voice command a blind person can establish voice call to an authorized person without touching the phone just by pressing the headset button. The blind assistive application gets the latitude and longitude values using GPS and then sends them to a server. The movement of the blind person is tracked through another android application that points out the current position in Google map. The basic objective of the system is to provide a artificial vision stick by providing information about the environmental scenario of static and dynamic objects surrounding him.

Keywords - Arduino, sensors like (ultrasonic, water, flame) and jumper wires for connection, GPS, artificial vision stick.

I. INTRODUCTION

According to Aristotle, our knowledge about the outside world depends on five sense organs. As vision is one of the most important sense organ of human that gets from the environment via sight. According to the World Health Organizations (WHO) of 2010, over 285 millions peoples in the world are visually challenged and of whom 39 millions are blind and 246 millions have moderate to severe visual impairment. In India about 21.5% of the total number of visually impaired with 53 millions of citizens are suffering from some of visionless. Blind people face several problems in their life, one of these problems that is the most important one is detection the obstacles when they are walking. In India 21.5% of the total number of visually impaired with 53 million citizens suffers from some form of visionless. Globally uncorrected refractive errors are the main cause of moderate and severe visual impairment; cataract is the leading cause of blindness in middle and clone income countries. According to the World Health Organization, approximately 0.4% of the population is blind in industrialized countries while the percentage is rising to 1% in developing countries. The main aim of the project is to design a voice based alerting system for the blind people. Ultrasonic Sensor senses the obstacles in its path by continuously transmitting the ultrasonic waves. The controlling device of the whole system is a Microcontroller and this system is very helpful for blind people. For blind person a greatest challenge is that blind person has to rely on other. The simplest and most widely used travelling aid used by all blinds is the white cane. It has provided those people with a better way to reach destination and detect obstacles on ground, but it cannot give them a high guarantee to protect themselves from all level of obstacles. Sometimes it happens that blind people are lost and their guardians are in tension about them. There have been many efforts but even now, it is not easy for the blind people to move independently from one place to another. In this system the modified electronic components and sensors. The ever growing and technology and with recent developments can help in

artificial and accurate navigate this model uses ultrasonic sensor for hurdle detection and Wi-Fi routers are installed in every bus stops; where the buses bus stops names are informed or notified through the earphone. The blind people also face the problem they cannot afford the dogs for guidance because of high cost for dogs. The blind people also face the problems to identify the objects in house like kitchen tools, cloths and other important things. They also face the problem while handling the electronic and electrical devices which can harm them. The project can reduces these kinds of problems of blind person.

II. LITERATURE SURVEY

The aim of this research is to provide a good understanding to make a suitable system in the future. In [1], the authors have proposed a system, & named Smart Vision, whose objective is to give blind users the ability to move around in unfamiliar environment, whether indoor or outdoor, through a user friendly interface. They focused mainly on the development of the computer vision module of the Smart Vision system. This system is specially designed to protect the area near to blind person head. The product is designed to provide full navigation to user into the environment. It guides the user about obstacles as well as also provides information about appropriate or obstacle free path. We are using buzzer and vibrator, two output modes to user. It is important to develop this application for the future. In [2], paper, the study about a blind assistive and tracking embedded system. The blind person is navigated through a spectacle interfaced with an android application. The blind person is guided through Bengali and English voice commands generated by the application according to the obstacle position. Using voice command a blind person can establish voice call to a predefined number without touching the phone just by pressing the headset button. The system has been tested through several test cases. The blind assistive device with Eye mate for Blind android application is very useful for a blind person to move

without the help of other and the user can seek emergency help through voice call. The tracking system involved here through Blind Tracker application is very applicable to track the current location of the blind person. This smart stick comes as a solution to enable visually impaired people to find difficulties in detecting obstacles and dangers in front of the blind people during walking and to identify the world around. The system consists of various sensors along with Arduino Uno microcontroller and the GPS GSM. Microcontroller receives the sensor signals and processes them to short pulses to the Arduino pins where buzzers and vibrator are connected, which get starts if the obstacle finds in the way. GPS and GSM technology helps for tracking the device is studied in [3]. In [4], proposed third type of aid that detects obstacles in his path ahead using ultrasonic waves on sensing obstacles passes this data to the microcontroller. The microcontroller then processes this data and calculates if the obstacle is close enough. If the obstacle is not that close the circuit does nothing. If the obstacle is close to the microcontroller sends a signal to sound a buzzer and produces appropriate alerts to save the person from hitting obstacles. The stick is generated using many sensors like Ultrasonic, Flame sensor and Water sensor. When the blind person moves from one place to another place with the help of sensors the message is passed to the blind person through the Arduino UNO in the form of different types of beep and vibrations. Because of this stick blind people can move easily from one place to another without help of others and it also increase the autonomy for the blinds. In [5], the focus on visually impaired have to face many challenges in their daily life. The problem gets worse when they travel to an unfamiliar location. Only few of the navigation systems available for visually impaired people can provide dynamic navigation through speech output. None of these systems work perfectly for both indoor and outdoor applications. In this paper, they propose a navigation device for the visually impaired which is focused on providing voice output for obstacle prevention and navigation using infrared sensors, RFID technology, and android devices. It aims to solve the problems faced by the blind people in their daily life. The system also takes measures to ensure their safety.

III. PROPOSED SYSTEM

Normally, a blind person uses cane as guide to protect him from obstacles. Most of area of surrounding is covered by the cane, especially the area near to his legs like stairs etc. But certain areas such as near to his head, especially when he is entering or leaving the door which is short in height. This system is specially designed to protect the area near to his head. The product is designed to provide full navigation to user into the environment. It guides the user about obstacles as well as also provides information about appropriate or obstacle free path. We are using buzzer and vibrator, two output modes to user.

The proposed system has Hardware, Android, GPS and web based system capable of assisting the blind and visually impaired without the help of sighted person. The proposed system detects obstacles in his path ahead using ultrasonic waves on sensing obstacles passes this data to the microcontroller. The microcontroller then processes this data and calculates if the obstacle is close enough. If the obstacle is not that close the circuit does nothing. If the obstacle is close to the microcontroller sends a signal to sound as a buzzer and produces appropriate alerts to save the person from hitting obstacles.

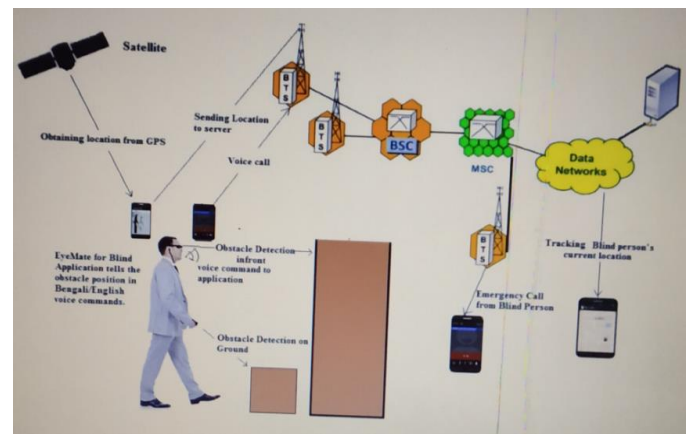


Fig. 1: Proposed solution to navigate and track Blind person

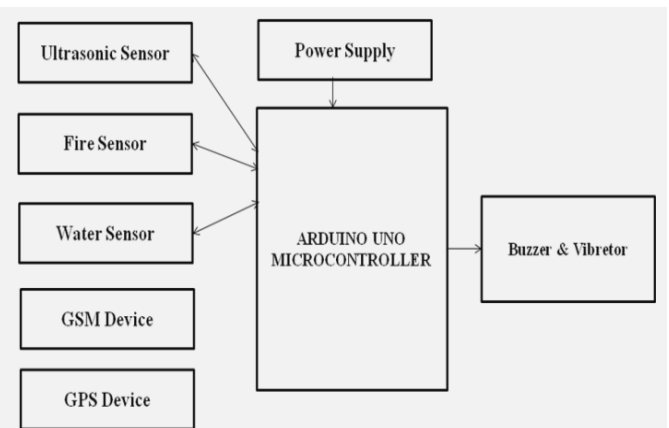


Fig.2 Block diagram of proposed design.

(a). ARDUINO UNO

Steps for connecting Arduino in IoT

Step 1 – First Arduino board and USB cable. In case you use Arduino UNO, Arduino Duemilanove, Nano, Arduino Mega 2560, or Diecimila, use a standard USB cable (A plug to B plug), the kind you would connect to a USB printer.

Step 2 – Download Arduino IDE Software.

You can get different versions of Arduino IDE from the Download page on the Arduino Official website. You must select your software, which is compatible with your operating system (Windows, IOS, or Linux). After your file download is complete, unzip the file.

Step 3 – Power up your board.

The Arduino Uno, Mega, Duemilanove and Arduino Nano automatically draw power from either, the USB connection to the computer or an external power supply. If you are using an Arduino Diecimila, you have to make sure that the board is configured to draw power from the USB connection. The power source is selected with a jumper, a small piece of plastic that fits onto two of the three pins between the USB and power jacks. Check that it is on the two pins closest to the USB port. Connect the Arduino board to your computer using the USB cable. The green power LED (labeled PWR) should glow.

Step 4 – Launch Arduino IDE.

After your Arduino IDE software is downloaded, you need to unzip the folder. Inside the folder, you can find the application icon with an infinity label (application.exe). Double-click the icon to start the IDE.

Step 5 – Open your first project.

Once the software starts, you have two options –

Create a new project.
 Open an existing project example.

To create a new project, select File → **New**.
 To open an existing project example, select File → Example → Basics → Blink.
 Here, we are selecting just one of the examples with the name **Blink**. It turns the LED on and off with some time delay. You can select any other example from the list.
 Step 6 – Select your Arduino board.
 To avoid any error while uploading your program to the board, you must select the correct Arduino board name, which matches with the board connected to your computer. Go to Tools → Board and select your board.
 Here, we have selected Arduino Uno board according to our tutorial, but you must select the name matching the board that you are using.

Step 7 – Select your serial port.
Serial Port menu. This is likely to be COM3 or higher (COM1 and COM2 are usually reserved for hardware serial ports). To find out, you can disconnect your Arduino board and re-open the menu, the entry that disappears should be of the Arduino board. Reconnect the board and select that serial port.

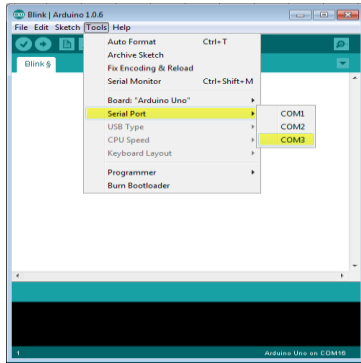
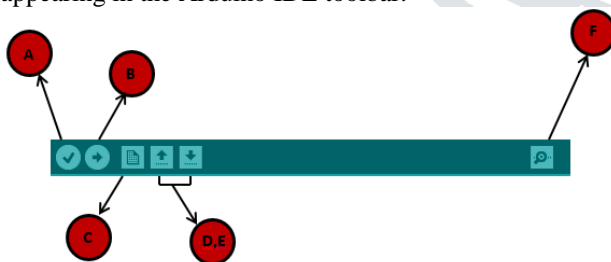


Fig. 4 Serial port tools

Step 8 – Upload the program to your board.
 Before explaining how we can upload our program to the board, we must demonstrate the function of each symbol appearing in the Arduino IDE toolbar.



- A – Used to check if there is any compilation error.
- B – Used to upload a program to the Arduino board.
- C – Shortcut used to create a new sketch.
- D – Used to directly open one of the example sketch.
- E – Used to save your sketch.
- F – Serial monitor used to receive serial data from the board and send the serial data to the board.

Now, simply click the "Upload" button in the environment. Wait a few seconds; you will see the RX and TX LEDs on the board, flashing. If the upload is successful, the message "Done uploading" will appear in the status bar.

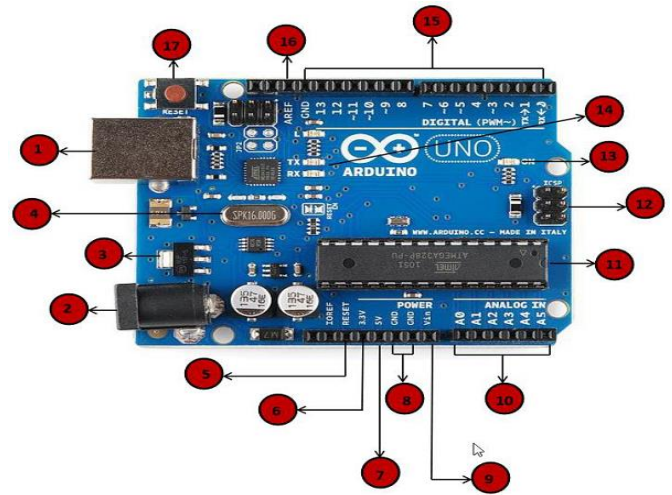


Fig.3 ARDUINO UNO KIT

- 1 Power USB
 Arduino board can be powered by using the USB cable from your computer. All you need to do is connect the USB cable to the USB connection (1).
- 2 Power (Barrel Jack)
 Arduino boards can be powered directly from the AC mains power supply by connecting it to the Barrel Jack (2).
- 3 Voltage Regulator
 The function of the voltage regulator is to control the voltage given to the Arduino board and stabilize the DC voltages used by the processor and other elements.
- 4 Crystal Oscillator
 The crystal oscillator helps Arduino in dealing with time issues. How does Arduino calculate time? The answer is, by using the crystal oscillator. The number printed on top of the Arduino crystal is 16.000H9H. It tells us that the frequency is 16,000,000 Hertz or 16 MHz.
- 5,17 Arduino Reset
 You can reset your Arduino board, i.e., start your program from the beginning. You can reset the UNO board in two ways. First, by using the reset button (17) on the board. Second, you can connect an external reset button to the Arduino pin labelled RESET (5).
- 6,7,8,9 Pins (3.3, 5, GND, Vin)
 3.3V (6) – Supply 3.3 output volt
 5V (7) – Supply 5 output volt
 Most of the components used with Arduino board works fine with 3.3 volt and 5 volt.
 GND (8)(Ground) – There are several GND pins on the Arduino, any of which can be used to ground your circuit.
 Vin (9) – This pin also can be used to power the Arduino board from an external power source, like AC mains power supply.
- 10 Analog pins
 The Arduino UNO board has five analog input pins A0 through A5. These pins can read the signal from an analog sensor like the humidity sensor or

temperature sensor and convert it into a digital value that can be read by the microprocessor.

Main microcontroller

Each Arduino board has its own microcontroller (11). You can assume it as the brain of your board. The main IC (integrated circuit) on the Arduino is slightly different from board to board. The microcontrollers are usually of the ATMEL Company. You must know what IC your board has before loading up a new program from the Arduino IDE. This information is available on the top of the IC. For more details about the IC construction and functions, you can refer to the data sheet.

ICSP pin

Mostly, ICSP (12) is an AVR, a tiny programming header for the Arduino consisting of MOSI, MISO, SCK, RESET, VCC, and GND. It is often referred to as an SPI (Serial Peripheral Interface), which could be considered as an "expansion" of the output.

Actually, you are slaving the output device to the master of the SPI bus.

Power LED indicator

This LED should light up when you plug your Arduino into a power source to indicate that your board is powered up correctly. If this light does not turn on, then there is something wrong with the connection.

TX and RX LEDs

On your board, you will find two labels: TX (transmit) and RX (receive). They appear in two places on the Arduino UNO board. First, at the digital pins 0 and 1, to indicate the pins responsible for serial communication. Second, the TX and RX led (13). The TX led flashes with different speed while sending the serial data. The speed of flashing depends on the baud rate used by the board. RX flashes during the receiving process.

Digital I/O

The Arduino UNO board has 14 digital I/O pins (15) (of which 6 provide PWM (Pulse Width Modulation) output. These pins can be configured to work as input digital pins to read logic values (0 or 1) or as digital output pins to drive different modules like LEDs, relays, etc. The pins labeled "~" can be used to generate PWM.

AREF

AREF stands for Analog Reference. It is sometimes, used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins.

The Arduino program structure and we will learn more new terminologies used in the Arduino world. The Arduino software is open-source. The source code for the Java environment is released under the GPL and the C/C++ microcontroller libraries are under the LGPL.

Sketch – The first new terminology is the Arduino program called "sketch".

Structure

Arduino programs can be divided in three main parts: Structure, Values (variables and constants), and Functions. In this tutorial, we will learn about the Arduino software program,

step by step, and how we can write the program without any syntax or compilation error.

Let us start with the Structure. Software structure consist of two main functions –

Setup() function

Loop() function

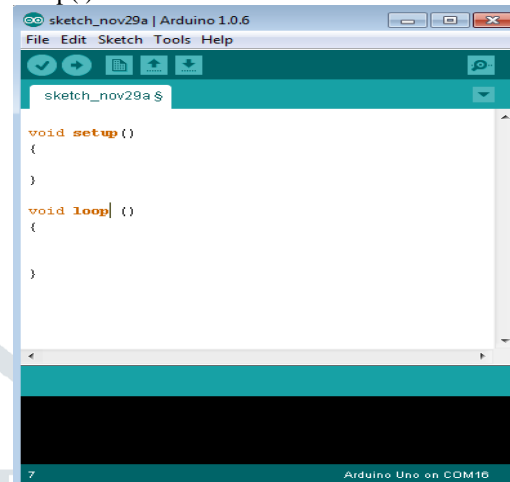


Fig.5 shows sketch_Arduino

```

Void setup () {
}
  
```

PURPOSE – The **setup()** function is called when a sketch starts. Use it to initialize the variables, pin modes, start using libraries, etc. The setup function will only run once, after each power up or reset of the Arduino board.

```

Void Loop () {
}
  
```

After creating a **setup()** function, which initializes and sets the initial values, the **loop()** function does precisely what its name suggests, and loops consecutively, allowing your program to change and respond. Use it to actively control the Arduino board.

(b) Ultrasonic Sensor

This ultrasonic sensor module can be used for measuring distance, object sensor, motion sensors etc. High sensitive module can be used with microcontroller to integrate with motion circuits to make robotic projects and other distance, position & motion sensitive products. The module sends eight 40Khz square wave pulses and automatically detects whether it receives the returning signal. If there is a signal returning, a high level pulse is sent on the echo pin. The length of this pulse is the time it took the signal from first triggering to the return echo. Distance = (speed of sound × time take n) / 2.

The HC-SR04 ultrasonic sensor uses SONAR to determine the distance of an object just like the bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package from 2 cm to 400 cm or 1" to 13 feet. The operation is not affected by sunlight or black material, although acoustically, soft materials like cloth can be difficult to detect. It comes complete with ultrasonic transmitter and receiver module.



Fig. 6 Ultrasonic sensor

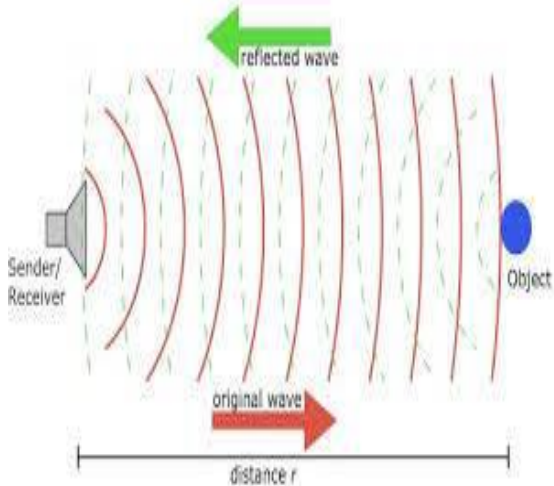


Fig.7

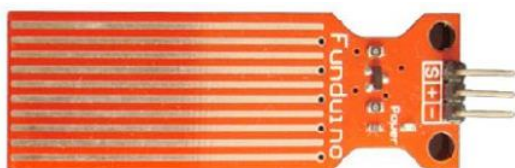
Technical Specifications

- Power Supply – +5V DC
- Quiescent Current – <2mA
- Working Current – 15mA
- Effectual Angle – <15°
- Ranging Distance – 2cm – 400 cm/1” – 13ft
- Resolution – 0.3 cm
- Measuring Angle – 30 degree

(c) Water sensor

Water sensor / liquid level sensor it brick is designed for water detection, which can be widely used in sensing rainfall, water level, and even liquid leakage. The sensor operates on 5V and needs less than 20mA for operating power current, which means the arduino can easily provide this (so no external power is needed to power it).

The liquid level sensor has 3 pins. It's very basic. The pinout is shown below.



- S = Signal Pin (connects to an analog pin on the arduino)
- + = Positive Voltage (connects to +5V terminal on arduino)
- = Ground (connects to ground terminal on arduino)

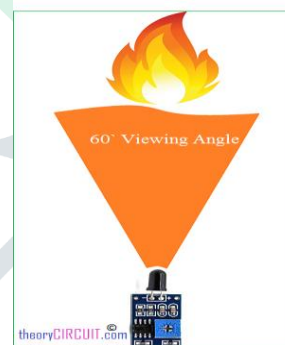
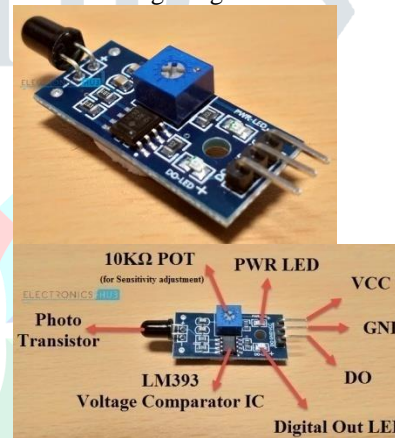
Fig. 8. Water sensors

The signal pin (S) gets connected to an analog pin on the arduino board. Here we connect it to analog pin A0. This allows the arduino board to be able to read the analog voltage value. 2 of the pins are for power, 1 connecting to the +5V of the arduino and the other connecting to the ground terminal of the arduino. The other pin, with an S, is the signal pin. This is the pin that outputs the analog voltage signal in proportion to the amount of the sensor which is covered with liquid. This pin connects to an analog pin on the arduino board to be read. Connecting a water sensor to an Arduino is a great way to detect a leak, spill, flood, rain, etc. It can be used to detect the presence, the level, the volume and/or the absence of water. While this could be used to remind you to water your plants, there is a better Grove sensor for that. The sensor has an array of exposed traces, which read LOW when water is detected.

4.5 flame sensor

A Flame Sensor is a device that can be used to detect presence of a fire source or any other bright light sources. There are several ways to implement a Flame Sensor but the module used in this project is an Infrared Radiation Sensitive Sensor.

The following image shows an Infrared type Flame Sensor.



This particular flame sensor is based on YG1006 NPN Photo Transistor. The black object at the front of the module is this Photo Transistor.

The YG1006 Photo Transistor looks like a black LED but it is a three terminal NPN Transistor, where the long lead is the Emitter and the shorter one is the collector (there is no base terminal as the light it detects will enable the flow of current). This photo transistor is coated with black epoxy, making it sensitive to

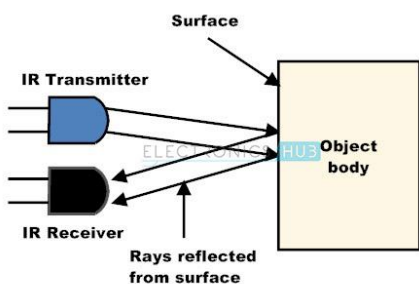
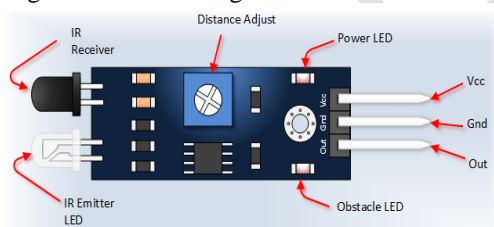
Infrared radiations and this particular Photo Transistor (YG1006) is sensitive to Infrared Radiation in the wavelength range of 760nm to 1100nm. Using this particular type of Flame Sensor, you can detect Infrared Light up to a distance of 100cm within its 60 degrees of detection angle.

There are two types of implementations of Flame Sensors using YG1006 Photo Transistor: one is with both Analog Output and Digital Output while the other is with only the Digital Output. Both these implementations require same components but the difference is that one module (the one with the Analog Output) provides the Sensor output as Analog Output.

The following image shows all the components of a typical Flame Sensor Module.

4.6 Infrared Sensor

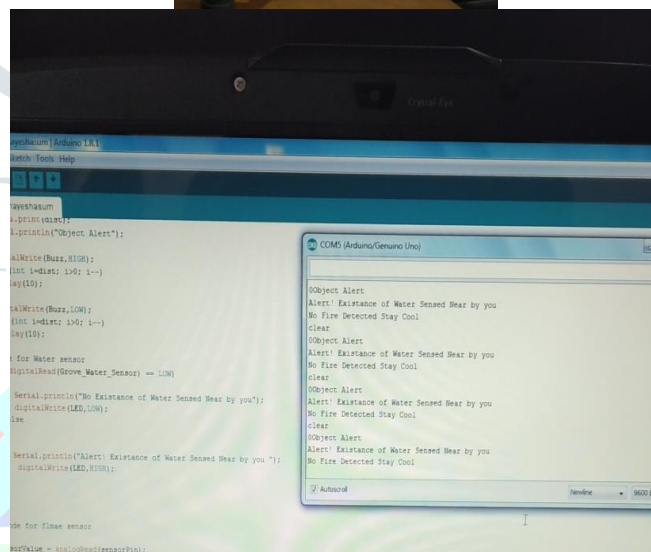
An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measures only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes, that can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, The resistances and these output voltages, change in proportion to the magnitude of the IR light received.



Principle of Working

The principle of an IR sensor working as an Object Detection Sensor can be explained using the following figure. An IR sensor consists of an IR LED and an IR Photodiode; together they are called as Photo – Coupler or Opto – Couple. When the IR transmitter emits radiation, it reaches the object and some of the radiation reflects back to the IR receiver. Based on the intensity of the reception by the IR receiver, the output of the sensor is defined.

IV. EXPERIMENTAL RESULTS AND DISCUSSIONS



V. CONCLUSION

the concept of Smart Stick for Blind People. It includes the detection of obstacles while blind people moves from one place to another place. The stick is generated using many sensors like Ultrasonic, Flame sensor and Water sensor etc. When the blind person moves from one place to another place with the help of sensors the message is passed to the blind person through the Arduino UNO microcontroller in the form of different types of beeps and vibration. The triggers are generated from the sensors if any danger or inconvenience is there. That trigger is passed to the microcontroller and it passes the alerts to the blind person through the beep message and vibration which are connected to the smart stick. Because of this stick blind people can move easily from one place to another without help of others and it also increase the autonomy for the blind.

References

[1]. Prof. Seem Udgirkar, Shivaji Sarokar, Sujit Gore, Dinesh Kakuste, Suraj Chaskar .Dept. of Comp, GHRCEM, Savitribai Phule Pune University, Pune, India (Object Detection System for

Blind People) IJIRCCE Vol. 4, Issue 9, September 2016. pp[15918-15921]

[2]. Md. Siddiqur Rahman Tanveer, M.M.A. Hashem and Md. Kowsar Hossain Department of Computer Science and Engineering Khulna University of Engineering & Technology (KUET) Khulna 9203, Bangladesh. pp[1-6]

[3]. Mr. Gurunath G. Machhale¹, Ms. Rutuja J. Patil², Ms. Smita B. Jangonda³, Ms. Swati V. Majalekar⁴, Ms. Shraddha A. Chougule⁵ 1(Assistant Prof. ,Sanjay Ghodawat Group of Institutions, India) 2, 3, 4, 5(Sanjay Ghodawat Group of Institutions, India) Corresponding Author: Mr. Gurunath G. Machhale pp[04-07]

[4]. Rutuja Patil, Smita Jangonda, Swati Majalekar, Shraddha Chougule, Gurunath Machhale (Assi. Prof) CSE, Sanjay Ghodawat Group of Institutions, Atigre, Maharashtra, India pp[1069-1073]

[5]. Kher Chaitrali S., Dabhade Yogita A., Kadam Snehal K, Dhamdhare Swati D, Deshpande Aarti V. JSPM's Jayawantrao Sawant College of Engineering. Pp[1-6]

[6]. Benjamin J. M., Ali N. A., and Schepis A. F., "A Laser Cane for the Blind." Proceedings of the San Diego Biomedical Symposium, Vol. 12, pp. 53-57.

[7]. B.R. Prudhvi and Rishab B. "Silicon Eyes: GPS-GSM based Navigation Assistant for Visually Impaired using Capacitive Touch Braille Keypad and Smart SMS Facility" Computer and Information Technology (WCCIT), World Congress on 2013, Pages: 1-3, DOI: 10.1109/WCCIT

[8]. Anuradha T, Bhakti, Chaitra R, Pooja D "IoT Based Low Cost System For Monitoring of Water Quality in Real Time, IRJET (International Research Journal of Engineering & Technology), May 2018. Pp[1658-1663]

VI. CONCLUSION

A conclusion section must be included and should indicate clearly the advantages, limitations, and possible applications of the paper. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

ACKNOWLEDGEMENTS

An acknowledgement section may be presented after the conclusion, if desired.

REFERENCES

This heading is not assigned a number.

A reference list **MUST** be included using the following information as a guide. Only *cited* text references are included. Each reference is referred to in the text by a number enclosed in a square bracket (i.e., [3]). References **must be numbered and ordered according to where they are first mentioned in the paper**, NOT alphabetically.

Examples follow:

Journal Papers:

[1] M Ozaki, Y. Adachi, Y. Iwahori, and N. Ishii, Application of fuzzy theory to writer recognition of Chinese characters, *International Journal of Modelling and Simulation*, 18(2), 1998, 112-116.

Note that the journal title and volume number (but not issue number) are set in italics.

Books:

[2] R.E. Moore, *Interval analysis* (Englewood Cliffs, NJ: Prentice-Hall, 1966).

Note that the title of the book is in lower case letters and italicized. There is no comma following the title. Place of publication and publisher are given.

Chapters in Books:

[3] P.O. Bishop, Neurophysiology of binocular vision, in J. Houseman (Ed.), *Handbook of physiology*, 4 (New York: Springer-Verlag, 1970) 342-366.

Note that the place of publication, publisher, and year of publication are enclosed in brackets. Editor of book is listed before book title.

Theses:

[4] D.S. Chan, *Theory and implementation of multidimensional discrete systems for signal processing*, doctoral diss., Massachusetts Institute of Technology, Cambridge, MA, 1978.

Note that thesis title is set in italics and the university that granted the degree is listed along with location information

Proceedings Papers:

[5] W.J. Book, Modelling design and control of flexible manipulator arms: A tutorial review, *Proc. 29th IEEE Conf. on Decision and Control*, San Francisco, CA, 1990, 500-506.

Note that the proceedings title is set in italics.

Biographies and Photographs

Short biographies (120-150 words) should be provided that detail the authors' education and work histories as well as their research interests. The authors' names are italicized. Small (3.5 X 4.8 cm), black-and-white pictures/digitized images of the authors can be included.

Note:

Since Camera Ready copy of the paper is final one, no further modification is entertained. So please make sure that the contents and format is fit for the Journal.

Mail the Camera Ready paper in MS-Word format to editor.ijana@gmail.com

