

SMART GUIDESTICK FOR BLIND USING ARTIFICIAL INTELLIGENCE

Submitted in partial fulfillment of the requirements for the award of Bachelor of
Engineering Degree in Electronics and Communication Engineering

by

BH.SUNIL VARMA (37130058)



**DEPARTMENT OF ELECTRONICS AND COMMUNICATION
ENGINEERING
SCHOOL OF ELECTRICAL AND ELECTRONICS ENGINEERING**

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY (DEEMED TO BE UNIVERSITY)

Accredited with Grade "A" by NAAC

JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119

MARCH 2021



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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of BH.SUNIL VARMA (37130058) who carried out the project title “ **SMART GUIDESTICK FOR BLIND USING ARTIFICIAL INTELLIGENCE**” under our supervision from September 2020 to March 2021.

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DECLARATION

I, **BH.SUNIL VARMA (37130052)** hereby declare that the Project Report entitled “SMART GUIDESTICK FOR BLIND USING ARTIFICIAL INTELLIGENCE” done by me under the guidance of Dr .P. GRACE KANMANI PRINCE, M.E., Ph.D. is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Electronics and Communication Engineering.

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ABSTRACT

Obstacle detection is one of the major concerns for a fully or a partially blind person. This paper describes guide blind walking stick based on ultrasonic sensor with the use of Arduino uno. According to World Health Organization (WHO), 30 million peoples are permanently blind and 285 billion peoples with vision impairment. In this paper discuss about smart guide blind stick which is proficient of detecting any obstruction, detect corners and even allow the user to find the stick if anyhow missed by the user by pressing a remote switch. The device is designed with an objective to sort out common issues faced by the blind people while using conventional sticks. With the electronics embed within the stick, it became a smart stick. Presented here is a smart guide blind stick using Arduino uno. The stick uses Ultrasonic sensors for obstacle detection. The main aim of this paper is to detect nearby obstacle and notify the user of the direction of that obstacle, thereby enabling the user to determine the corrective direction to head.

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CHAPTER 1

INTRODUCTION

The purpose of this project is to get rid of those excuses caused by lack of ability to take complete control of movement for visually disabled people through a crowded place along with enormous types of obstacles which is the well-known characteristics of busy city life. Every day during competing in the global race to reach absolute perfectness, lifestyle of people completely depends upon technology which result Eye Dog and White Cane to compensate this ability- gap somehow. But in the widen horizon these technical aids are proven not fully reliable as they failed to overcome the super crazy situations, arises in modern streets especially in busy market places. Our society still contains about 285 million visually impaired, 39 million blind and 246 million poor vision infested people as confirmation of WHO [1]. Well, though it is a myth to say completely good bye to this ability-gap, but there are still some innovative modifications are exposed, which can be appliedto existing technology to minimize this gap.

1.1 INTRODUCTION TO ARDUINO:

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board.

Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessable knowledge that can be of great help to novices and experts alike.

Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and

programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments. All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt them to their particular needs. The software, too, is open-source, and it is growing through the contributions of users worldwide.

1.2 WHY ARDUINO?

Thanks to its simple and accessible user experience, Arduino has been used in thousands of different projects and applications. The Arduino software is easy-to-use for beginners, yet flexible enough for advanced users. It runs on Mac, Windows, and Linux. Teachers and students use it to build low cost scientific instruments, to prove chemistry and physics principles, or to get started with programming and robotics. Designers and architects build interactive prototypes, musicians and artists use it for installations and to experiment with new musical instruments. Makers, of course, use it to build many of the projects exhibited at the Maker Faire, for example. Arduino is a key tool to learn new things. Anyone - children, hobbyists, artists, programmers - can start tinkering just following the step by step instructions of a kit, or sharing ideas online with other members of the Arduino community.

There are many other microcontrollers and microcontroller platforms available for physical computing. Parallax Basic Stamp, Netmedia's BX-24, Phidgets, MIT's Handyboard, and many others offer similar functionality. All of these tools take the messy details of microcontroller programming and wrap it up in an easy-to-use package. Arduino also simplifies the process of working with microcontrollers, but it offers some advantage for teachers, students, and interested amateurs over other systems:

- **1.2.1 Inexpensive** - Arduino boards are relatively inexpensive compared to other microcontroller platforms. The least expensive version of the Arduino module can be assembled by hand, and even the pre-assembled Arduino modules cost less than \$50.

- **1.2.2 Cross-platform** - The Arduino Software (IDE) runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.
- **1.2.3 Simple, clear programming environment** - The Arduino Software (IDE) is easy-to-use for beginners, yet flexible enough for advanced users to take advantage of as well. For teachers, it's conveniently based on the Processing programming environment, so students learning to program in that environment will be familiar with how the Arduino IDE works.

1.3 ARDUINO UNO:

The UNO is the best board to get started with electronics and coding. If this is your first experience tinkering with the platform, the UNO is the most robust board you can start playing with. The UNO is the most used and documented board of the whole Arduino family.



FIG 1.1: ARDUNIO UNO

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6

can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an 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. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

1.4 EMBEDDED SYSTEMS:

Embedded System is a system composed of hardware, application software and real time operating system. It can be small independent system or large combinational system.

Our Embedded System tutorial includes all topics of Embedded System such as characteristics, designing, processors, microcontrollers, tools, addressing modes, assembly language, interrupts, embedded c programming, led blinking, serial communication, lcd programming, keyboard programming, project implementation etc.

An embedded system is a combination of three major components:

- **1.4.2 Hardware:** Hardware is physically used component that is physically connected with an embedded system. It comprises of microcontroller based integrated circuit, power supply, LCD display etc.
- **1.4.3 Application software:** Application software allows the user to perform varieties of application to be run on an embedded system by changing the code installed in an embedded system.

- **1.4.4 Real Time Operating system (RTOS):** RTOS supervises the way an embedded system work. It act as an interface between hardware and application software which supervises the application software and provide mechanism to let the processor run on the basis of scheduling for controlling the effect of latencies.

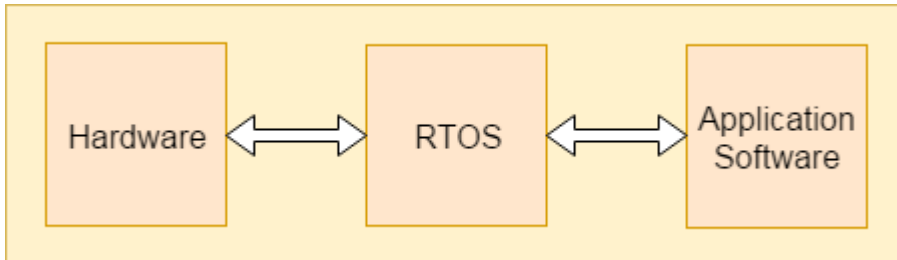


FIG 1.2: REAL TIME OPERSTION SYSTEM

1.5 CHARACTERISTICS OF EMBEDDED SYSTEM:

- An embedded system is software embedded into computer hardware that makes a system dedicated to be used for variety of application.
- Embedded system generally used for do specific task that provide real-time output on the basis of various characteristics of an embedded system.
- Embedded system may contain a smaller part within a larger device that used for serving the more specific application to perform variety of task using hardware-software intermixing configuration.
- It provides high reliability and real-time computation ability.

1.5.1 Advantages:

- Same hardware can be used in variety of application.
- Lesser power requirement
- Lower operational cost of system
- Provide high performance and efficiency

1.5.2 Disadvantages:

- Developing a system required more time. Due to functional complexity.

- Skilled engineers required because one mistake may result in destroying of complete project.

1.6 EXISTING SYSTEM AND PROPOSED SYSTEM:

TABLE 1.1.EXISTING SYSTEM AND PROPOSED SYSTEM

EXISTING SYSTEM	PROPOSED SYSTEM
➤ In practice, the blind people use a walking stick to detect the object in front of them. But they never know about it. ➤ The blind people may injured while move towards staircase. Drawbacks ➤ The Blind people may injured. ➤ Time taken is more for walk.	➤ In our proposed system, the blind people has camera enabled walking stick to examine which object it is. ➤ Here, we have distance sensor detects depth or height the staircase step and tells to people. Advantages ➤ The chances of injury are less. ➤ Time less

1.7 HARDWARE REQUIRED:

- ARDUINO UNO (2).
- ZIGBEE PAIR.
- APR MODULE.
- SPEAKER.
- BUZZER.
- ULTRASONIC SENSOR.

1.7 SOFTWARE REQUIRED:

- ARDUINO IDE.
- EMBEDDED C.

1.7.1 TECHNICAL SPECIFICATIONS:

TABLE 1.2. TECHNICAL SPECIFICATIONS

Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 Ma
DC Current for	50 mA

3.3V Pin	
Flash Memory	32 KB (ATmega328P) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 MHz
LED_BUILTIN	13
Length	68.6 mm
Width	53.4 mm
Weight	25 g

CHAPTER 2

LITERATURE REVIEW

Survey carried from various sources on blind people about the difficulties they are facing in our society from past generations .Here mainly we considered obstacle detection which will be the major help to the blind people of our society Our society still contains about 285 million visually impaired, 39 million blind and 246 million poor vision infested people as confirmation ofWHO.

1. **“On-the-fly Image Classification to Help Blind People”**,Dalal Khalid Aljasem, Michael Heeney, Armando PesentiGritti, Franco Raimondi, 2016, International Conference on Intelligent Environments.

In this paper we present an affordable solution to help blind people navigate unknown environments. Our solution performs image classification on a Raspberry Pi and provides feedback to users by means of vibration motors to signal the presence of an obstacle in a given direction. The training phase is performed off-line, while the on-line phase can classify an image in 1.12 seconds on average. We provide an evaluation using several thousand images, showing that we can achieve a precision of 79% and a recall of 79%. All our code and the hardware design files are released open source.

2. **“New Developments in Mobility and Orientation Aids for the Blind”**,John a. brabyn, Member, 1982, IEEE.

An overview of both early and recent developments in artificialaids for blind orientation and mobility is presented. Most aids developed previously fall into the category of "mobility aids" intended to sense obstacles in or near the traveler's immediate path. The more global problem of absolute orientation and navigation has not been well addressed by researchers in electronic aids, but this situation is now changing. A new system for aiding blind orientation, described here, is now advancing beyond the experimental stage.

3. **“Wearable Obstacle Avoidance Electronic Travel Aids for Blind: A Survey”**, Dimitrios Dakopoulos and Nikolaos G. Bourbakis, Fellow, 2010, IEEE.

The last decades a variety of portable or wearable navigation systems have been developed to assist visually impaired people during navigation in known or unknown, indoor or outdoor environments. There are three main categories of these systems: Electronic travel aids (ETAs), electronic orientation aids (EOAs), and position locator devices (PLDs). This paper presents a comparative survey among portable/wearable obstacle detection/avoidance systems (a subcategory of ETAs) in an effort to inform the research community and users about the capabilities of these systems and about the progress in assistive technology for visually impaired people. The survey is based on various features and performance parameters of the systems that classify them in categories, giving qualitative-quantitative measures. Finally, it offers a ranking, which will serve only as a reference point and not as a critique on these systems.

4. **“A Blind Mobility Aid Modeled After Echolocation of Bats”**, Tohrufukube, Tadayuki Sasaki, and Chen Peng, 1991, IEEE.

A new model of a mobility aid for the blind was designed using microprocessor and ultrasonic devices. This mobility aid was evaluated based on psychophysical experiments. In this model, a downswapped FM ultrasound signal is emitted from a transmitting array with broad directional characteristics in order to detect obstacles. The ultrasound reflections from the obstacles are picked up by a two-channel receiver. The frequency of the emitted ultrasound is swept from 70 to 40 kHz within 1 ms, so it has almost the same characteristics as the ultrasound a bat produces for echolocation. The frequency of the reflected ultrasound wave is down converted by about 50 : 1 by using a microcomputer with A/D and D/A converters. These audible waves are then presented binaurally through earphones. In this method obstacles may be perceived as localized sound images corresponding to the direction and the size of the obstacles. From the results of psychophysical experiments, it was found that a downswapped FM ultrasound was superior for the recognition of small obstacles compared to other ultrasonic schemes. With it a blind person can recognize a 1-mm-diameter wire. It was also proved that the blind could discriminate between several obstacles at the same time without any virtual

images. This mobility aid, modeled after the bat's echolocation system, is very effective at detecting small obstacles placed in front of the head.

5. **“Obstacles Recognition System for the Blind People Using RFID”**, M. Nassih, I. Cherradi, Y. Maghous, B. Ouriaghli and Y. Salih-Alj, 2012, IEEE.

This paper outlines an obstacle recognition system for the blind people using the Radiofrequency identification (RFID). In order to walk without being accompanied, people with visual impairment use touching clues such as canes. The main concern of blind people is to be able to detect any type of obstacle within their surroundings. For that, several techniques have been developed such as Differential Global Positioning System (DGPS) or Radio-frequency identification (RFID). Previous experiences of different researches have proven the limits of the DGPS in localizing the position of people and obstacles in different situations, while the RFID is being developed to better meet the needs of the visually impaired people. This paper aims on developing a blind recognition system through canes using RFID and covers a brief insight of relevant work about the RFID system. The review of RFID system introduces the technical features of this utility and presents the concept of research being developed in smart canes for blind people. The information such as the costs of the components of the suggested RFID-based system is provided.

6. **“Character Detection and Recognition System for Visually Impaired People”**, Akhilesh A. Panchal, ShrugalVarde, M.S. Panse, 2016, IEEE.

Nowadays, increasing use of digital technology, availability of economical image capturing devices like mobile phones, digital cameras, etc. and need of powerful technology to aid blind or visually impaired people, attracting researchers to the problem of recognizing text in images. Detecting text from scene image is more difficult as compared to that from printed documents. Lots of research has been done on detecting scene text to overcome certain challenges like perspective distortion, aspect ratio, font size, etc. Speed, complexity, cost and accuracy are important parameters must be taken into consideration while designing such systems. Computer vision is one of the emerging technologies that can be used to

aid visually impaired people for navigation (both indoor and outdoor), accessing printed material, etc. This paper describes an approach to extract and recognize text from scene images effectively using computer vision technology and to convert recognized text into speech so that it can be incorporated with hardware to develop Electronic travel aid for visually impaired people in future.

7. **“The Nav belt—A Computerized Travel Aid for the Blind Based on Mobile Robotics Technology”**, Shraga Shoval, Johann Borenstein, and Yoram Koren, 1998, IEEE.

This paper presents a new concept for a travel aid for the blind. A prototype device, called the Nav Belt, was developed to test this concept. The device can be used as a primary or secondary aid, and consists of a portable computer, ultrasonic sensors, and stereophonic headphones. The computer applies navigation and obstacle avoidance technologies that were developed originally for mobile robots. The computer then uses a stereophonic imaging technique to process the signals from the ultrasonic sensors and relays their information to the user via stereophonic headphones. The user can interpret the information as an acoustic “picture” of the surroundings, or, depending on the operational mode, as the recommended travel direction. The acoustic signals are transmitted as discrete beeps or continuous sounds. Experimental results with the Nav Belt simulator and a portable prototype show that users can travel safely in an unfamiliar and cluttered environment at speeds of up to 0.8 m/s.

CHAPTER 3

MATERIALS AND METHODS USED

3.1 HARDWARE SETUP:

Arduino is open-source hardware. The hardware reference designs are distributed under a Creative Commons Attribution Share-Alike 2.5 license and are available on the Arduino website. Layout and production files for some versions of the hardware are also available.

Although the hardware and software designs are freely available under copyleft licenses, the developers have requested the name Arduino to be exclusive to the official product and not be used for derived works without permission. The official policy document on use of the Arduino name emphasizes that the project is open to incorporating work by others into the official product. Several Arduino-compatible products commercially released have avoided the project name by using various names ending in-duino. An early Arduino board with an RS-232 serial interface (upper left) and an Atmel ATmega8 microcontroller chip (black, lower right); the 14 digital I/O pins are at the top, the 6 analog input pins at the lower right, and the power connector at the lower left.

Many Arduino-compatible and Arduino-derived boards exist. Some are functionally equivalent to an Arduino and can be used interchangeably. Many enhance the basic Arduino by adding output drivers, often for use in school-level education, to simplify making buggies and small robots. Others are electrically equivalent but change the form factor, sometimes retaining compatibility with shields, sometimes not. Some variants use different processors, of varying compatibility.

3.1.1 MEMORY:

The ATmega328 has 32 KB (with 0.5 KB occupied by the bootloader). It also has 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library).

INPUT AND OUTPUT:

See the mapping between Arduino pins and ATmega328P ports. The mapping for the Atmega8, 168, and 328 is identical.

Note that this chart is for the DIP-package chip. The Arduino Mini is based upon a smaller physical IC package that includes two extra ADC pins, which are not available in the DIP-package Arduino implementations.

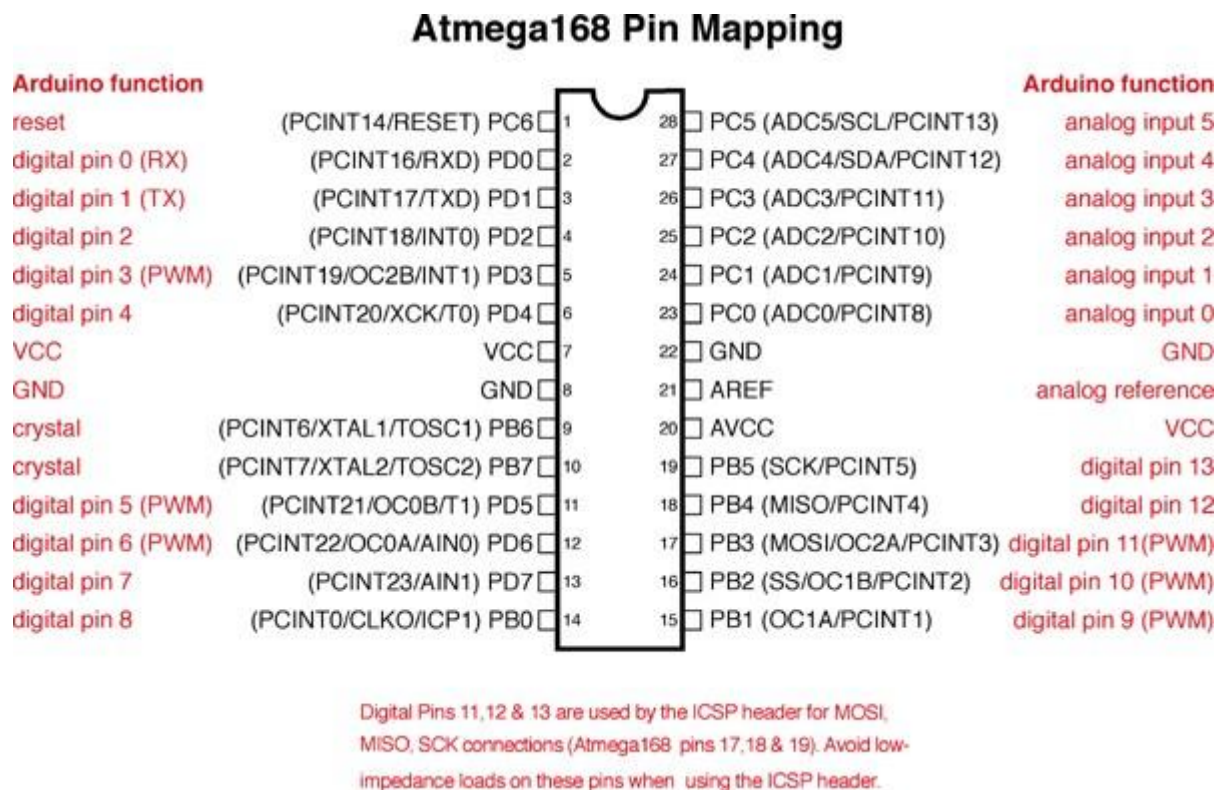


FIG 3.1: DIGITAL PINS

Each of the 14 digital pins on the Uno can be used as an input or output, using **pin Mode()**, **digital Write()**, and **digital Read()** functions. They operate at 5 volts. Each pin can provide or receive 20 mA as recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50k ohm. A maximum of 40mA is the value that must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller.

3.2 COMMUNICATION:

Arduino/Genuino Uno has a number of facilities for communicating with a computer, another Arduino/Genuino board, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The 16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a .inf file is required. The Arduino Software (IDE) includes a serial monitor which allows simple textual data to be sent to and from the board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1).

A Software Serial library allows serial communication on any of the Uno's digital pins. The ATmega328 also supports I2C (TWI) and SPI communication. The Arduino Software (IDE) includes a Wire library to simplify use of the I2C bus; see the documentation for details. For SPI communication, use the SPI library.

3.3 PROCESSOR:

AUTOMATIC (SOFTWARE) RESET:

Rather than requiring a physical press of the reset button before an upload, the Arduino/Genuino Uno board is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the ATmega8U2/16U2 is connected to the reset line of the ATmega328 via a 100 nanofarad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip. The Arduino Software (IDE) uses this capability to allow you to upload code by simply pressing the upload button in the interface toolbar. This means that the bootloader can have a shorter timeout, as the lowering of DTR can be well-coordinated with the start of the upload.

This setup has other implications. When the Uno is connected

to either a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half - second or so, the bootloader is running on the Uno. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened. If a sketch running on the board receives one-time configuration or other data when it first starts, make sure that the software with which it communicates waits a second after opening the connection and before sending this data.

3.3.1 APPLICATIONS:

- Arduboy, a handheld game console based on Arduino.
- Arduinome, a MIDI controller device that mimics the Monome.
- Ardupilot, drone software and hardware.
- ArduSat, a cube sat based on Arduino.
- C-STEM Studio, a platform for hands-on integrated learning of computing, science, technology, engineering, and mathematics (C-STEM) with robotics.
- Data loggers for scientific research.
- OBDuino, a trip computer that uses the on-board diagnostics interface found in most modern cars.
- XOD, a visual programming language for Arduino.

3.4 ULTRASONIC SENSOR



FIG 3.2: HCSR04 DESCRIPTION

The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object like bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package. It comes complete with ultrasonic transmitter and receiver modules.as the name indicates measure distance by using ultrasonic waves. The sensor head emits ultrasonic wave and receives the wave reflected back from the target. Ultrasonic measures the distance through the target by measuring time between emission and reception

Product features:

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work:

- (1) Using IO trigger for at least 10us high level signal.
- (2) The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.
- (3) IF the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning. Test distance = (high level time*velocity of sound (340M/S) / 2,

3.4.1 HC-SR04 Specifications

The sensor chosen for the Firefighting Drone Project was the HCSR04. This section contains the specifications and why they are important to the sensor module. The sensor modules requirements are as follows.

- Cost.
- Weight.
- Community of hobbyists and support.
- Accuracy of object detection.
- Probability of working in a smoky environment.
- Ease of use .

3.4.2 Electric Parameter

TABLE 3.1. ELECTRIC PARAMETER

Working Voltage	DC 5 V
Working Current	15mA
Working Frequency	40Hz
Max Range	4m
Min Range	2 cm
Measuring Angle	15 degree
Trigger Input Signal	10uS TTL pulse
Echo Output Signal	Input TTL lever signal and the range in proportion
Dimension	45*20*15mm
Main parts	Transmitter & receiver
Technology used	Non-contact technology
Resolution	3mm

3.5 Working principle of ultrasonic sensor

- Ultrasonic sensor transmits sound waves.
- These waves are reflected back from the surface of an object.
- An ultrasonic sensor receives the reflected waves.
- Then it measures the time elapsed during the entire process, from transmission to receiving, it is known as round trip time.
- This time is equal to the distance between an object and the sensor itself.
- I have also provided some visual, so that you can easily understand its working principle.
- Ultrasonic sensor principle is shown in the figure given below.

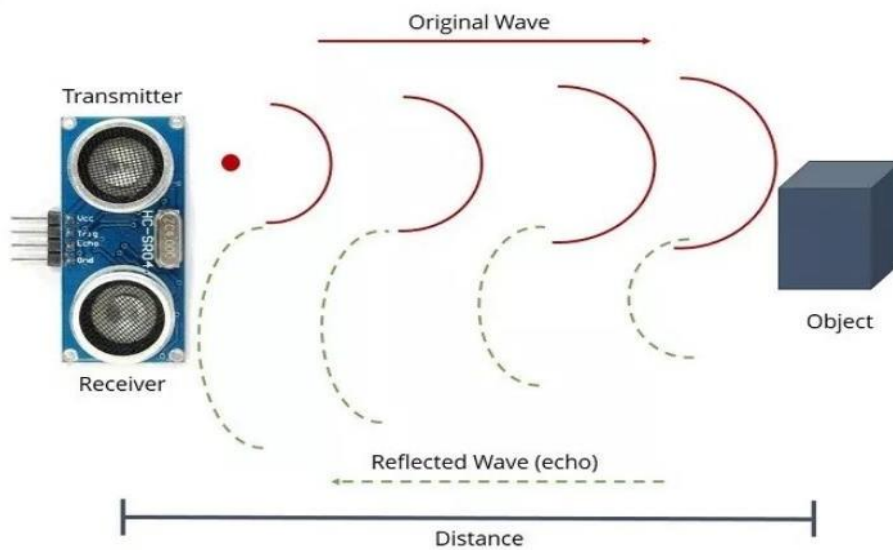


FIG 3.3: ULTRASONIC SENSOR

The time between the transmission and reception of the signal allows us to calculate the distance to an object. This is possible because we know the sound's velocity in the air.

HC-SR04 Ultrasonic Sensor Pinout



FIG 3.4: HC-SR04 ULTRASONIC SENSOR PINOUT

TABLE 3.2. ULTRASONIC SENSOR PIN CONFIGURATION

Pin number	Pin name	Description
1.	Vcc	The Vcc pin powers the sensor, typically with +5V
2.	Trigger	Trigger pin is an Input pin. This pin has to be kept high for 10us to initialize measurement by sending US wave.
3.	Echo	Echo pin is an Output pin. This pin goes high for a period of time which will be equal to the time taken for the US wave to return back to the sensor.
4.	Ground	This pin is connected to the Ground of the system.

3.5.1 Timing diagram

The Timing diagram is shown below. You only need to supply a short 10uS pulse to the trigger input to start the ranging, and then the module will send out an 8 cycle burst of ultrasound at 40 kHz and raise its echo. The Echo is a distance object that is pulse width and the range in proportion .You can calculate the range through the time interval between sending trigger signal and receiving echo signal. Formula: $\mu\text{S} / 58 = \text{centimeters}$ or $\mu\text{S} / 148 = \text{inch}$; or: the range = high level time * velocity (340M/S) / 2; we suggest to use over 60ms measurement cycle, in order to prevent trigger signal to the echo signal.

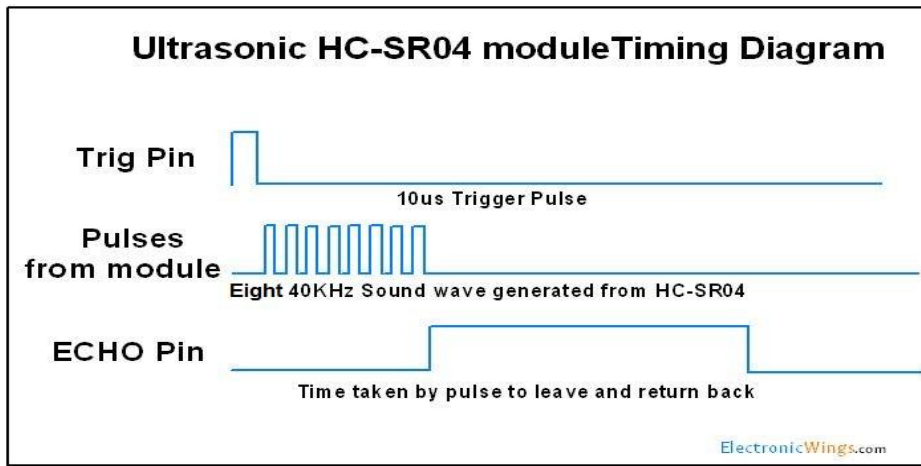


FIG 3.5: HC-SR04 MODULE TIMING DIAGRAM

3.6 Interfacing ultrasonic sensor with arduino uno

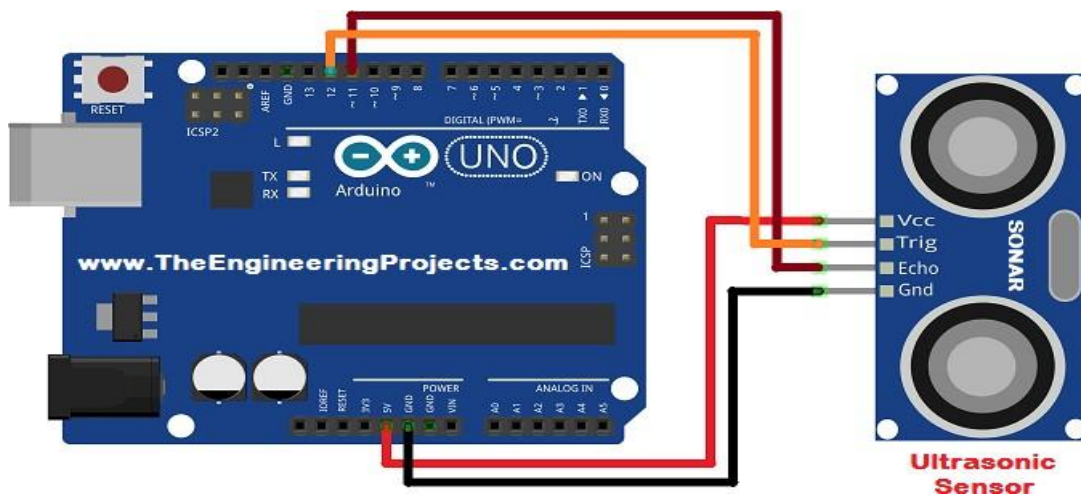


FIG 3.6: ULTRASONIC SENSOR WITH ARDUINO

- First, you need to power up the sensor using 5V DC regulated input to the sensor. Connect the ground pin with the ground of the voltage source. You can also power the sensor module using the Arduino 5V pins as the current drawn by the sensor is less than 15mA, won't be affecting the current ratings of the Arduino Module.

After setting up the initial arrangement, connect both Trig and Echo pins to the I/O pins of the Arduino Board. As mentioned earlier, in order to initialize the measurement process, the Trig pin must be kept high for 10us in the start. The sensor module will start generating sound waves with the frequency around

40,000 Hz per second from the transmitter.

- As the waves bounce back, consequently, the Echo pin will turn on until the sounds waves are received by the receiver. This time will be calculated using Arduino Module.

3.6.1 Applications

- Used to avoid and detect obstacles with robots like biped robot, obstacle avoider robot, path finding robot etc.
- Can be used to map the objects surrounding the sensor by rotating it.
- Depth of certain places like wells, pits etc can be measured since the waves can penetrate through water
- Speed and direction measurement
- Wireless charging
- Humidifiers
- Medical ultrasonography
- Burglar alarms
- Embedded system
- Depth measurement
- Non-destructive testing

3.7 ZIGBEE PROTOCOL

3.7.1 NRF24L01:

The nRF24L01+ is a single chip 2.4GHz transceiver with an embedded baseband protocol engine (Enhanced ShockBurst™), suitable for ultra-low power wireless applications. The nRF24L01+ is designed for operation in the world wide ISM frequency band at 2.400 - 2.4835GHz.

To design a radio system with the nRF24L01+, you simply need an MCU (microcontroller) and a few external passive components.

You can operate and configure the nRF24L01+ through a Serial Peripheral Interface (SPI). The register map, which is accessible through the SPI, contains all configuration registers in the nRF24L01+ and is accessible in all

operation modes of the chip.

The embedded baseband protocol engine (Enhanced ShockBurst™) is based on packet communication and supports various modes from manual operation to advanced autonomous protocol operation. Internal FIFOs ensure a smooth data flow between the radio front end and the system's MCU. Enhanced Shock- Burst™ reduces system cost by handling all the high speed link layer operations.

The radio front end uses GFSK modulation. It has user configurable parameters like frequency channel, output power and air data rate. NRF24L01+ supports an air data rate of 250 kbps, 1 Mbps and 2Mbps. The high air data rate combined with two powers saving modes make the nRF24L01+ very suitable for ultra-low power designs.

NRF24L01+ is drop-in compatible with nRF24L01 and on-air compatible with nRF2401A, nRF2402, nRF24E1 and nRF24E2. Intermodulation and wideband blocking values in nRF24L01+ are much improved in comparison to the nRF24L01 and the addition of internal filtering to nRF24L01+ has improved the margins for meeting RF regulatory standards.

Internal voltage regulators ensure a high Power Supply Rejection Ratio (PSRR) and a wide power supply range.

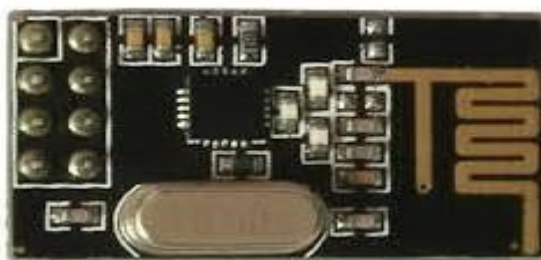


FIG 3.7: NRF24L01

FEATURES:

Features of the nRF24L01+ include:

➤ **Radio**

- ✓ Worldwide 2.4GHz ISM band operation
- ✓ 126 RF channels
- ✓ Common RX and TX interface
- ✓ GFSK modulation
- ✓ 250kbps, 1 and 2Mbps air data rate
- ✓ 1MHz non-overlapping channel spacing at 1Mbps
- ✓ 2MHz non-overlapping channel spacing at 2Mbps

➤ **Transmitter**

- ✓ Programmable output power: 0, -6, -12 or -18dBm
- ✓ 11.3mA at 0dBm output power

➤ **Receiver**

- ✓ Fast AGC for improved dynamic range
- ✓ Integrated channel filters
- ✓ 13.5mA at 2Mbps
- ✓ -82dBm sensitivity at 2Mbps
- ✓ -85dBm sensitivity at 1Mbps
- ✓ -94dBm sensitivity at 250kbps

➤ **RF Synthesizer**

- ✓ Fully integrated synthesizer
- ✓ No external loop filter, VCO varactor diode or resonator
- ✓ Accepts low cost ± 60 ppm 16MHz crystal

➤ **Enhanced Shock Burst™**

- ✓ 1 to 32 bytes dynamic payload length
- ✓ Automatic packet handling
- ✓ Auto packet transaction handling

- ✓ 6 data pipe MultiCeiver™ for 1:6star networks

➤ Power Management

- ✓ Integrated voltage regulator
- ✓ 1.9 to 3.6V supply range
- ✓ Idle modes with fast start-up times for advanced power management
- ✓ 26μA Standby-I mode, 900nA power down mode
- ✓ Max 1.5ms start-up from power down mode
- ✓ Max 130us start-up from standby-I mode

➤ Host Interface

- ✓ 4-pin hardware SPI
- ✓ Max 10Mbps
- ✓ 3 separate 32 bytes TX and RX FIFOs
- ✓ 5V tolerant inputs

➤ Compact 20-pin 4x4mm QFN package

3.7.2 BLOCK DIAGRAM:

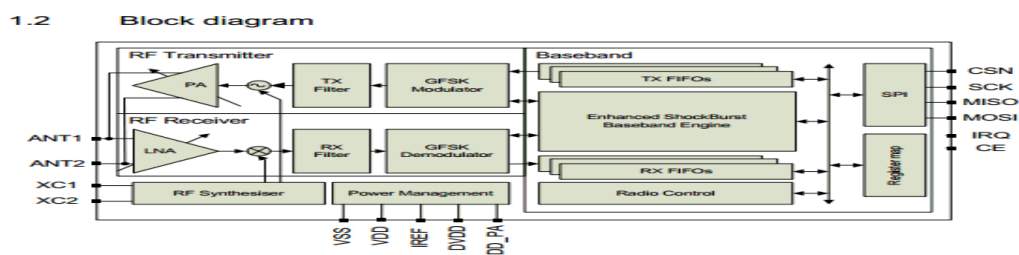


Figure 1. nRF24L01 block diagram

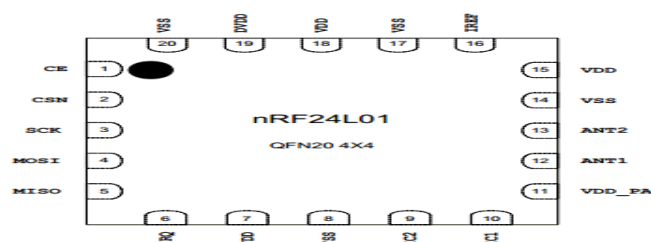


TABLE 3.3 PIN FUNCTIONS

Pin	Name	Pinfunction	Description
1.	CE	Digital Input	Chip Enable Activates RX or TX mode
2.	CSN	Digital Input	SPI Chip Select
3.	SCK	Digital Input	SPI Clock
4.	MOSI	Digital Input	SPI Slave Data Input
5.	MISO	Digital Output	SPI Slave Data Output, with tri-state option
6.	IRQ	Digital Output	Maskable interrupt pin. Active low
7.	VDD	Power	Power Supply (+1.9V - +3.6V DC)
8.	VSS	Power	Ground (0V)
9.	XC2	Analog Output	Crystal Pin 2
10.	XC1	Analog Input	Crystal Pin 1
11.	VDD_PA	Power Output	Power Supply Output(+1.8V) For the internal nRF24L01+ Power Amplifier. Must be connected to ANT1 and ANT2
12.	ANT1	RF	Antenna interface 1
13.	ANT2	RF	Antenna interface 2
14.	VSS	Power	Ground (0V)
15.	VDD	Power	Power Supply (+1.9V - +3.6V DC)
16.	IREF	Analog Input	Reference current. Connect a 22k Ω resistor To ground.
17.	VSS	Power	Ground (0V)
18.	VDD	Power	Power Supply (+1.9V - +3.6V DC)
19.	DVDD	Power Output	Internal digital supply output for de-coupling Purposes.
20.	VSS	Power	Ground (0V)

3.8 BUZZER:

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.



3.8.1 MAGNETIC TRANSDUCER:

Magnetic transducers contain a magnetic circuit consisting of a iron core with a wound coil and a yoke plate, a permanent magnet and a vibrating diaphragm with a movable iron piece. The diaphragm is slightly pulled towards the top of the core by the magnet's magnetic field. When a positive AC signal is applied, the current flowing through the excitation coil produces a fluctuating magnetic field, which causes the diaphragm to vibrate up and down, thus vibrating air. Resonance amplifies vibration through resonator consisting of sound hole(s) and cavity and produces a loud sound.

3.8.2 MAGNETIC BUZZER (SOUNDER):

Buzzers like the TMB-series are magnetic audible signal devices with built-in oscillating circuits. The construction combines an oscillation circuit unit with a detection coil, a drive coil and a magnetic transducer. Transistors, resistors, diodes and other small devices act as circuit devices for driving sound generators. With the application of voltage, current flows to the drive coil on primary side and to the detection coil on the secondary side. The amplification circuit, including the transistor and the feedback circuit, causes vibration. The oscillation current excites the coil and the unit generates an AC magnetic field corresponding to an oscillation frequency. This AC magnetic field magnetizes the yoke comprising the

magnetic circuit. The oscillation from the intermittent magnetization prompts the vibration diaphragm to vibrate up and down, generating buzzer sounds through the resonator.

RECOMMENDED DRIVING CIRCUIT FOR MAGNETIC TRANSDUCER INTRODUCTION OF MAGNETIC BUZZER (TRANSDUCER).

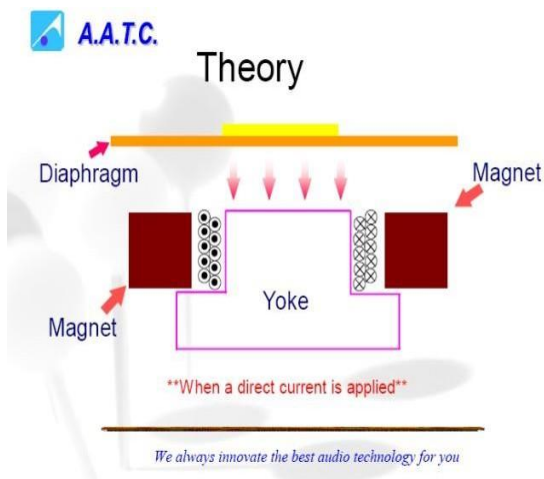


FIG 3.8: THEORY

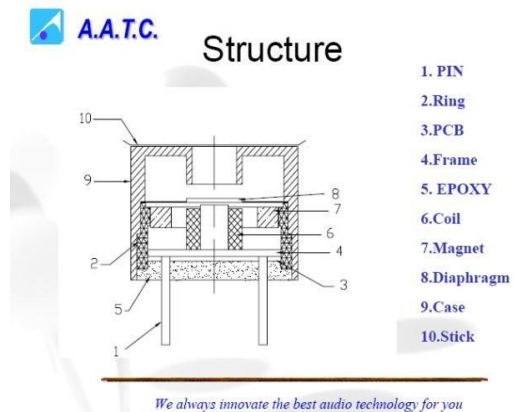


FIG 3.9: STRUCTURE

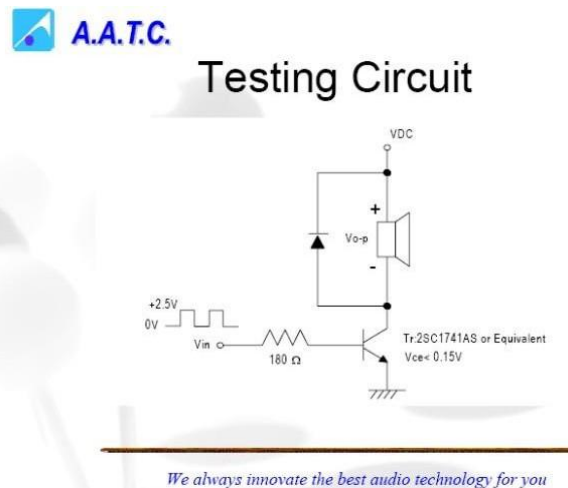


FIG 3.10: TESTING CIRCUIT

SPECIFICATIONS:

Rated Voltage: A magnetic buzzer is driven by 1/2 square waves (V o-p).

Operating Voltage: For normal operating. But it is not guaranteed to make the minimum Sound Pressure Level (SPL) under the rated voltage.

Consumption Current: The current is stably consumed under the regular

operation. However, it normally takes three times of current at the moment of starting to work.

Direct Current Resistance: The direct current resistance is measured by ammeter directly.

Sound Output: The sound output is measured by decibel meter. Applying rated voltage and 1/2 square waves, and the distance of 10 cm.

Rated Frequency: A buzzer can make sound on any frequencies, but we suggest that the highest and the most stable SPL comes from the rated frequency.

Operating Temperature. : Keep working well between -30°C and +70°C.

How to choose:

Driving methods: AX series with built drive circuit will be the best choice when we cannot provide frequency signal to a buzzer, it only needs direct current.

Dimension: Dimension affects frequency, small size result in high frequency.

Voltage: Depend on V o-p (1/2 square waves)

Fixed methods: From the highest cost to the lowest- DIP, wires/ connector, SMD.

Soldering methods: AS series is soldered by hand, the frequency is lower because of the holes on the bottom. On the other hand, we suggest AC series for the reflow soldering, the reliability is better.

How to choose a buzzer:

There are many different kinds of buzzer to choose, first we need to know a few parameters, such as voltage, current, drive method, dimension, mounting type, and the most important thing is how much SPL and frequency we want.

Operating voltage: Normally, the operating voltage for a magnetic buzzer is from 1.5V to 24V, for a piezo buzzer is from 3V to 220V. However, in order to get enough SPL, we suggest giving at least 9V to drive a piezo buzzer.

Consumption current: According to the different voltage, the consumption current of a magnetic buzzer is from dozens to hundreds of mill amperes; oppositely, the piezo type saves much more electricity, only needs a few mill amperes, and consumes three times current when the buzzer start to work.

Driving method: Both magnetic and piezo buzzer have self drive type to choose. Because of the internal set drive circuit, the self drive buzzer can emit sound as long as connecting with the direct current. Due to the different work principle, the magnetic buzzer need to be driven by 1/2 square waves, and the piezo buzzer need square waves to get better sound output.

Dimension: The dimension of the buzzer affects its SPL and the frequency, the dimension of the magnetic buzzer is from 7 mm to 25 mm; the piezo buzzer is from bigger.

Connecting way: Dip type, Wire type, SMDtype, and screwed type for big piezo

Sound Pressure Level (SPL): Buzzer is usually tested the SPL at the distance of 10 cm, if distance double, the SPL will decay about 6 dB; oppositely, the SPL will increase 6 dB when the distance is shortened by one time. The SPL of the magnetic buzzer can reach to around 85 dB/ 10 cm; the piezo buzzer can be designed to emit very loud sound, for example, the common siren, are mostly made of piezo buzzer.

3.9 INTRODUCTION OF PIEZO BUZZER:

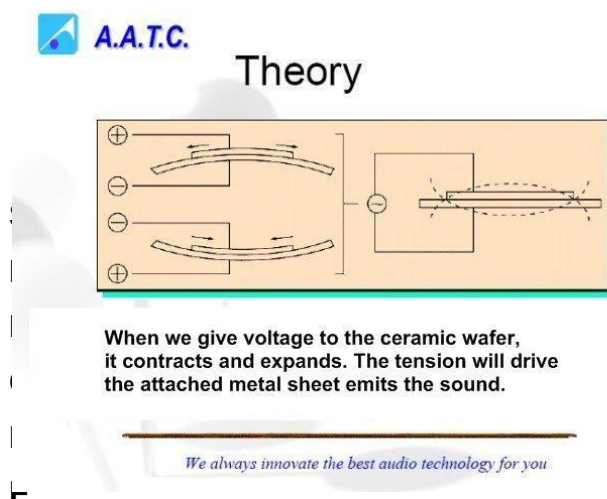


FIG 3.11: THEORY OF PIEZO BUZZER

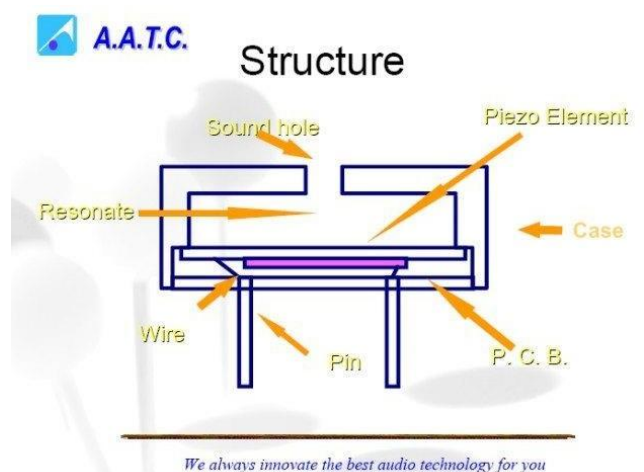


FIG 3.12: STRUCTURE

Rated Voltage: A piezo buzzer is driven by square waves (V p-p).

Operating Voltage: For normal operating. But it is not guaranteed to make the minimum SPL under the rated voltage.

Consumption Current: The current is stably consumed under the regular operation

Capacitance: A piezo buzzer can make higher SPL with higher capacitance

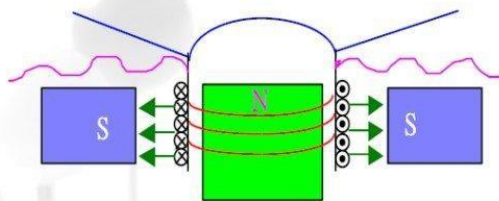
Sound Output: The sound output is measured by decibel meter. Applying rated voltage and square waves, and the distance of 10 cm.

Rated Frequency: A buzzer can make sound on any frequencies, but we suggest that the highest and the most stable SPL comes from the rated frequency.

Operating Temp.: Keep working well between -30°C and +70°C.



Theory

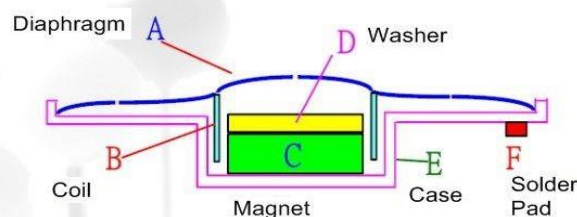


When the signals pass through the sound coil, the magnetic field generated from the sound coil will be repulsive to the iron magnetic field, and then drive the diaphragm to vibrate the air and emit the sound.

We always innovate the best audio technology for you



Structure



We always innovate the best audio technology for you

Driving methods: AZ-xxx S-x series with built drive circuit will be the best choice when we cannot provide frequency signal to a buzzer, it only needs direct current. Besides, there are different tone nature for you to choose, such as continuous, fast pulse.

Dimension: Dimension affects frequency, small size result in high frequency.

Voltage: Driven by square waves (V p-p), the higher voltage results in the higher SPL.

Pin Pitch: The numerous spec. for the piezo buzzers lead to the difficulty in finding a spec. in facsimile, therefore we suggest that you can firstly choose a spec. with the same pitch and similar frequency. Introduction of Micro Speaker

How to choose:

The factors which affect the SPL: the square measure of diaphragm, the amplitude of vibration, magnetic field intensity, power, impedance, resonant chamber, the pattern and the thickness of diaphragm, and the holes.

Power vs. SPL: Suppose all the conditions are the same, increasing the power dose not mean the SPL will increase as well. We need to revise the diaphragm and the sound coil to load the higher power, but it leads to lower SPL instead.

Dimension vs. SPL: A larger speaker can vibrate more air, therefore it provides higher SPL. In addition, the thicker speaker can give wider amplitude of vibration which also leads to higher SPL.

Acoustics: What we request most is how much SPL a micro speaker can output.

Matching: It will be better to provide the power slight higher than the rated power for the enlarged circuit.

Question for mechanism:

The volume of the resonant chamber: The general problem of the consuming products is that the resonant chambers are not big enough. We can only try to find space to enlarge the volume of the resonant chamber.

Sound Hole: Must be more than 1/8 of the diaphragm's area at least.

Airtight: The front and back sound fields of the speaker should be separated to avoid neutralization.

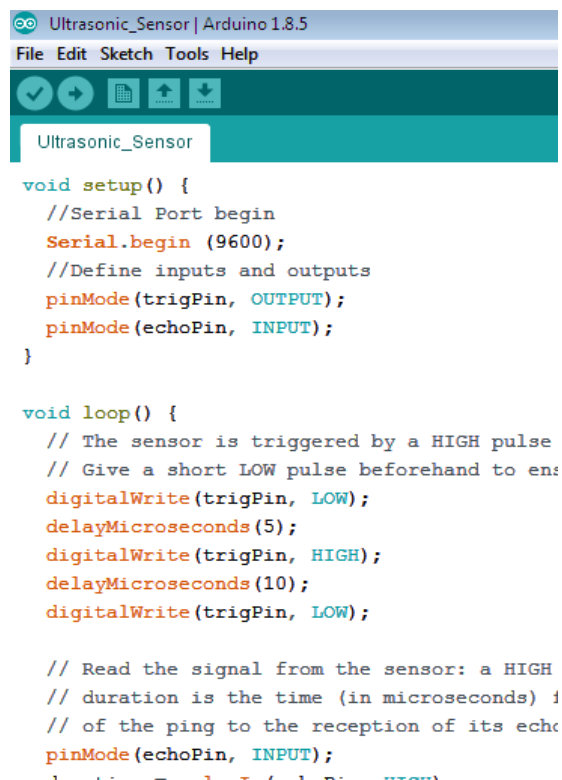
Shock absorber: When a speaker works the vibration will also happen at the same time. In order to reduce interference, it will do good to have some material between speaker and case to absorb the shock.

CHAPTER 4

RESULT AND DISCUSSION

This smart guide stick is basically a prototype model not a real time project. here we consider image as an input, buzzer sound and the obstacle detection along with the sound from the speaker was the final output. At last the blind will get the voice from the speaker about the obstacle. In this we are using image processing with the help of MATLAB as software equipment and head unit ,stick unit as hardware equipment consists of Arduino uno, buzzer, speaker, Zigbee, ultrasonic sensor, USB camera .

The Arduino Uno can be programmed with the (Arduino Software (IDE)). Select "Arduino/Genuino Uno from the Tools > Board menu (according to the microcontroller on your board). For details, see the reference and tutorials. The ATmega328 on the Arduino Uno comes preprogrammed with a bootloader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol (reference, C header files).

The image is a screenshot of the Arduino IDE interface. At the top, the title bar reads "Ultrasonic_Sensor | Arduino 1.8.5". Below it is a menu bar with "File", "Edit", "Sketch", "Tools", and "Help". A toolbar with icons for opening, saving, and uploading files is visible. The main text area shows the code for the "Ultrasonic_Sensor" sketch. The code includes a setup function for serial communication and pin modes, and a loop function that triggers the ultrasonic sensor and reads the echo signal.

```
void setup() {
  //Serial Port begin
  Serial.begin (9600);
  //Define inputs and outputs
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
}

void loop() {
  // The sensor is triggered by a HIGH pulse
  // Give a short LOW pulse beforehand to ens
  digitalWrite(trigPin, LOW);
  delayMicroseconds(5);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);

  // Read the signal from the sensor: a HIGH
  // duration is the time (in microseconds) f
  // of the ping to the reception of its echo
  pinMode(echoPin, INPUT);
  // duration = pulseIn(echoPin, HIGH);
}
```

FIG 4.1: SCREENSHOT OF ULTRASONIC SENSOR

You can also bypass the bootloader and program the microcontroller through the ICSP (In-Circuit Serial Programming) header using Arduino ISP or similar; see these instructions for details.

The ATmega16U2 (or 8U2 in the rev1 and rev2 boards) firmware source code is available in the Arduino repository. The ATmega16U2/8U2 is loaded with a DFU bootloader, which can be activated by:

➤ 4.1 DIFFERENCES WITH OTHER BO

On Rev1 boards: connecting the solder jumper on the back of the board (near the map of Italy) and then resealing the 8U2.

- **On Rev2 or later boards:** there is a resistor that pulling the 8U2/16U2 HWB line to ground, making it easier to put into DFU mode.

You can then use Atmel's FLIP software (Windows) or the DFU programmer (Mac OS X and Linux) to load a new firmware. Or you can use the ISP header with an external programmer (over writing the DFU bootloader). See this user-contributed tutorial for more information.

4.2 ARDUINO SOFTWARE (IDE):

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

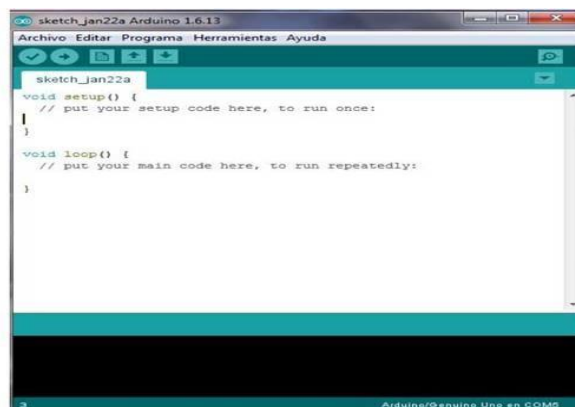


FIG 4.2: SCREENSHOT OF SKETCH

4.3 WRITING SKETCHES:

Programs written using Arduino Software (IDE) are called **sketches**. These sketches are written in the text editor and are saved with the file extension. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom righthand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

TABLE 4.1 WRITING SKETCHES.

	<i>Verify</i> Checks your code for errors compiling it.
	<i>Upload</i> Compiles your code and uploads it to the configured board. See uploading below for details. Note: If you are using an external programmer with your board, you can hold down the "shift" key on your computer when using this icon. The text will change to "Upload using

	Programmer"
	<i>New</i> Creates a new sketch.
	<i>Open</i> Presents a menu of all the sketches in your sketchbook. Clicking one will open it within the current window overwriting its content. Note: due to a bug in Java, this menu doesn't scroll; if you need to open a sketch late in the list, use the File Sketchbook menu instead.
	<i>Save</i> Saves your sketch.
	<i>Serial Monitor</i> Opens the serial monitor.

Additional commands are found within the five menus: **File**, **Edit**, **Sketch**, **Tools**, and help. The menus are context sensitive, which means only those items relevant to the work currently being carried

4.3.1 FILE:

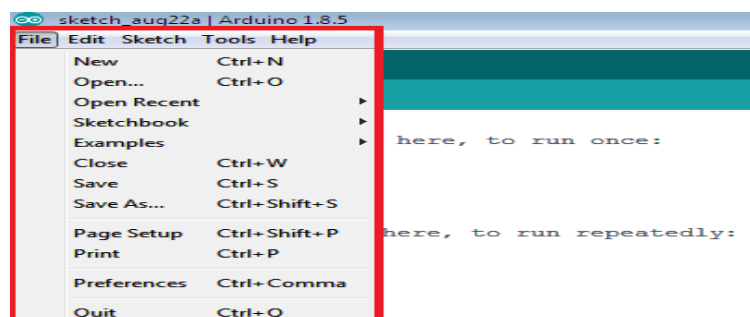


FIG 4.3: SCREENSHOT OF FILE

4.3.2 EDIT:

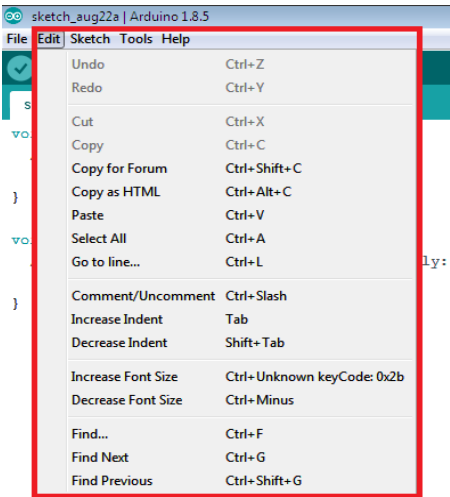


FIG 4.4: SCREENSHOT OF EDIT

4.3.3 SKETCH:

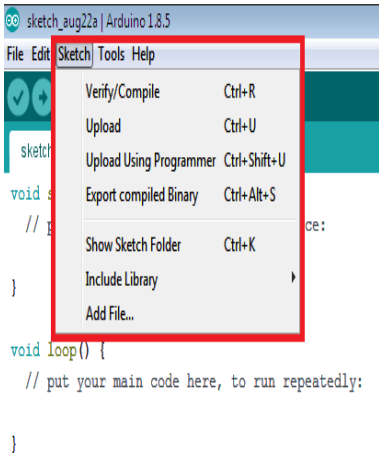


FIG 4.5: SCREENSHOT OF SKETCH

4.4 IMAGE PROCESSING:

Preprocessing techniques are needed on colour grey-level or binary document images containing text and/or graphics. In character recognition systems most of the applications use grey or binary images since processing colour images is computationally high. Such images may also contain non-uniform background and/or watermarks making it difficult to extract the document text from the image without performing some kind of preprocessing, therefore; the desired result from preprocessing is a binary image containing text only. Thus, to achieve this, several steps are needed, first, some image enhancement techniques to remove noise or correct the contrast in the image, second, thresholding to remove the background containing any scenes, watermarks and/or noise, third, page segmentation to separate graphics from text, fourth, character segmentation to separate characters from each other and, finally, morphological processing to enhance the characters in cases where thresholding and/or other preprocessing techniques eroded parts of the characters or added pixels to them. The above techniques present few of those which may be used in character recognition systems and in some applications; few or some of these techniques or others may be used at different stages of the OCR system. The rest of the chapter will present some of the techniques used during the preprocessing stage of a character recognition system.

In our proposed system, we have Arduino UNO microcontroller which acts as brain of our system, hence entire system program is stored in it. We have two units, 1.Walkstick unit 2. Head Unit. The Walkstick consists camera to capture the image of the object and send the information to controller via serial communication. Ultrasonic sensor determines the distance between ground and stick in case of staircase they approaches, these data transmitted via zigbee to the Head Unit. Where the APR module is used to store voice messages it play through speaker depending upon the data received via zigbee.

4.5 WALKSTICK UNIT:

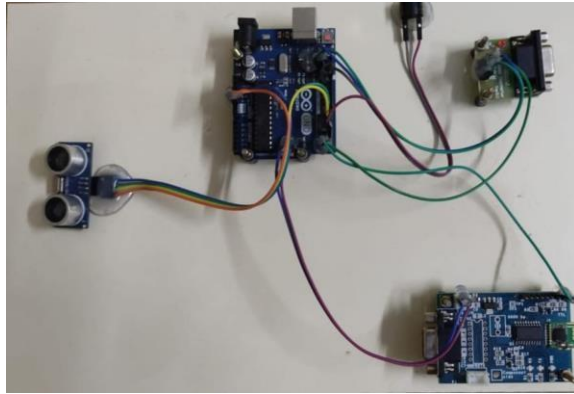


FIG 4.6: WALKSTICK UNIT

4.6 HEAD UNIT:

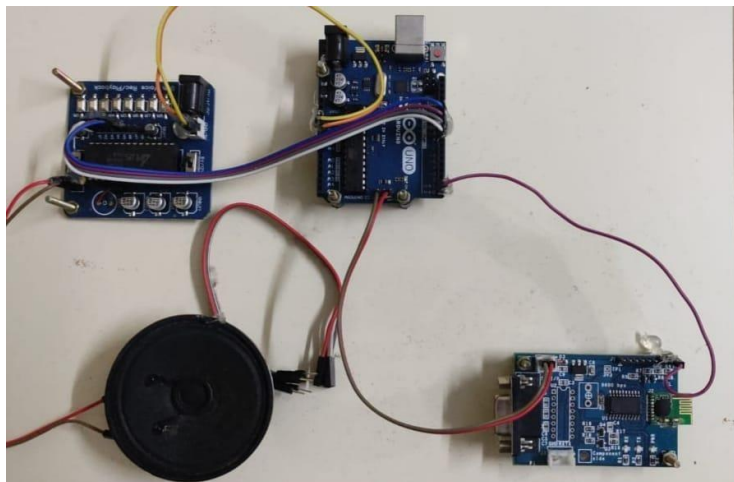


FIG 4.7: HEAD UNIT

4.7 INPUT IMAGE:

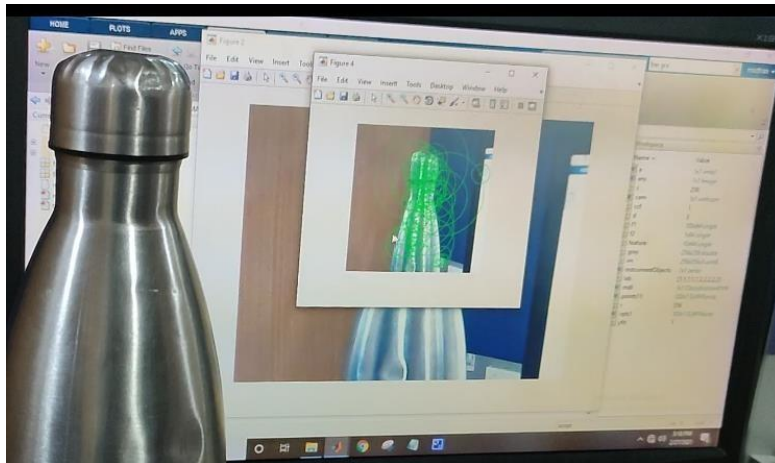


FIG 4.8: INPUT IMAGE

4.8 OUTPUT IMAGE:

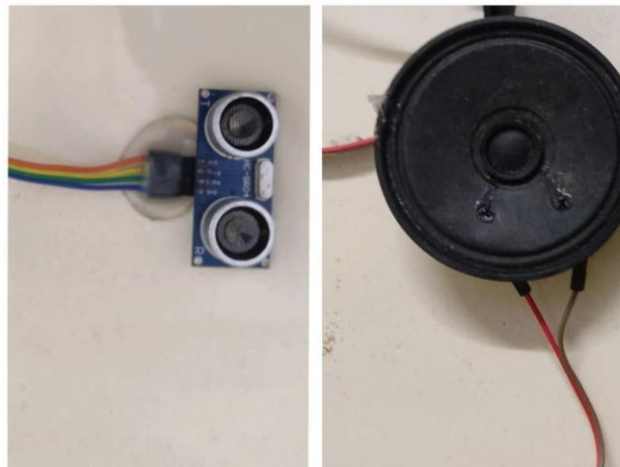


FIG 4.9: OUTPUT IMAGE

CHAPTER 5

CONCLUSION AND FUTURE ENHANCEMENTS

5.1 CONCLUSION

This updated route framework is tested increasingly more time in the all referenced basic circumstances to guarantee the authentication of greatness in achievability test. It is unequivocally expected that with more essential changes the development capacity hole can be made more limited in not-so-distant future.

5.2 FUTURE ENHANCEMENTS:

- ✓ New prototyping hardware & capability & interfacing with other consumer electrone/tv/smartphones & flooding of shields.
- ✓ Mining equipment's may require where entail.
- ✓ Already compatible with many major simulation software like MATLAB & lab view, we may see even move flexible programming environment & development option.
- ✓ Using temp. Compensation, it can be used over wide temp range.
- ✓ Height measurement, agriculture veiled, collision /protection can be other application.

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