A

PBL PROJECT REPORT

On

"MULTIFUNCTIONING ULTRASONIC SECURITY SYSTEM"

Submitted by

MR. SIDDHANT BURLE

MR. ANISH BHOYATE

MS. KARISHMA BARGAJE

MS. SAMIKSHA BHUJBAL

MS ANJALI ABHANG

MS TRUSHNA BAGADE

MS. AISHWARYA AYARE

In partial fulfillment of the requirements for the degree of

FIRST YEAR ENGINEERING

Under the guidance of

Mrs. J.S.Kulkarni

VPKBIET

DEPARTMENT OF FIRST-YEAR ENGINEERING

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Kamalnayan Bajaj Institute of Engineering and Technology, Baramati

Vidyanagari, Bhigwan Road, Baramati, Dist. Pune (Maharashtra) - 413 133, India.

DEPARTMENT OF FIRST-YEAR ENGINEERING

CERTIFICATE

This is to certify that, A Project Report entitled **“MULTIFUNCTIONING ULTRASONIC SECURITY SYSTEM” was** submitted by **MR. SIDDHANT BURLE, MR. ANISH BHOYATE, MS. KARISHMA BARGAJE, MS. SAMIKSHA BHUJBAL, MS. ANJALI ABHANG, MS. TRUSHNA BAGADE, MS. AISHWARYA AYARE** to **Savitribai Phule Pune University** for the partial fulfillment of the requirements of PBL under the **First year** is a record of bonafide work carried out by them under my supervision and guidance. Further, it is certified that the work done by them is original and carried out under my guidance as prescribed in the syllabus of **Savitribai Phule Pune University** during the academic year 2021-2022.

Project Guide
Mrs. J.S.Kulkarni
Assistant Professor
Department of Electrical Engineering

Dr.Aparna Sajjan
FE, HEAD
VPKBIET,Baramati.

Dr.R.S.Bichkar
PRINCIPAL
VPKBIET,Baramati

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Abstract

Traditional Household Security Systems often require installation and detection on the based of opening doors and windows. In the cases where installation is not possible and/or the area of interest has no door, our ultrasonic security system will come in handy because it requires no installation, and detects intruders based on their physical presence. Security is an important part of the home, especially if we are going to share our house with prior strangers without an out lock on our room door. And we anticipate that many college students could face a similar problem. What is not to love about a device that looks like WALL-E scans around for possible intruders? In case of intruders, it sends off a sound alarm and alerts the owner via message. It is also password protected and could be disabled via the correct password. In this paper, a highly advanced ultrasonic and an At89c51microcontroller are used to alert the security personnel. The ultrasonic sensor is sensitive to any human movement. It detects infrared radiation coming from any alive body. At89c51 microcontroller is used for the main module. In inactivated conditions, when an intruder enters the prohibited area, the sensor triggers main module zones, which in turn sends the message to the central camp, and a visual and audible alert is produced. Security is an important part of the home, especially if we are going to share a house with prior strangers without a lock on our room door. Here GSM Modem is used to send the message to the owner’s mobile when the unwanted person crosses into the prohibited area. It is also password protected and could be disabled via the correct password.

Keywords: Ultrasonic Sensor, Arduino UNO, Buzzer, etc

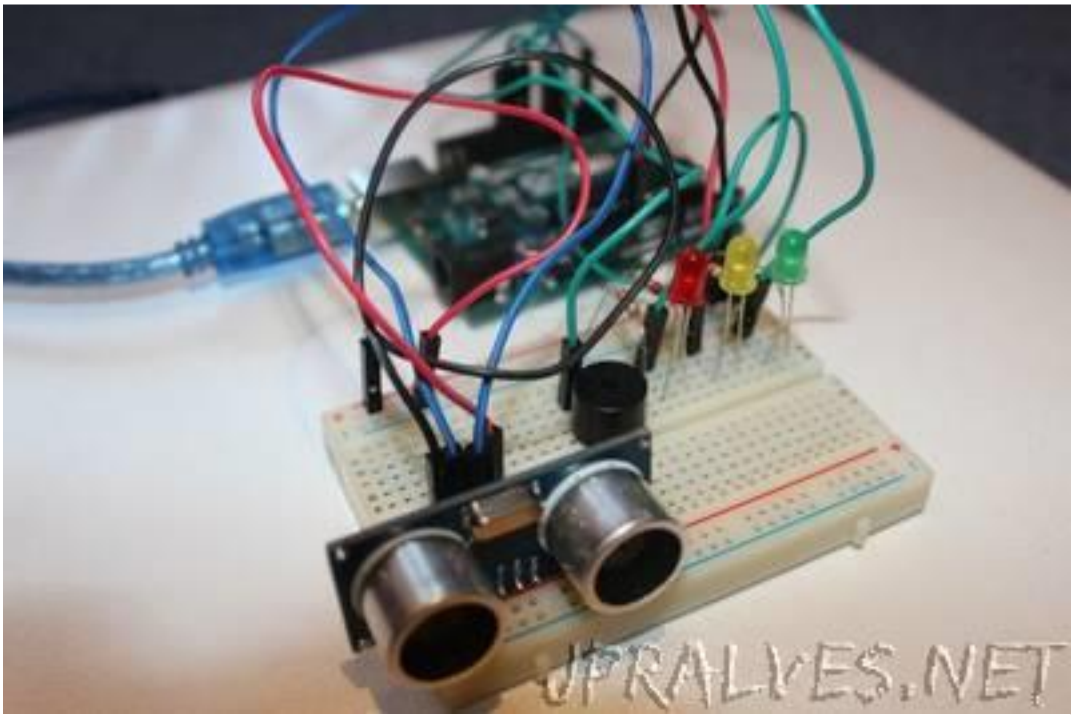
CONTENTS

Chapter 1

Introduction

Security is an integral part of the home, especially if we are going to share a house with prior strangers without a lock on our room door for which our multifunctioning ultrasonic system works. This is a simple alarm system made with the help of a buzzer, Arduino UNO, and an Ultrasonic sensor also known as a Proximity/Distance Sensor (HC-SR04). An ultrasonic sensor is also known as a Proximity/Distance Sensor (HC-SR04). The circuit uses a matched pair of 40 kHz transducer elements to detect movement up to 1.5 feet away. The system beeps a buzzer sound continuously or with few delays for movement indication. Sensitivity is adjustable via control. The circuit uses PCB and 40khzs transducers. One transducer is used as a transmitter and the other as a receiver. A 9 to 12-volt DC is supplied to the PC board. In inactivated conditions, when an intruder enters the prohibited area the sensors trigger, and the audible buzzer sound is produced. To turn off the buzzer we can turn off the switch.

1.1 Introduction to the ultrasonic sensor



Ultrasound is acoustic (sound) energy in the form of waves having a frequency above the human hearing range. The highest frequency that the human ear can detect is approximately 40 thousand cycles per second (40,000 Hz). This is where the sonic range ends, and where the ultrasonic range begins. Ultrasound is used in electronic, navigational, industrial, and security applications. It is also used in medicine to view the body’s internal organs. Ultrasound can locate objects by means similar to the principle by which radar works. High-frequency acoustic waves reflect from objects, even comparatively small ones, because of the short wavelength. The distance to an object can be determined by measuring the delay between the transmission of an ultrasound pulse and the return of the echo. This is the well-known means by which bats navigate in darkness. It is also believed to be used underwater by cetaceans such as dolphins and whales. Ultrasound can be used in sonar systems to determine the depth of the water in a location, find schools of fish, locate submarines, and detect the presence of SCUBA divers.

In this paper, a highly advanced ultrasonic and an At89c51microcontroller are used to alert the security personnel. The ultrasonic sensor is sensitive to any human movement. It detects infrared radiation coming from any alive body. At89c51 microcontroller is used for the main module. In inactivated conditions, when an intruder enters the prohibited area, the sensor triggers main module zones, which in turn sends the message to the central camp, and a visual and audible alert is produced. Security is an important part of the home, especially if we are going to share a house with prior strangers without a lock on our room door. Here GSM Modem is used to send the information to the camp when the unwanted person crosses into the prohibited area.

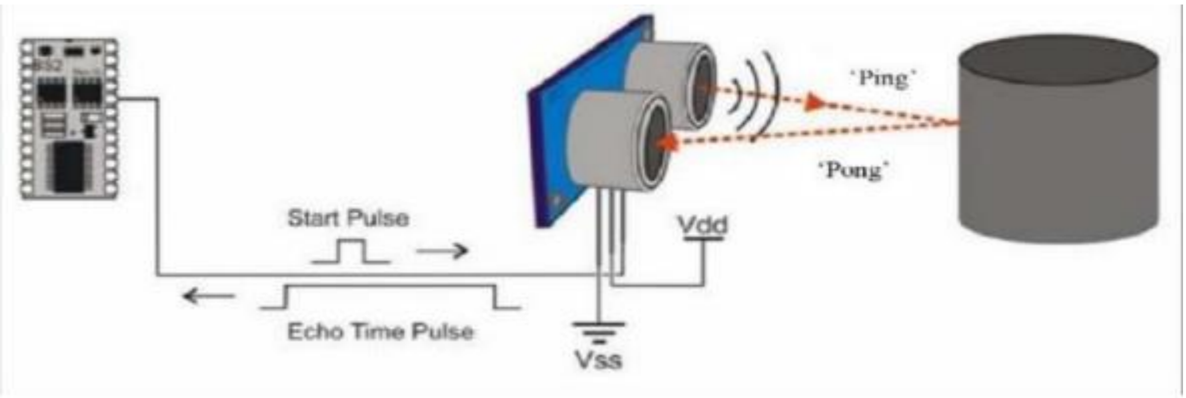
1.2 Necessity of the project

The main objective of the project is to provide a useful and low-cost measurement system that is easy to configure and handle

Chapter 2

Literature Survey

A security alarm is a system designed to detect intrusion – unauthorized entry – into a building or area. Security alarms are used in residential, commercial, industrial, and military properties for protection against burglary (theft) or property damage and personal protection against intruders. Car alarms likewise protect vehicles and their contents. Prisons also use security systems to control inmates. Ultrasonic signals are like audible sound waves, except the frequencies are much higher. The ultrasonic transducers have piezoelectric crystals which resonate to a preferred frequency and convert electric energy into acoustic energy and vice versa.

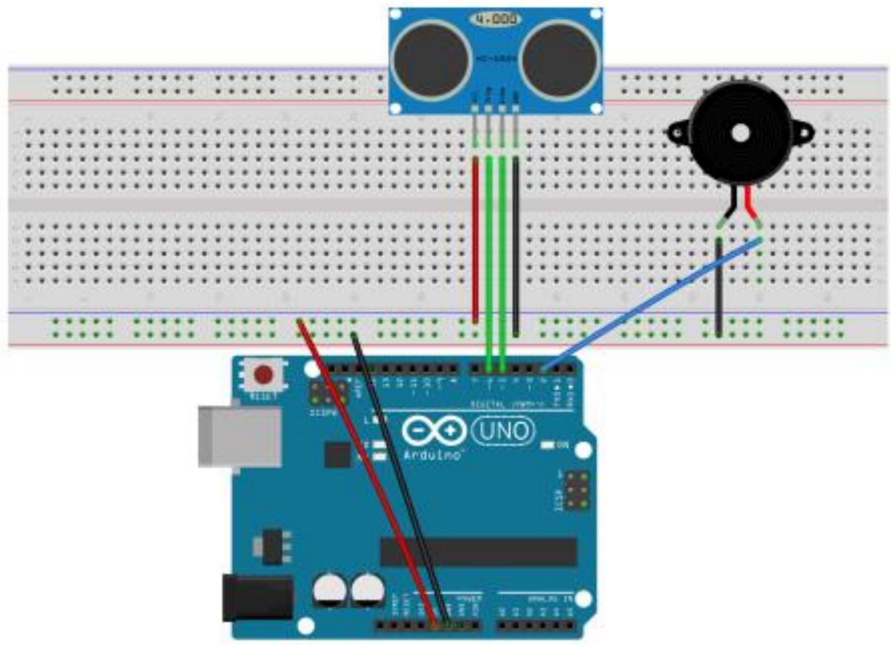


The illustration in the Figure shows how sound waves, transmitted in the shape of a cone, are reflected from a target back to the transducer. An output signal is produced to perform some kind of indicating or control function. A minimum distance from the sensor is required to provide a time delay so that the "echoes" can be interpreted. Figure Basic ultrasonic sensor working Variables that can affect the operation of ultrasonic sensing include target surface angle, reflective surface roughness, or changes in temperature or humidity. The targets can have any kind of reflective form - even round objects. Ultrasonic sensors (also known as transceivers when they both send and receive) work on a principle similar to radar or sonar which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generate high-frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object. This technology can be used for measuring: wind speed and direction (anemometer), tank or channel level, and speed through air or water. For measuring speed or direction a device uses multiple detectors and calculates the speed from the relative distances to particulates in the air or water. To measure tank or channel level, the sensor measures the distance to the surface of the fluid. Further applications include humidifiers, sonar, medical ultrasonography, burglar alarms, and non-destructive testing. Systems typically use a transducer that generates sound waves in the ultrasonic range, above 18,000 hertz, by turning electrical energy into sound, then upon receiving the echo turn the sound waves into electrical energy which can be measured and displayed. The technology is limited by the shapes of surfaces and the density or consistency of the material. Foam, in particular, can distort surface-level readings. The history dates back to 1790 when Lazzaro Spallanzani first discovered that bats maneuvered in flight using their hearing rather than sight. Jean-Daniel Col-Ultrasonic Security System lad on in 1826 discovered sonography using an underwater bell, successfully and accurately determining the speed of sound in water. Thereafter, the study and research work in this field went on slowly until 1881 when Pierre Curie's discovery set the stage for modern ultrasound transducers. He found out the relationship between electrical voltage and pressure on crystalline material. The unfortunate Titanic accident spurred rigorous interest in this field because of which Paul Langevin invented the hydrophone to detect icebergs. It was the first ultrasonic transducer. The hydrophone could send and receive low-frequency sound waves and was later used in the detection of submarines in World War 1.

Chapter 3

Methodology

3.1 Schematic Diagram



3.2 Connections

1. Wireless distance measurement system is used to measure the distance between two objects precisely. In this particular project, we are using an ultrasonic sensor to measure the distance.

2. Now for the hardware port first we take a male-to-male jumper wire and connect it with a 5V pin and connect the other end to the positive rail of the breadboard. Next, we take another male-to-male jumper wire and connect it to the 'GND' pin of Arduino and we connect the other port to the negative rail of the breadboard. After that, we connect the 'Vcc' and 'GND' pin of both the ultrasonic sensor and servo motor to the positive and negative rail of the breadboard respectively. Next, we connect the trigger pin of the ultrasonic sensor to 'pin 9' of the Arduino board and we connect the pin of the ultrasonic sensor to 'pin 11' of the Arduino board and we connect the data pin of the servo motor to 'pin 12' of Arduino board. And hence the connection of Arduino is completed. Next, we write the code on Arduino IDE and burn it to the Arduino board.

3. We use 'processing 3.3.7' software. It is mainly a programming language and environment built for the electronics art and graphics used in the design. We use this software to locate the object on the computer screen. And print the distance of the object measured by the ultrasonic sensor

. 4. We use ‘processing IDE’ to write the code processing IDE similar to the ‘Arduino IDE’. And the ‘processing IDE’ communicate through serial communication with the ’Arduino IDE’.

5. For the communication process we send the data received from the ultrasonic sensor to the serial monitor with the same additional characters. These data in the serial monitor will be later received by the ‘processing IDE’ and hence the communication between Arduino IDE and Processing IDE is completed.

6. Now we can see the distance of the object at which angle it is located as well as the location of the object on the monitor.

Step 1: Assemble Materials

Step 2: Setup

Connect a red wire from the 5V pin on the Arduino to the positive channel of the breadboard. Connect a black wire from the GND pin on the Arduino to the negative channel of the breadboard: Buzzer = pin 7 On Ultrasonic Sensor: Echo = pin 3 Trig = pin 2

Step 3: Assembly Breadboard

Firstly, let's connect the 5V and GND pin on the Arduino to the breadboard. As I mentioned before, be sure that the wire attached to the 5V pin is connected to the positive channel of the breadboard, and the wire attached to the GND pin is connected to the negative channel of the breadboard.

Step 4: Assembly - Ultrasonic Sensor

Time to connect the HC-SRO4 ultrasonic sensor! A great tip is to place the ultrasonic sensor as far-right to the breadboard as possible and make sure that it is facing out. Referring back to the setup picture, you should connect the GND pin on the ultrasonic sensor to the negative channel on the breadboard. Next, connect the Trig pin on the sensor to pin 2 on the Arduino and connect the Echo pin on the sensor to pin 3 on the Arduino. Lastly, connect the VCC pin on the ultrasonic sensor to the positive channel on the breadboard. Refer to the picture above if anything gets confusing.

Step 5: Assembly – Buzzer

The last part of the setup for this is connecting the buzzer to the breadboard and the Arduino. This is one of the easiest parts of the whole setup. All that is required to do is to connect the longer leg of the buzzer to pin 7 of the Arduino using a green wire and then connect the shorter leg of the buzzer to the negative channel of the breadboard using 220-ohm resistors. It is HIGHLY recommended to use a resistor in connecting the shorter leg of the buzzer to the negative channel of the breadboard. This greatly reduces the volume of the buzzer and prevents it from drying too quickly.

Chapter 4

System Description

4.1 Components Used

1. Ultrasonic Sensor

2. Buzzer

3. ARDUINO UNO

4. BREAD BOARD

5. JUMPER WIERS

4.1.1. Ultrasonic Sensor

The ultrasonic sensor is also known as (HC-SR04) Ultrasonic sensors generate high-frequency sound waves and evaluates the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object. This technology can be used for measuring wind speed and direction (anemometer), tank or channel level, and speed through air or water. The HC-SR04 Ultrasonic Distance Sensor is an inexpensive device that is very useful for robotics and test equipment projects. This tiny sensor is capable of measuring the distance between itself and the nearest solid object. The HC-SR04 can be hooked directly to an Arduino or other microcontroller and it operates on 5 volts. This ultrasonic distance sensor is capable of measuring distances between 2 cm to 400 cm. It’s a low-current device so it’s suitable for battery-powered devices.

4.1.2. 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, training, and confirmation of user input such as a mouse click or keystroke. The buzzer subsystem produces a 2KHz audible tone when powered. The buzzer will sound when the signal coming into the driver is high. It must be connected to a transistor. The buzzer is connected between the supply rail and the input signal. this act as a load on the drive.The vital role of the buzzer in ultrasonic distance meter.

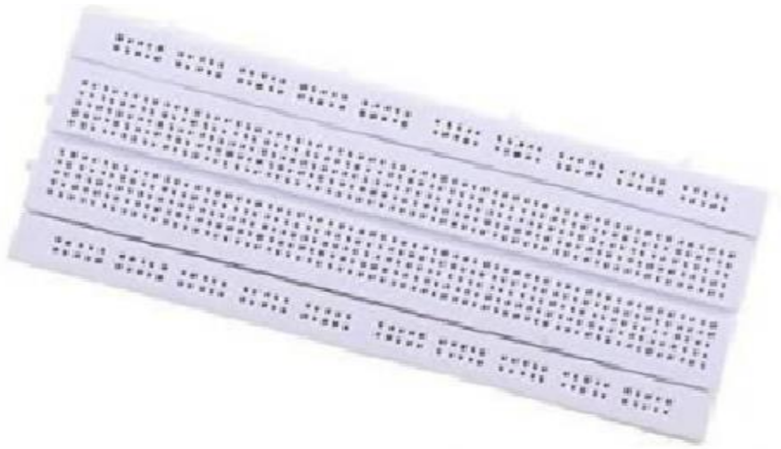
4.1.3 . ARDUINO UNO

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards can read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn them 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. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

Arduino refers to an open-source electronics platform or board and the software used to program it. An Arduino board can be purchased preassembled or because the hardware design is open source, built by hand. A pre-assembled Arduino board includes a microcontroller, which is programmed using the Arduino programming language and the Arduino development environment. Arduino programming language is simplified from C/C++ programming language based on what Arduino calls "sketches," which use basic programming structures, variables, and functions. These are then converted into a C++ program.

4.1.4 BREADBOARD

Breadboards are designed to work with through-hole electronic components. These components have long metal leads that are designed to be inserted through holes in a printed circuit board (PCB) that are plated with a thin copper coating, which allows the components' leads to be soldered to the board. Breadboards do not work with surface mount components. These components have short, flat pins on their sides that are designed to be soldered to the surface of a printed circuit board, instead of through holes.



4.1.5 JUMPER WIERS

Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points without soldering. Jumper wires are typically used with breadboards and other prototyping tools to make it easy to change a circuit as needed.

Chapter 5

Working

5.1 Implementation:

Ultrasonic distance sensors use pulses of ultrasonic sound (sound above the range of human hearing) to detect the distance between them and nearby solid objects.

The sensors consist of two main components:

• An Ultrasonic Transmitter – This transmits the ultrasonic sound pulses, it operates at 40 kHz

• An Ultrasonic Receiver – The receiver listens for the transmitted pulses. If it receives them it produces an output pulse whose width can be used to determine the distance the pulse traveled.

The HC-SR04 has the following four connections:

• VCC – This is the 5 Volt positive power supply.

• Trig – This is the "Trigger" pin, the one driven to send the ultrasonic pulses.

• Echo – This is the pin that produces a pulse when the reflected signal is received. The length of the pulse is proportional to the time it took for the transmitted signal to be detected.

• GND – This is the Ground pin. The device operates as follows: 1 A 5-volt pulse of at least 10 uS (10 microseconds) in duration is applied to the Trigger pin.

The device operates as follows:

1. A 5-volt pulse of at least 10 uS (10 microseconds) in duration is applied to the Trigger pin.

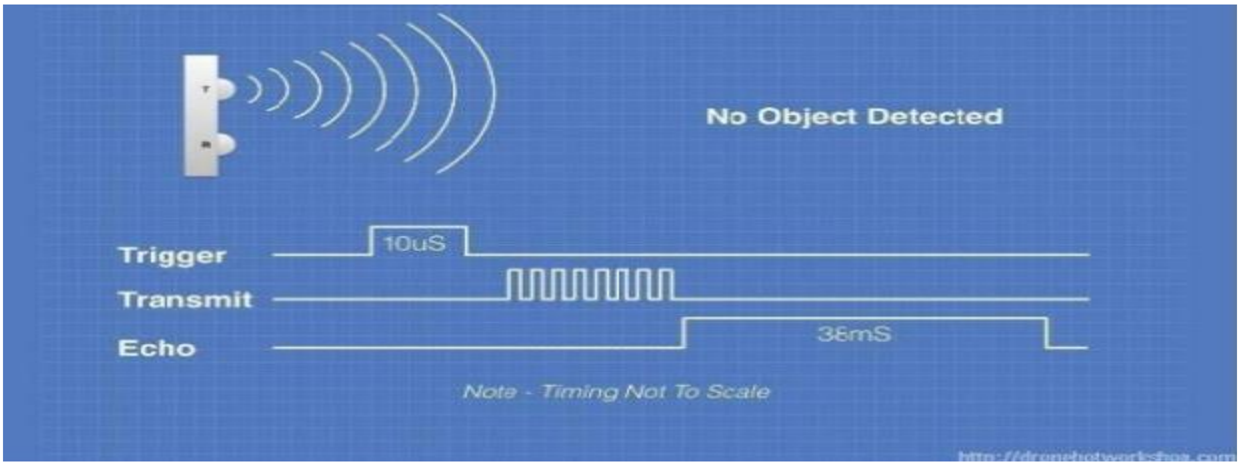
2. The HC-SR04 responds by transmitting a burst of eight pulses at 40 kHz. This 8- pulse pattern makes the "ultrasonic signature" from the device unique, allowing the receiver to discriminate between the transmitted pattern and the ultrasonic background noise.

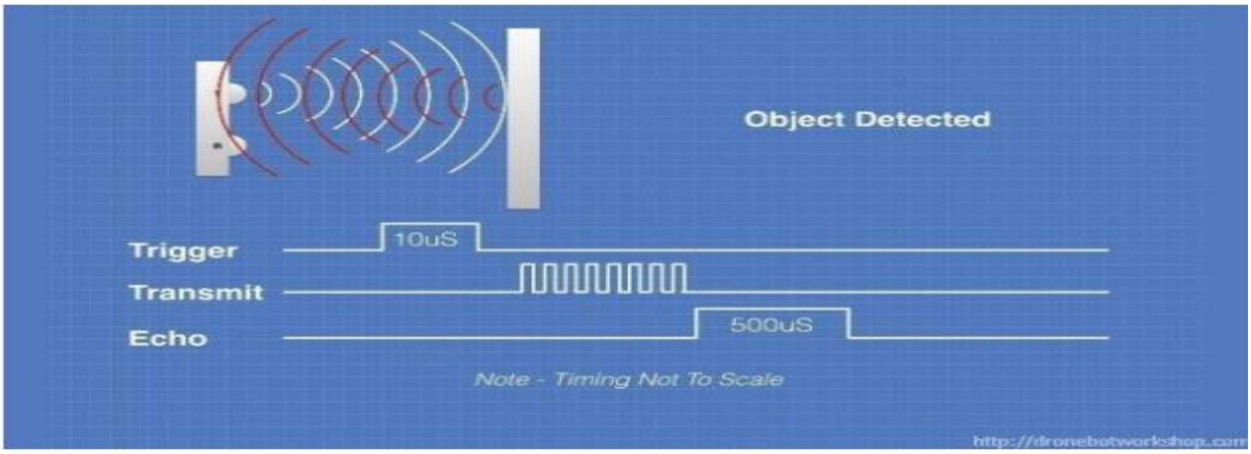
3. The eight ultrasonic pulses travel through the air away from the transmitter. Meanwhile, the Echo pin goes high to start forming the beginning of the echo-back signal.

4. If the pulse is NOT reflected then the Echo signal will timeout after 38 mS (38 milliseconds) and return low. This produces a 38 mS pulse that indicates no obstruction within the range of the sensor.

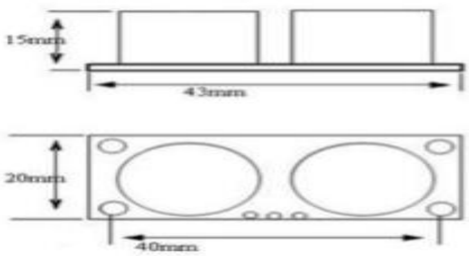
5. If the pulse IS reflected the Echo pin goes low when the signal is received. This produces a pulse whose width varies between 150 uS to 25 mS, depending upon the time it took for the signal to be received.

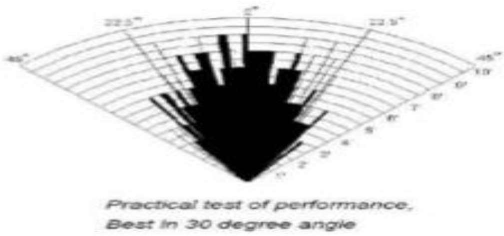
6. The width of the received pulse is used to calculate the distance to the reflected object. Remember that the pulse indicates the time it took for the signal to be sent out and reflected so to get the distance you'll need to divide your result in half.





The illustration below shows the dimensions of the HC-SR04 Ultrasonic Distance Sensor as well as the effective angle of operation. As you can see the sensor is most accurate when the object to be detected is directly in front of it but you do get a response from objects within a 45-degree "window". The documentation recommends confining that window to 30 degrees (15 degrees on either side) for accurate readings.





Chapter 6

Program

6.1 Programming Language used

First, the Arduino compiler/IDE accepts C and C++ as-is. Many of the libraries are written in C++. Much of the underlying system is not object-oriented, but it could be. Thus, "The Arduino language" is C++ or C.

6.2 Programming Explanation

In this project, we have explained, how we program our system. In this project, we used c++ languages to program the Arduino board. Firstly made a setup by connecting the Arduino board to the laptop using a cable. In 1st code, we code for the buzzer system, and we print origin output, echo pin Input, & buzzer output. After it, in 2the and Code, we adjusted our project’s distance? of Sound. intensity. For minimum distance sound intensity is maximum. For met intermediate distance it is medium and for the maximum distance, the buzzer beeps with some microseconds delay. And here in this way, we made code for our multifunction ultrasonic security system.

Our concept of the differences between Arduino programs Vs 'pure C/C++ ' is more likely not understanding which common functions are Arduino library functions Vs functions you might wish to write yourself. You are free to use or not use any of the Arduino functions (like digital Write(), digital Read(), etc.), and instead write your own that can be optimized (for speed or size) for your specific needs. Arduino programming is 'pure' C/C++ with added Arduino function libraries and a little preprocessing performed before passing on the source to the AVR GCC compiler.

Chapter 7

Conclusion & future advancements

7.1 Conclusion

The objective of this project was to design and implement a wireless distance measurement device using an ultrasonic sensor. By using the system we can not only calculate the distance of the object but we can also locate the object. The following can be concluded from the above project-:

- The system can calculate the distance of an object without errors.
- The system can locate the object.
- The system provides a low-cost and efficient solution.
- Low-cost motion detection home security system.
- Low-cost cruise control radar system.

7.2 Future Scope

- We can use humidity sensors in the future to measure distance in a different environment.
- Using an ultrasonic sensor with better specification we can increase the distance measurement range.
- This system is used in driverless cars to detect an obstacle.
- To Avoid Car Accidents.
- And motion detection movements.

Chapter 8

Result and discussion

8.1 Result:

• The working model of the proposed distance measurement system using an ultrasonic sensor was successfully designed and implemented.

• The circuit was able to measure distances up to 400cm.

• The circuit was also able to locate the object.

• Circuit was tested to measure various distances.

• It has a fast response.

• The ultrasonic module works well.

• By using an ultrasonic sensor we were able to reduce cost and increase efficiency.

• This implementation has been readily used in the fast-growing electronic industry.

8.2 Discussions:

A)Distance measurement accuracy

• Our sensor calibration and utilization gave us a distance measurement with roughly 400cm accuracy.

• Provided that we are using the sensor to detect the presence of an object more so than the exact distance, this accuracy is tolerable.

B)Speed of detection

• It takes a maximum of three seconds for the system to detect a newly presented object, and to turn on the alarm.

C)Detection accuracy

• We believe our system is capable of detecting intruders 95%of of the time, provided that sensors were placed at the Appropriate position.

• The few times that intruders get away are when they are capable of crossing past the sensor quicker than 200 milliseconds, which is our measurement interval hardcoded into our code

IMPLEMENTATION RESULTS OF DIFFERENT SENSING DISTANCES

Distance	Overall sensing probability
1m	100%
2m	99%
3m	94%
4m	87%
5m	79%