PROJECT REPORT

On

ANTI FACE TOUCHING ALARM CAP

Submitted For Partial Fulfillment of Award of

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In

Instrumentation & Control Engineering

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CERTIFICATE

Certified that the project entitled “**ANTIFACE TOUCH ING ALARM CAP**”in the partial fulfillment of the requirements for the award of the degree of Bachelor ofTechnology “INSTRUEMENTATION AND CONTROL ENGINEERING” of Dr. APJ Abdul Kalam Technical University, is a record of students own work carried under our supervision and guidance. The project embodies result of original work and studies carried out by students and the contents do not form the basis for the award of any other degree to the candidate or to anybody else submitted by “**AKANKSHA SINGH**[1901100220003]” ,**AKHIL PAL[**1901100220005] and “**ADARSH PATEL**[1901100220002].

NITESH JAISWAL
I.C.E Proctor

DECLARATION

We the undersigned solemnly declare that the project report “ANTIFACE TOUCHING ALARM CAP” is based on our own work carried out during the course of our study under the supervision of MR. NITESH JAISWALSIR.

We assert the statements made and conclusions drawn are an outcome of our research work. We further certify that

● The work contained in the report is original and has been done by us under the general supervision of our supervisor.
● The work has not been submitted to any other Institution for any other degree/diploma/certificate in this university or any other University of India or abroad.
● We have followed all the guidelines provided by the university in writing the report.
● Whenever we have used materials (data, theoretical analysis, and text) from other sources, we have given due credit to them in the text of the report and giving their details in the references.

ACKNOWLEDGEMENT

It gives immense pleasure in bringing out this synopsis of the project entitled "**ANTI FACE TOUCHING ALARM CAP"**.We had to take the help and guideline of some respected persons, who deserve our greatest gratitude. The completion of this assignment gives us much Pleasure. We would like to show our gratitude Mr. **NITESH JAISWAL SIR** for giving us a good guideline for project throughout numerous consultations. We would also like to expand our deepest gratitude to all those who have directly and indirectly guided us in writing this project.

Many people, especially our classmates and team members itself, have made valuable comment suggestions on this proposal which gave us an inspiration to improve our project. We thank all the people for their help directly and indirectly to complete our assignment.

PREFACE

This basis for this research originally stemmed from my passion for developing better methods for ANTIFACE TOUCHING ALARM (Integrated with arduino module) in this covid time . This report is based on application of Antiface touching alarm cap (Integrated with arduino) and also on its future scope. This report elicits the system function in a lucid and under stable manner.

We have tried to cover all necessary information related to the project. This report presents the research, methodology, resulting from the project. The objective was to compile and synthesize information on project Antiface touching alarm cap based on arduino.

The objective of this report is to provide the reader with conceptual understanding and the exact idea about this “ANTIFACE TOUCHING ALARM CAP “ (Integrated with arduino module).

ABSTRACT

CHAPTER = 1

INTRODUCTION

Coronavirus disease (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has spread worldwide, with more than 88 million cases and 1.9 million fatalities as of January, 2021 WHO (2020). Maintaining social distancing, washing hands frequently, avoiding touching the face including eyes, nose, and mouth, are the majormethods associated with preventing COVID-19 transmission Chu et al. (2020). Contaminated hands have the potential to disseminate COVID-19 especially ifassociated with touching the face Macias et al. (2009). Face touching is an act that can happen without much thought, and in fact, happens with such a high occurrence that reducing it could mitigate a heavy source of transmission.

Beyond simple skin irritations, face touching has been linked to emotional and cognitive processes Barroso et al. (1980), Mueller et al. (2019), increasing with attentiveness while tasks are being performed, as well as with increasing pressure and anxiety Harrigan (1985).For such common underlying motives,it is no surprise to see that on average a person touches their face 23 times in an hour Kwok et al. (2015). Given that the primary source of COVID-19 transmission is through contact with respiratory droplets [via the nose, mouth, or eyes, either directly from another individual or picked up from a surface Pisharady and Saerbeck (2015)], avoiding face touching is of a great value. Developing a system to avoid face touching outright by stopping hand movement raises two main challenges. First of all, a system must predict rather than detect when a hand movement will result in face touching well before the hand reaches the face. Secondly, once a hand movement is predicted to result in face touching, a sensory feedback must be presented immediately in order to stop the hand movement and thus avoid face touching. Note that the prediction and response components are evaluated separately to better analyze the capabilities/limits of each components.

1.1) PREDICTING HAND MOVEMENT

Predicting face touching requires precise hand tracking. Two common approaches for tracking hand movement are vision-based approaches Al-Shamayleh et al. (2018) and wearable sensor-based approaches Jiang X. et al. (2017), Mummadi et al. (2018). A combination of these have also shown potential for enhanced accuracy Jiang S. et al. (2017),Siddiqui and Chan (2020). Vision-based hand tracking utilizes camera networks Pisharady and Saerbeck (2015), and as mentioned, can be supplemented with wearable devices such as motion sensor systems placed along the body, to map either whole body or hand movement Liu et al. (2019). One particular wearable device often used is the inertial measurement unit (IMU), capable of collecting data along six degrees of freedom, with three additional angular sensors to enable a total of nine inputs. Found in many smart watches, the IMU is equipped with an accelerometer and gyroscope, providing an inexpensive option that is not only accurate, taking measures along all three dimensions for each of its components, but also one that does not require complementary infrastructure to operate. This allows the IMU to be versatile yet effective in the context in which it is implemented. Paired with an appropriate machine learning model, the data from an IMU can be used to notify a user how often they are touching their face, as well as whether they have done so after each movement. IMUs have been used to correctly identify a completed face touch with high accuracy Fu and Yu (2017), Rivera et al. (2017). Even though detecting face touching greatly upports awareness training, it does not prevent face touching from happening. The motivation of the proposed system is to apply machine learning in order to predict face touching and provide vibrotactile feedback to prevent it rather than detecting it.

1.2) SENSORY FEEDBACK FOR MOTOR CONTROL

Along with the development of hand tracking, the user must also be notified of their impending action before it is committed, with ample time for them to react. The notification must be delivered through a medium that will elicit the fastest response time. The three feedback modalities of relevance are visual, auditory, and vibrotactile, and it has been shown that vibrotactile feedback produces the fastest response times Ng and Chan (2012). Vibrotactile feedback systems can be used to achieve this, with benefits similar to that of an IMU, being cost-effective, and easily implemented into a wearable device.

A low-cost wearable system that prevents people from touching their face, and in the long run, assist people in becoming more aware of their face-touching, is proposed. The system exploits widespread and off-the-shelf smartwatches to track the human hand and provide timely notification of hand movement in order to stop touching the face. The decision to build the system with just a smartwatch makes it immediately available to people, without the requirement of building or wearing additional hardware. The system assumes a smartwatch with an IMU module and a vibration motor; a reasonable assumption as most commercial smartwatches are equipped with such hardware. Although preventing the spread of COVID-19 is the most evident, the system can be adapted for other applications such as habit reversal therapy (HRT) Bate et al. (2011) and treatment of chronic eye rubbing McMonnies (2008).

The main contributions of this paper are summarized as follows:

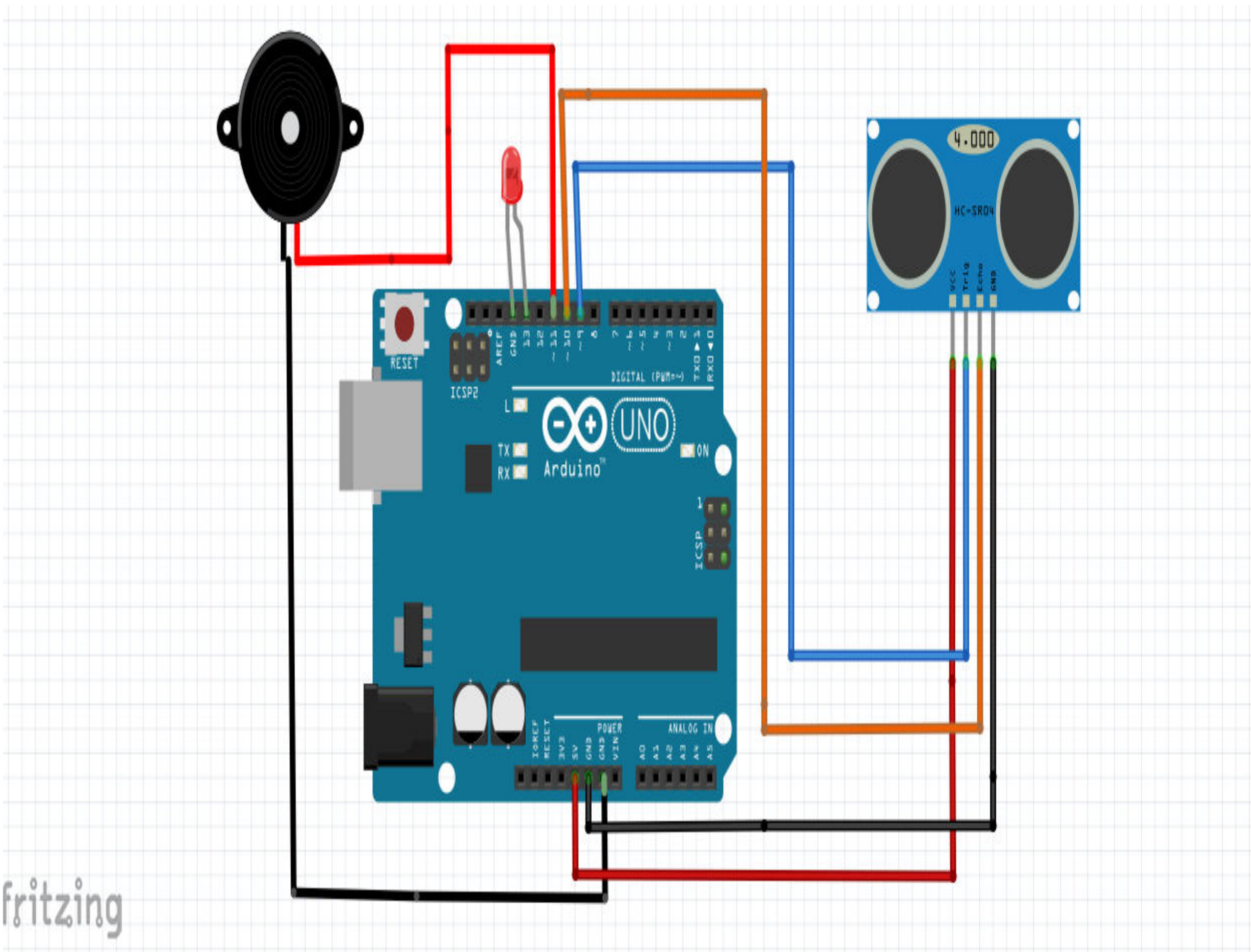
1.Proposing a conceptual approach that utilizes IMU data to predict if a hand movement would result in face touching and provides real-time sensory feedback to avoid face touching.

2. Developing a model for tracking hand movement and predicting face touching using convolutional neural networks based on IMU data. To train the model, a database of 4,800 hand motion trials recording with 40 users under three conditions, sitting, standing, and walking is built.

3. Presenting a psychophysical study with 30 participants to compare the effectiveness of sensory feedback modalities, namely visual, auditory, and vibrotactile, to stop the hand while already in motion before reaching the face. The response time and success rate were used as the evaluation metrics for the comparison.

CHAPTER=2
ARCHITECTURE OF THE SYSTEM

2.1) <u>CIRCUIT DIAGRAM</u>



2.2) <u>**COMPONENTS DESCRIPTION**</u>

2.2.1) Ultrasonic Distance Sensor - HC-SR04

This is the HC-SR04 ultrasonic distance sensor. This economical sensor provides 2cm to 400cm of non-contact measurement functionality with a ranging accuracy that can reach up to 3mm. Each HC-SR04 module includes an ultrasonic transmitter, a receiver and a control circuit.

There are only four pins that you need to worry about on the HC-SR04: VCC (Power), Trig (Trigger), Echo (Receive), and GND (Ground). You will find this sensor very easy to set up and use for your next range-finding project!

This sensor has additional control circuitry that can prevent inconsistent "bouncy" data depending on the application.

2.2.2) Buzzer

An audio signaling device like a beeper or buzzer may be electromechanical or piezoelectric or mechanical type. The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc. Based on the various designs, it can generate different sounds like alarm, music, bell & siren.

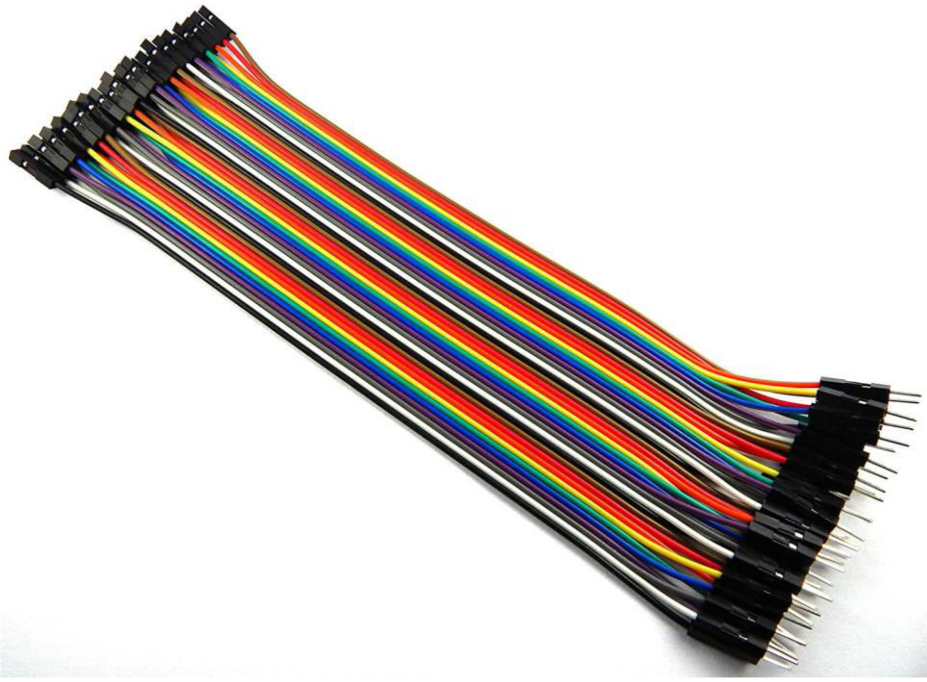
The **pin configuration of the buzzer** is shown below. It includes two pins namely positive and negative. The positive terminal of this is represented with the '+' symbol or a longer terminal. This terminal is powered through 6Volts whereas the negative terminal is represented with the '-'symbol or short terminal and it is connected to the GND terminal.

Working Principle

The working principle of a buzzer depends on the theory that, once the voltage is given across a piezoelectric material, then a pressure difference is produced. A piezo type includes piezo crystals among two conductors.

Once a potential disparity is given across these crystals, then they thrust one conductor & drag the additional conductor through their internal property. So this continuous action will produce a sharp sound signal.

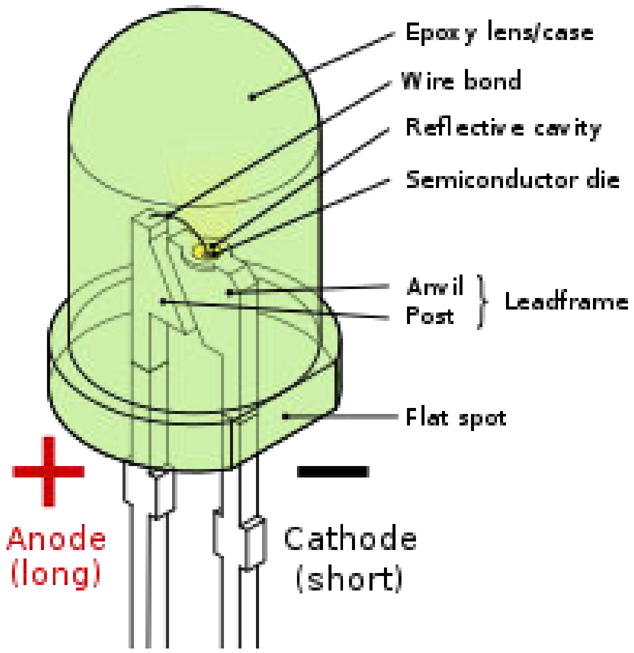
2.2.3) FEMALE JUMPER WIRE



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

Though jumper wires come in a variety of colors, the colors don’t actually means anything. This means that a red jumper wire is technically the same as a black one. But the colors can be used to your advantage in order to differentiate between types of connections, such as ground or power.

2.2.4) LED

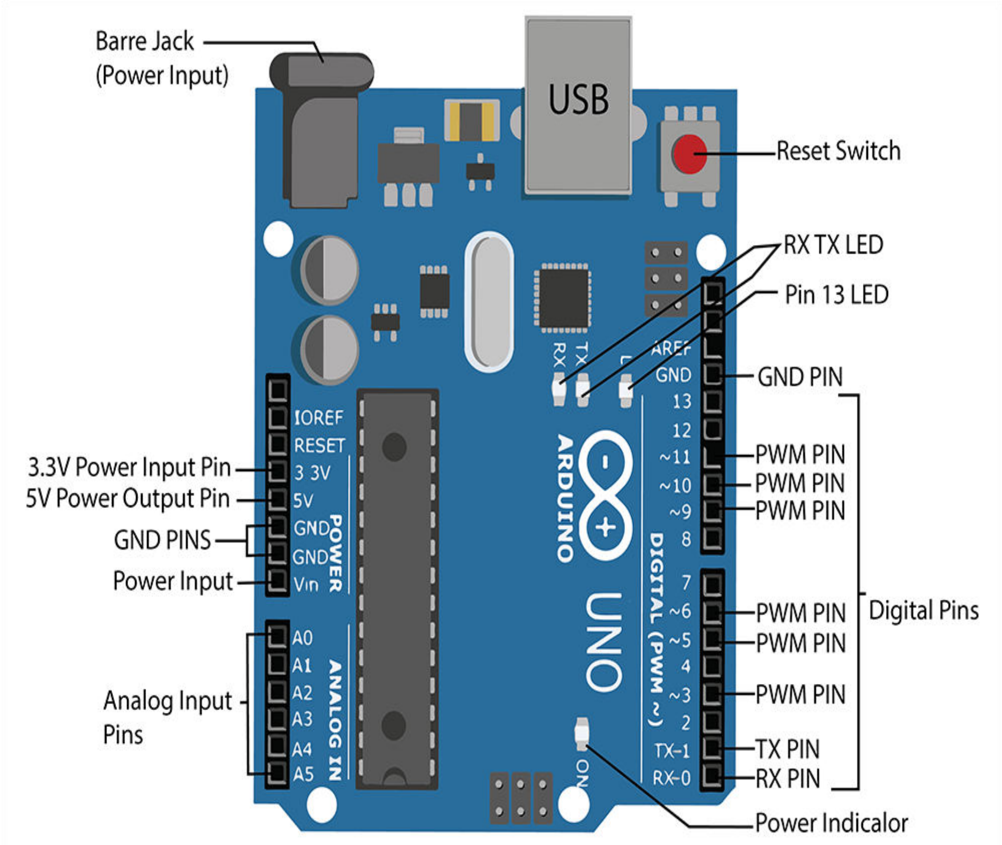


A **light-emitting diode** (**LED**) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor. White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device.

The main semiconductor materials used to manufacture LEDs are:

- **Indium gallium nitride (InGaN):** blue, green and ultraviolet high-brightness LEDs.
- **Aluminum gallium indium phosphide (AlGaInP):** yellow, orange and red high-brightness LEDs
- **Aluminum gallium arsenide (AlGaAs):** red and infrared LEDs
- **Gallium phosphide (GaP):** yellow and green LEDs

2.2.5) ARDUINO UNO



Arduino/Genuino 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 worring 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.

2.3) WORKING

The circuit diagram of the alarm cap is shown in Fig. 2. It is built around Arduino Uno, four HC-SR04 ultrasonic sensors, and a few other components.

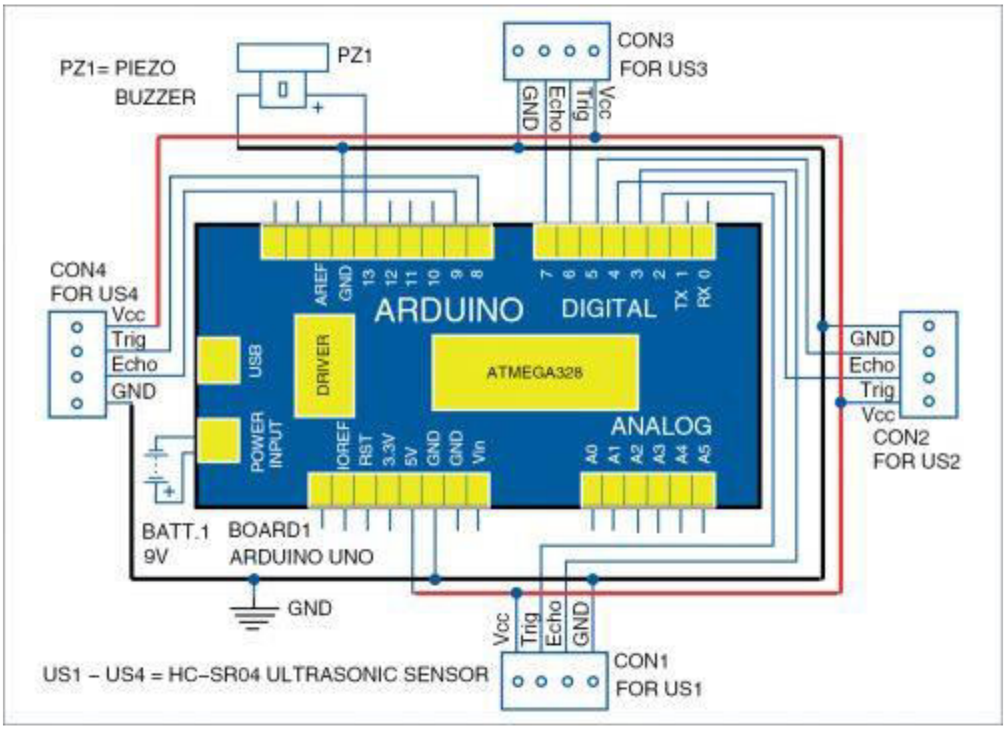


Fig. 2 circuit diagram of antiface touching alarm

HC-SR04 ultrasonic sensor utilises sonar to determine distance from an object (or humans as in this case). It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package. Its range is from 2cm to 400cm with an accuracy of 5mm. The module consists of an ultrasonic transmitter, receiver, and control circuit. HC-SR04 ultrasonic sensor is shown in Fig. 3. It has the following four pins, namely:

1. VCC: +5V DC
2. Trig: Trigger (input)
3. Echo: Output
4. GND: Ground

The working of HC-SR04 is simple. When the sensor is triggered (a short 10µs pulse to the trigger input pin 2 from Arduino Uno board), the transmitter sends a high-frequency sound signal at 40kHz. The transmitted signal reflects back from the nearby object and is picked up by the receiver.

The output of HC-SR04 (echo-pin 3) is a pulse where the width of the pulse is proportional to the distance of the object. The width of the pulse can be calculated by the pulseIn( ) function in the code. Arduino program calculates the distance of the objects in all its four directions.

Here, four ultrasonic sensors are placed in four directions and connected to Arduino Uno. Each sensor collects the distance of the object in all four directions and compares it with the distance safety value defined in the program. When the user comes too close to another person in any of the directions, an alarm sound is produced.

Pin connections of Arduino with components are shown in the Table.

Arduino Uno Pin Connections with Components

Arduino Uno pins	Connected to Sensors	
5V pin	Connected to VCC pins of HC-SR04	
Pin 2	HC-SR04-1 Trigger Pin	Ultrasonic Sensor (US1)
Pin 3	HC-SR04-1 Echo Pin	Ultrasonic Sensor (US1)
Pin 4	HC-SR04-2 Trigger Pin	Ultrasonic Sensor (US2)
Pin 5	HC-SR04-2 Echo Pin	Ultrasonic Sensor (US2)
Pin 6	HC-SR04-3 Trigger Pin	Ultrasonic Sensor (US3)
Pin 7	HC-SR04-3 Echo Pin	Ultrasonic Sensor (US3)
Pin 8	HC-SR04-4 Trigger Pin	Ultrasonic Sensor (US4)
Pin 9	HC-SR04-5 Echo Pin	Ultrasonic Sensor (US4)
Pin 13	+Ve pin of PZ1	Piezo Buzzer (PZ1)
GND	-Ve pin of PZ1 and GND pin of HC-SR04	

2.4) SOFTWARE

The circuit operation is performed through the software program loaded into the internal memory of Arduino Uno. The program is simple and easy to understand. Comments are given at the end of each command line.

The code starts with defining the pin numbers. Trigger and echo pins are needed for each sensor. So, a total of eight pins are needed to connect to the Arduino board. The buzzer is used, so you need to define the buzzer pin in the code. Here, two variables are needed for each sensor: the duration received from the sensor and the distance to be calculated from the pulse duration.

Set the input and output pins of the four sensors and the buzzer. Also set the serial communication for monitoring the working of the four HC-SR04 sensors. Now in the loop, start initialising the trigger pin of the sensor to the high state for ten microseconds, and then using Pulse in( ) function read the output from the sensor and calculate the distance in centimetres. The initialisation is similar for all four HC-SR04 sensors.

There are four variables: distance1, distance2, distance3, and distance4 to mark the distance from all four directions. Perform logical ‘or’ operation. Next, use an ‘if’ statement to compare with the safe distance and turn on the buzzer if the distance crosses the threshold limit.

2.5) CODE

```
  //Dynamic Innovator

const int trigPin = 9;
const int echoPin = 10;
const int buzzer = 11;
const int ledPin = 13;

// defines variables
long duration;
int distance;
int safetyDistance;


void setup() {
pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
pinMode(echoPin, INPUT); // Sets the echoPin as an Input
pinMode(buzzer, OUTPUT);
pinMode(ledPin, OUTPUT);
Serial.begin(9600); // Starts the serial communication
}


void loop() {
// Clears the trigPin
digitalWrite(trigPin, LOW);
delayMicroseconds(2);

// Sets the trigPin on HIGH state for 10 micro seconds
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);

// Reads the echoPin, returns the sound wave travel time in microseconds
duration = pulseIn(echoPin, HIGH);

// Calculating the distance
distance= duration*0.034/2;

safetyDistance = distance;
if (safetyDistance <= 22
){ // Enter the Distance
  digitalWrite(buzzer, HIGH);
  digitalWrite(ledPin, HIGH);
}
else{
  digitalWrite(buzzer, LOW);
  digitalWrite(ledPin, LOW);
}

// Prints the distance on the Serial Monitor
Serial.print("Distance: ");
Serial.println(distance);
}
```

CHAPTER=3

PROPOSED METHODOLOGY

This chapter contains the methodology and the basic foundation used to carry out this project. The project is based on five main phases: Pilot Study, Design of Prototype, Implementation of Design, Code Used and Testing.

3.1) Pilot Study

A research study was conducted before the phase of design and implementation. The research aimed to understand the nature, architecture and security challenges of implementing an anti face touching alarm cap.

Gathering sufficient information regarding the main theme of this thesis; The architecture design of common IOT applications . The first task consisted of figuring out the common architecture of IoT systems and understanding the main three layers that are mentioned in the pilot study leading us to set-up a foundation of the physical environment and classifying the overall structure for our own IoT system represented by anti face touching alarm cap.

3.2) Design of Prototype

A complete specification for the prototype is derived and considered from the pilot study. The sensor detects face touching accurately up to 7 inches away from the sensor on the hat, which is roughly the average face length. To use the built device, all you need to do is turn the power switch on while wearing the hat, and it will automatically begin sensing face touches.

3.3) Implementation of the Design

The phase of development and implementation is conducted with an iterative strategy to construct the prototype that would match the specifications of the design. By breaking down the design into small chunks, we are able to develop and test in repeated sequences. In each iteration, new features can be developed and tested until we have a fully functional system that fulfills the purpose of the thesis.

3.4) Test Plan

An elaborate test plan that encapsulates all the functionality of the prototype will be written. The test plan is used to verify that the prototype lives up to the expectation. The goal is to continuously update and develop the test plan parallel to the implementation of the design. This will lead to an iterative working environment where implementation continuously will be tested against the testbench. The ideal goal is that the prototype will have an evaluated test for every state of the running implementation.

We aim to restrict the tests to three main categories: Software Tests, Hardware tests and "Conclusive-End" tests where the final prototype, combined with both hardware and software, will be tested. The results of the tests will strictly focus on functionality. This will influence the way we write tests and the test plan itself. Results of the hardware and software tests will mostly be used to collect data for further development while the end tests will be neatly analyzed for future research and conclusions.

CHAPTER=4

ADVANTAGES AND DISADVANTAGES

4.1) ADVANTAGE OF ANTIFACE ALARM SYSTEM

- Every time when you try to touch your face, The ANTI FACE TOUCHING ALARM CAP reminds you to avoid face touching through buzzer.

- Sensor of ANTI FACE TOUCHING ALARM CAP can be used in doors which gives you the idea of someone's presence behind the door via alarm.

- These sensors can be used on back of the cars, which detect object to avoid accident while reversing.

- You can reduce your chances of being infected or spreading COVID-19 through social distancing, these sensors warn you through alarm to maintain distance in crowd.

4.2) DISADVANTAGE OF ANTIFACE ALARM SYSTEM

- These **sensor when used in car, it cannot differentiate between the objects.**

Using these sensors in crowded places as social distancing gadget makes you irritate by continues alarming