A SPYSHEILD DEVICE TO PROVIDE PERSONAL SAFETY AND SECURITY

Submitted in partial fulfilment of the requirements for the award of the Degree of

BACHELOR OF TECHNOLOGY

in

COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY)

Submitted By

N. J. R. SAI MANIKANTA

22ME5A4603

Under the Guidance of

Dr. Shameena Begum

Professor & Head

DEPARTMENT OF CSE (CYBER SECURITY)

RAMACHANDRA COLLEGE OF ENGINEERING (AUTONOMOUS)

(Approved by AICTE, Affiliated to JNTUK, Kakinada)

Accredited by NBA, NAAC A+

NH-16 Bypass, Vatluru (V), Eluru -534007, W.G. Dist., A.P

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DEPARTMENT OF CSE (CYBER SECURITY)

CERTIFICATE

This is to certify that N. Janaki Ramanjaneya Sai Manikanta (**22ME5A4603)** students of Bachelor of Technology in Computer Science & Engineering (Cyber Security) have successfully completed their project work entitled **"A spySHEild Device To Provide Personal Safety and Security"** at Ramachandra College of Engineering, Vatluru during the Academic Year 2023-2024

Project Guide

Dr. Shameena Begum

Head of the Department

CSE(CS)

External Examiner

DECLARATION

I am, N. Janaki Ramanjaneya Sai Manikanta (22ME5A4603) hereby declares the project report titled "**A spySHEild Device To Provide Personal Safety and Security"** under the supervision of **Dr. Shameena Begum, Professor & Head, Department of CSE(Cyber Security)** is submitted in partial fulfillment of the requirements for the award of the degree of Bachelor in CSE(Cyber Security).

This is a record of work carried out by me and the results embodied in this project have not been reproduced or copied from any source. The results embodied in this project report haven't been submitted to any other University or Institute for the award of any other degree or diploma.

N. Janaki Ramanjaneya Sai Manikanta

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Project Associate
N. J. R. Sai Manikanta

CHAPTER - 01

INTRODUCTION

CHAPTER-1
INTRODUCTION

1.1. Introduction

Women safety is the growing concern globally in recent years. According to various studies and surveys, a significant percent of women feels insecure in public places. Many women require access to instruments that can provide quick support in dangerous situations despite attempts to raise awareness and implement legislative reforms.

There is a critical need for efficient safety solutions due to the rise in personal safety risks, including assaults, stalking, and harassment. Existing personal safety systems frequently have limits in real time monitoring, detection accuracy, and ease of use.

A spySHEild device has been proposed in the present invention which provides protection and calls for assistance in an emergency through a microphone attached to a camera or by a button on an external device. The spySHEild device integrates with an application for comprehensive monitoring and alert capabilities. The spySHEild device includes a spySHEild camera and a spySHEild application

- **Forms and Context of Violence against Women**

  Violence against women and girls is a major public issue globally. This study was conducted to assess the safety and security of women and girls in public transport and to identify factors contributing to violence.

  Child sexual abuse involves the sexual exploitation of a child by an adult, adolescent, or older child. The abuse does not always involve physical force; children are often bribed or verbally coerced into sexual acts.

  Ejiro Umukoro and Akiode Afolabi mentioned homeowner-house help violence, boyfriend-girlfriend violence, violence on widows, police-sex worker violence, police-citizen violence, visitor-caught-in-lock-down child rape. [1]

- **Crimes against Women in India**

Based on prevalence surveys in some countries in the Asian region, nearly half of the women have experienced physical and sexual violence at the hands of an intimate partner.

According to the National Crime Records Bureau (NCRB) of India; 89,546 cases of cruelty by husband and relatives; 21,397 cases of rape; 11,009 cases of sexual harassment and 5,650 cases of dowry harassment were reported in India during the year 2009.

[Source: National Crime Records Bureau (NCRB) India, 2009]

The latest data from the National Crime Records Bureau (NCRB) reveals that the rate of crimes against women in India (calculated as crimes per 100,000 of the women population) increased by 12.9% between 2018 and 2022. In India, the reported crimes against women per 100,000 women population is 66.4 in 2022, in comparison with 58.8 in 2018. This increase could be due to a number of factors, including an increase in actual crimes, an improvement in reporting mechanisms, and a growing willingness of women to speak out about their experiences of violence.

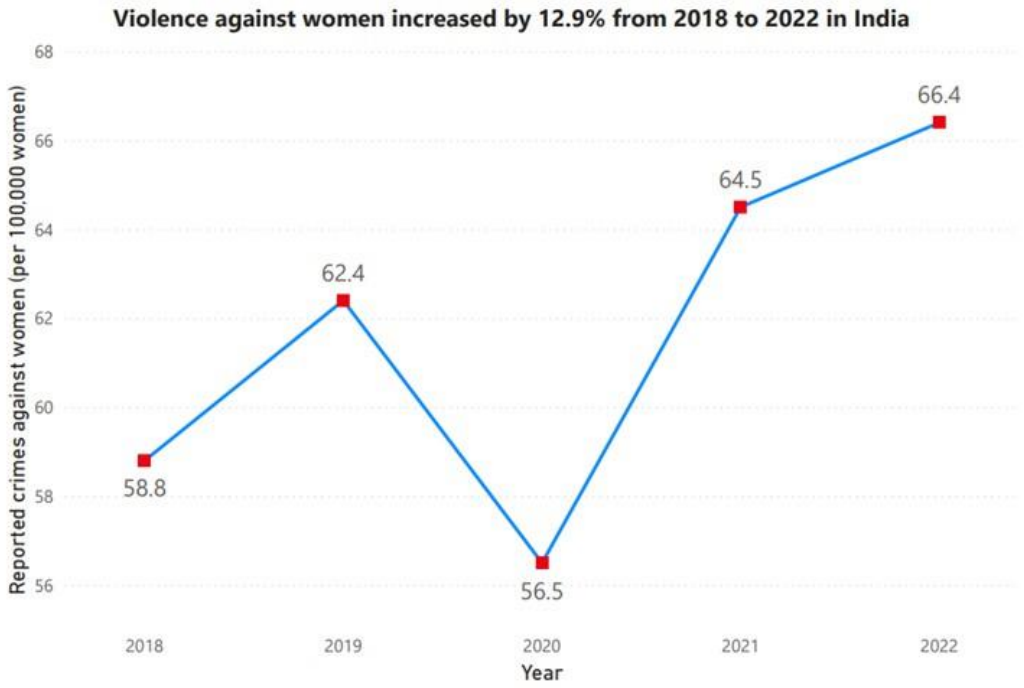

Fig 1.0. Violence against women increased by 12.9% from 2018 to 2020 in India

According to the "Crime in India 2022" report by NCRB, 13 States and Union Territories had crime rates against women higher than the national average of 66.4. Although Uttar Pradesh reported the highest number of cases (15% of India's total), its crime rate was 58.6, which is below the national average.

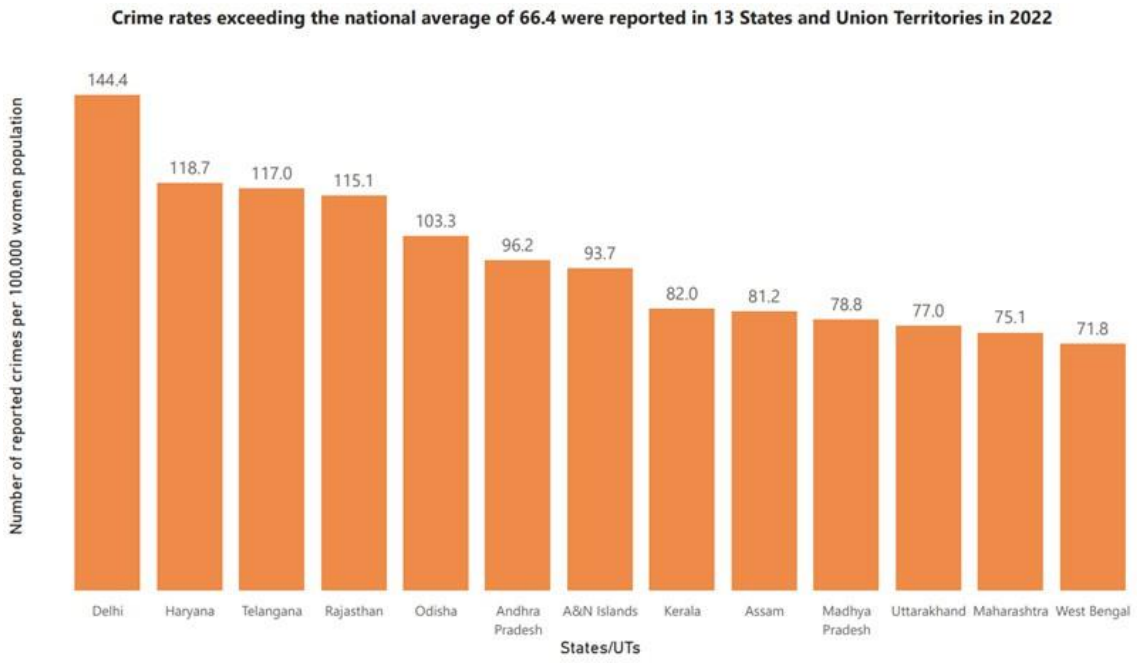

Fig 1.1: Crime rates exceeding the national average of 66.4 were reported in 13 States and Union Territories in 2022

Sharma stated that India takes women's safety seriously and has introduced strict laws over time, such as the Protection of Women from Domestic Violence Act (2005).

However, according to NCRB records, the most common crimes against women under the Indian Penal Code (IPC) are:

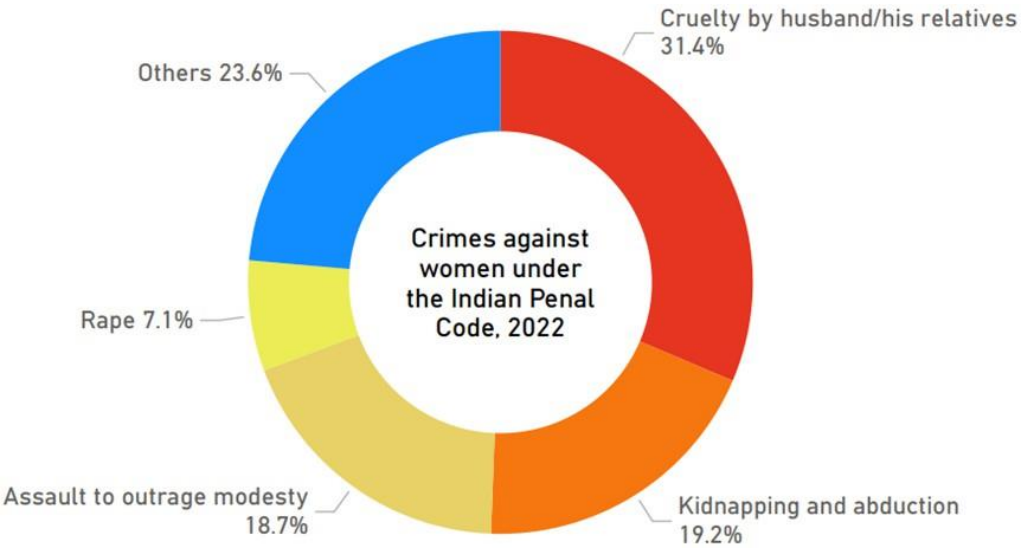

Fig 1.2 : Crimes against women under the Indian Penal Code,2022

During the COVID-19 pandemic, the crime rate per 100,000 women population jumped from 56.5 in 2020, to 64.5 in 2021. A number of factors could have contributed to this, including reverse migration, social isolation, and economic strain.

Women face a higher risk of gender-based violence in the workplace. Even though the POSH Act (2013) was created to protect them, harassment at work continues to be a serious issue. As per NCRB, the victim count for workplace sexual harassment against women has increased from 402 in 2018 to 422 in 2022.This is concerning because many women do not report harassment due to fear of consequences, lack of awareness, and societal pressure.

A national survey in Madives on "Women's Health and Life Experiences" showed that 1 in 3 Maldivian women aged between 15-49 reported experiencing sime form of physical or sexual violence at least once during their lifetime.

Source:http://minivannews.com/files/2010/10/Maldives-Study-on-Womens-Health-and-Life-Experiences-

Globally too, Violence Against Women and Girls (VAWG) is a serious and pervasive issue. According to the World Health Organization, at least one in three women worldwide has experienced physical or sexual violence in their lifetime, and nearly one in 10 girls has experienced forced intercourse or other sexual acts.

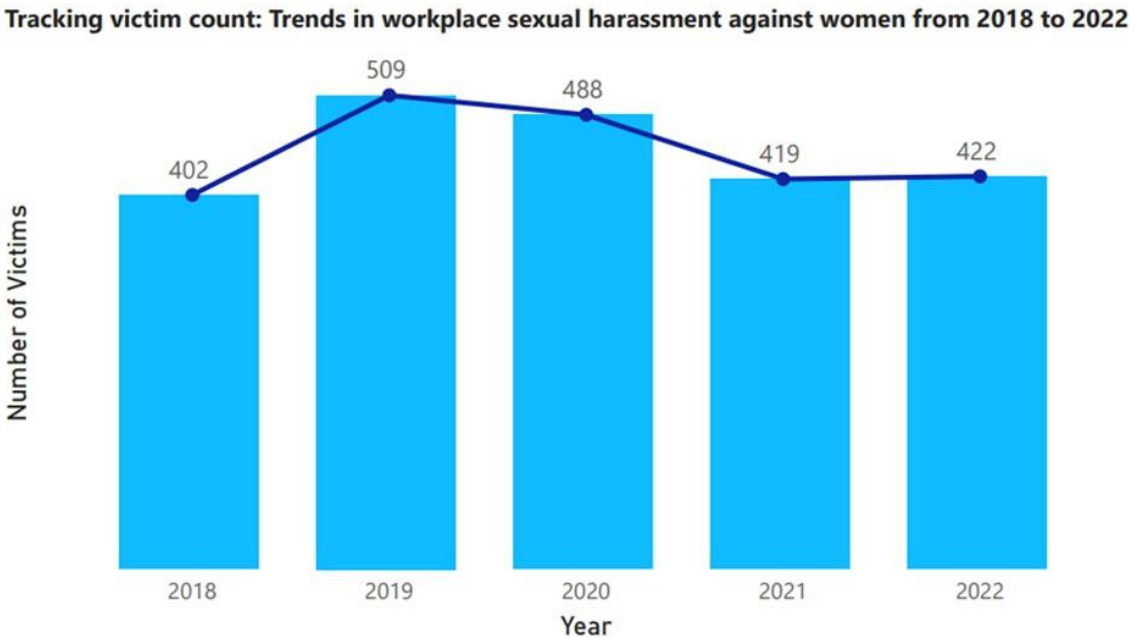

Fig 1.3: Tracking Victim count: Trends in workplace sexual harassment against women from 2018 to 2022

The finding shows that 50.8% of women and girls have experienced more than one type of violence while using public transport. The results indicated that six variables significantly contributed to violence. These variables were age, marital status, type of public transport used, travel time, facilities, and management of public transport services.[2]

As per the reports from the Women's Empowerment and Development Organization (WEDO) and the National Organization for Women (NOW), crimes against women

have been steadily rising from 2000 to 2024.The statistics show a significant rise in reported incidents over the years, with the numbers steadily growing. The data from NOW consistently reflects higher figures than WEDO, indicating either an actual rise in crimes or improved reporting mechanisms.

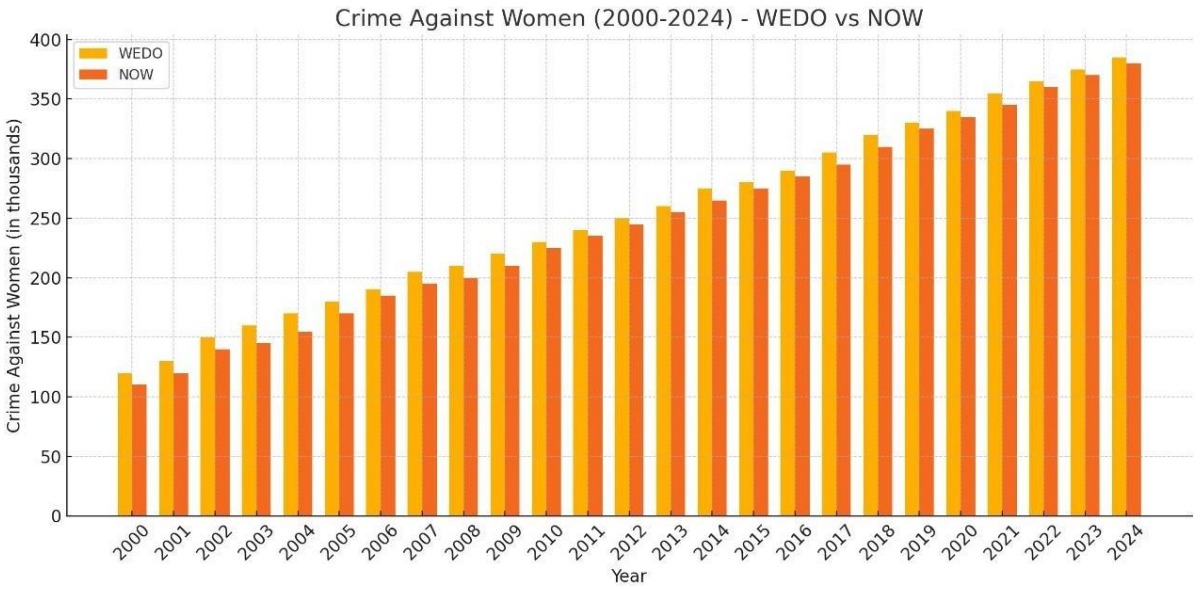

Fig 1.4 :(Crime Against Women (2000-2024) - WEDO vs NOW)

1.2. Overview of the Project

A device for monitoring and tracking women safety by motion detection has been proposed in the present invention. The proposed invention includes the spySHEild camera which is embedded with a distance sensor, E-SIM, an emergency alert button Bluetooth, GPS tracking and a camera module to record voice, video, and images

1.3. Objective

The main objective of the proposed invention is to enhance personal safety, crime deterrence, evidence collection, location tracking, and remote monitoring

1.4. Scope of the Project

The solution offers a wide range of features, including media-based evidence collection, real-time emergency response, and personal security. It could be used in a variety of fields, including business security, law enforcement support, and personal safety.

It is a personal safety device designed to provide real-time GPS tracking, distance sensing, and automatic camera activation. It offers an emergency alert system that notifies pre-registered contacts, law enforcement, and crime patrol units. The device is equipped with a user-friendly interface and customizable settings for personalized use.

1.5. Expected Outcome

This leads to a safer environment, both at an individual and societal level, by enabling quicker responses and better protection in emergencies.

It also

- Measures the Proximity of a Person
- Real-Time Monitoring
- Captures Video and Pictures
- Tracks Live Location
- Sends Emergency Alerts
- Track a Person's Location and Movements Remotely.

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CHAPTER-2

LITERATURE REVIEW

2. LITERATURE REVIEW

The growing need for personal safety, particularly for women, has driven the development of advanced technologies such as mobile applications and wearable devices that leverage IoT, AI, GPS tracking, automated alerts, and real-time monitoring, forming the foundation for innovations like the spySHEild project.

Current Technologies in Women's Safety Solutions

Current safety systems can be broadly grouped into three categories:

2.1. Mobile Applications

2.1.1. Voice-Activated Apps

- These apps recognize the user and activate the app functionality even when the mobile keypad locked. The GPS module tracks the longitude and latitude to trace an exact location of a user and sends the pre-stored emergency message including location to the registered contact numbers. The Audio Recording module starts the recording of the conversation for five minutes and stored as evidences.The message goes in queue if network problem and send when network gets available. A notification is generated for successful deliver message. Also user can select contact through voice based contact list and make a call [1] .

  Note: The spoken keyword converted into a text to compare with the registered keyword.

2.1.2. Shake Detection Apps

- These apps are IPROB apps,used to provide safety to women by just shaking the mobile phones above the predefined threshold value to automatically activate the system. These apps analysis the surrounding noise to test the emergency,then alert the emergency contacts.If the registered mobile phone os on silent, this by switching the phone to general mode and continuously plays a voice message saying, "YOUR CHILD IS IN TROUBLE PLZ HELP...PLZ HELP…" until acknowledged. If a register contact confirms a PROB then appropriate emergency services like ambulance, fire brigade are alerted. if a registered contact responds with an audible notification, the app connects and activates the speakerphone on the victim's phone to facilitate communication. An integrated tri-axial accelerometer used to evaluate the unique movements that a phone experiences as threshold [2] .

2.1.3. Spy Camera and Rescue Systems

- The SCIWARS app (Spy Camera Identification and Women Attack Rescue System) consists of two modules aims to enhance personal safety.A first module act as an intelligent alerts system that detects the infrared rays coming from every Night-vision hidden cameras placed in changing rooms hotels room etc and also informed the user about unsafe place through message.Now it's the user responsibility whether to register a complaint or not by forwarding the notification with the location to legal authorities such as Police. The second module will get activated by pressing any key continuously which will provide the help to the victim from physic attack in unsafe situation. It sends the emergency message containing location to register contacts. It also records the voice and captures the images of the surrounding for 45 seconds. This information also stored in secret location of mobile for future evidences. This app also able to converts the receiver mobile profile from silent to general mode, and also supports the auto-call receiving system at victim side [3] .

2.1.4. SOS Apps

- An innovative Android application is designed to enhance security in two key scenarios.The First module provide security to Women at Emergency Situations propose a Save Our Souls (SOS) app to provides the security on a single click of SOS button for the women travelling at night or alone. No need to unlock the screen, instead by just pressing the power button it directly triggers the application to run at the background, to send the emergency message including the location in the form of latitude and longitude to the registered contacts. The second module proposes an android based home security system that provides security of house belongings and Senior Citizen in the user absence. Since the security of senior citizen is always a concern with increasing number of robbery incidents. This app informs the user about an attempt of intrusion activity at home through a message and a feedback SMS triggers an alarm in the house [4] .

2.1.5. Comprehensive Safety Apps

- An innovative mobile application is designed to enhance safety and provide assistance in emergencies through a variety of features. With a single click of an SOS button,sends a message containing the location and/ or audio- video call to the guardian number. At receiver touch the location URL in the message to view it in the Google Map. It also provides different help tools like First-Aid help, Fake Call Help and video call. The First-Aid help tool provides the help on various health issue problems occurred at an accidental or emergency situation during the night time. First aid help for various problems are as: unconscious and not breathing, choking, bleeding heavily, burns, heart attack, diabetes etc. The Fake call help to escape from the meetings- parties at a time when women start feeling uncomfortable and think that, “if someone calls me then I can leave this place”. Fake call rings tone same as that of normal incoming call ring and once call accepted it stop ringing. It also supports Fake Hang Up option. The guardian contacts are by-default for this app, but it able to search the cops, firemen, hospitals contacts nearby to your location. It also sends the audio-video recording via Email-Gmail of emergency situation taken by the user where user unable to speak or tell the circumstances [5] .

2.2. Advanced AI-Based Systems

2.2.1. Emotion and Behavior Recognition

An advanced automated system has been developed to predict unsafe situations by analyzing female emotions such as fear and anger within a monitored area. The process begins with surveillance through two cameras strategically placed to gather different data [10].

- **Step 1:-** At a higher altitude camera2 placed to obtain the body movements as well as to provide the surveillance. If the population density calculated for a given frame contain more than fifteen individuals then such situations are not consider for further processing since the chances of attack in the crowded place are less.For smaller groups, Camera 1 focuses on facial analysis, capturing images to determine the distance between individuals.The system compares this distance against a predefined threshold, identifying unsafe scenarios, if the variance is small indicating the safe distance whereas the large variance indicate the unsafe situation to activate the gender detection section.

- **Step 2:-** It check the gender as male or female base on the facial features (correlation value) to identify at least one female to activate the system.

- **Step 3** employs a Facial Expression Recognition System (FERS) to analyze individual actions based on emotions. This step involves four sub-processes:
    1. **Acquisition:** Detecting and capturing the face, primarily focusing on head position.
    2. **Extraction:** Pre-processing the image to extract facial features.
    3. **Gesture Recognition:** Classifying features into emotional categories such as smile, fear, or anger. This step provides detailed facial expressions critical for identifying chaotic situations.

    4. **GSM module and alarm system:** - If emotion on female face is detected as fear/ anger, and notification generated and send to the control room. Also it activates the surrounding siren. The system able to capture and store the face expression of suspect as for the evidences.

Since the system predicts about an unsafe situation hence require advance technology.

2.3. Devices with Microcontroller Integration

2.3.1. Devil Will Cry Defence Emergency Alarm in Keychain for Women Safety | Security Personal Protection Device

Fig 2.0 : (Devil Will Cry Defence Emergency Alarm in Keychain for Women Safety)

Fig 2.1: (Suitable for any age groups)

Fig 2.2 (Dedicated alarm function for emergency Purposes)

Fig 2.3 ;(Inbuilt torch will helpful during night times

- **Functionality of Devil Will Cry Defence Emergency Alarm:**

  The Devil Will Cry Defence Emergency Alarm is a small, keychain-sized safety device that helps users in emergencies by producing an extremely loud **140-decibel siren**—comparable to a military jet taking off—to attract attention and scare off attackers. It is activated simply by pulling the hand strap, requiring no complex actions or thinking in stressful situations. The device also includes a **built-in LED torch**, which is handy for navigating dark environments. Its compact design allows it to be attached to bags, purses, or keychains for easy access. The loud siren provides a critical window of time for the user to escape danger while drawing the attention of bystanders.[11]

2.3.2. Women Safety Device with GPS Tracking & Alerts(Button, GSM, DHT11)

- The Women Safety Device with GPS Tracking & Alerts is a compact and easy-to-use gadget designed for personal safety. In an emergency, you press a button on the device, which triggers it to send your real-time location through a GPS module. This location is shared via SMS using a GSM module to pre-selected contacts, like family or authorities, so they can help you. It also has a DHT11 sensor that detects environmental conditions, like temperature and humidity, which can add extra information about your surroundings. The device aims to quickly alert trusted people and provide them with your location during critical situations.

2.3.3. Women Safety Device with GPS Tracking and Alerts(Smart Band)

- The "Women Safety Device with GPS Tracking and Alerts" is a wearable smart band designed to enhance personal safety. This device continuously monitors the user's physiological signals, such as heart rate and body temperature, to detect distress. In an emergency, it automatically sends the user's location coordinates to the nearest police station, selected family members, and nearby individuals who have the associated application installed. This immediate alert system facilitates rapid assistance from authorities and the public. The device integrates hardware components like sensors and GPS modules with a smartphone application that has internet access, ensuring seamless communication and real-time tracking.[13]

2.3.4. All-in-One Intelligent Safety System for Women Security

- The All-in-One Intelligent Safety System for Women Security is a multifunctional device designed to ensure women's safety during emergencies. It features a manual activation mechanism using a pressure switch, which triggers several safety measures. Upon activation, the device emits a loud alarm to attract attention and deter attackers. It also includes a self-defense mechanism, where tear gas is released to temporarily incapacitate the attacker, giving the user a chance to escape. Additionally, the device tracks the user's location and sends it to predefined contacts or authorities to facilitate quick assistance. This combination of features provides immediate protection, self-defense, and the ability to summon help effectively.[14]

2.3.5. Wearable Safety Devices

- These devices propose an automated highly reliable women security device which consist of the advanced sensors embedded in a wearable dresses. It consist of advanced sensors, GSM and ATMEGA8 microcontroller with ARDUINO tool which keep user under observation at all the time. It monitors the heart beat-rate, temperature and vibration in body through sensors to check for uneasy situation. In such situation it will activate the GPS module to track the location and wireless camera to capture the images that get send to the control room of the receiver through GSM modules to take necessary actions. At the same time processor activate the mice unit with amplifier which strengthens the voice of the women to screams or shout above the threshold limit [6].

2.3.6. Self-Defense Belts

- A portable device as a belt which is automatically activated base on the pressure difference crosses over the threshold in unsafe situation. A GPS module track the location and sends the emergency messages to three emergency contacts every two minutes with updated location through GSM. The system also activates the screaming alarm that uses a siren, to call out for help and also generates an electric shock to harm the attacker for self-defense which may help the victim to escape. The device mainly consists of micro controller on the ATMega328 board which programmed using the ARDUINO programming language [7].

2.3.7. Multi-functional Devices

- The “Suraksha” device is an advanced and easy-to-operate women’s security solution, designed to enhance personal safety through multiple activation methods. It can be triggered via a voice command, by pressing a switch key, or automatically through a force sensor when the device is thrown with force.In emergency situation it will send the message including instant location to the police, via the transmitter module and registered numbers via a GSM module.These are being integrated into accessories like jewelry for ease of use.t can play a major role in the propose projects where all the

police stations are connected and share the criminal records, crime investigating cases etc [8].

2.3.8. Vehicle Safety Systems

- An advanced vehicle tracking and safety system is designed to ensure the security of passengers, particularly women employees, during transportation provided by companies. This system integrates GPS technology for real-time vehicle tracking with an emergency response mechanism. An emergency button is discreetly installed beneath the vehicle seat and is connected to a GSM-based communication module.In the unsafe situation an **employee need to press the emergency button to activate** the device Teltonika-FM1100. It in turn enables simultaneously the android device used to capture the images inside the vehicle and the GPS system which track the vehicle position in the form of latitude and longitude. An alert message including the location is send card to the company special team and nearby police station through GSM SIM. After that it is the responsibility of police squad and company team to handle the situation. The security in the system can be further enhances by using Geo-Fencing software that uses the GPS and Google Earth to define the Area-Zone for a vehicle that act as a virtual barrier. An admin uses the tools provided by the software to set geographical boundaries which help to detect wherever a vehicle enters or leaves the customized geo-fenced area and restrict the drivers to travel from the sensitive zones. The admin can see the reports of vehicle position, speed, ignition status and travelling report and also instruct the driver on the speaker phone that is placed inside the vehicle [9].

Conclusion

Women's safety is a serious issue, and while many safety devices exist, they often have big limitations. Some require manual activation, which may not be possible in an emergency. Others depend on smartphones for alerts, making them useless if the phone runs out of battery or has no network. Many devices also lack real-time tracking, automatic threat detection, or the ability to record evidence like photos and videos.

SpySHEild solves these problems by offering a smart, all-in-one safety solution. It automatically detects danger, captures photos, videos, and audio, and sends real-time alerts to authorities and emergency contacts—all without needing a smartphone. It also has an E-SIM for independent connectivity, ensuring it works anytime, anywhere. Unlike traditional safety tools, SpySHEild acts immediately, even if the user cannot, making it a more reliable and effective way to stay safe. By combining smart technology, AI-powered detection, and real-time response, SpySHEild is a game-changer in personal security, helping women feel safer and more protected in any situation.

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CHAPTER - 3

SYSTEM ANALYSIS

3. SYSTEM ANALYSIS

3.1. Existing Safety Systems

Many safety solutions have been developed to protect women, but they come with several limitations:

- **Mobile Applications**
    - Some apps use voice activation or shake detection to send alerts, but they depend on smartphones, which may run out of battery or lose network connectivity.
    - Some apps record audio and video, but they don’t provide real-time tracking.
    - SOS apps require manual activation, which may not always be possible in emergencies.
- **Wearable Safety Devices**
    - Some smart bands track heart rate and temperature, but they don’t have media capture or real-time tracking.
    - Self-defense belts provide electric shocks to attackers, but they lack GPS tracking and alert systems.
    - Devices like Devil Will Cry Alarm use loud sirens to scare off attackers but do not alert authorities or provide location tracking.
- **Self-Defense Gadgets**
    - Devices with tear gas or electric shocks help in self-defense but do not send alerts or capture evidence.
    - They require manual activation, which may not always be possible in high-risk situations.

Drawbacks in Existing Systems

- Depend on manual activation (not useful if the user is unconscious or in shock).
- Rely on smartphones, which may be dead or out of network coverage.
- Do not have real-time tracking to continuously update the user's location.
- Lack photo/video recording, making it hard to provide evidence.
- Do not directly alert police or emergency contacts in a fast and effective way.

3.3. Proposed System

SpySHEild is a next-generation wearable safety device that overcomes these issues by integrating automatic activation, real-time tracking, media capture, and independent connectivity.

- **Automatic Threat Detection**
    - Uses a proximity sensor to detect threats without manual activation.
- **Real-Time GPS Tracking**
    - Continuously updates the user's location and shares it with emergency contacts and authorities.
- **Instant Alerts to Police & Family**
    - Sends distress signals directly to police patrols and registered contacts without needing a smartphone.
- **Media Capture for Evidence**
    - Automatically records videos, takes photos, and captures audio, helping in legal cases.
- **Independent Connectivity (E-SIM)**
    - Unlike mobile apps, SpySHEild does not rely on a phone; it has an embedded SIM (E-SIM) to stay connected at all times.

Advantages of spySHEild

- Works without a smartphone, making it more reliable.
- No manual activation required – detects danger automatically.
- Sends real-time alerts to emergency contacts and police.
- Captures evidence (photos, videos, audio) to help in investigations.
- Tracks location continuously with GPS.

3.3.Technology gap

Feature	**spySHEild**	**Existing solutions**	**Technology gap**
Emergency alerts	Direct notification to police stations,crime	Limited to calling emergency services	Real-time,targeted alert system alert

	patrolling and registered devices.		system
Media captureDistance sensor	Video,audio,and photo capture	Limited to photo capture	Comprehensive media recording for evidence
Gps Tracking	Precise location tracking	Limited location tracking	Real-time,accurate GPS for immediate response
Distance sensor	Proximity detection for alerts	No proximity detection	Enhanced situational awareness and timely alerts
E-sim	Independent network connection	Reliance on personal devices network	Ensure reliable communication in emergencies
Integrated App and Device	Seamless interaction between device and application	Separate devices for tracking and alerts	Streamlined user experience and improved efficiency

Conclusion

Existing safety devices help to some extent, but they have big flaws that can make them unreliable in emergencies. Many require manual activation, rely on smartphones, or lack

real-time tracking and evidence capture—which may not be helpful when someone is in real danger. SpySHEild fixes these issues by automatically detecting threats, tracking location in real-time, capturing photos/videos, and sending instant alerts to police and emergency contacts. It works without needing a phone, making it a more dependable and effective safety solution for women.

CHAPTER - 4

SYSTEM STUDY

4.SYSTEM STUDY

4.1. Feasibility Study

4.1.1. Operational Feasibility

Operational feasibility determines whether SpySHEild can be used easily and effectively in real-life situations.The device is user-friendly, efficient, and reliable for real-world safety applications.

- **Easy to Use:** The device is wearable and lightweight, making it comfortable for daily use.
- **Hands-Free Activation:** Automatic threat detection ensures it works without requiring manual input.
- **Instant Alerts:** Sends real-time notifications to police and emergency contacts.
- **Reliable in Any Environment:** Works indoors and outdoors, ensuring safety in all situations.
- **Long Battery Life:** Optimized battery management ensures extended use without frequent charging.
- **Real-Time Tracking:** Authorities and family can monitor the user's location continuously.

4.1.2. Economic Feasibility

Economic feasibility checks if the project is cost-effective and provides value for money.The device is affordable to produce and offers high value to users at a competitive price.

- **Affordable Production Cost:** Using widely available microcontrollers, sensors, and communication modules reduces production expenses.
- **E-SIM for Low Data Costs:** SpySHEild's E-SIM technology provides cost-effective internet access without relying on expensive mobile plans.
- **One-Time Investment:** Unlike subscription-based safety apps, SpySHEild is a one-time purchase, making it a cost-effective solution.
- **Mass Production Potential:** The modular design allows for large-scale manufacturing, reducing per-unit costs.

- **High Market Demand:** With increasing concerns about women's safety, the device has a strong market potential and can generate good returns.

4.1.3. Technical Feasability

Technical feasibility determines whether the SpySHEild device can be developed using available technology.All required components and software are available and can be integrated effectively.

- **Advanced Sensors & Hardware:** The device integrates GPS, proximity sensors, an emergency button, and a mini camera for real-time safety.
- **Embedded SIM (E-SIM):** Unlike mobile-dependent solutions, E-SIM allows independent connectivity without needing a smartphone.
- **Automatic Activation:** Uses proximity sensors to detect danger and AI-driven alerts for fast response.
- **Media Capture & Storage**: Captures photos, videos, and audio, storing them in cloud storage for evidence collection.
- **Low Power Consumption:** Optimized battery management system ensures long-lasting operation.
- **Mobile App Integration:** Connects with a smartphone app for remote monitoring and real-time alerts.

4.2. System Requirements

4.2.1. Hardware Requirements

- GPS Module
- Distance Sensors (Ultrasonic)
- Camera (Mini HD/Surveillance)
- Microcontroller (ESP8266/ESP32)
- Battery and Power Management Unit
- Connectivity Module (Wi-Fi/e-sim)

4.2.2. Software Requirements

- AI & Machine Learning Algorithm Development
- Arduino IDE(Embedded C)
- App Development (Android/iOS)
- Cloud Storage Setup

CHAPTER - 5

PROJECT ARCHITECTURE

5.PROJECT ARCHITECTURE

5.1. System Architecture

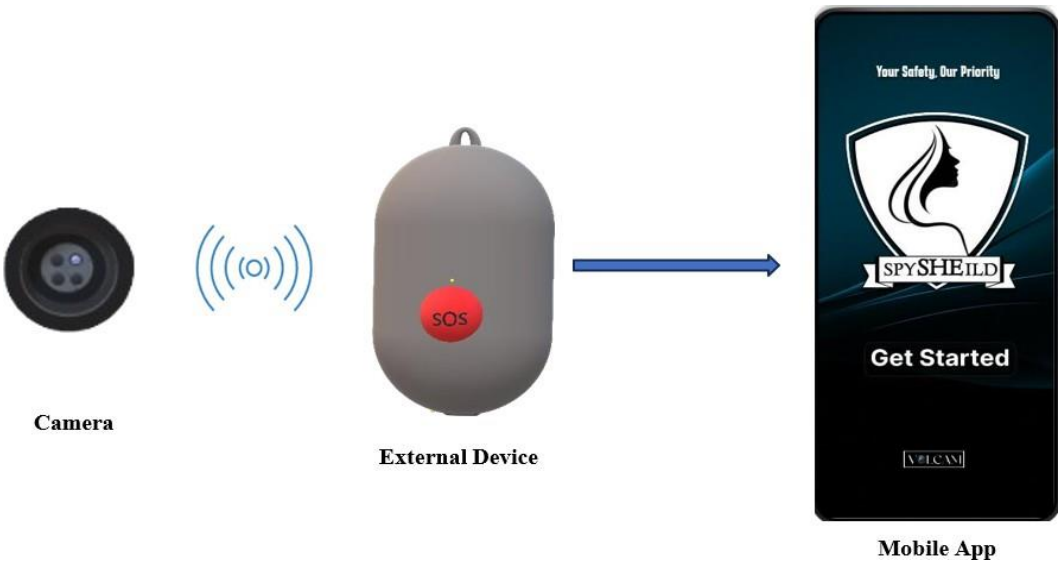


Fig 5.0 (System Architecture)

5.2. Design and Diagrams

5.2.1. Block Diagrams

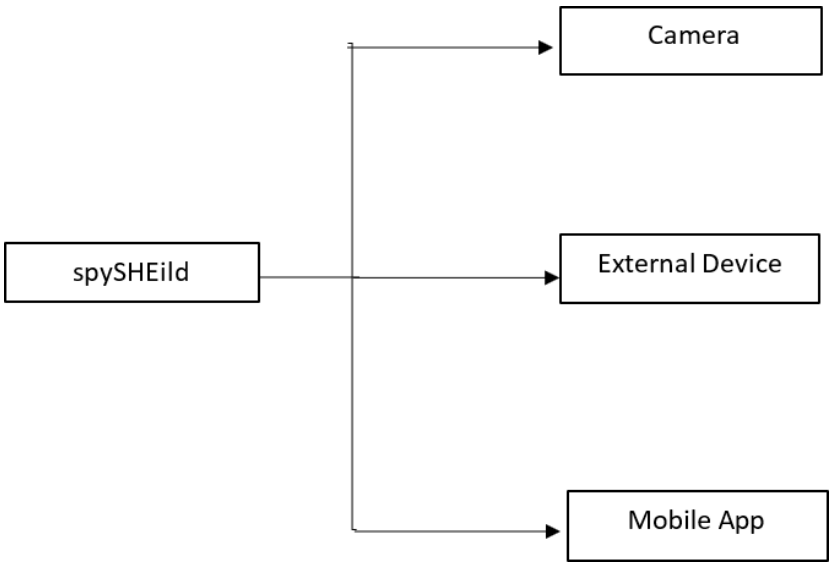


Fig 5.1 (Block Diagram of hardware components 1.0)

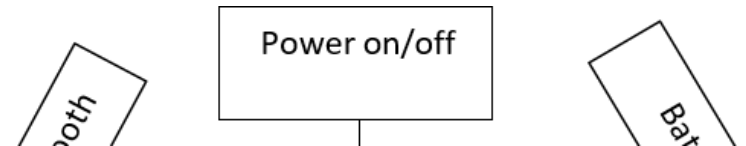


Fig 5.2 (Block Diagram of hardware components 1.1)

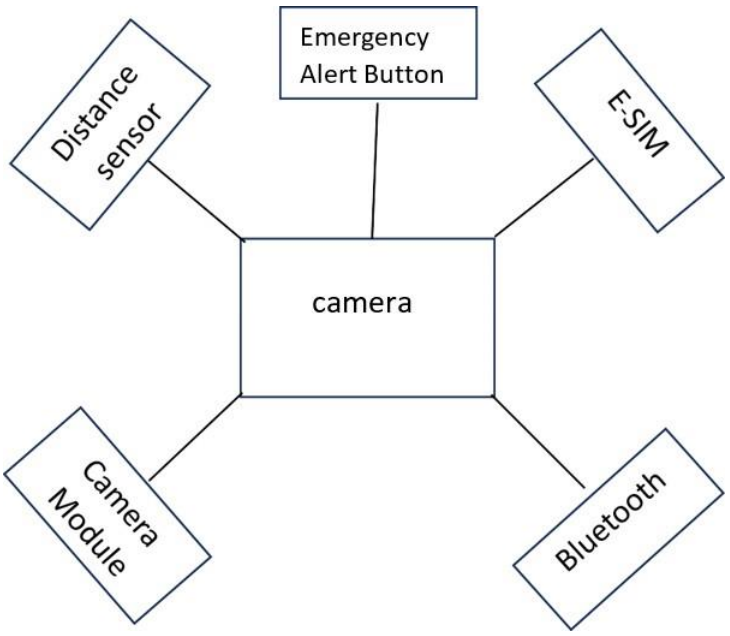


Fig 5.3 (Block Diagram of hardware components 1.2)

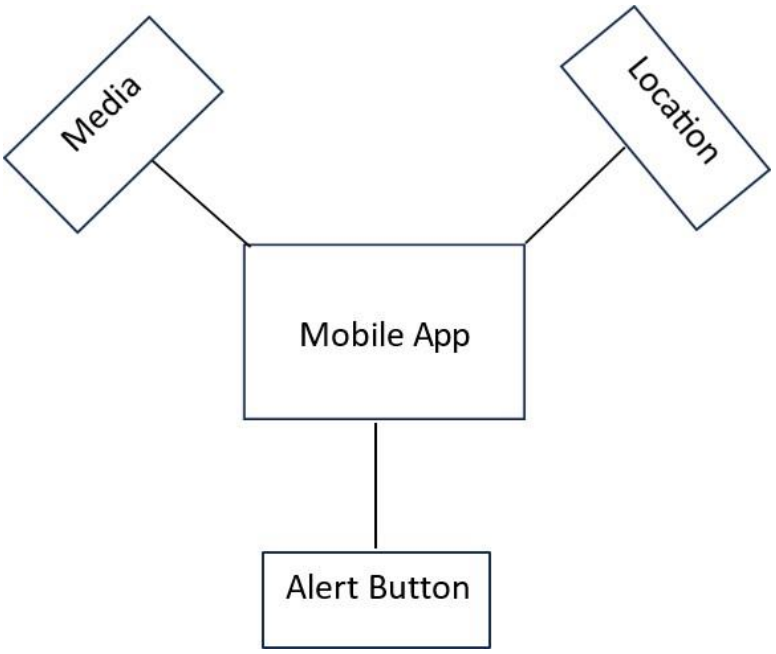


Fig 5.4 (Block Diagram of hardware components 1.3)

FLOWCHART: Flowchart External Device

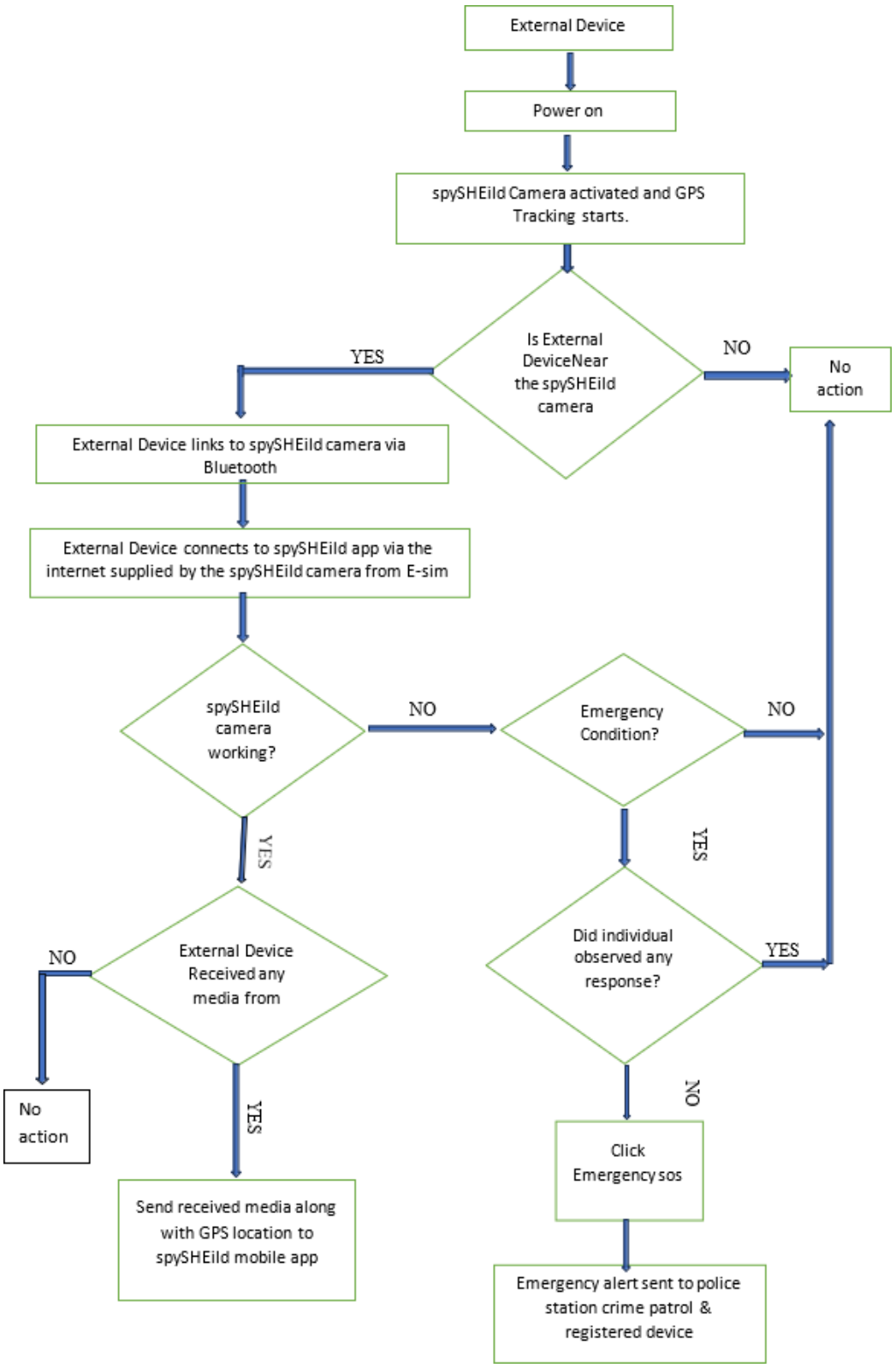


Fig 5.5 (Flowchart External Device 1.0)

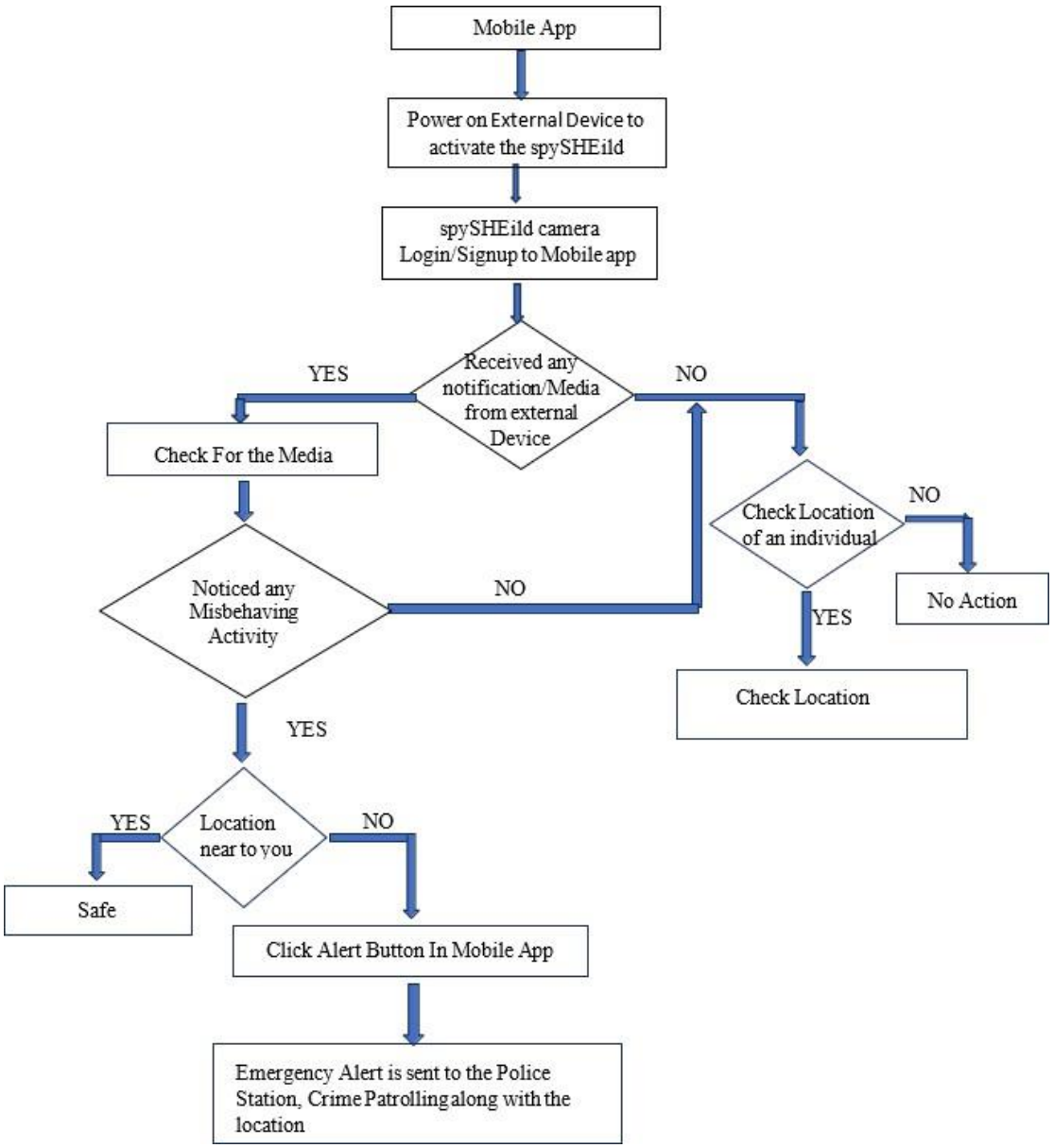


Fig 5.6 (Flowchart External Device 1.1)

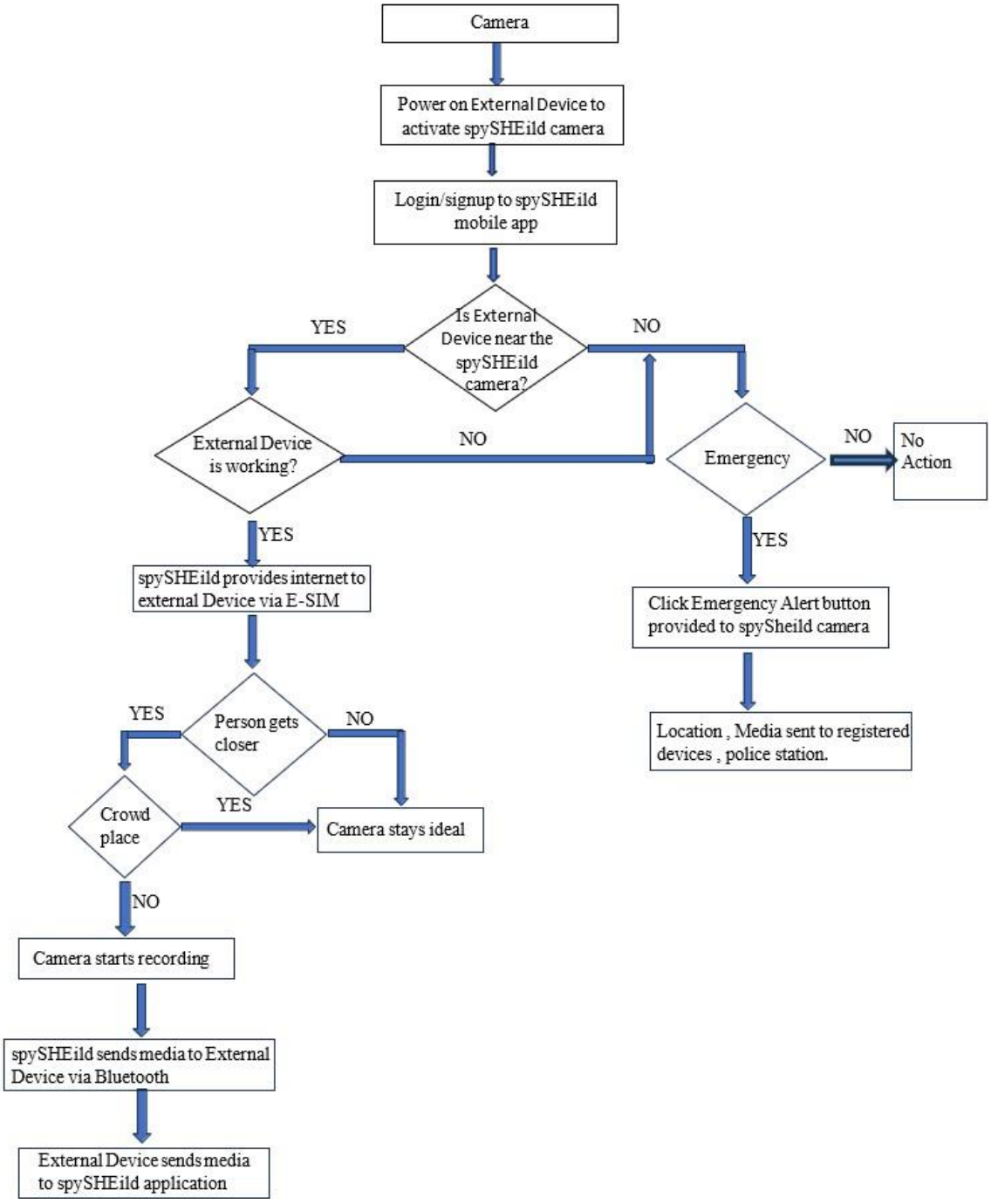


Fig 5.7 (Flowchart External Device 1.2)

CHAPTER-6

METHODOLOGY

CHAPTER-6

METHODOLOGY

6.1. Arduino:

Arduino Uno is a popular microcontroller development board based on 8-bit ATmega328P microcontroller. Along with ATmega328P MCU IC, it consists of other components such as crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroller.

Block Diagram:

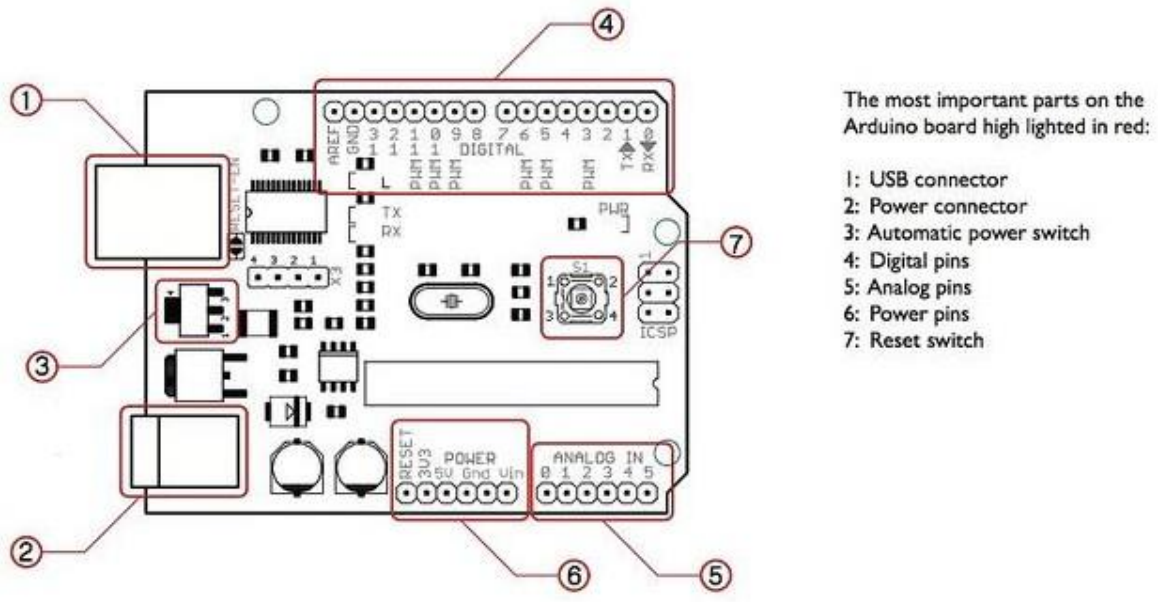


Fig 6.0 (Important Parts on the Arduino Board)

Arduino Uno consists of 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button

Power Jack: Arduino can be power either from the pc through a USB or through external source like adaptor or a battery. It can operate on a external supply of 7 to 12V. Power can be applied externally through the pin Vin or by giving voltage reference through the IORef pin.

Digital Inputs: It consists of 14 digital inputs/output pins, each of which provide or take up 40mA current. Some of them have special functions like pins 0 and 1, which act as Rx and Tx respectively , for serial communication, pins 2 and 3-which are external interrupts, pins 3,5,6,9,11 which provides pwm output and pin 13 where LED is connected.

Analog inputs: It has 6 analog input/output pins, each providing a resolution of 10 bits.

ARef: It provides reference to the analog inputs

Reset: It resets the microcontroller when low.

Pinouts:

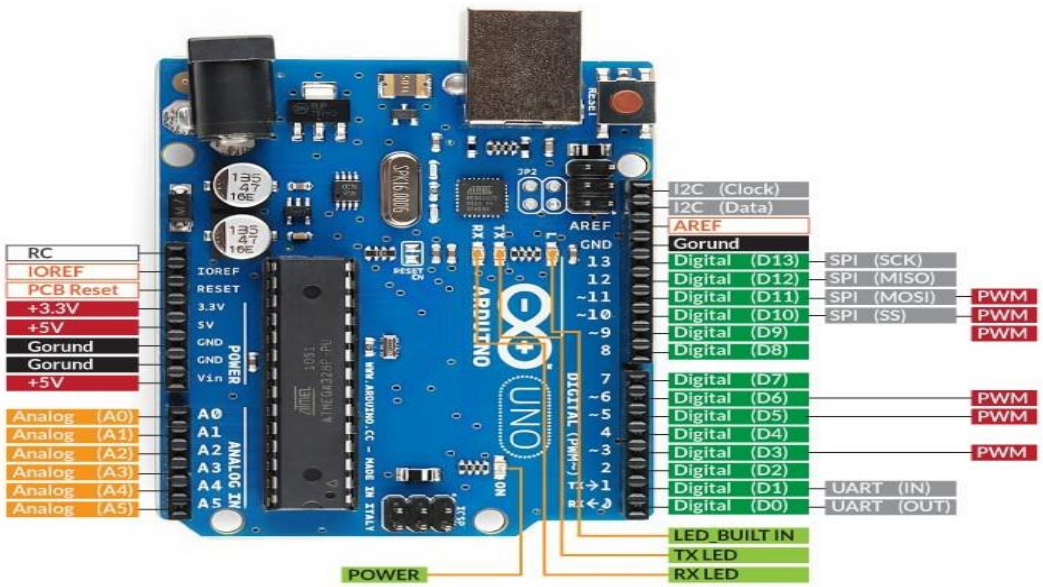


Fig 6.1 (Pinouts of Arduino Board)

Pin Category	Pin Name	Pin Description

Power	Vin, 3.3V, 5V, GND	**Vin:** Input voltage to Arduino when using an external power source. **5V:** Regulated power supply used to power microcontroller and other components on the board. **3.3V:** 3.3V supply generated by on-board voltage regulator. Maximum current draw is 50mA. **GND:** ground pins.
Reset	Reset	Resets the microcontroller.
Analog Pins	A0 – A5	Used to provide analog input in the range of 0-5V
Input/Output Pins	Digital Pins 0 - 13	Can be used as input or output pins.
Serial	0(Rx), 1(Tx)	Used to receive and transmit TTL serial data.
External Interrupts	2, 3	To trigger an interrupt.
PWM	3, 5, 6, 9, 11	Provides 8-bit PWM output.
SPI	10 (SS), 11 (MOSI), 12 (MISO) and 13 (SCK)	Used for SPI communication.
Inbuilt LED	13	To turn on the inbuilt LED.
TWI	A4 (SDA), A5 (SCA)	Used for TWI communication.
AREF	AREF	To provide reference voltage for input voltage.

6.2. **LED:**Light Emitting Diode

It is a semiconductor diode that emits light when a voltage is applied to it and that is used especially in electronic devices (as for an indicator light)

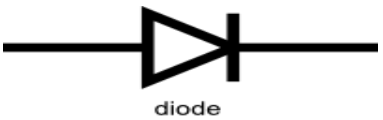


Fig 6.2: (A typical 2- pin LED 1.0)

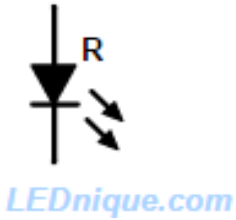


Fig 6.3: (A typical 2- pin LED 1.1)

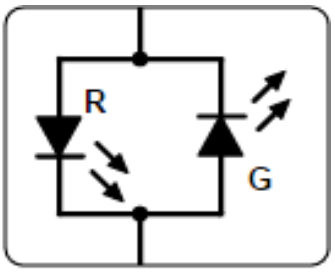


Fig 6.4: (A typical 2- pin LED 1.2)

Fig: The two-pin package can contain a single or two back-to-back LEDs.

Pinout:

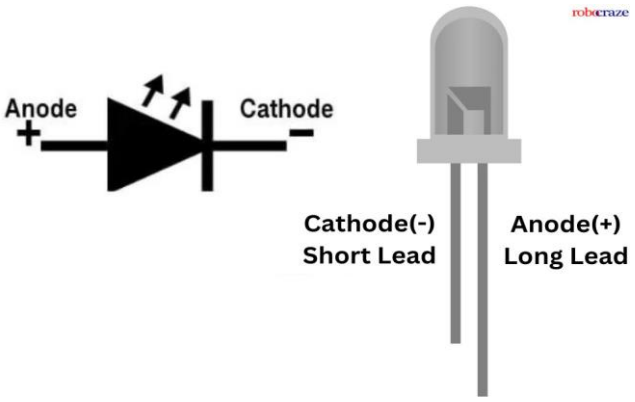


Fig 6.5: (pinout LED)

Question:

Write an Embedded C program for blinking an LED using Arduino.

Program:

```
void setup() {
  pinMode(13,OUTPU
  T);

}

 void loop() {

digitalWrite(13,1);

delay(1000);

digitalWrite(13,0);
delay(1000);

}
```

Output:

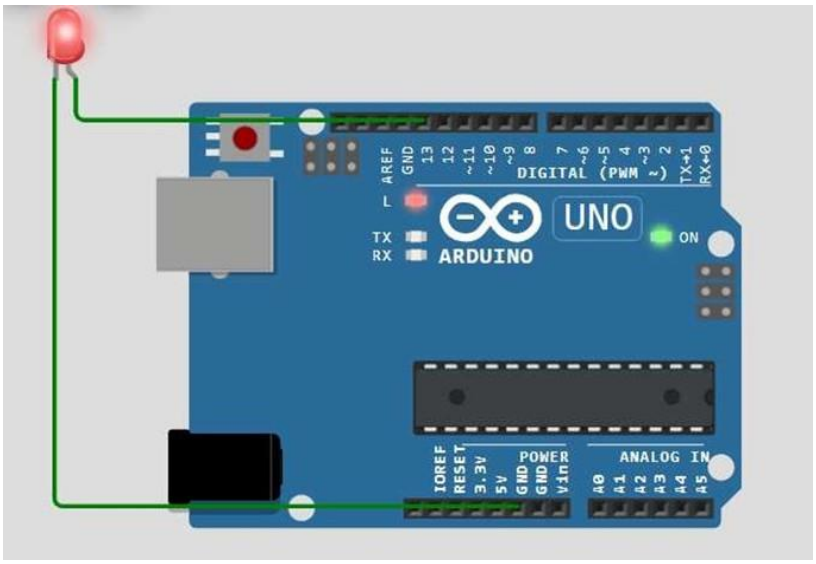


Fig 6.6 (Output for the Question)

6.3. PIR Motion Sensor:

A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in PIR-based motion

detectors. PIR sensors are commonly used in security alarms and automatic lighting applications.

PIR sensors detect general movement, but do not give information on who or what moved. PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensor's range. For that purpose, an imaging IR sensor is required.

PIR sensors are commonly called simply "PIR", or sometimes "PID", for "passive infrared detector".

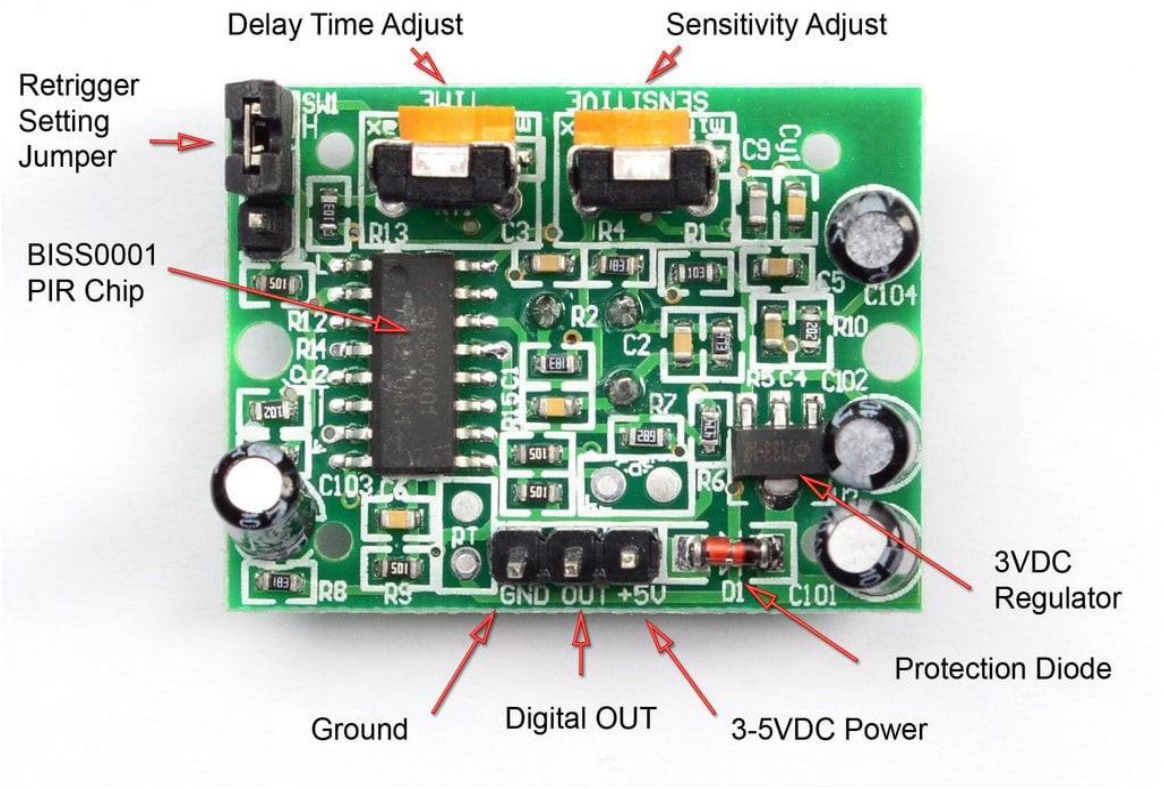


Fig 6.7 (PIR Motion Sensor)

<u>Question 1</u> : Write an Embedded C program to interface a PIR motion sensor and an LED with Arduino. The LED should turn on when motion is detected;otherwise,the LED should turn off.

Program:

```
void setup() {

// put your setup code here, to run once:
pinMode(13,OUTPUT);

pinMode(12,INPUT);
Serial.begin(9600);

}

void loop() {

int a=digitalRead(12);

if(a==1)

{

digitalWrite(13,1);
delay(1000);

}

else{
  digitalWrite(13,0
  ); delay(1000);
}

}
```

Output 1:

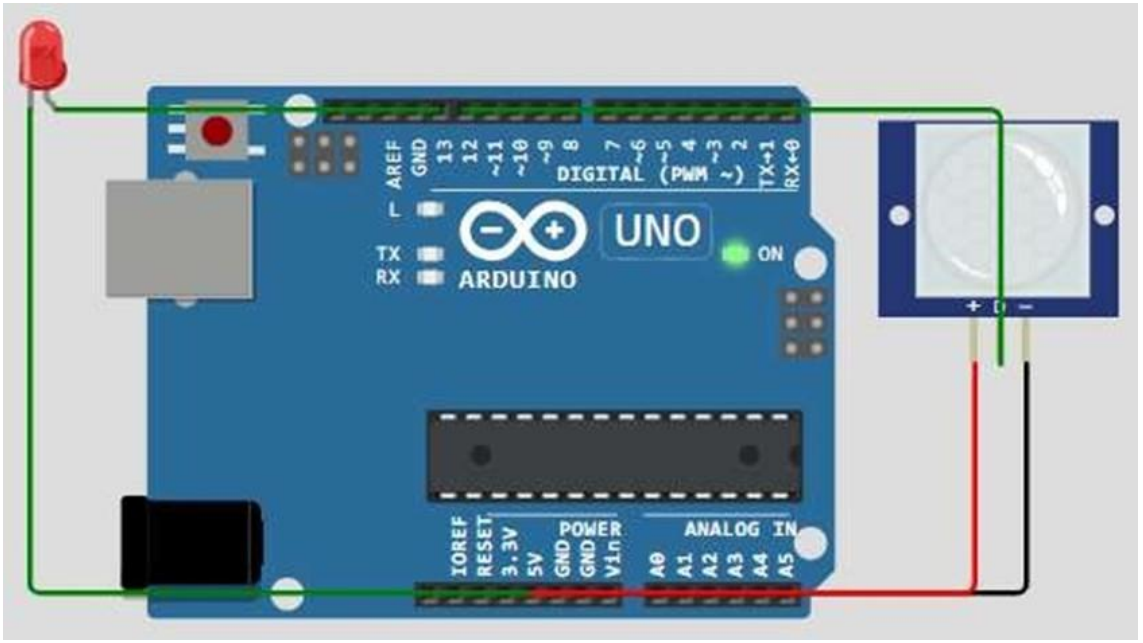


Fig 6.8 (Output for the Question 1.0)

Output 2:

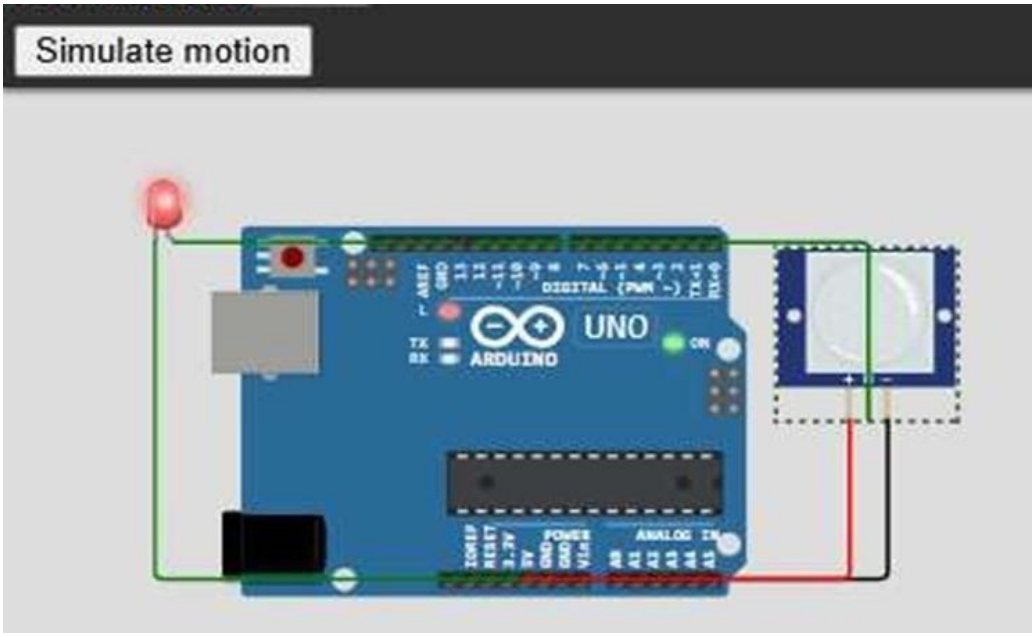


Fig 6.9 (Output for the Question 1.1)

<u>Question 2</u> : Write an Embedded C program to interface a PIR motion sensor and two LEDs (Red and Green) with Arduino. The Red LED should turn on when motion is detected; otherwise, the Green LED should turn on.

Program:

```
void setup() {

// put your setup code here, to run
once: pinMode(13,OUTPUT);
pinMode(11,OUTPUT);
pinMode(12,INPUT);
Serial.begin(9600);

}

void loop() {

int a=digitalRead(12);
```

```
if(a==1){

digitalWrite(11,0
);
digitalWrite(13,
1); delay(1000);
}

else{
  digitalWrite(13,0
  );
  digitalWrite(11,1
  ); delay(1000);

}

}
```

Output 1:

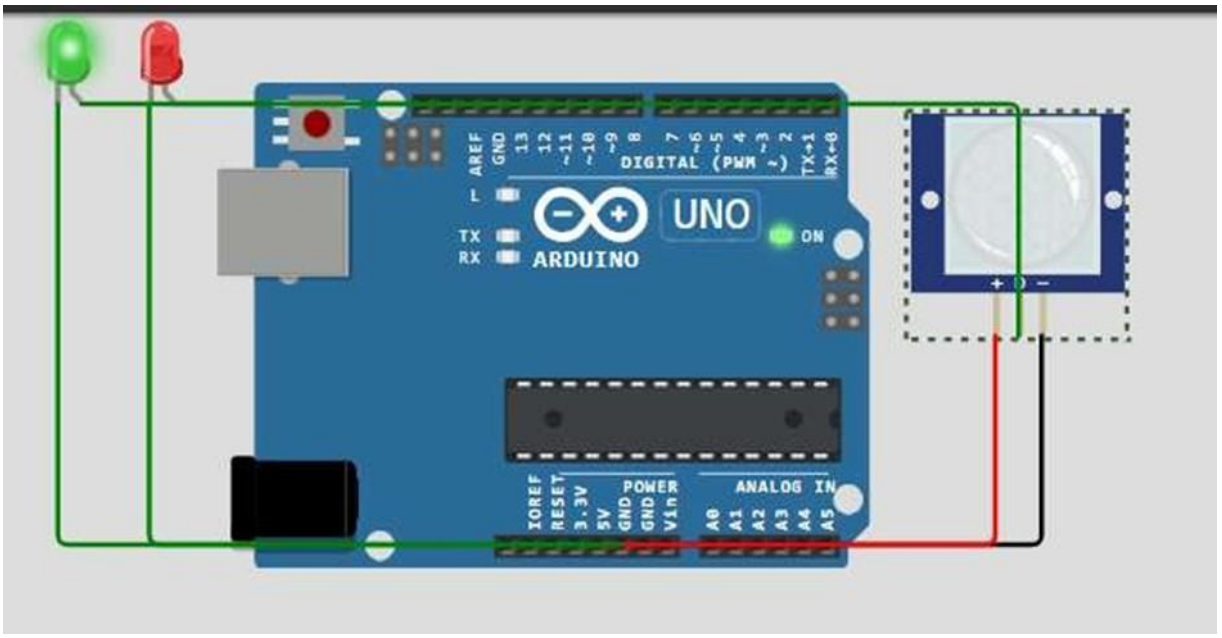


Fig 6.10 (Output for the Question- 2.0)

Output 2:

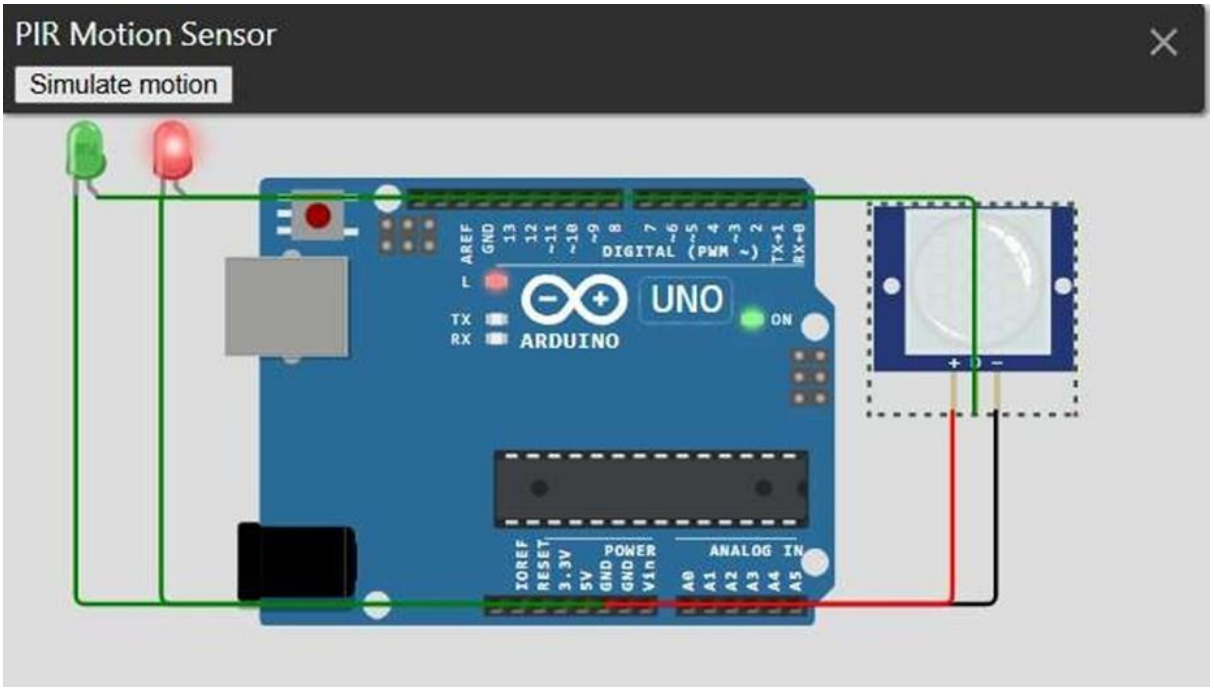


Fig 6.11 (Output for the Question-2.1)

6.4. Ultrasonic Sensor:

The Ultrasonic Sensor is an electronic device that calculates distance by emitting sound waves and collecting their echoes.

Fig 6.12 (Ultrasonic Sensor 1.0)

Ultrasonic Sensors are used as proximity sensors. They are used in parking technologies and anti-collision safety systems. Ultrasonic sensors are also employed in automated obstacle detection systems and factory engineering.

The distance is calculated by measuring the ultrasonic sound's travel time and speed:

Distance = Time * Speed of sound / 2

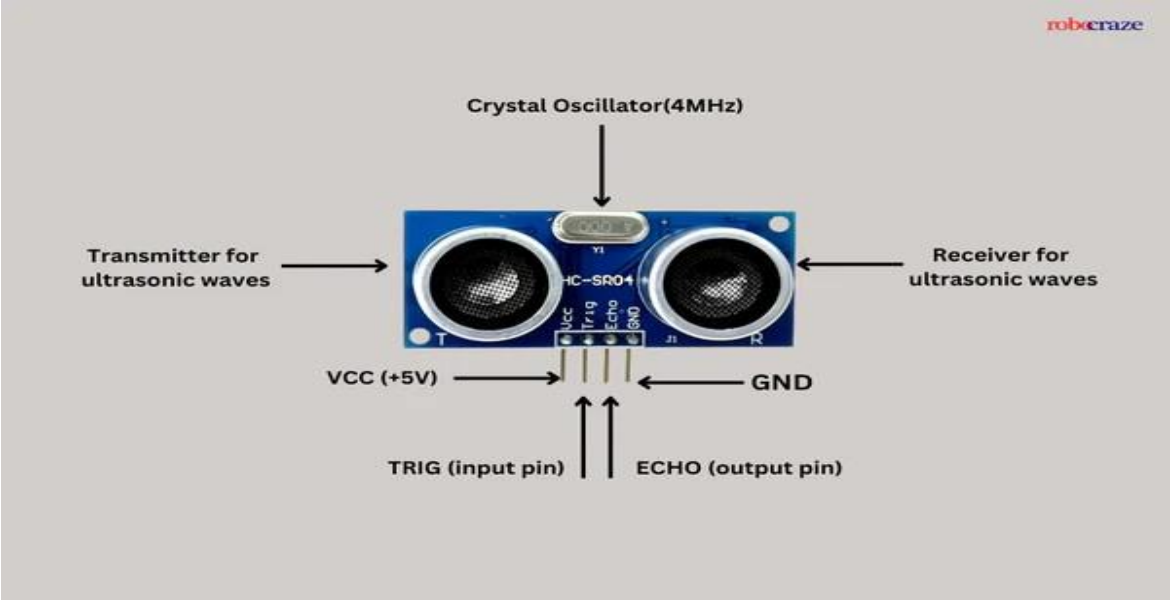


Fig 6.13 (Ultrasonic Sensor 1.1)

Question : Write an Embedded C program to display the distance detected by an ultrasonic sensor interfaced with Arduino

Program:

```
const
int
t=7;
const
int
e=6;
void
setup(
) {

pinMode(e, INPUT);
```

```
pinMode(t, OUTPUT);
Serial.begin(9600);

}

void loop() {

digitalWrite(t, LOW);

delayMicroseconds(2);
digitalWrite(t, HIGH);
delayMicroseconds(10
); digitalWrite(t,
LOW);

long
duration=pulseIn(e,HIGH); int
distance=duration*0.034/2;
Serial.print("distance ");
Serial.print(distance);
Serial.println(" cm");

}
```

Output 1:

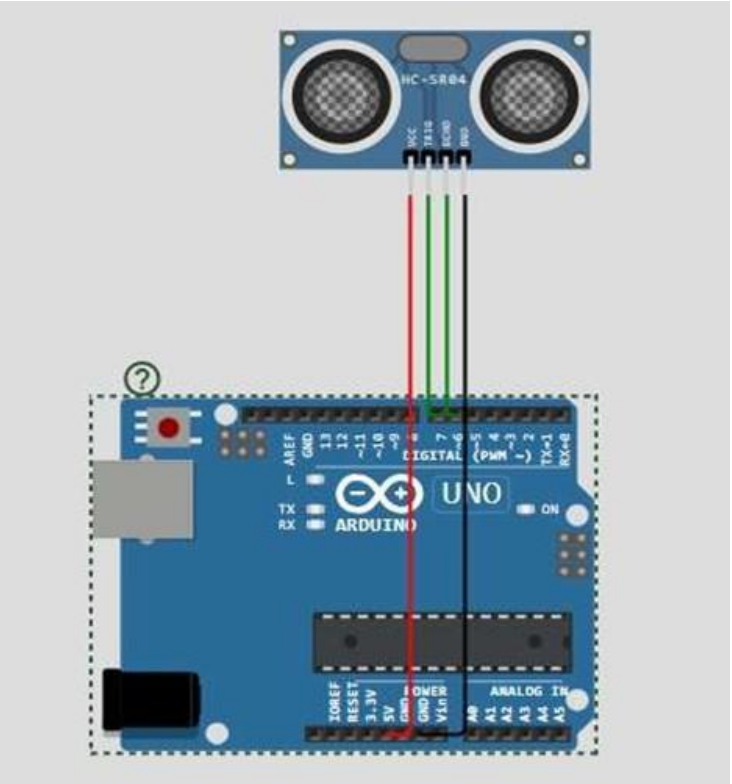


Fig 6.14 (Output for the Question 1.0)

Output 2:

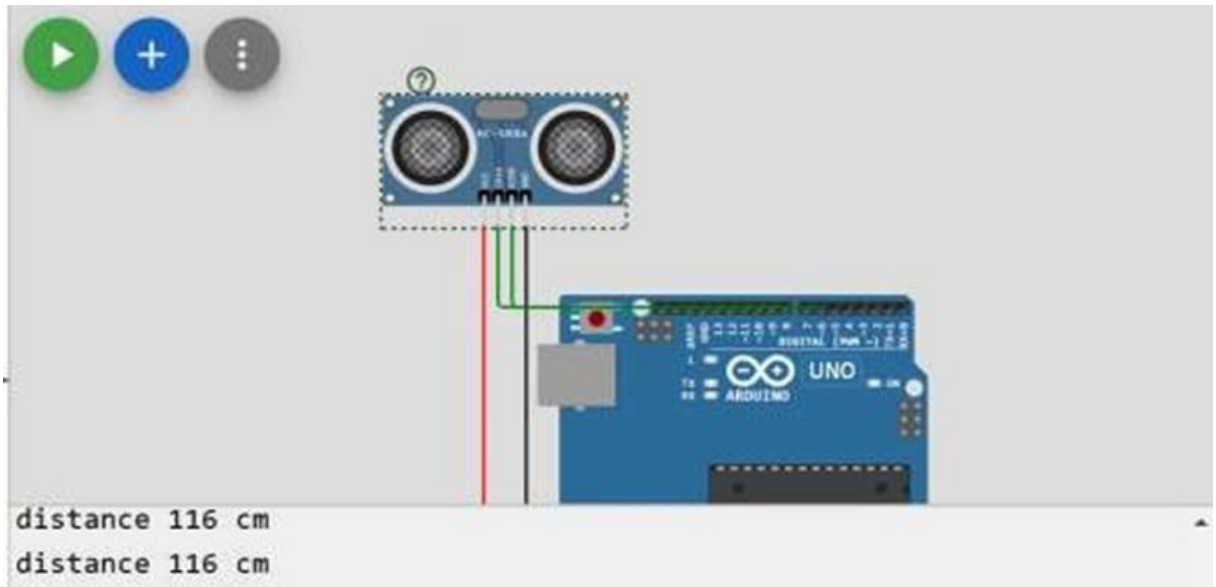


Fig 6.15 (Output for the question 1.1)

<u>Question 2</u> : Write an Embedded C program to interface an ultrasonic sensor and two LEDs (Red and Yellow) with Arduino. Display the distance

detected by the ultrasonic sensor. The Red LED should turn on if the distance is less than 50, and the Yellow LED should turn on if the distance is between 50 and 100.

Program:

```
const int
t=7; const
int e=6;
const int
red=11;

const int
yellow=10;
void setup() {

pinMode(e, INPUT);

pinMode(t, OUTPUT);
pinMode(red, OUTPUT);
pinMode(yellow,
OUTPUT);
Serial.begin(9600);

}

void loop() {

digitalWrite(t, LOW);

delayMicroseconds(2);
digitalWrite(t, HIGH);
delayMicroseconds(10
); digitalWrite(t,
LOW);
```

```
long
duration=pulseIn(e,HIG
H); int
distance=(duration*0.03
4/2); if(distance>100)
{

digitalWrite(yellow, LOW);

digitalWrite(red, LOW);

}

else{

if(distance<=100 && distance>50){

digitalWrite(yellow, HIGH);
digitalWrite(red, LOW);

}

if(distance <=50){
digitalWrite(red,
HIGH);
digitalWrite(yellow,
LOW);

}

}

Serial.print("distance
");
Serial.print(distance);
Serial.println(" cm");

}
```

Output 1:

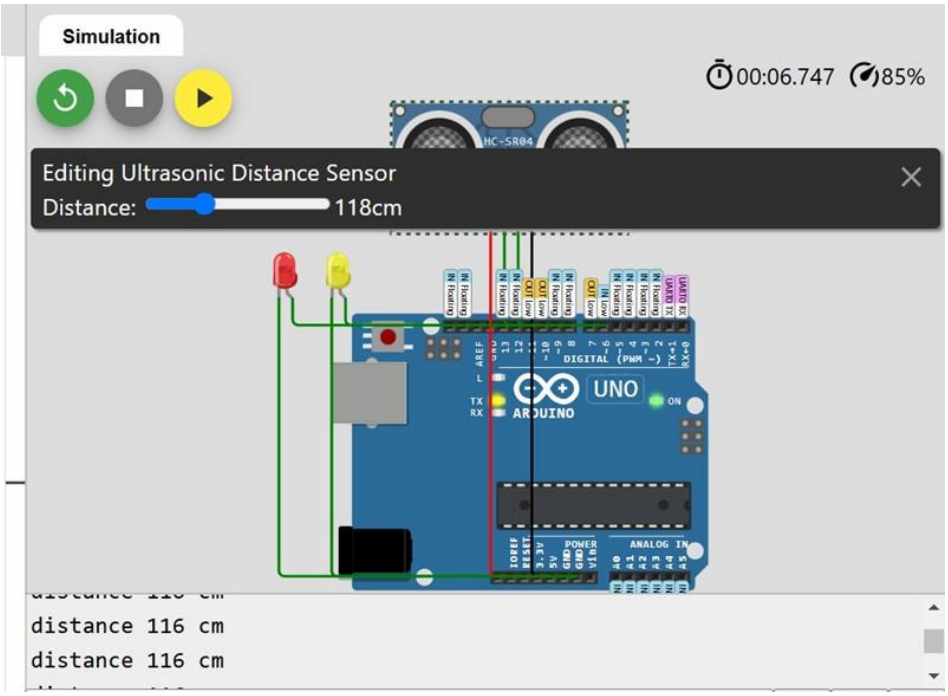


Fig 6.16 (Output for the question 2.0)

Output 2:

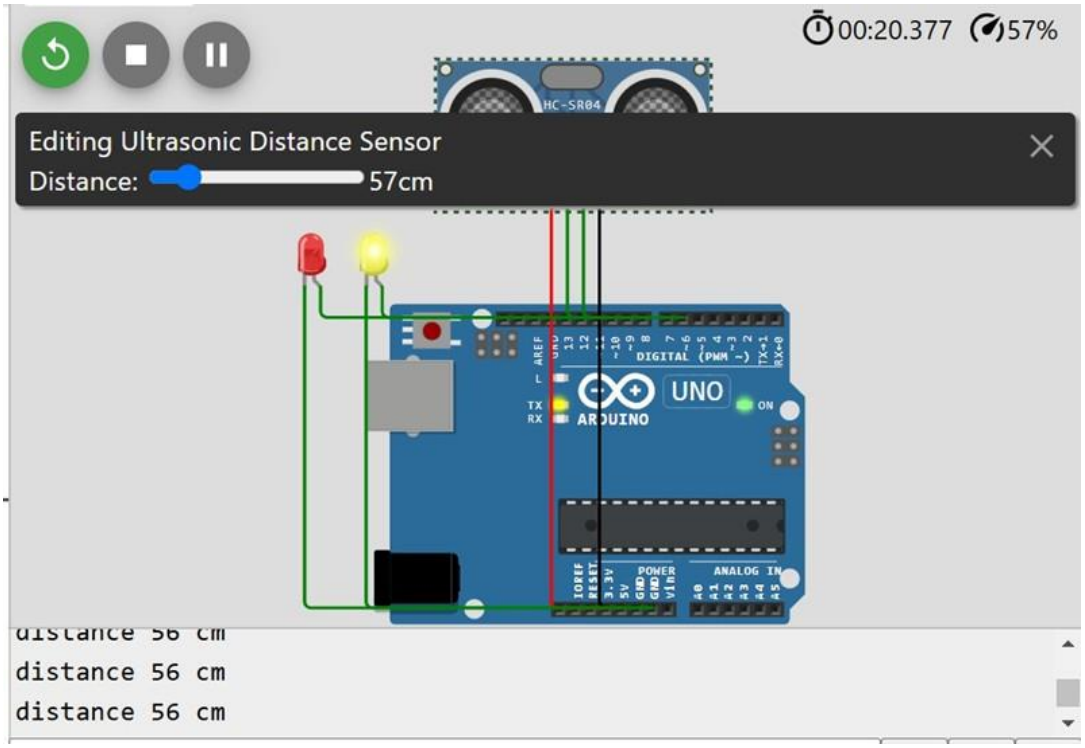


Fig 6.17 (Output for the question 2.1)

Output 3:

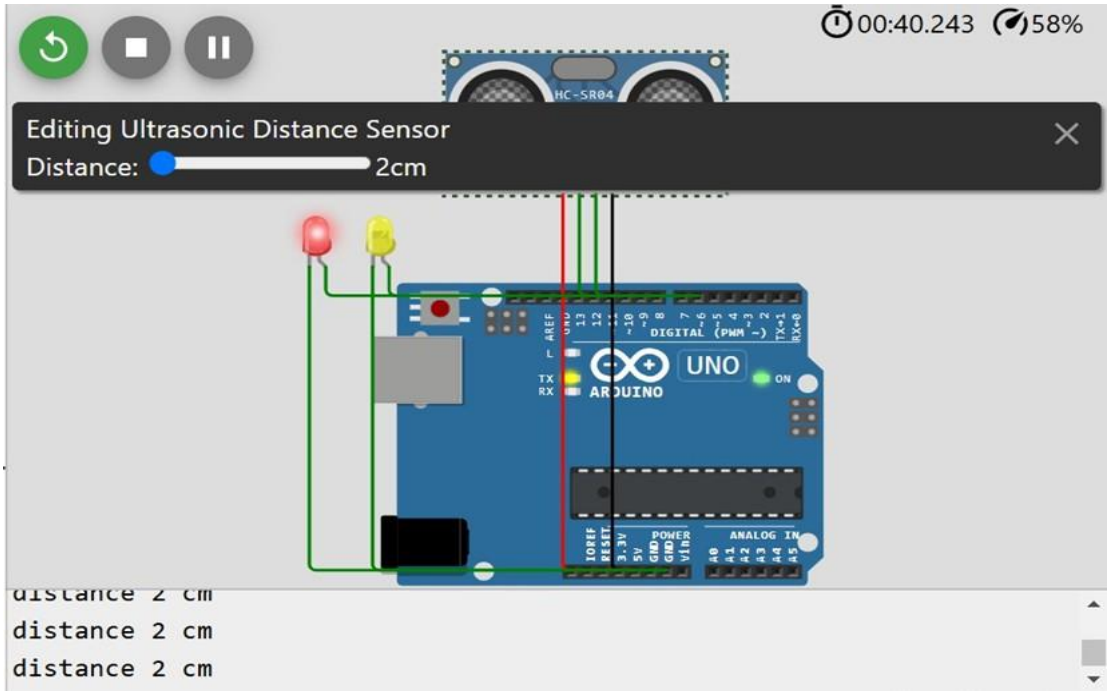


Fig 6.18 (Output for the question 2.2)

6.5. LCD(16x2):

An LCD screen is an electronic display module that uses liquid crystal to produce a visible image. The 16×2 LCD display is a very basic module commonly used in DIYs and circuits. The 16×2 translates a display of 16 characters per line in 2 such lines. In this LCD, each

character is displayed in a 5×7 pixel matrix.

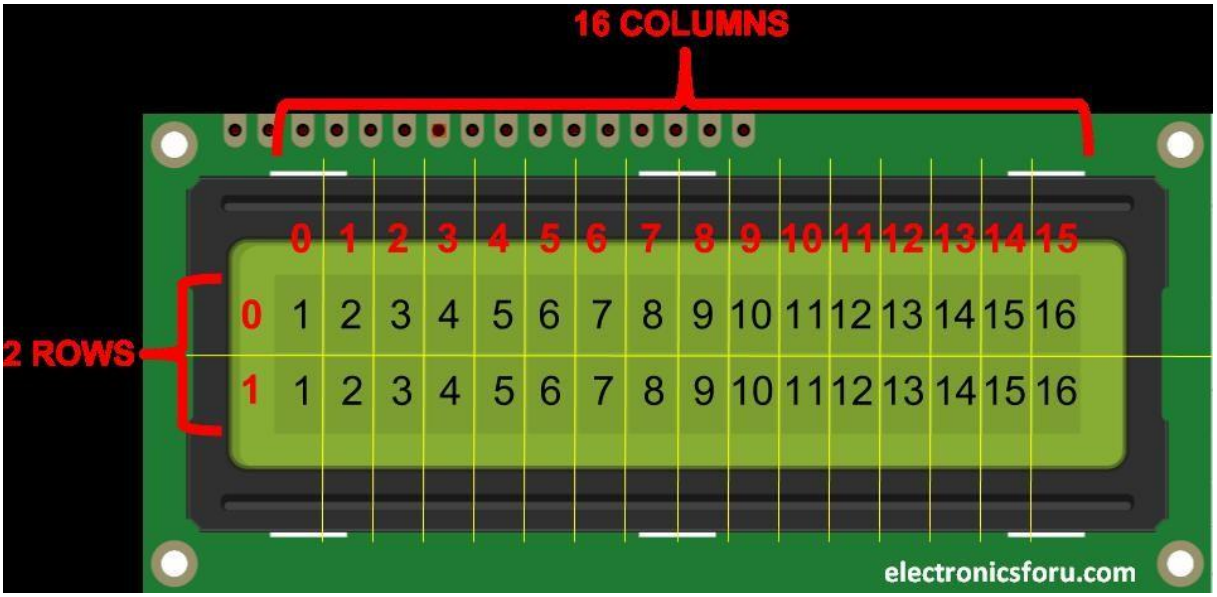


Fig 6.19 (_LCD(16x2))

Pinouts:

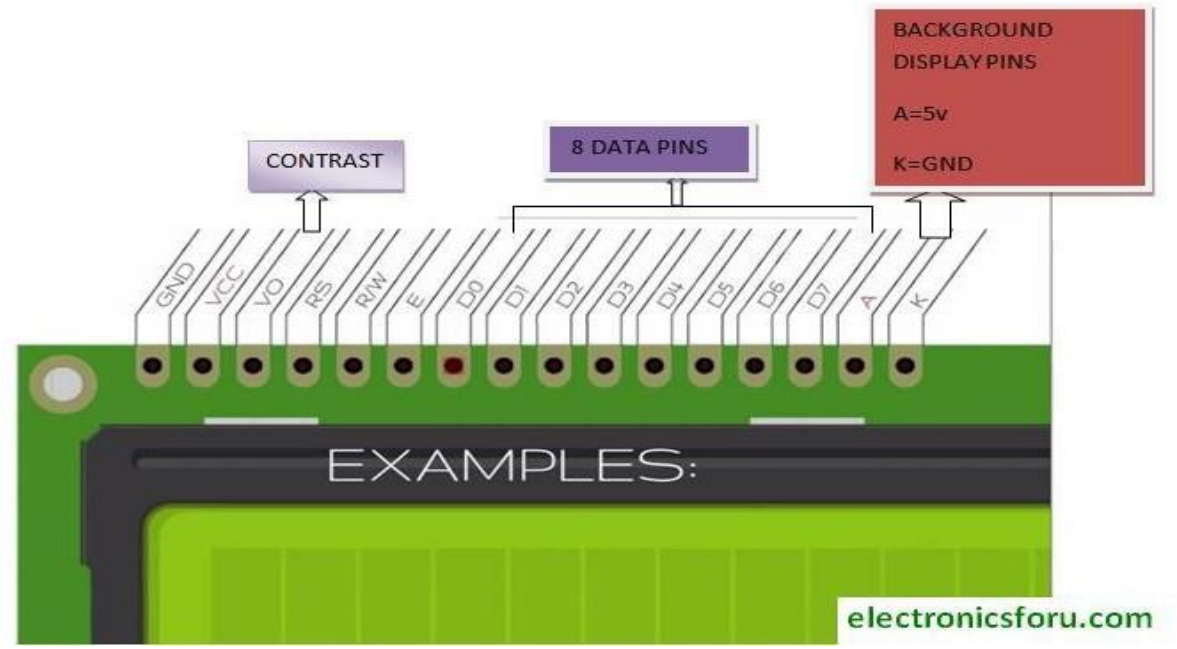


Fig 6.19 (Pinouts of _LCD(16x2))

Pin No.	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	Vcc

3	Contrast adjustment; the best way is to use a variable resistor such as a potentiometer. The output of the potentiometer is connected to this pin. Rotate the potentiometer knob forward and backward to adjust the LCD contrast.	Vo / VEE
4	Selects command register when low, and data register when high	RS (Register Select)
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given; Extra voltage push is required to execute the instruction and EN(enable) signal is used for this purpose. Usually, we set en=0, when we want to execute the instruction we make it high en=1 for some milliseconds. After this we again make it ground that is, en=0.	Enable
7	8-bit data pins	DB0
8		DB1
9		DB2
10		DB3
11		DB4
12		DB5
13		DB6
14		DB7
15	LED Backlight VCC (5V)	Led+
16	LED Backlight Ground (0V)	Led-

Steps to interface LCD display with Arduino:

Step 1: Install the library for LCD display in Arduino IDE.

- Open Arduino IDE and navigate to Tools>Library Manager.
- Search for “LiquidCrystal I2C” and install the “LiquidCrystal I2C” library in the Arduino IDE.

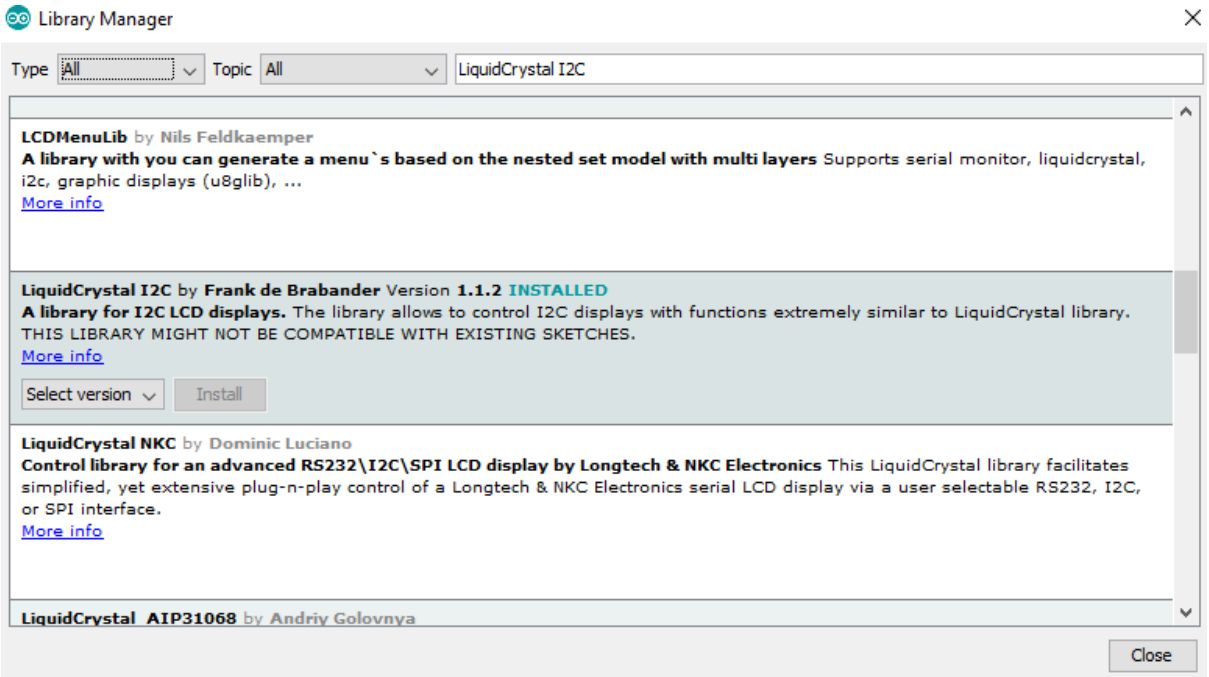


Fig 6.20 (Steps to interface LCD display with Arduino)

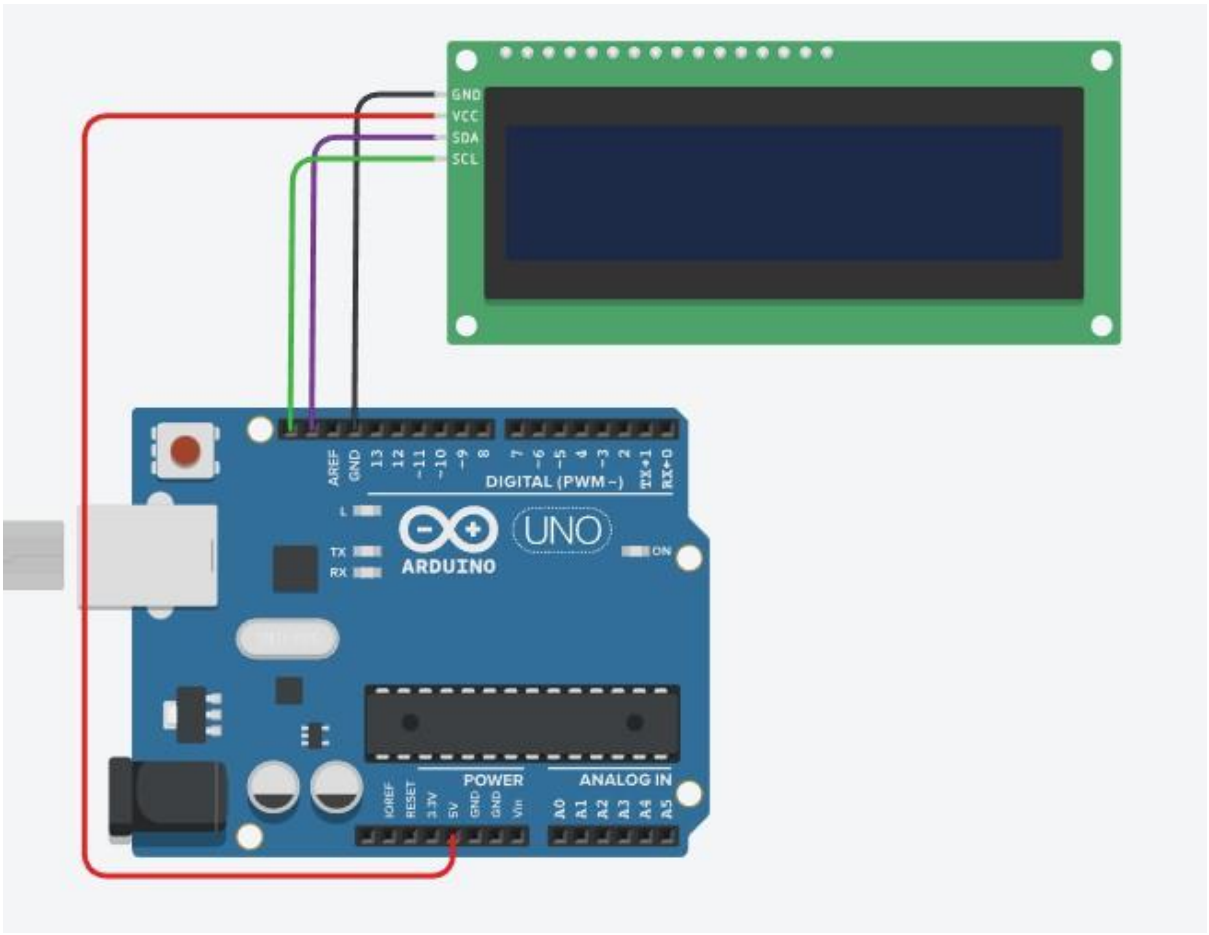
Library Manager

Step 2: Import “LiquidCrystal_I2C.h” header file in the code.

- Define header file in the code ” #include <LiquidCrystal_I2C.h> “.

Step 3: Connect display device to Arduino.

- Connect the SDA pin of an LCD display to the SDA pin of the Arduino.
- Connect the SCL pin of an LCD display to the SCL of the Arduino.
- Connect VCC to 5V pin
- Connect GND to GND pin.



LCD display interfacing circuit

Fig 6.21 (LCD Display interfacing circuit)

Step 4: Find the I2C Address of the display device.

- Compile and run the below code to find the I2C Address.
- Before running this try step 5 using most commonly used addresses “0x27” or “0x3F“. If those are not working, then continue with step 4.

Question 1 : Write an Embedded C program to display 'Hello' on an LCD connected to Arduino.

Program:

```
#include<LiquidCrystal_I2C.h>

LiquidCrystal_I2C
lcd(0x27,16,2); void setup() {

lcd.begin(16,2,0x27);

lcd.backlight();

lcd.setCursor(1,0);
lcd.print("Hello");

}

void loop() {

}
```

Output:

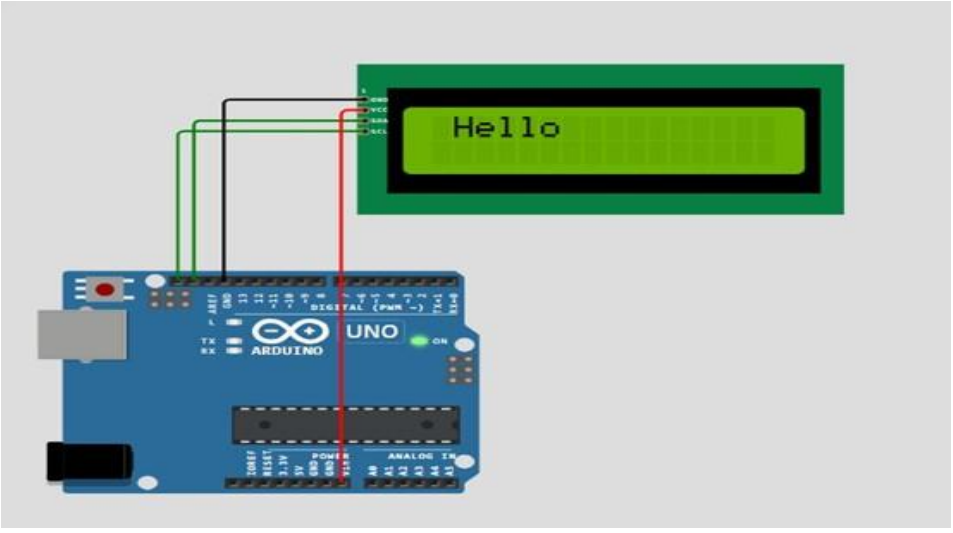


Fig 6.22 (Output for Question 1.0)

<u>Question 2</u> : Write an Embedded C program to display Team Members Names on an LCD connected to Arduino.

Program:

```
#include<LiquidCrystal_I2C.h>

LiquidCrystal_I2C
lcd(0x27,16,2); void setup() {

lcd.begin(16,2,0x27);

lcd.backlight();

}

void loop() {

lcd.clear();

lcd.setCursor(0,0);
lcd.print("Mounika");
lcd.setCursor(0,1);

lcd.print("21ME1A4617
"); delay(5000);

lcd.clear();

lcd.setCursor(0,0);
lcd.print("Vyshnavi");
lcd.setCursor(0,1);

lcd.print("21ME1A4612
"); delay(5000);

lcd.clear();
```

```
lcd.setCursor(0,0);
lcd.print("Onila");
lcd.setCursor(0,1);
lcd.print("21ME1A4619"
); delay(5000);

lcd.clear();

lcd.setCursor(0,0);

lcd.print("Hari
Chandan");
lcd.setCursor(0,1);

lcd.print("22ME5A4604
"); delay(5000);

lcd.clear();

lcd.setCursor(0,0);
lcd.print("Kartheek");
lcd.setCursor(0,1);
lcd.print("21ME1A4616
"); delay(5000);

lcd.clear();

}
```

Output :

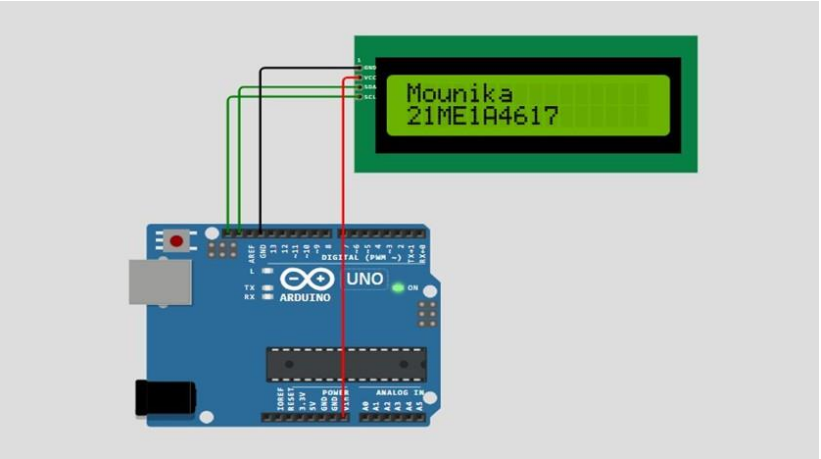


Fig 6.23 (Output for Question 2.0)

<u>Question 3</u> : Write an Embedded C program to interface an ultrasonic sensor, LCD, and two LEDs (Red and Yellow) with Arduino. Display the distance detected by the ultrasonic sensor on the LCD. The Red LED should turn on if the distance is less than 50, and the Yellow LED should turn on if the distance is between 50 and 100

Program:

```
#include<LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27,16,2);

const int t=7;

const int e=6;

const int red=11;
const int
yellow=10; void
setup() {

pinMode(e, INPUT);
```

```
pinMode(t, OUTPUT);
pinMode(red, OUTPUT);
pinMode(yellow,
OUTPUT);
Serial.begin(9600);
lcd.begin(16,2,0x27);
lcd.backlight();

}

void loop() {

digitalWrite(t, LOW);

delayMicroseconds(2);
digitalWrite(t, HIGH);
delayMicroseconds(10
); digitalWrite(t,
LOW);
long duration=pulseIn(e,HIGH);
int distance=(duration*0.034/2);
if(distance>100){

digitalWrite(yellow, LOW);
digitalWrite(red, LOW);
 }

else{

if(distance<=100 && distance>50){

digitalWrite(yellow, HIGH);
digitalWrite(red, LOW);
}

if(distance <=50){
```

```
 digitalWrite(red, HIGH);
digitalWrite(yellow, LOW);
}

}

 lcd.clear();
lcd.setCursor(0,0);
lcd.print("Distance");
lcd.setCursor(0,1);
lcd.print(distance);
lcd.setCursor(4,1);
lcd.print("cm");
delay(5000); lcd.clear();

}
```

Output 1:

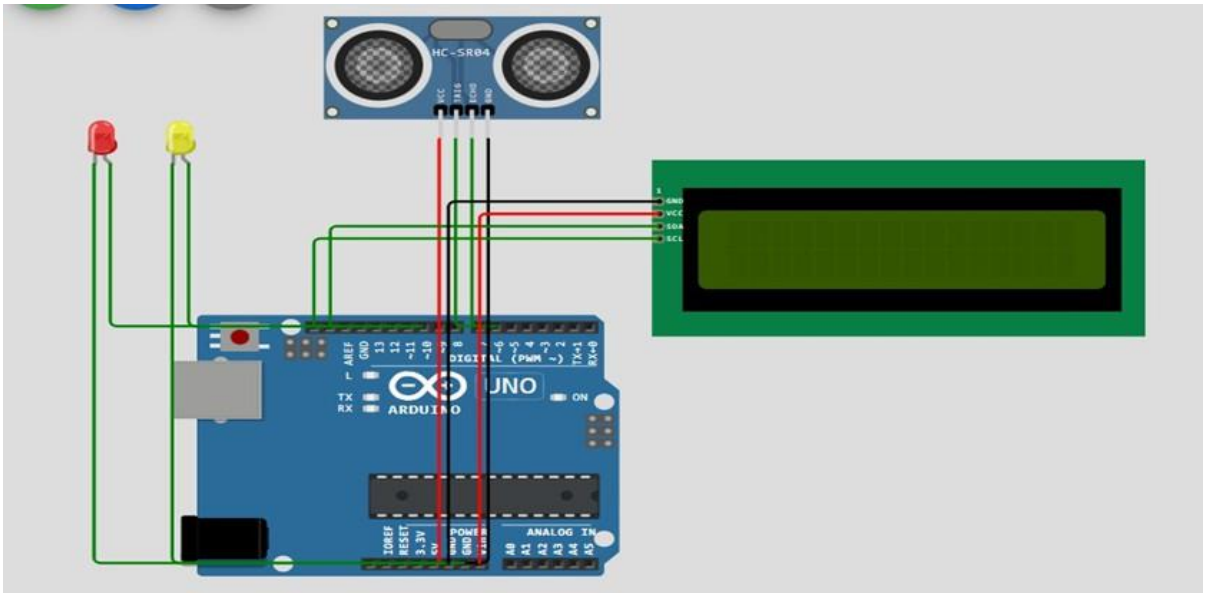


Fig 6.24 (Output for Question 3.0)

Output 2:

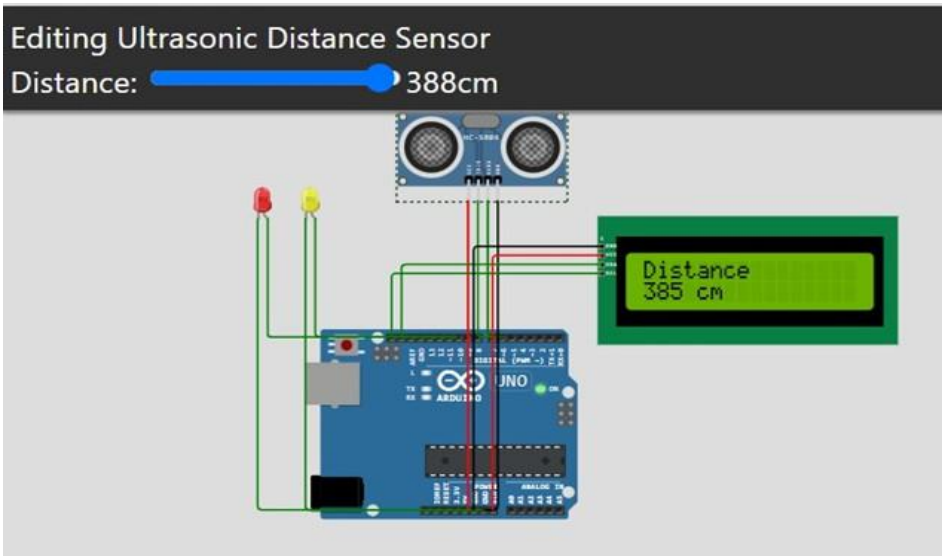


Fig 6.25 (Output for Question 3.1)

Output 3 :

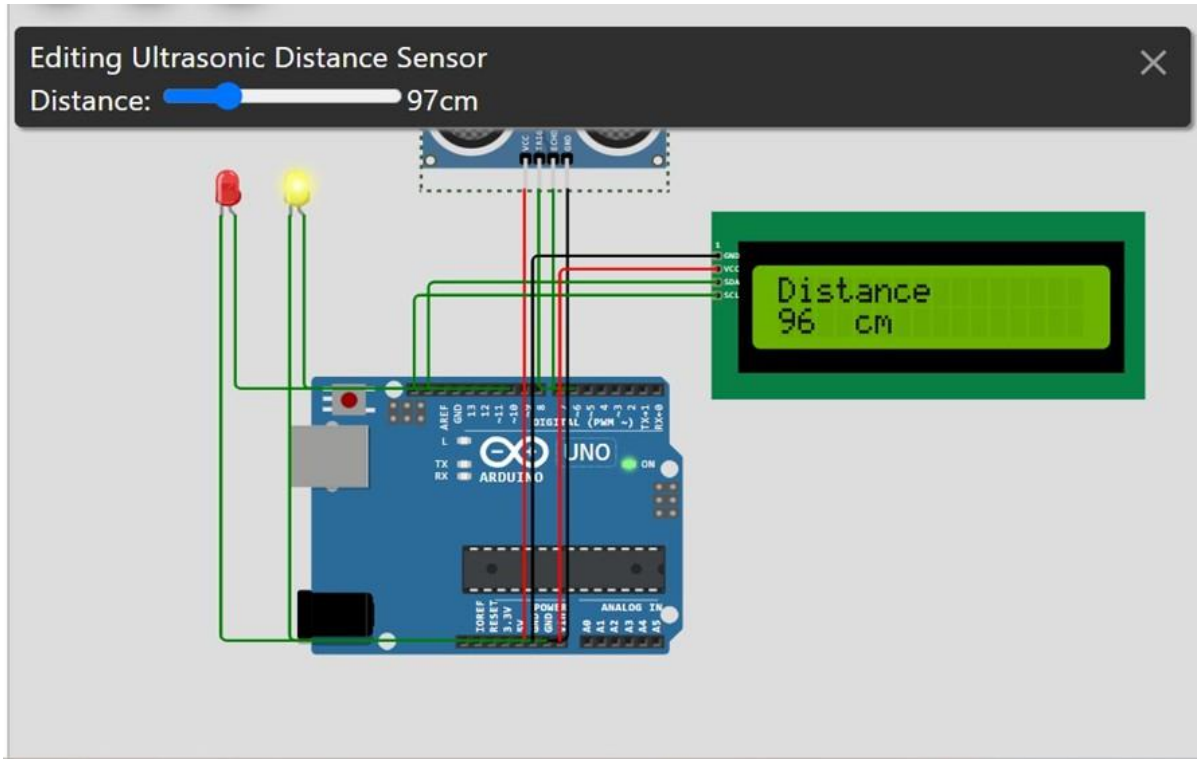


Fig 6.26 (Output for Question 3.2)

Output 4:

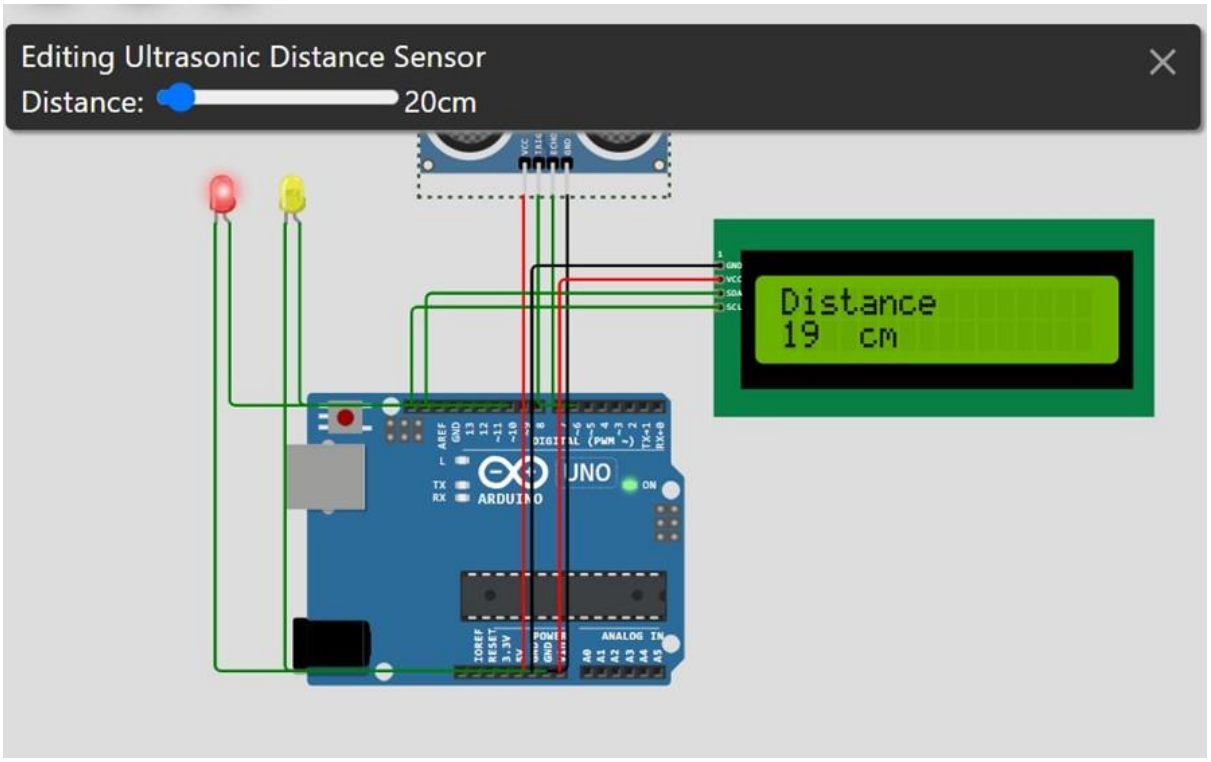


Fig 6.27 (Output for Question 3.3)

<u>Question 4</u> : Write an Embedded C program to interface an ultrasonic sensor, LCD, and two LEDs (Red and Yellow) with Arduino. The Red LED should turn on and display 'Danger' on the LCD if the distance is less than 50. The Yellow LED should turn on and display 'Caution' on the LCD if the distance is between 50 and 100. Otherwise, display 'Safe' on the LCD.

Program:

```
#include<LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27,16,2);
const int t=7;

const int e=6;
```

```
const int red=11;

const int
yellow=10;

void setup() {

pinMode(e, INPUT);

pinMode(t, OUTPUT);
pinMode(red, OUTPUT);
pinMode(yellow,
OUTPUT);
Serial.begin(9600);
lcd.begin(16,2,0x27);
lcd.backlight();

}

void loop() {

digitalWrite(t, LOW);
delayMicroseconds(2);
digitalWrite(t, HIGH);
delayMicroseconds(10
); digitalWrite(t,
LOW);

long duration=pulseIn(e,HIGH);

int distance=(duration*0.034/2);
if(distance>100)

{

digitalWrite(yellow, LOW);

digitalWrite(red, LOW);
```

```
lcd.clear();

lcd.setCursor(0,0);
lcd.print("Safe");

 delay(5000);

}

else{

if(distance<=100 && distance>50){

digitalWrite(yellow, HIGH);
digitalWrite(red, LOW);
lcd.clear(); lcd.setCursor(0,0);
lcd.print("Caution"); delay(5000);
}

if(distance <=50){
digitalWrite(red, HIGH);
digitalWrite(yellow,
LOW); lcd.clear();
lcd.setCursor(0,0);
lcd.print("Danger");
delay(5000);
}

}

}
```

Output 1:

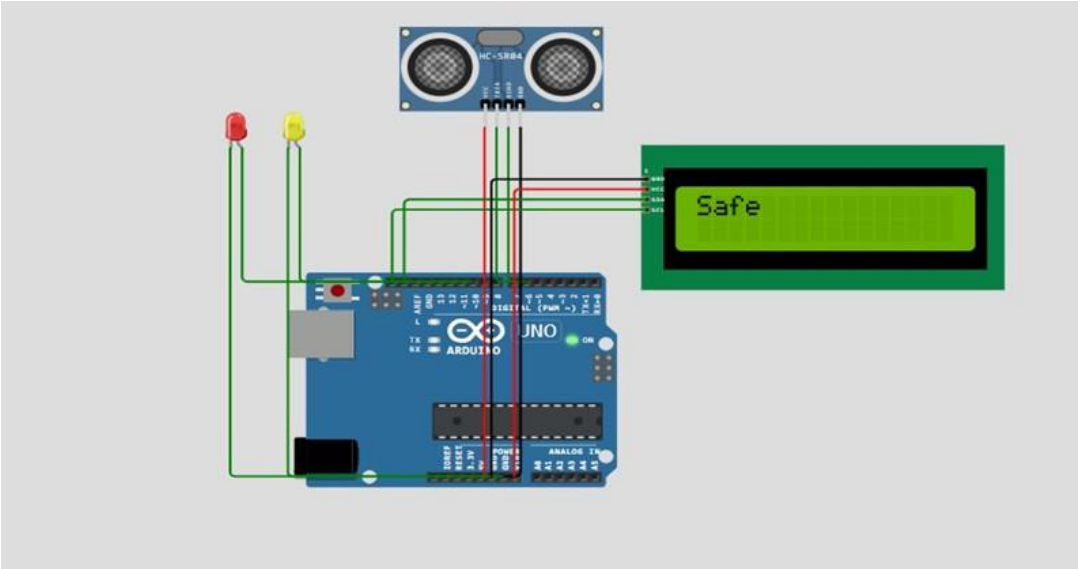


Fig 6.28 (Output for Question 4.0)

Output 2:

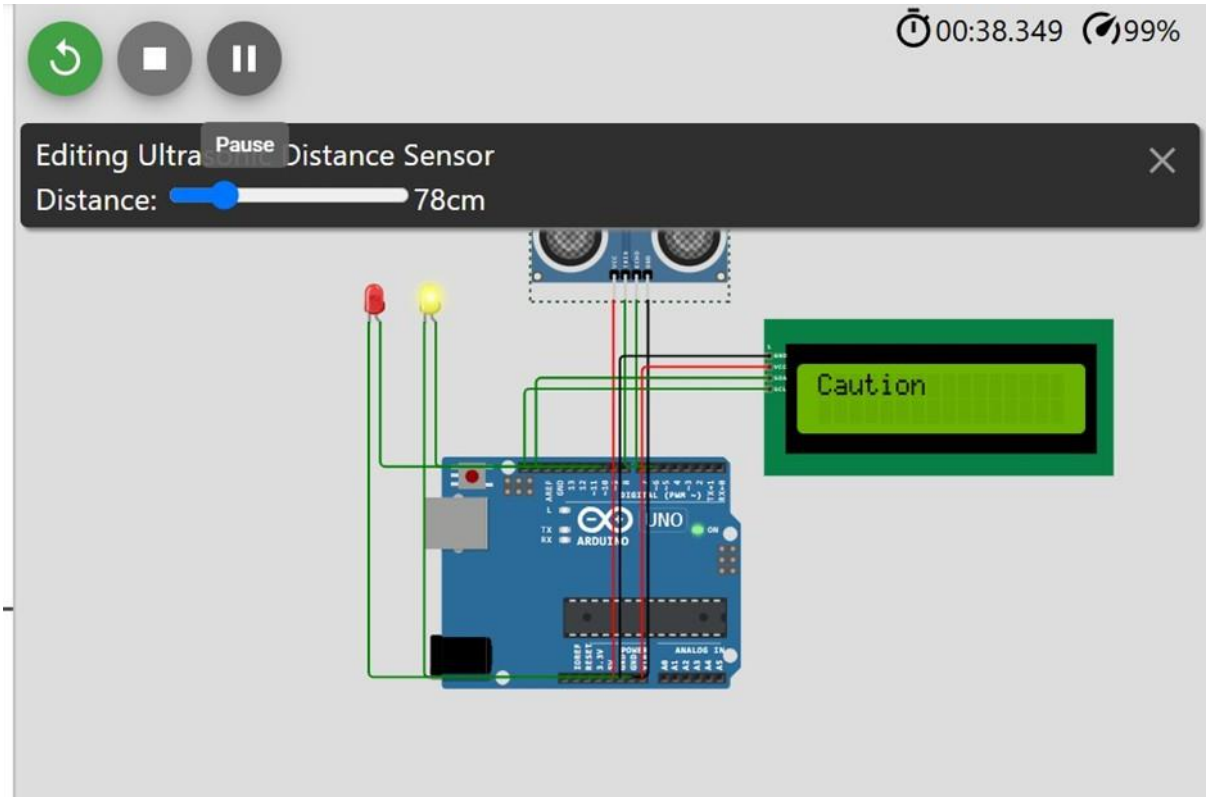


Fig 6.29 (Output for Question 4.1)

Output 3:

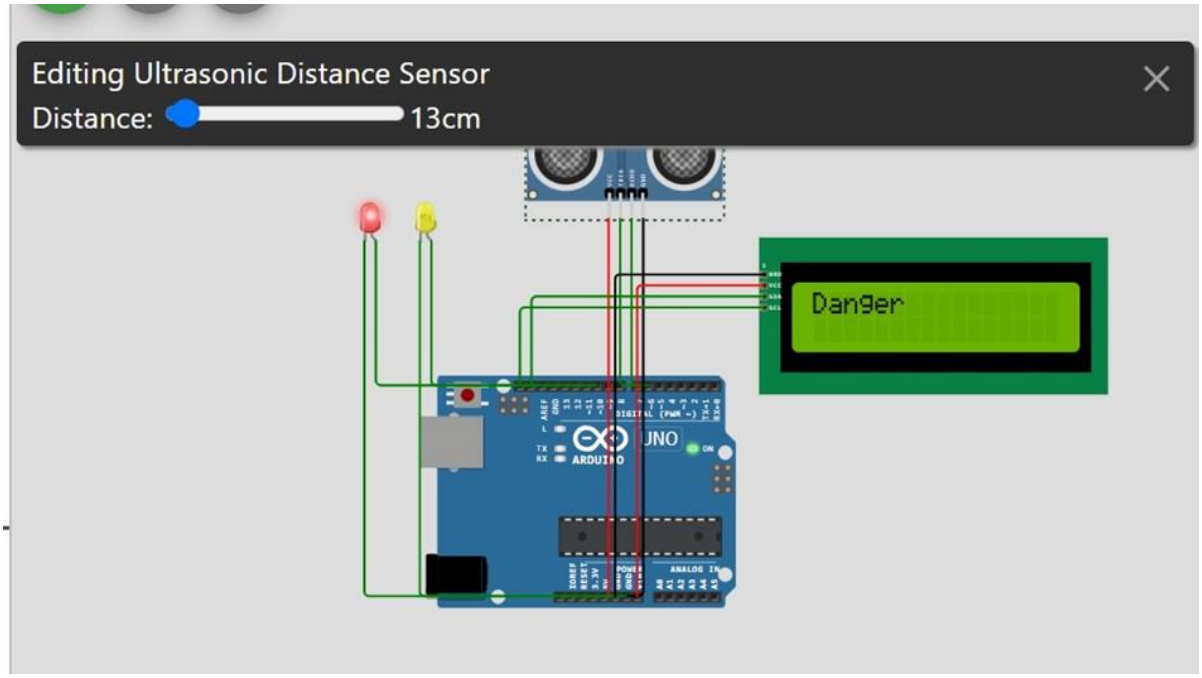


Fig 6.30 (Output for Question 4.2)

6.6. Push Button:

A push button switch is a mechanical device used to control an electrical circuit in which the operator manually presses a button to actuate an internal switching mechanism. They come in a variety of shapes, sizes, and configurations, depending on the design requirements.

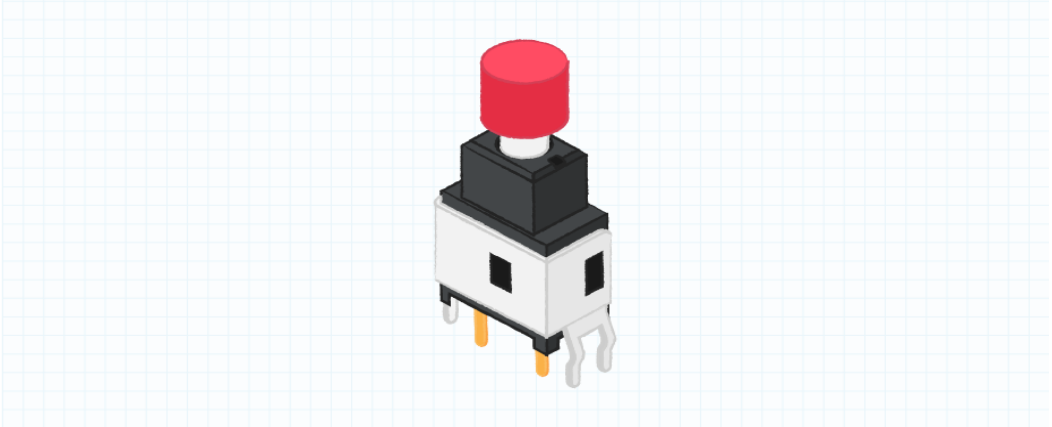


Fig 6.32 (Push Button)

Circuit:

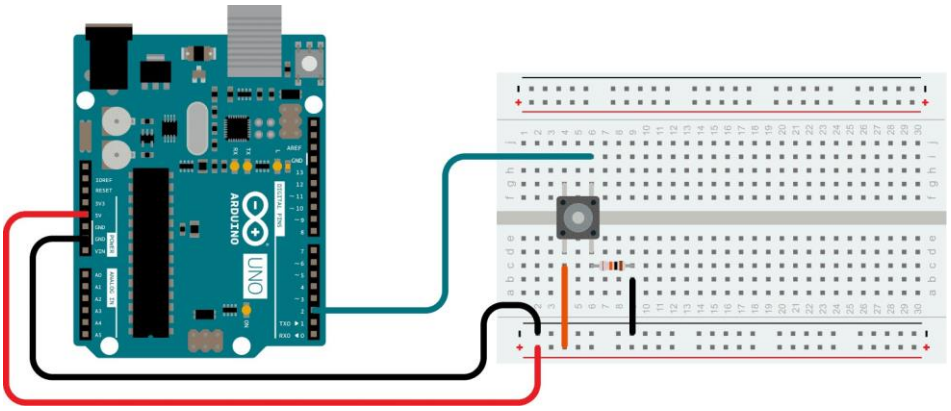


Fig 6.33 (circuit of Push Button)

Question : Write an Embedded C program to interface an ultrasonic sensor and push button with Arduino. If the input is '1' or the push button is pressed, print 'Danger' and display the distance detected by the ultrasonic sensor.

Program:

```
const int
sw=12; const
int t=7; const
int e=6; void
setup() {

pinMode(e,
INPUT);
```

```
pinMode(t,
OUTPUT);
pinMode(sw,
INPUT);
Serial.begin(9600);

}

void loop() {

int data=digitalRead(sw);

digitalWrite(t, LOW);
delayMicroseconds(2);
digitalWrite(t, HIGH);
delayMicroseconds(10
); digitalWrite(t,
LOW);

long
duration=pulseIn(e,HIGH);
int
distance=duration*0.034/2;
Serial.println("Distance ");
Serial.print(distance);
Serial.println(" cm");
if(distance<50 || data==1){

Serial.println("Danger ");

}

 else{

Serial.println("Normal ");

}
```

}

Output 1:

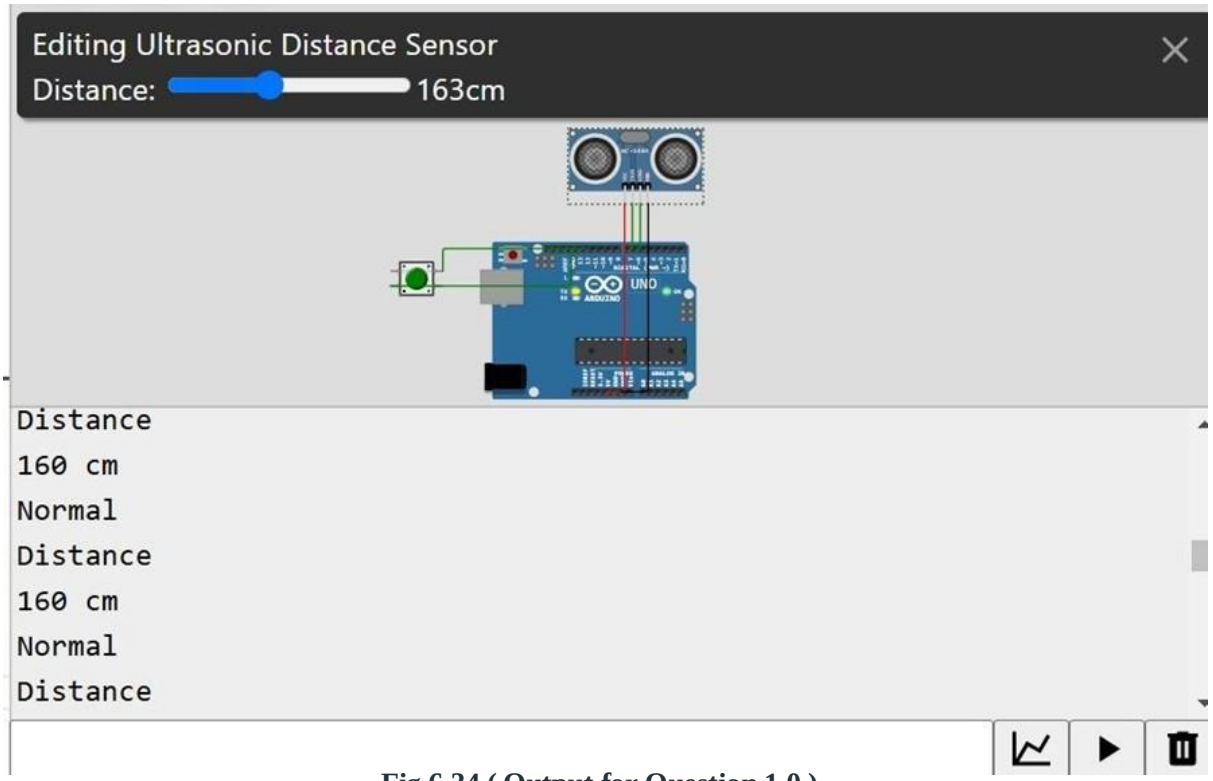


Fig 6.34 (Output for Question 1.0)

Output 2:

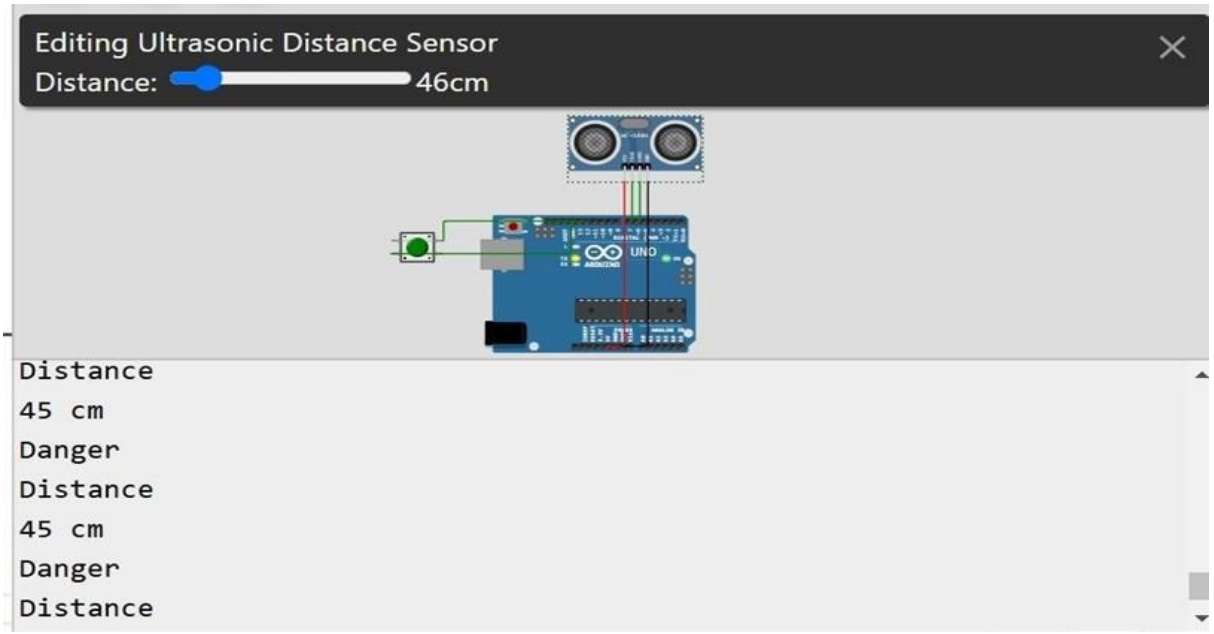


Fig 6.35 (Output for Question 1.1)

Output 3:

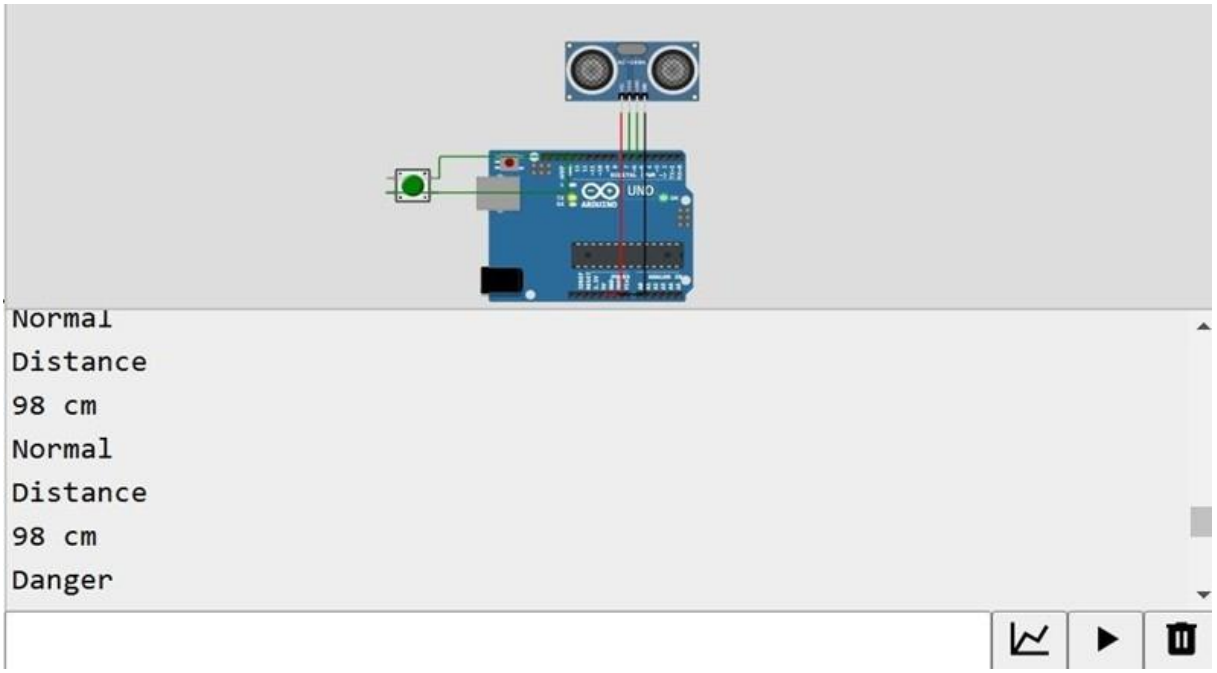


Fig 6.36 (Output for Question 1.2)

6.7. 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.

Fig 6.37 (Buzzer pin configuration)

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.

<u>Question</u> : Write an Embedded C program to interface an ultrasonic sensor, push button, PIR motion sensor, and a buzzer with Arduino. If the input is '1', the buzzer should be activated. Display the distance detected by the ultrasonic sensor. Additionally, if the PIR sensor detects motion and the distance is less than 50, or if the push button is pressed, print 'Danger.' Otherwise, print 'Normal.

Program:

```
const int
sw=12; const
int t=7; const
int e=6; const
int d=13;
```

```
const int
BZ=5; void
setup() {
pinMode(e,
INPUT);
pinMode(t,
OUTPUT);
pinMode(sw, INPUT);
pinMode(d, INPUT);
pinMode(BZ,
OUTPUT);
Serial.begin(9600);

}

void loop() {

int
data=digitalRead(sw);

char PIR=digitalRead(d);
Serial.println("Enter any
Number");
if(Serial.available()>0){

char a=Serial.read();
Serial.print("Number is:
");

Serial.println(a);
if(a=='1'){

digitalWrite(BZ,HIGH
); delay(5000);

}

else{ digitalWrite(BZ,LOW);
```

```
}

}

digitalWrite(t, LOW);
delayMicroseconds(2);
digitalWrite(t, HIGH);
delayMicroseconds(10
); digitalWrite(t,
LOW);

long
duration=pulseIn(e,HIGH);
int
distance=duration*0.034/2;
Serial.println("Distance ");
Serial.print(distance);
Serial.println("cm");

if((PIR==1 && distance<50 )|| data==1)

{

Serial.println("Danger ");

}

else{

Serial.println("Normal ");

}

delay(5000);

}
```

Output 1:

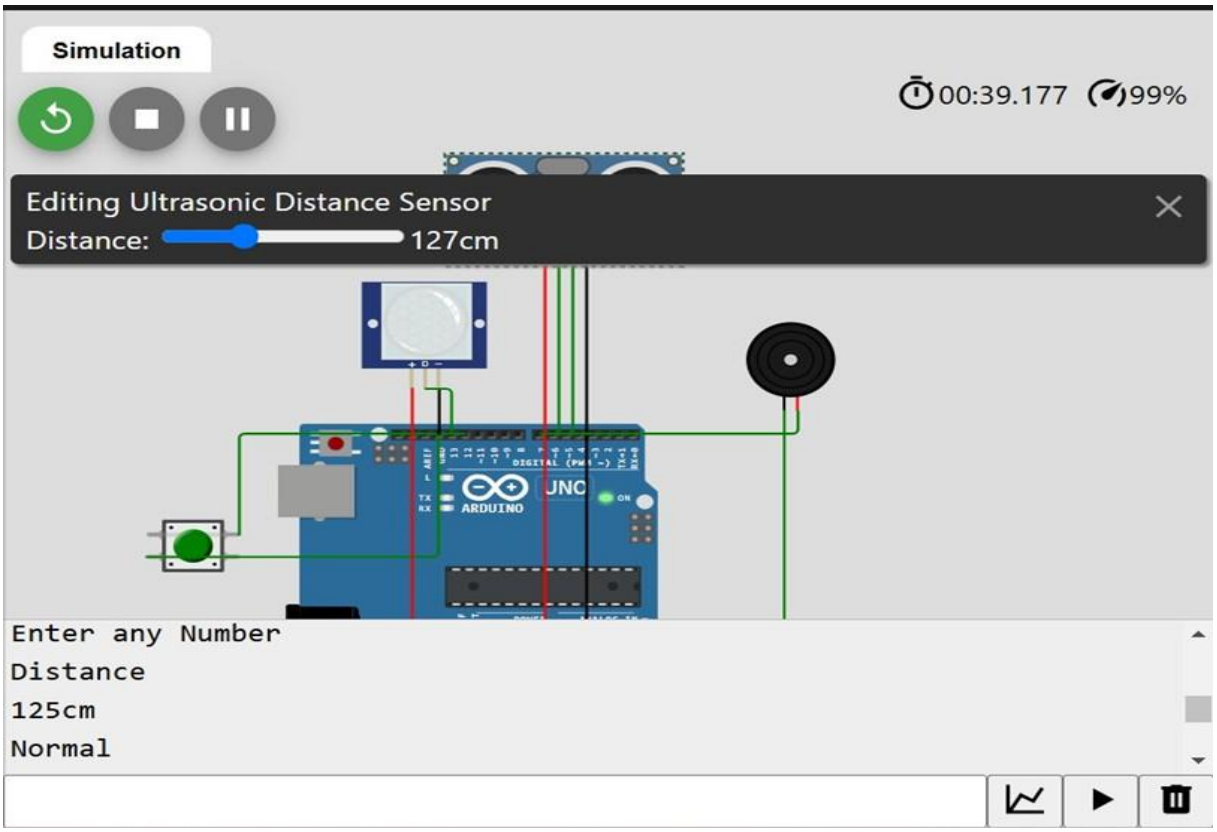


Fig 6.38 (Output for Question 1.0)

Output 2:

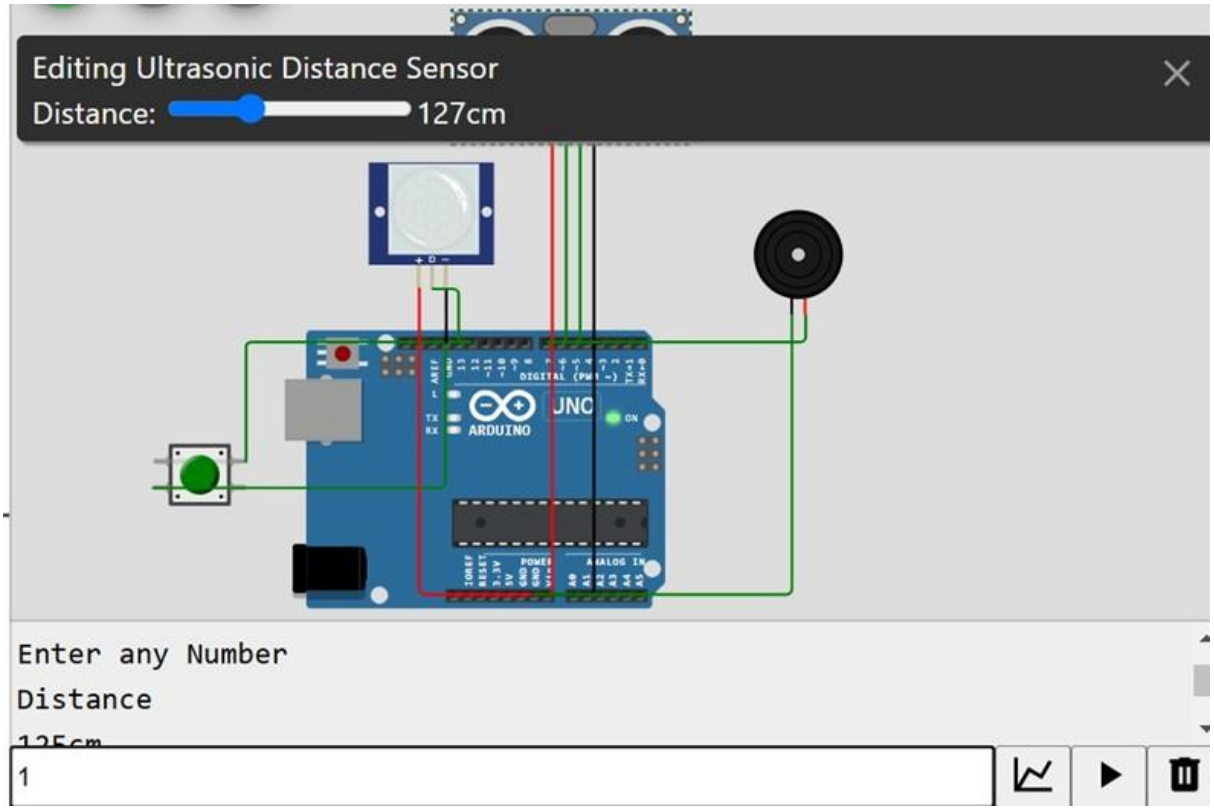


Fig 6.39 (Output for Question 1.1)

Output 3:

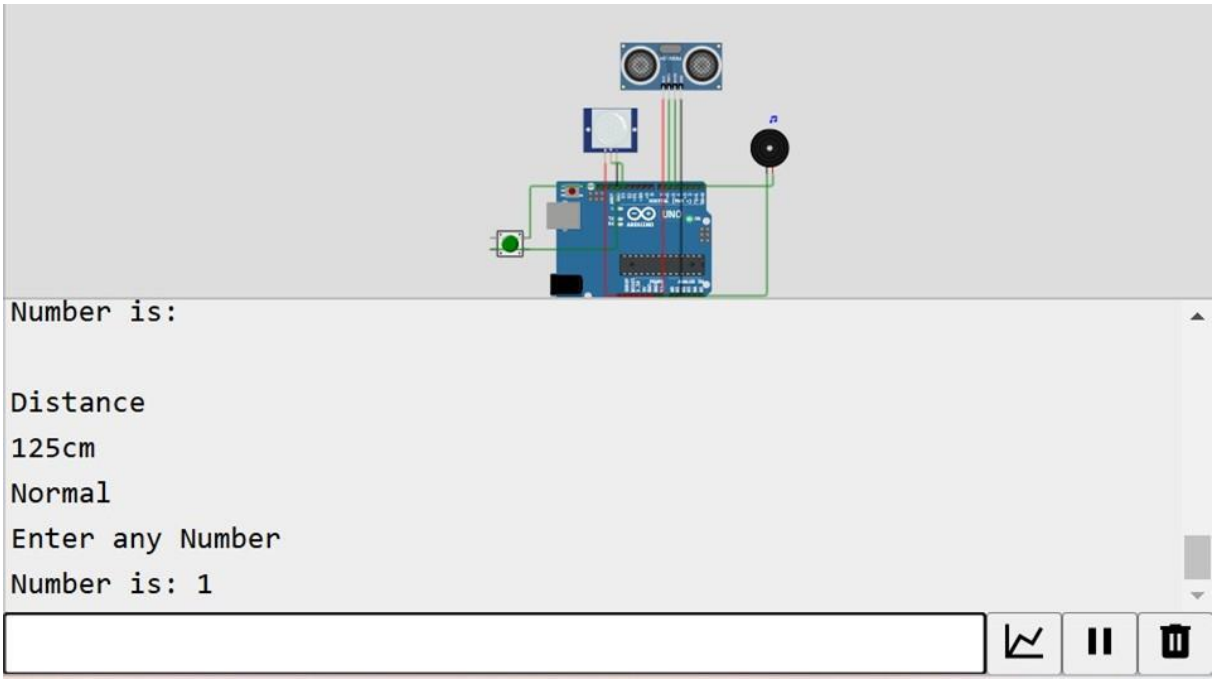


Fig 6.40 (Output for Question 1.2)