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Safe Distance Device Based on IoT

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Abstract*— When COVID-19 occurs, the WHO suggests some guidance, like having social distance between people, but it's not possible to maintain social distance in crowded areas. We cannot identify whether the people are within a defined range of each other. To resolve this issue, we came up with an IoT device that helps us maintain social distance between people. This IoT device has a PIR sensor that senses human presence within a defined range. When the sensor senses some human presence within the range, it will beep with the help of the buzzer and also send an alert message to the user. Not only for social distancing, the device also works for security. The device has a database that stores the owner's data and captures images through the ESP32 Cam. The ESP32 Cam has features like video surveillance, motion detection, face recognition, IoT integration, and low power consumption, which make it a good solution for security applications. It also helps women who want to feel safe in crowded areas when someone comes nearer to them. They can use it as their safety device. It also has GPS to track the location of the device. It also minimizes the effect of COVID-19 or any other disease that spreads when a person comes into contact with it. The Safe Distancing and Security project utilizes IoT technology to create a comprehensive solution that addresses the challenges of maintaining safe distances in crowded environments while ensuring enhanced security measures. By deploying a network of smart sensors, cameras, and connected devices, the system continuously monitors and analyses real-time data to detect and alert when individuals breach the safe distancing guidelines. It's ironic how, in a world that is technologically advanced and interconnected, ensuring safe distancing and security remains a significant challenge. Despite our ability to send data across the globe in seconds, we struggle to maintain a safe distance between individuals in crowded areas, leading to potential disease transmission. While we have advanced surveillance technologies and sophisticated security measures, we still witness incidents of theft, vandalism, and violence in public spaces.

Keywords—COVID-19, Social distancing, GPS, PIR sensor, Arduino board, WHO, Buzzer, ESP32 Cam, GSM

I. INTRODUCTION

Safe distancing, as we know, is how important it is to keep safe or social distancing maintained in today's environment. Nowadays, no one can be trusted, which is why it is important to maintain distance in crowded places like buses, trains, malls, etc. so that no one can harm us or steal anything from us. It is important to maintain distance due to the compassion that is going on nowadays that spreads very quickly from person to person, and if we do not maintain this safe distance, then the virus spreads even more quickly. The proposed methodology in the paper is to maintain safe distancing and provide security, the user will set the range according to them, and it will help us in maintaining safe distancing. If someone hits one of our areas or comes close to the ring, then it will give a message and the buzzer will beep, due to which we will know someone is coming close to us and we will know we should maintain safe distancing. The device also contains a GSM module, which is used for sending an alert message. It depends on the user and what they want to use if they want to get an alert with the help of a buzzer, they will go for the buzzer, but if they want to continue with SMS, they can turn the buzzer off, and they can use both as per their requirement. Additionally, the device is embedded with an ESP32 camera, which is especially used for the security of the device owners. So, the user can click pictures of whoever has bad intuitions. This device has owner access it depends on the owner whether they want to turn it on or off. This is a very small device that will attach to anything, and it will be affordable so everyone can use it. We will use it to maintain distance and protect our things from being stolen in crowded places. It's not always possible to sit near our belongings if we want them to be safe. We can put it on our belongings, and it will sense if someone comes near. We can use it for security and safety purposes. We can use this for home security purposes as well. we will put it near the door, so it will sense if someone comes near our door or device. It helps each maintain at least a safe distance. The device senses only humans. This will alert us when someone is near us. It will beep when someone enters within range of its reach. Its frequency of sound will increase as the person comes closer to us. It will capture the image of the person near the device through the ESP32 Cam in a defined range. The database will be accessible by the owner, who can delete the files whenever they want. Lots of people under the guise of a crowd try to make body contact, which makes an individual victim uncomfortable. It will also help us in this situation the buzzer will beep as soon as it senses someone's presence near us within a defined range. The GSM module will send an alert message to the user. The database will have an owner's sense. By using a database it will not sense the owner's touch. The device will store all the images it captured in the past and be accessible by the user, which will help the owner get to know about the person who came into contact with it in the past. The owner will have all the access. They can check the database anytime and free it whenever they want. It is user-dependent. When the user wants, they can turn on the device. It also has a GPS location tracking system. Users can access the location from their phone, and in case the device gets stolen, the owner can check the location of the device from their phone. The GPS will show the live location of that device. Moreover, when something looks wrong, we can click pictures using the ESP32 Cam, and the owner can easily access them. The phone's software has a strong password that only the owner has access to.

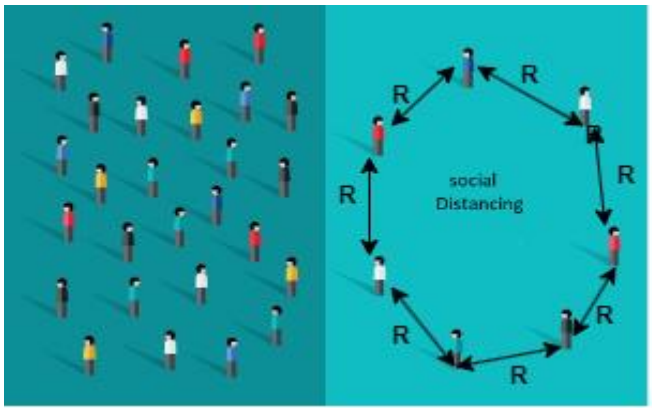

Fig.1: Users and their ranges

II.SYSTEM

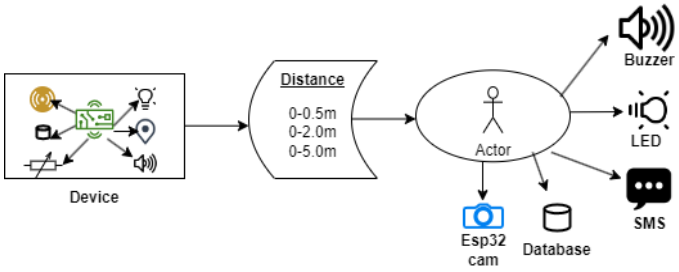

Fig.2: Safe Distance system

The above diagram shows the workings of the device. As soon as a person opens the device, it will show them a list of the distance range they want to choose. Depending on their choice, the respective functionality will get started. The device has a database that will store the owner's touch to avoid noise pollution, which occurs whenever it senses the owner's touch. As soon as an attacker crosses the range, the buzzer will start beeping and the LED will glow. Its intensity increases as the distance between the defaulter and the device decreases and as soon as someone enters the defined range, it will capture the image.

III. USEFULNESS FOR SOCIETY

Safe distancing and security can be incredibly useful for society in several ways:

1. **Preventing the spread of contagious diseases:** During a pandemic or epidemic, maintaining a safe distance is crucial to preventing the spread of the disease. A device that ensures safe distancing can help people maintain a safe distance from one another, reducing the risk of infection.
2. **Ensuring workplace safety:** In workplaces, especially those that require people to work close to one another, a device that ensures safe distancing can help ensure the safety of all employees. It can alert workers when they are getting too close to one another and help prevent accidents and injuries.
3. **Enhancing security:** A device that ensures safe distancing can also help enhance security.
4. **Helping those with disabilities:** Individuals with disabilities may find it challenging to maintain a safe distance or be aware of their surroundings, especially if they are visually impaired. A device that ensures safe distancing and alerts them to potential hazards or obstacles can help these individuals stay safe and aware of their surroundings.

IV. MOTIVATION

Nowadays, social distancing plays an important role in keeping a person safe from viruses and other problems. An online survey conducted by the NGO found that more than 90% of urban women fear everyday bullying, including abusive language, inappropriate touching, and other forms of sexual violence in public. More than 86% believe it is unsafe to touch public transportation, especially when they are alone, and it has been found that pickpocketing is increasing day by day. We found that in 2018, about 19,500 cases of pickpocketing occurred and as we all know, one of the major reasons for the spread of COVID was the lack of social distancing. Due to this reason, social distancing devices are introduced, which help maintain social distancing between people so there is no spread of COVID-19. Many countries use Bluetooth and Wi-Fi devices to maintain social distancing. In India, DRISHTI is used to analyze social distance in subways and public places. In India, we had Arogya Setu, which is a tracking app that uses the smartphone's GPS and Bluetooth to track COVID cases. By Bluetooth, it is determined the COVID case is nearly six feet. We have added a GSM module to avoid noise pollution, which can be created by the buzzer. Sometimes, according to the situation, the user doesn't want any noise to occur, so this SMS will help them get an alert. It will capture the image of the person near it and store it in the database. The device is user-friendly they can turn it on or off. Our proposed device has a PIR sensor for sensing the person who is in the defined range, and the buzzer will start beeping as soon as the person comes into the defined range. There is one tonne that will be used for starting as well as shutting down the sensing activity. The device is fully accessible to the person who is wearing it. If they want it to sense the activity happening in the defined range, they can start it otherwise, it will remain close. It is also used by the women for their protection if someone tries to come near them. We can store the data of the person who comes closer to us, and the device also stores the data of the owner in the database. The device also provides the feature of taking pictures, as the ESP32 Cam is a versatile and affordable development board that is ideal for projects that require video or image capture. The real motivation to do this research came to us because of the COVID-19 virus. The COVID-19 virus has had a profound impact on the life systems of all human beings. Today, every person on earth knows about this virus. For the prevention of this dreadful virus, thousands of ways were taken out by all the medical and technical forces of the world, and we got success. Social distancing was the easiest way to prevent this virus. To provide safety to the people, many devices were made to help prevent social distancing. So, with this motivation and being students of the technology field, we came up with the idea to make a device that is easily available, affordable, and easy to use for humans. This is based on IoT, which creates awareness about social distancing as well as security. Security, along with social distancing, is what makes this device stand out from the rest.

V. DIFFERENT SYSTEMS USED IN THE WORLD FOR PRECAUTION AGAINST COVID-19

Aarogya Setu is a mobile application developed by the Government of India in April 2020 to aid in contact tracing and prevent the spread of COVID-19. The app uses Bluetooth and GPS technology to track the movements of individuals who have tested positive for COVID-19, allowing health authorities to quickly identify and contact individuals who may have come into contact with an infected person in the past few days.

Here are some key features and information about the Aarogya Setu app or the working of this app. Here's a step-by-step overview of how the app works:

1. **User Registration:** Users are required to register on the app by providing their mobile number and a few personal details such as name, age, gender, and profession. The app then generates a unique digital identity for the
2. **Health Assessment:** After registration, users are asked to complete a health assessment questionnaire to check for COVID-19. If the user reports any symptoms, the app advises them on the next steps, such as self-isolation or contacting a healthcare provider.
3. **Contact Tracing:** The app uses Bluetooth and GPS technology to identify other Aarogya Setu users who are near the user. The app uses anonymized IDs to record the user's interactions with other users and stores this data on the user's
4. **Risk Assessment:** Based on the user's travel history and contact with other Aarogya Setu users, the app calculates the user's risk of contracting COVID-19. If the user's risk is deemed to be high, the app advises them on the next steps, such as self-isolation or contacting a healthcare provider.
5. **COVID-19 Updates**: The app provides users with the latest COVID-19 news and updates from the government, including information on testing centers and healthcare facilities.
6. **E-pass:** The app allows users to apply for e-passes for travel during the lockdown.
7. **Privacy and Security:** The app has been designed with strict privacy and security measures to protect user data. The data collected by the app is encrypted and stored securely on the government

The impact of the app has been significant in India, with millions of users downloading and using the app to help prevent the spread of COVID-19. The app has been successful in aiding contact tracing efforts and has been praised by health experts for its usefulness in the fight against the pandemic. However, there have also been concerns raised about privacy and security, and users are advised to read the app's privacy policy carefully before using it. Overall, the Aarogya Setu app has been an important tool in the fight against COVID-19 in India.

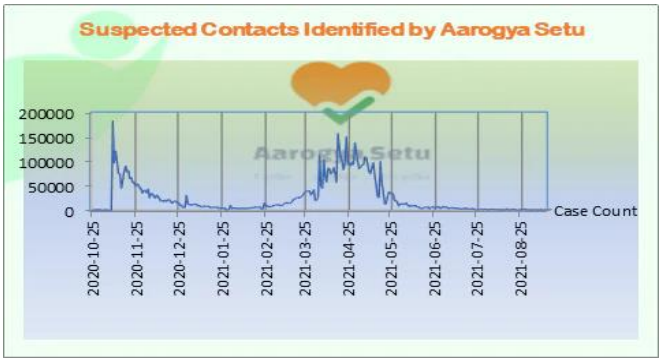

Fig.3: Aarogya Setu analyzing the COVID Cases.

Here are some examples of popular COVID-related apps and devices used in foreign countries:

1. **South Korea** The Korean government developed a contact tracing app called "Corona 100m" that used GPS and credit card transaction data to track the movements of confirmed COVID-19 cases and alert users who had been close to them. The app was downloaded by over 10 million people in South Korea and was credited with helping to contain the spread of the virus.
2. **Singapore:** The Singaporean government developed a contact tracing device called "Trace Together" that used Bluetooth technology to detect nearby devices and store encrypted data on close contacts. The device was used by over 2.4 million people in Singapore and was credited with helping to identify and isolate COVID-19 cases early.
3. **Germany:** The German government developed a COVID-19 warning app called "Corona-Warn-App" that used Bluetooth technology to detect nearby devices and notify users if they had been in close contact with a confirmed COVID-19 case. The app was downloaded by over 28 million people in Germany and was credited with helping to contain the spread of the virus.
4. **United States** Several social distancing sensors and wearable devices have been developed and implemented in the US to help maintain social distancing. For example, the "Safe Distance" device developed by Proxidyne uses infrared technology to detect how far apart people are and can alert users if they are getting too close. The "Safe Zone" wearable device developed by Triax Technologies can be worn on a lanyard or wristband and emits an audible alarm if users get too close to each other.
5. **China:** China has implemented several measures to maintain social distancing, including the use of drones equipped with loudspeakers to enforce social distancing rules in public areas. In addition, some schools and workplaces in China have implemented facial recognition technology to monitor compliance with social distancing rules.

Overall, these apps and devices were popular in their respective countries and were effective in helping to contain the spread of COVID-19. They were able to do so by using innovative technologies like GPS, Bluetooth, and transaction data to track the movements of confirmed COVID-19 cases and alert users who had been in close contact with them.

VI. RELATED WORK

Safe Distancing and Security The IoT project offers a comprehensive solution that combines social distancing measures with security features, providing an innovative approach to address the challenges posed by crowded environments, especially during times of pandemics and health emergencies. Researchers have made significant progress in the field of social distancing and security using IoT technology. Existing work includes IoT-based solutions that utilize sensors such as PIR, ultrasonic, and infrared sensors to detect human presence and enforce safe distancing measures in real time. Innovative use of IoT technologies in enhancing security measures and enforcing safe distancing guidelines in various environments has been researched. Successful deployments of IoT-based solutions in real-world scenarios have shown potential benefits for mitigating the spread of diseases and improving safety in crowded areas.

S. Meivel et al. [1] describe a drone that has a camera and speaker for detecting unmasked individuals and alerting authorities, as well as warning people who are not maintaining social distance. This system focuses on industrial IoT monitoring using a Raspberry Pi 4 and an OpenCV camera with a faster R-CNN algorithm. In [2], Hamdi Firji et al. proposes an end-to-end smart navigation framework that uses social IoT (SIoT) and AI techniques to ensure pedestrian safety in a given geographical area. The system creates weighted graphs representing social relations using different IoT devices, groups them into communities based on IoT, and estimates the level of social distancing

practice on different roads using a computer vision model. In [3], Mayuri Diwakar Kulkarni et al. propose a wristband equipped with PIR sensors for sensing humans within a 1.5-meter vicinity. The proposed PIR sensor-fitted band is easily wearable on the wrist and consists of an Arduino, two PIR sensors, a speaker jack, a buzzer, a push button, and connecting wires. If a person comes within the range of 1.5 m or less, it sends an audio signal and a signal to the buzzer. In [4], Sharanya Mahapatra et al. proposes an IoT-based system that provides automatic tracking and contact tracing of people using RFID, unique IDs, and GPS-enabled wristbands. The system offers robust and modular data collection, authentication through a fingerprint scanner, and real-time database management. In [5], K. Venkatesh et al. proposes an IoT-based wristband that contains a trigger, microcontroller, GSM module, GPS module, IoT module, neurostimulator, buzzer, and vibrating sensor. The wristband sends an alert when the person wearing it comes too close to another person. In [6], Dr. K. Mala et al. propose a wristwatch equipped with a Raspberry Pi-based camera that records the image of an assaulter in case of danger. The device sends the image as a message and email to a set of pre-stored emergency contacts and the nearby police station and tracks the location of the victim. In [7], Dr. S. Sreenath Kashyap et al. present an automotive localization system using GPS and GSM-SMS services and alerts over IoT for women's security. The system allows localization of the woman and transmitting her position to the rescue team as a short message (SMS) and over the Internet. In [8], K. Sahithi Chowdary et al. proposes a smart ring (SMARISA) comprising a Raspberry Pi Zero, a Raspberry Pi camera, a buzzer, and a button to activate the services. The ring is activated by the victim being assaulted with just the click of a button that fetches her current location and captures the image of the attacker via the Raspberry Pi camera. In [9], Dr. Ritu Shrivastava et al. proposes a smartwatch equipped with a microchip and a panic button that communicates with an intelligent transport (IoT) platform, GPS for location information, and GPRS/CDMA communication technology for sending location updates. The watch also has a Raspberry Pi camera that takes pictures and videos of the incident and consists of an LM35 for sensing body temperature. In [10], Rifat-Ibn-Alam and colleagues proposed a wearable device that includes an Arduino UnoR3, an ultrasonic distance sensor, a Neo Pixel Ring 12, and a buzzer. The device measures the distance of a person using ultrasonic waves and alerts the person by blinking the LED light and changing its color. The buzzer starts beeping when someone is excessively close to the sensor. In [11], Muskan and colleagues proposed a wearable device for women's safety that includes temperature and pulse sensors. The data generated by the sensors is sent to the cloud, where a machine learning algorithm (logistic regression) is applied to analyze the data. In [12], B. Sathvasri and colleagues proposed a smart band with a trigger, microcontroller (ATmega2560), GSM module (SIM900), GPS module (Neo-6M), IoT module (ESP-12E), neurostimulator, buzzer, and vibrating sensor. When a woman senses danger, she holds the trigger, and the device tracks her location using GPS and sends an emergency message using GSM to the registered mobile number and nearby police station. The neurostimulator produces a non-lethal electric shock in emergencies, the buzzer is used as an alarm to alert nearby people, and the vibrating sensor sends the last location in case of a device malfunction. In [13], Alhmiedat and colleagues developed a wearable electronic device that estimates the proximity distance between users based on the received signal strength of Wi-Fi signals emitted by other wearable devices. In [14], Bian and colleagues designed a wearable, oscillating magnetic field-based proximity sensing system to monitor social distances between people. In [15], Kobayashi and colleagues proposed a social distance monitoring system for students on a university campus to prevent the spread of COVID-19 infections. The system consists of ESP32-based microcontroller nodes distributed among students, and the distances between the students are calculated by periodically transmitting and receiving Bluetooth Low Energy (BLE) advertising packets between the nodes. In [16], Neelavathy and colleagues proposed a smart social distance (SSD) mobile application-based monitoring system that can predict the social distances between two people, assisted by mobile Bluetooth and a mobile camera. In [17], Diana Yacchirema and colleagues proposed a portable IoT device, integrated with a laser sensor and Wi-Fi adapter, that measures the distance between two people and captures RSSI signals from wireless networks to monitor the environment of common indoor spaces. In [18], Rajasekar et al. proposed an IoT-based automated tracking system to identify possible contacts using cost-effective RFID tags and a mobile phone as an RFID reader. In [19], Lubis et al. proposed a proximity-based COVID-19 contact tracing system using BLE technology that can trace and control the spread of COVID-19 in the local community. In [20], Alrashidi et al. proposed a system of placement and relocation of people in an indoor environment using an intelligent method based on two optimizers (ant colony and particle swarm) to determine the optimal relocation of a set of students equipped with IoT tags to control their locations and movements.

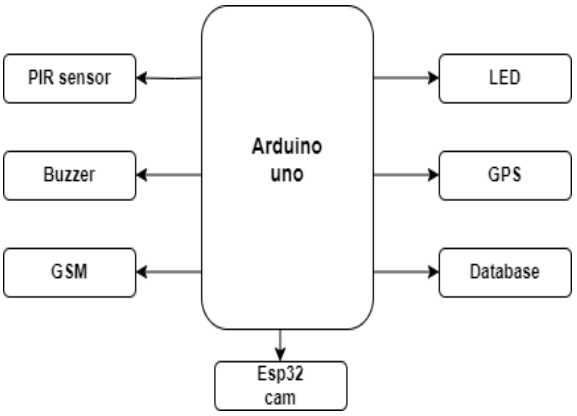

Fig.4: Safe Distance Device and its Important Parts

VII METHODOLOGY

With this device, we help people maintain distance so that the social distancing guidelines are maintained. When the person goes to a crowded place, if the user wants to maintain social distancing and be safe and secure, the user will start the device, and it has PIR, which will sense the human presence. If someone enters the defined range, crosses the defined range, or just touches the defined range, the buzzer will start beeping. The device had a GPS, so if the device is stolen or lost, we can find it by tracking its location. The women can also use it for safety purposes and can click pictures as the device has an ESP32 camera to detect unauthorized access. The proposed device will detect moving objects in all directions within the vicinity of the defined range.

A PIR sensor is a motion detection device that is used to detect the presence of humans. To detect heat energy, a PIR sensor uses a pair of pyroelectric sensors. As soon as someone comes into the vicinity of the defined range, it senses their presence.

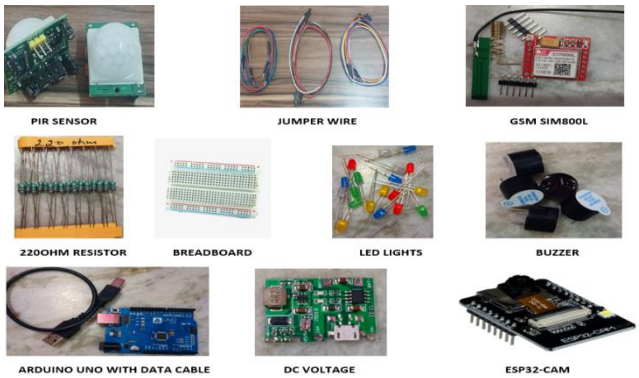

Fig.5: Devices Used in the System

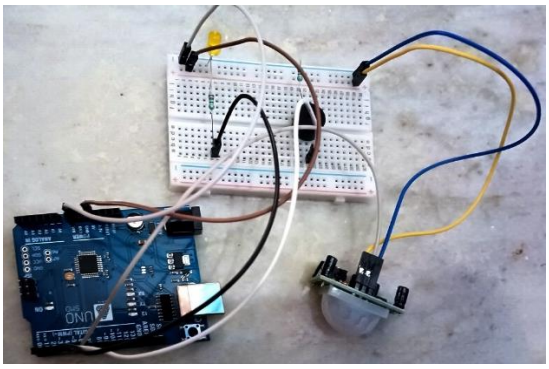

Fig.6: Device Module

An **Arduino board** can take inputs like a light from a sensor, a finger on a button, or a tweet and turn them into outputs that turn on motors, turn on LEDs, and post something online. For this purpose, we use the Arduino programming language and the Arduino software (IDE).

GPS is used to find the location of the device, so if the device gets lost or someone steals it, we can find the location of the device by checking its GPS location on our smartphone.

A breadboard is used to develop the circuit and wiring of the device with Arduino.

The buzzer is connected to a PIR sensor so that if it detects human presence, it can beep and the user can stay alert. When someone comes within a defined range of the device, it will start beeping.

A jumper wire connects our items to our breadboard. It is used to store information related to the device owner and the person's senses, so it can detect a known person and an unknown person.

A 5-mm LED bulb will glow when it senses a human presence. A 220-ohm resistor is often used with LEDs. It helps LED bulbs consume less current so that they cannot quickly burn out. We use a resistor to limit the current of the LED bulb.

The **GMS module** in the context of the IoT (Internet of Things) refers to a version of Google Mobile Services that is optimized for use with IoT devices. This module provides a set of prebuilt Google applications and APIs that can be used by IoT devices to connect to and interact with Google's cloud service.

The **ESP32-CAM** is a small, low-cost camera module that integrates an ESP32-S chip, an OV2640 camera, and a microSD card slot. It is designed for projects that require video or image capture, such as security systems, robotics, and IoT devices.

On our device, we are using the **MongoDB** database. It will store the owner's data, and then it will not buzz whenever it senses the owner's touch. For this, in the database, we have to define a schema for the data, and then we can collect our items in a table or database.

WORKING OF DEVICE-

1. **Object Detection:** With the help of a PIR sensor, the owner can get to know that someone is coming near.
2. **Variable Distance**: The owner can set the range according to their
3. **Image**: When someone enters the defined range, the device will capture the image of the person. We have used the ESP32-CAM for this.
4. **Database:** The device will store the owner's We have used the database to not sense the owner's touch. To avoid noise pollution. The owner will have all the access. They can check the database anytime and free it whenever they want. Here we will use the MongoDB database, which is easy to access. The owner can freely access this database and delete the data as per their needs.
5. **Notification:** The device will send an alert message to the owner with the distance and time when someone enters the defined area.
6. **Buzzer:** The device has a buzzer, which will beep as a PIR sensor senses It depends on the user whether they want to get an alert by buzzer, by getting an alert message, or by both.
7. **Owner Control:** The owner can stop the alert sound or change the distance range. The owner can turn the device on or off as per their needs.
8. **GPS:** It has GPS embedded in it that tracks the device's or user's location. In case the device gets stolen, it will help in tracking the location of the device.

EMBEDDED FEATURE-

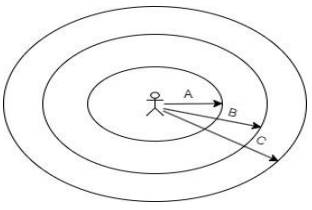

Fig.7: Users and their ranges

A: distance from P to 0.5 meters
B: distance from P to 2 meters
C: distance from P to 5 meters.

A PIR (passive infrared) sensor is a device that is designed to detect motion within a defined range of its surroundings. It

operates by detecting the infrared radiation emitted by objects in its field of view. Upon detection of motion, the PIR sensor provides a switching feature that allows for automatic on/off control of an electrical device or system. This capability makes it a popular choice for security and lighting applications. The user can easily incorporate PIR sensors into their systems and benefit from their automated functionality. PIR sensors are typically used for security systems such as motion-activated lighting and burglar alarms. They can detect movement within their field of view and trigger an alarm or turn on lights. PIR sensors are also used in home automation systems to control the operation of heating, ventilation, and air conditioning systems. The PIR sensor consists of a pyroelectric sensor, which generates an electrical signal when it detects changes in the infrared radiation emitted by objects in its field of view. This signal is then processed by a built-in amplifier, which can trigger the switching feature of the PIR sensor. One of the advantages of PIR sensors is that they are very sensitive to changes in infrared radiation but not to ambient temperature changes. This means that they can detect the presence of a person or an animal while ignoring changes in temperature due to sunlight or other environmental factors. PIR sensors are also easy to install and use, as they do not require any complex wiring or programming. They can be integrated into a wide range of devices and systems, making them a versatile and cost-effective solution for many applications. It has a facility through which a user can choose the range according to themselves. Our devices provide three distance ranges, and those options are:

1. **0-0.5 meters:** If a user sets this range, it means the buzzer will start beeping, or they will get an alert message as soon as the defaulter crosses the 0.5 meters range. This range is provided to overcome gold snatching, wallet snatching, and phone snatching, to be safe from unwanted body contact with anybody, and to deal with inappropriate touching. Although the user also has the option of taking a picture of the faulty/attacker. According to a national survey on violence against women, 21% of women found that public transportation is the most likely place where sexual auscultation occurs at its peak [21]. To get away from unwanted touch, which is mostly done in public places like buses, trains, or public places like markets, the defaulters try to make unwanted physical contact, which affects the victim mentally, physically, and socially. Touching in public places is a crime under the law. Therefore, to be safe from sexual assault, the device has this feature.
2. **0–2 meters:** If a user sets this range, the buzzer will start beeping, or they will get an alert message crossing 2 meters and coming towards the person. As we all know, viruses spread mainly through the air, and COVID is one of their examples. It is found that people within 2 meters are at greatest risk. COVID cases increase due to the lack of social distancing between people. Every airborne disease spreads in the air, and various infections also spread in the air. It has been found that high rates of secondary infection have been reported among people with COVID-19 who are likely to get within 1-2 meters. To maintain a distance of at least 1-2 meters, this range is suitable. People will be safe from unwanted touches, viruses, etc. As in public places, it's not an easy task to maintain social distancing, but with the help of our devices, a user can maintain at least a safe distance of 1-2 meters, which will help in decreasing the risk of transmission.
3. **0–5 meters:** This distance range is provided to keep our belongings safe. It's not always possible to keep our luggage bags with us. To keep them safe, it has an embedded feature that will sense if a defaulter crosses the limit of 5 meters. Usually, when we travel on public transport, baggage must be carried either overhead or under the seat. According to the data collected over the last 3.5 years by the Indian Railways, a total of 55,369 cases of theft of passengers' belongings and 1570 robberies took place inside running trains [22]. In case we have to go somewhere, we have to take our luggage with us, which is not always possible because there is a fear of stealing it. Therefore, to keep our belongings safe, we have embedded this feature.

ALGORITHM

With this device, we are helping people be safe and secure. It helps users sense human presence within a given range. The users set the range according to their requirements, and if someone breaches that range, then the buzzer will beep and a message will be sent to the user. If the user wants to take pictures, they can click it.

Step1: Start
Step 2: Give input in system users (U_i), attackers (A_i), the distance of the defaulter (d_i) and range (R_i), and the distance of the user (p_i).
Step 3: Start the device by giving a suitable range (R_i) as per user requirement.
Step 4: Sensor (S_i) present in the system will sense the presence of attackers (A_i) and gives an alert to the user (U_i) at each instance.
Step 5: Set $t_i=0$ and $d_i=0$ repeat step 6 to step until $d_i<0$.
Step 6: Set k=5.1 and repeat step 7 until k>0.
Step 7: k=distance of the defaulter (d_i)-a distance of user (p_i)

```
If(k<=0.5) then
    Xi=1
Type of activity= Physical Assault
  And buzzer will beep 2 times
    Break
  Else If(k>0.5 && k<=2) then
    Xi=11
Type of activity= COVID-19
  And buzzer will beep 4 times
    Break
  Else If(k>2 && k<=5) then
    Xi=111
Type of activity= Luggage Theft
  And buzzer will beep 8 times
    Break.
```

Step 9: As per the result of the step 8 type of activity, the device takes precise information from the user, and according to the requirement, the user can take a picture.
Step 10: Stop.

FUNCTION FOR BUZZER BEEP AND LED GLOW

```
int calibrationTime = 5;
long unsigned int lowIn;
 long unsigned int pause = 5000;

boolean lockLow = true;
boolean takeLowTime;
int pirPin = 7;
int ledPin = 5;
int Buzzer = 6;
```

```
void setup(){
  Serial.begin(9600);
  pinMode(pirPin, INPUT);
  pinMode(ledPin, OUTPUT);
  pinMode(Buzzer, OUTPUT);
  digitalWrite(pirPin, LOW);
  Serial.print("calibrating sensor ");
    for(int i = 0; i < calibrationTime; i++){
      Serial.print(".");
      delay(1000);
      }
    Serial.println(" done");
    Serial.println("SENSOR ACTIVE");
    delay(50);
  }

void loop(){
     if(digitalRead(pirPin) == HIGH){
       digitalWrite(ledPin, HIGH);
       tone(Buzzer,500);

       if(lockLow){
         lockLow = false;
         Serial.println("---");
         Serial.print("motion detected at ");
         Serial.print(millis()/1000);
         Serial.println(" sec");
         delay(50);
         }
         takeLowTime = true;
       }

     if(digitalRead(pirPin) == LOW){
       digitalWrite(ledPin, LOW);
       noTone(Buzzer);
       if(takeLowTime){
        lowIn = millis();
        takeLowTime = false;
        }

       if(!lockLow && millis() - lowIn > pause){
           lockLow = true;
           Serial.print("motion ended at ");
           Serial.print((millis() - pause)/1000);
           Serial.println(" sec");
           delay(50);
           }
       }
  }
```

VIII. RESULT

Safe distancing is an effective way to reduce the spread of viruses and also decrease the likelihood of molestation and theft. However, maintaining a safe distance in public places can be challenging for individuals. As responsible citizens, we must avoid noise pollution for this, we have embedded a GSM module for sending an alert message to the user. The device can be turned on when required and senses people within a defined range, emitting a beeping sound as soon as someone approaches. The device has a feature that users can decide whether they want to get an alert by buzzer or by SMS. The intensity of the buzzer increases as someone comes closer, alerting the user to maintain a safe distance. The owner can also click on the pictures if something unwanted happens. The benefits are numerous. Firstly, it provides an easy and effective way to maintain safe distancing, which is especially important in crowded public places. Secondly, it helps reduce the risk of spreading viruses by alerting users to maintain a safe distance. Thirdly, it can provide a sense of security for individuals who are concerned about theft or molestation, and we can also use it for home security. We can put it near the door, and when we want to access it, we can turn it on, and it will alert the user that someone is near their door. It can also be easily activated or deactivated as required. Our device is based on the owner's call. The inclusion of GPS technology and an ESP32 camera in the device provides an added layer of security, allowing for tracking and taking pictures if needed. GSM will help to get an alert message, and it also has an LED that will glow. In addition, the device has the potential to be beneficial in various settings, such as schools, hospitals, and workplaces, where maintaining a safe distance is crucial. It can also be helpful for individuals who may have difficulty maintaining a safe distance, such as those with certain disabilities or children.

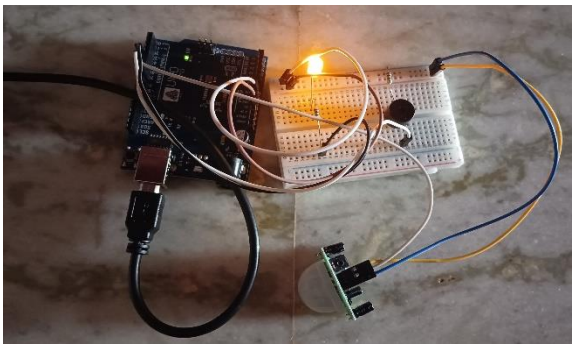

Fig.8: Resulting Module

IX. FUTURE ASPECTS AND LIMITATIONS

The future of the device could include a range of enhancements and integrations that make it more effective and user-friendly.

1. **Integration with other IoT devices:** As IoT technology continues to evolve, the device could be integrated with other IoT devices, such as smart home devices or office sensors, to provide a comprehensive solution for social distancing and
2. **Machine learning algorithms:** The device could be enhanced with machine learning algorithms that can learn and adapt to the user's behavior and environment. This could help reduce false alarms and improve the accuracy of the
3. **Geolocation and geofencing:** The device could be enhanced with geolocation and geofencing technology to provide location-based alerts For example, the device could be programmed to alert the user if they enter a crowded area or if they are not maintaining safe social distancing in a certain location.
4. **Analytics and reporting:** The device could be enhanced to collect data on social distancing compliance and generate reports that provide insights into social distancing practices. This data could be useful for businesses, schools, and public health agencies to monitor and improve social distancing.
5. **Wearable technology integration:** The device could be integrated with other wearable technologies, such as fitness trackers or smartwatches, to provide a more comprehensive solution for health and safety monitoring.
6. **Voice and gesture controls:** The device could be enhanced to include voice or gesture controls, allowing the user to control the device hands-free. This could be useful in situations where the user needs to keep their hands free for other

Limitations: A device based on IoT technology for safe distancing and security could help ensure compliance with social distancing guidelines and maintain security in public spaces. However, the device would also

have certain limitations. Here are some of the potential limitations of the device:

1. **Limited Accuracy:** The accuracy of the device could be limited, as it would depend on the quality of the sensors and the accuracy of the data collected. This could result in false alarms or missed violations of social distancing guidelines.
2. **Limited Functionality:** The device would only be able to detect violations of social distancing guidelines within its range. It would not be able to detect violations outside of its range or in areas where the device is not installed.
3. **Privacy Concerns:** The device would need to collect data on individuals in public spaces to detect violations of social distancing guidelines. This is raising concerns about privacy and data protection.
4. **Technical Issues**: The device would need to be maintained and updated regularly to ensure its proper functioning. Technical issues or malfunctions could lead to false alarms or missed violations of social distancing guidelines.
5. **Behavioural Issues:** The device could potentially lead to a false sense of security among individuals, leading them to become complacent about following social distancing guidelines.
6. **Social Issues:** The device could potentially create social tensions or conflicts as individuals may feel that their privacy or personal space is being violated.

X. CONCLUSION

Safe distancing will always be beneficial because it reduces the risk of the spread of viruses and molestation cases. By following safe distancing, one can be safe from the fear of stealing. But for an individual, it is not easy to maintain social distance in a public place. Despite sitting at home, this suggested device will be a protective solution to maintain safe distancing. It can be used according to the user's requirements. They can turn it on if they think it's required. If the device is activated, it will sense the person in the defined range and start beeping. As soon as a person comes nearer to the device, the intensity of the buzzer increases, it will send an alert message to the user, and it will capture the image. The device will store the owner's touch in its database. Hence, it will alert the person and allow them to maintain a safe distance. If someone tries to touch the case body of a wristwatch, it will store its sense in a database, and for tracking purposes, GPS is fitted into the wristwatch.

XI. REFERENCES

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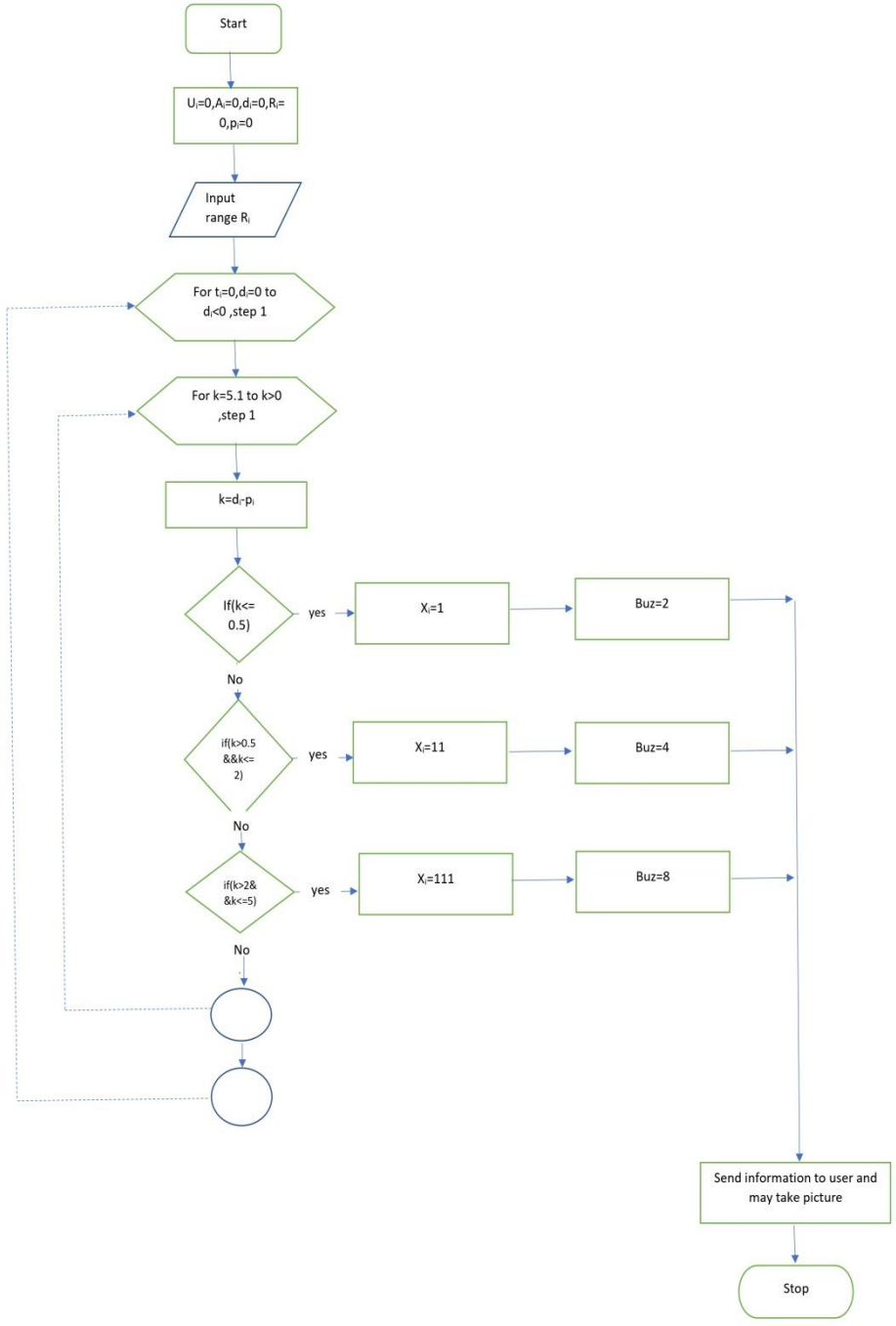
FLOWCHART


Start
Ui=0,Ai=0,di=0,Ri=0,pi=0
Input range Ri
For ti=0,di=0 to di<0 ,step 1
For k=5.1 to k>0 ,step 1
k=di-pi
If(k<= 0.5)
yes
Xi=1
Buz=2
No
if(k>0.5 &&k<= 2)
yes
Xi=11
Buz=4
No
if(k>2& &k<=5)
yes
Xi=111
Buz=8
No
Send information to user and may take picture
Stop