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Raspberry Pi Based Advanced Women Safety with Auto Voice Call and Email Alert

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Abstract – In recent years, the safety of women has become a major concern worldwide, with an increasing number of reports of harassment, assault, and violence. Women's safety is a crucial concern around the world, and technology can be leveraged to develop innovative solutions to address this problem. Women have the right to feel safe and secure at all times, and it is the responsibility of society to ensure that this right is respected and upheld. The advancements in technology have paved the way for innovative solutions to tackle these issues. The aim of this research paper is to present a Raspberry Pi-based advanced women's safety system that includes an auto voice call and email alert system. This proposed system is designed to alert emergency contacts and authorities in case of any emergency situation, providing women with a greater sense of security and safety.

***Key Words*:** Raspberry Pi, Pi Camera, Python, GPS Module, IOT

1.INTRODUCTION

Women's safety is a crucial issue that has been gaining more attention in recent years. Violence against women, including harassment, assault, and domestic violence, has become increasingly prevalent, creating a pressing need for innovative solutions that can address these concerns.

One of the most effective ways to improve women's safety is through education and awareness. Women should be educated about their rights, the resources available to them, and how to identify and report incidents of violence. Governments and organizations can also provide training programs for law enforcement officials, healthcare providers, and other professionals to ensure that they are equipped to handle cases of violence against women effectively.

One way of addressing the issue of women's safety is by providing women with education, information, and awareness-raising campaigns that can help them protect themselves from harm. Many organizations provide training and education programs that help women understand their rights and how to take action when they are faced with harassment, abuse, or discrimination.

However, education and awareness alone are not enough to address the safety concerns of women. Technology can also play a crucial role in providing women with safety and security. Innovative solutions such as smartphone apps, wearable devices, and security systems can alert emergency contacts or authorities in case of any emergency situation, providing women with a greater sense of security and safety.

For example, the Raspberry Pi-based advanced women's safety system with auto voice call and email alerts is an innovative solution that can provide real-time alerts to emergency contacts and authorities in case of any emergency situation. This system includes various components such as a pulse sensor, Pi camera, buzzer, push button, and GPS module that work together to create a comprehensive safety system. The pulse sensor monitors the heartbeat rate of the user, which helps to detect any abnormal behaviour or physical harm. In case of any abnormality, the system is triggered, and an alert is sent to the emergency contacts through a voice call and email alert. The Pi camera is used to capture the image of the surroundings, which helps to identify the attacker or the location of the user. The system also includes a push button, which is used.

By creating and implementing innovative safety solutions like the Raspberry Pi-based system, we can make a tangible impact on the safety and well-being of women. But we must also strive to create a culture that values and respects women and promotes gender equality. With these efforts, we can create a brighter future where women can live without the fear of violence and oppression.

2. LITERATURE SURVEY

Tejonidhi M.R et al. [1] developed "IOT BASED SMART SECURITY GADGET FOR WOMEN'S SAFETY" system ensures security for women by providing automatic sensing of problems, and threats and sends help messages and positions of the victim to the relatives and nearby police station using the Internet of Things. It is used to to resemble a smart band that can protect with the various sensors integrated within the band.

Navya R Sogi et al. [2] implemented "SMARISA: A Raspberry Pi based Smart Ring for Women Safety Using IoT" The System comprises of Raspberry Pi Zero, a Raspberry Pi camera, a buzzer, and a button to activate the services. System further uses the URL of the image and alert message to inform the family and police personnel.

ADhiraj Sunehra et al. [3] suggested "Raspberry Pi-Based Smart Wearable Device for Women Safety using GPS and GSM Technology". The system uses Google map API from which the police can know the exact location of the victim and reach the place or inform the nearest police station to protect the victim.

Prashant Johri et al. [4] designed "Smart Tracker Device for Women's Safety".The system uses a voice recorder in case the women want to record any suspicious activity or information that can be helpful in the future for evidence purposes.

Mohit Jain et al. [5] developed "Design of a Smart Safety Device for Women using IoT". The system will try to overcome human intervention for activating the device such as

pressing the button or shaking the device after sensing the danger and providing false proof of safety to women. The fingerprint is used in the safety device which is a unique identifier for the user so that no one can generate a false alarm and also ensure that the alert is raised only in stressful situations. In case a woman feels the need for self-defense she can make use of a shock wave generator to temporarily incapacitate the perpetrator.

3. THEORETICAL BACKGROUND

1. Raspberry Pi 3 B+

Raspberry Pi 3 B+ is a small single-board computer designed for a wide range of DIY projects and applications. It is an upgrade to the Raspberry Pi 3 Model B, with improved features and performance. Some of the key features of the Raspberry Pi 3 B+ include a 1.4GHz quad-core ARM Cortex-A53 CPU, 1GB of RAM, dual-band 802.11ac wireless LAN, Bluetooth 4.2/BLE, Gigabit Ethernet, and support for Power-over-Ethernet (PoE) via a separate PoE HAT. The board also features four USB 2.0 ports, a full-size HDMI port, a CSI camera port, a DSI display port, a 3.5mm audio jack, and a microSD card slot for storage. Raspberry Pi 3 B+ is compatible with a wide range of operating systems, including Raspbian, Ubuntu, and several others. It can be used for a variety of projects, including media centres, retro gaming consoles, home automation, and many more. Overall, the Raspberry Pi 3 B+ is a powerful and versatile board that offers a lot of value for its low price, making it a popular choice for DIY enthusiasts and hobbyists.

Fig -1: Raspberry pi 3 Model B+ Board

2. Pi Camera

The Raspberry Pi camera, also known as the Pi Camera, is a camera module designed specifically for use with the Raspberry Pi single-board computer. There are two versions of the Pi Camera: the original Raspberry Pi Camera Module and the newer Raspberry Pi High-Quality Camera. We used the original Raspberry Pi Camera Module features a 5-megapixel sensor and is capable of capturing 1080p video at 30 frames per second. It connects to the Raspberry Pi via a ribbon cable and uses the Camera Serial Interface (CSI) bus. We used this pi camera for capturing surrounding images.

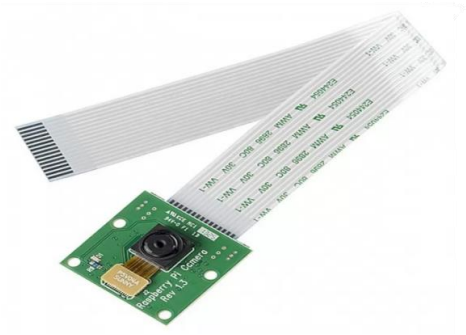

Fig -2: Pi Camera

3. GPS Module

A GPS sensor is a device that can be used to determine the location, velocity, and time of a user or object. GPS stands for Global Positioning System, which is a network of satellites that orbit the Earth and transmit signals that can be received by GPS receivers, such as GPS sensors. GPS Sensor used in this model to find women's latitude and longitude further it will use to calculate exact location. It provides an additional feature in this safety system.

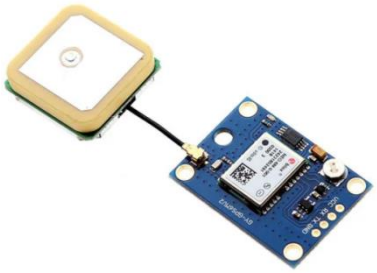

Fig -3: GPS Module

4. Pulse Sensor

A pulse sensor is a device that measures the heart rate or pulse of an individual. It is commonly used in fitness tracking devices, medical monitoring equipment, and other health-related applications. Here is some information about pulse sensors. Usually normal heart beat is between 70 to 90. But it will rises to 90 in critical conditions.

Pulse sensors work by detecting the changes in blood volume in the body, which occur as blood is pumped through the arteries with each heartbeat. The most common type of pulse sensor is a photoplethysmogram (PPG) sensor, which uses light to measure these changes in blood volume. PPG sensors typically use a light-emitting diode (LED) to emit light into the skin and a photodetector to measure the amount of light that is absorbed or reflected back. The LED emits light at a specific wavelength that is absorbed by hemoglobin in the blood. When the heart beats and blood is pumped through the arteries, the volume of blood in the arteries increases, causing more light to be absorbed by the hemoglobin. This results in a decrease in the amount of light that is reflected back to the photodetector. The PPG sensor measures these changes in light absorption and reflection and converts them into an electrical signal, which can then be processed to calculate the heart rate. The electrical signal is typically amplified and filtered to remove any noise or interference, and then digitized for further processing. The signal can be analyzed in several ways to determine the heart rate. One common approach is to measure the time between each pulse, which corresponds to the time between each heartbeat. This time interval is then used to calculate the heart rate in beats per minute (BPM). Overall, pulse sensors, and PPG sensors in particular, are an effective and non-invasive way to

measure heart rate. They are commonly used in wearable fitness trackers, medical devices, and research studies to monitor heart rate in real-time.

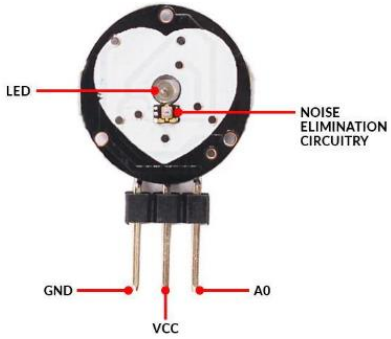

Fig -4: Pulse Sensor

5. ADC of Arduino UNO

The Arduino Uno uses a microcontroller called ATmega328P, which has a built-in 10-bit successive approximation Analog-to-Digital Converter (ADC). This ADC allows the Arduino Uno to read analog signals on up to 6 analog input pins (A0 through A5) and convert them into digital values that can be processed by the microcontroller. The ADC of the Arduino Uno has a resolution of 10 bits, which means that it can represent analog signals with a resolution of 1024 values (2^10). The ADC is capable of measuring voltages in the range of 0 to 5 volts, and it uses a reference voltage of 5 volts by default.

Fig -5: ADC

6. Buzzer

A buzzer is an electronic device that produces a loud and distinct sound. It is commonly used in electronic circuits, alarms, and other applications where an audible signal is required. There are several types of buzzers, including mechanical buzzer, piezoelectric buzzer, active buzzer, passive buzzer, Magnetic buzzers, Transducer buzzers, Indicator buzzers. Here we are using Active Buzzer which is self-contained units that have a built-in oscillator, so they can produce a tone without the need for an external signal.

Fig -6: Buzzer

7. Push Button

A push button is a type of switch that is commonly used in electronic circuits to control the flow of electricity. It is designed to be pressed by a person's finger, and when pressed, it completes a circuit and allows current to flow through it. When the button is released, the circuit is broken, and the current stops flowing. In this project push button act as panic button which help to send alert manually.

Fig -7: Push Button

8. Twilio platform for call and message alert

Twilio is a cloud communications platform that provides a set of APIs (Application Programming Interfaces) for building scalable and customizable communication applications. One of the services offered by Twilio is the ability to send and receive voice calls and text messages, which can be used to create alerts and notifications for various purposes.One of the services offered by Twilio is the ability to make and receive voice calls over the internet using WebRTC (Web Real-Time Communication) technology. With Twilio's Programmable Voice API, developers can easily add internet calling functionality to their applications, without the need for complex infrastructure or hardware. The API provides a set of RESTful endpoints that can be used to initiate and manage calls, as well as to handle call events and Responses.

Also with Twilio's Programmable Voice API, developers can easily create voice call alerts that notify users of important events such as system failures, security breaches, or appointment reminders. Developers can customize the message, voice, and timing of the alert to fit their specific needs, and can also configure the system to handle user responses and redirect calls to different numbers if needed.
Similarly, with Twilio's Programmable Messaging API, developers can send SMS and MMS messages to alert users of important events. This could include notifications for order confirmations, appointment reminders, and service updates. Like with the voice calls, developers can customize the message, sender ID, and timing of the alert to fit their specific needs.

9. Things peak for pulse rate monitoring

ThingSpeak is an open-source IoT (Internet of Things) platform that allows developers to collect, analyze, and act on data from a variety of sensors and devices. It provides an API (Application Programming Interface) and a web interface that allows users to easily store, analyze and visualize data from IoT devices.

With ThingSpeak, developers can create IoT applications that gather data from sensors, store that data in the cloud, and visualize it in real time. The platform supports a variety of IoT protocols, including MQTT, HTTP, and HTTPS, making it easy to connect devices from different manufacturers.

ThingSpeak offers a range of features, including data storage, real-time data visualization, data analysis, and alerts. ThingSpeak can be used for heart rate monitoring by

connecting a pulse sensor to a microcontroller such as an Arduino or Raspberry Pi, and sending the data to a ThingSpeak channel using the ThingSpeak API.

4. PROPOSED SYSTEM

The main aim of this paper is women safety and security using raspberry pi 3B+. For this purpose, python language is used. The raspberry pi is integrated with a heart Beat sensor, GPS, and pi camera module. When a woman is in danger the alert will send automatically or manually to the concerned authorities or relatives. When the woman is in danger if she presses the push button, location data as well as surrounding captured images taken by our system will be sent this will help to save her life.

1. System Architecture

The system architecture comprises of Raspberry Pi 3 B+ Board, Pulse sensor, Pi camera, GPS module, Arduino uno board, Buzzer, Push Button acts as an input. The figure 8 describe the architecture diagram of women safety device which contains the raspberry pi a low-cost single Board computer used for connecting the raspberry pi camera and a push button to start the manually system. For sending alert automatically, we connected a pulse sensor with Arduino which measures pulse rate in terms of Beats Per Minute and send serially to a raspberry pi. For sending an SMS alert and call alert to a selected person here we are using Twilio cloud-based service. Also for sending surrounding captured images via email we are using the SMTP library of python. Pi cameras can click the image of criminals and also use GPS for sending the current location of the women.

Here we are using a pulse sensor which is integrated with Arduino Uno. Further, Arduino UNO is connected to Raspberry pi such that Arduino read pulse rate data from the pulse sensor and serially sends data to a raspberry pi. The normal pulse rate of a healthy person is 60-90/minutes. When a woman is in danger then her heartbeat rate will increase if conditions exceed the threshold value level means the message will be sent automatically to the family/police/friends. this is one of the major advantages of our paper. when she presses the button then the SMS, image, and location will send to the concerned authorities.

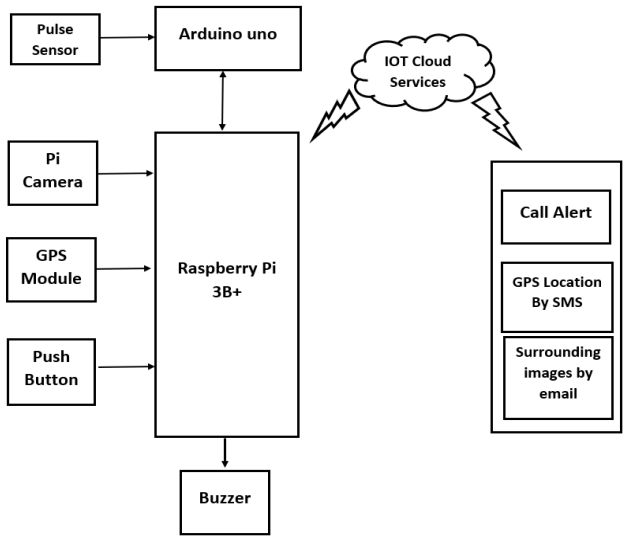

Fig -8: Block Diagram of Women Safety System.

5. IMPLEMENTATION

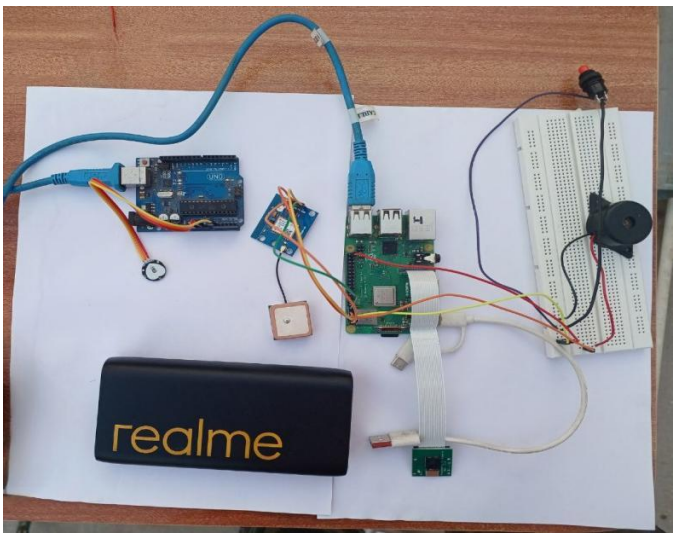

Fig -9: Prototype model of the women safety and Security system

The prototype model of women's safety and security system consists of a Raspberry pi board, heartbeat sensors, pi camera, GPS, push button, buzzer, and Arduino used to interface with pulse rate. A raspberry pi is charged by using a micro USB charger. A power supply of 12 volts 1 Amp is provided. Where pulse rate sensors continuously monitor and send data over Things Peak. In our project Here we are trying to help a woman when she is in danger. Here we are using a pulse rate sensor which is integrated with the raspberry pi. Where the normal pulse rate of a healthy person is 60-90/minutes. When a woman is in danger then her heartbeat means the message will be sent automatically to the family/police/friends. When a woman is in danger, she presses the button then the SMS, image and location will send to the respected person manually.

Following is flowchart that explains women security system. When device is powered on, Raspberry pi will be boot up along with other sensors. Pulse sensor start continuously reading pulses of respected women. Condition is set for sending alert is panic button must be pressed for sending manually alert or Average pulse calculated from reading pulses must greater than 90 BPM for sending Automatically alert.

If one of the condition satisfied then Pi camera captures surrounding images and send email alert to respected person. Further GPS Sensor will find location. Using Twilio Cloud Services SMS and Call Alert will be send. Finally, Buzzer will be on which produce sound. If None of the above condition is not satisfied then it will continuously checking conditions.

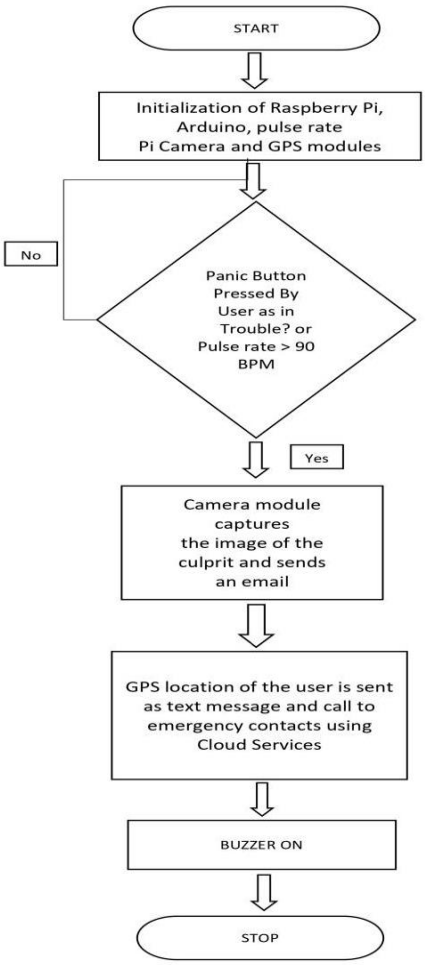

Fig -10: Flowchart of women safety and security system

6. RESULT AND DISCUSSION

This section represents the performance of the project model with the use of hardware raspberry pi to obtain results we are using python as the programming language with the use of this software we get the result of our project.

As shown in the figures, the message alert, current location, and the captured image will send to concerned authorities. In our system GPS data are sent to the respected person via message with help of the Twilio platform which consists of latitude, longitude and Geo decoded location. Also, Call alert is also sent to a respected person using the Twilio library which plays a voice containing "Help me please I am in danger and my location is sent to you". Surrounding images including criminal photos are captured by the pi camera and are sent to the registered email ID using SMTP Module.

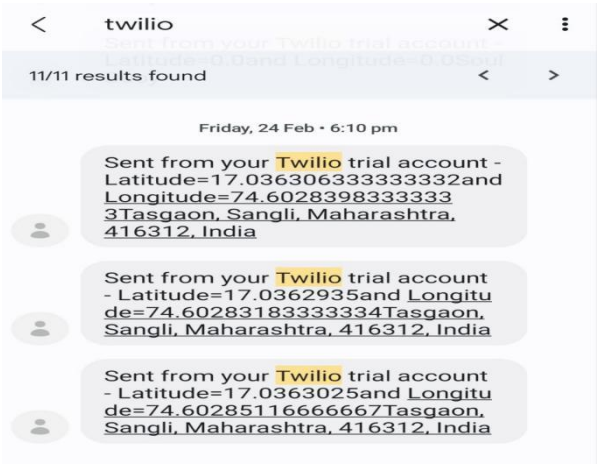

Fig -11: Message containing GPS Location

Figure shows pulse rate graph on Things peak cloud service measured by pulse rate sensor.

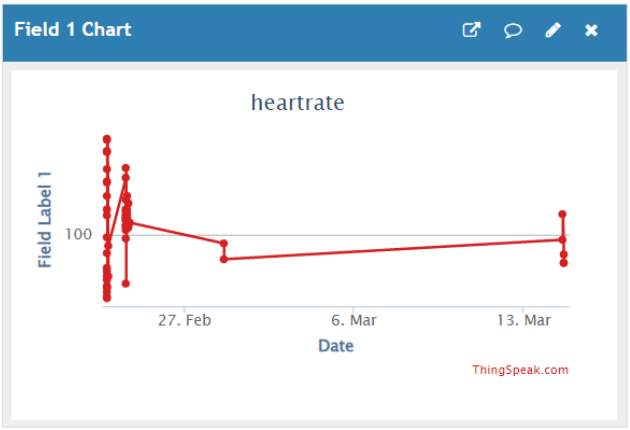

Fig -12: Pulse rate graph on Things peak Cloud

7. CONCLUSION

This System plays important role in providing safety to women as well as older persons. Its low cost, versatility, and customization features make it an ideal system for building various safety-related applications. Before Anyone does any crime against women will be deterred, it helps to reduce the crime rate against the women. By using these different forms of system attacker can be easily tackled because he might not know and has no knowledge about the presence of such devices.

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