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IoT Based Integrated Women Security System

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ABSTRACT
Nowadays, women are facing various issues like rape and sexual harassment. This will affect the mental health of women throughout their lives or at least some period. These kinds of actions keep on increasing day by day. Even old age women are kidnapped and sexually abused. Nowadays, a newborn baby girl is also not safe or their parents are insecure about their safety. Looking forward towards this issue we need to make some application or device which will make women feel comfortable around society. So, in this project, we have planned to propose a device that will provide security and confirm the safety of the women. ESP32 Microcontroller, GSM, and GPS module are used to send a signal and live location of women to enrolled emergency mobile numbers in their contact. In addition, this project will also work in remote areas.

KEYWORDS;- *women safety, screaming, Global system for communication, Global positioning system*

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I. INTRODUCTION

We have developed an IoT technology to meet the urgent need to improve women's safety. The system combines a wireless wearable device with various sensors to address security concerns, especially in countries li ke India. Our solutions provide instant tracking of vital signs and locations. Although women are respected as m others, sisters, grandmothers and wives, they still face incredible challenges. Statistics show that the rate of wom en being kidnapped is 44 minutes. Traditional protections have not been effective in stopping crimes against wo men, including rape, torture, domestic violence and kidnapping. Workplace bullying, mostly by electrical worke rs, exacerbates the problem. Even in seemingly safe places like home and school, women and girls are vulnerabl e. Our wearable device is built into the shirt and uses GPS to continuously track the user's location. In case of an emergency, the GSM module quickly sends the emergency signal to the first party. The device also includes a t hermometer and alarm, allowing women to seek help and stay safe. We aim to create a safe and fair environmen t in women's daily lives by using technology.

II. LITERATURE SURVEY

Al-Fuqaha et al. (2017) highlighted the importance of IoT security in ensuring the protection of data and privacy. Security measures such as encryption, authentication, and access control are essential in an IoT environment. Implementing secure communication protocols and regularly updating software is vital for maintaining a robust security system.

Sarwar et al. (2017) introduced the ESP32 as an affordable IoT hardware option. The ESP32 provides connectivity options like Wi-Fi and Bluetooth, making it suitable for various IoT applications. Its low cost and high performance make it an attractive choice for developing security systems.

Pandey et al. (2018) discussed the use of wearable devices for monitoring vital signs like heart rate. Integrating heart rate monitoring into a security system can provide valuable information about an individual's health and well-being. Real-time monitoring can alert authorities in case of emergencies, enhancing overall security measures.

Adewole et al. (2012) emphasized the integration of GSM and GPS technologies for vehicle tracking. Applying this integration to a women's security system can enable real-time tracking and location-based alerts. In case of emergencies or incidents, the system can provide accurate information to responders for quick action.

Jain et al. (2019) highlighted the significance of GSR sensors in measuring stress levels and emotional responses. Integrating GSR sensors into a security system can detect changes in a woman's emotional state, signaling potential threats. This real-time data can trigger automated responses or alerts to ensure immediate assistance.

Hossain et al. (2015) discussed the challenges faced in implementing integrated security systems. Issues like interoperability, scalability, and data privacy need to be addressed for a seamless user experience. Overcoming these challenges presents opportunities for creating more effective and reliable security solutions.

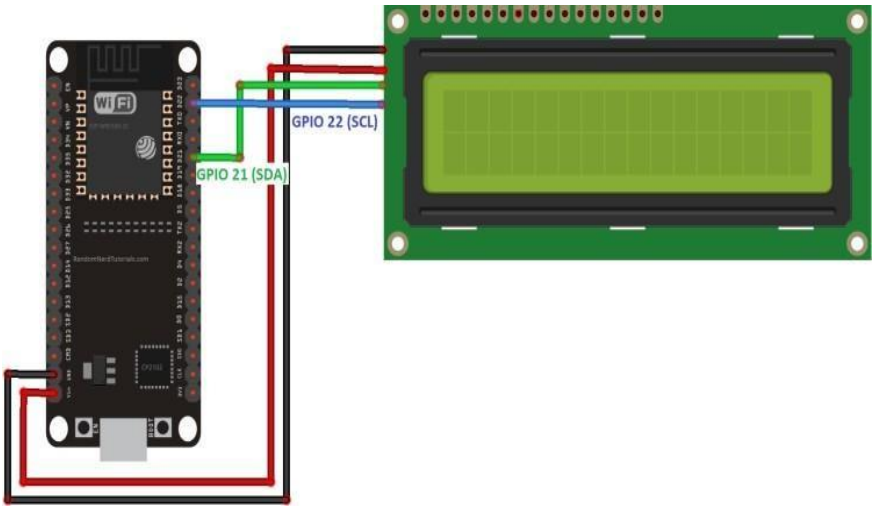
Patel et al. (2018) presented a case study on the real-world implementation of IoT-based security systems. The study highlighted practical challenges, successes, and lessons learned from deploying such systems. Learning from real-world examples can guide the development of integrated women's security systems for optimal functionality and user experience.

III. Component Selection and Functionality in the Smart Notice Board

- **Microcontroller: ESP32**

The ESP32 PLC is a versatile microcontroller designed for industrial applications, providing a wide range of connectivity options such as Wi-Fi, Bluetooth LE, Ethernet IP protocol, and various industrial Ethernet protocols including Modbus TCP. Not only does the ESP32 support a low voltage level, but it also boasts an impressive 48 GPIO pins, making it a powerhouse for industrial control needs. Whether it's monitoring sensors wirelessly or controlling machinery through a mobile device, the ESP32 ensures seamless connectivity and reliable communication.

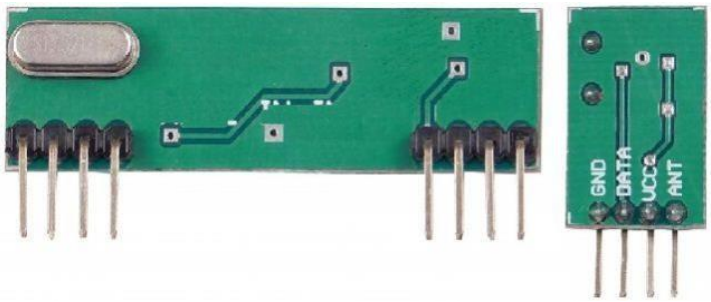
- **LCD Module**



LCDs are perfect for displaying text and characters. The 16x2 character LCD, for example, with its LED backlight, can showcase 32 ASCII characters arranged neatly in two rows of 16 characters each.

The 16x2 Alphanumeric LCD Display Module is a favorite among hobbyists and professionals due to its affordability and user-friendly nature. It can display up to 32 characters (16 columns and 2 rows) consisting of alphabets, numbers, or even custom characters. While the standard version comes with a green backlight, you can opt for a Blue Backlight LCD also.

- **433MHz RF Module**



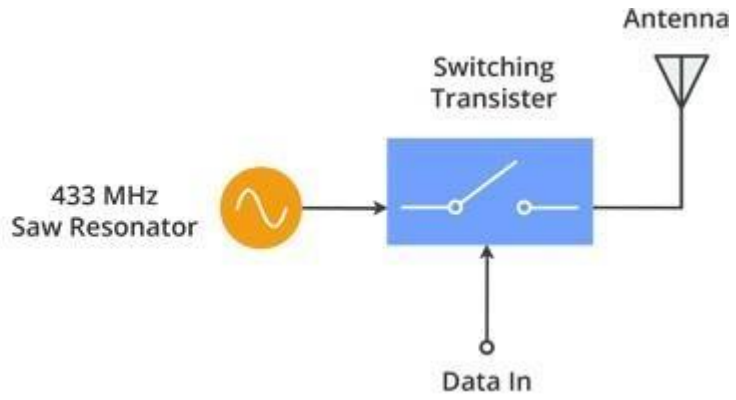
This module looks exactly similar to as shown in the figure. And also available in different packages. But, all these modules have the same function. You can purchase any of these modules. The transmitter section is tiny and has 4 pins, while the receiver section is a little bigger and has 8 pins.

- The transmitter section of the 433MHz RF module is compact and efficient, with 4 pins that allow for easy integration into various projects.
- On the other hand, the receiver section is slightly larger and features 8 pins, providing additional functionality and versatility for communication purposes.

Transmitter Section

This little module is a transmitter. The heart of the module is the Surface Acoustic Wave (SAW) resonator which is tuned for 433 MHz operations. Alongside the resonator, there is a switching transistor and a few passive components that work together seamlessly to transmit signals wirelessly.

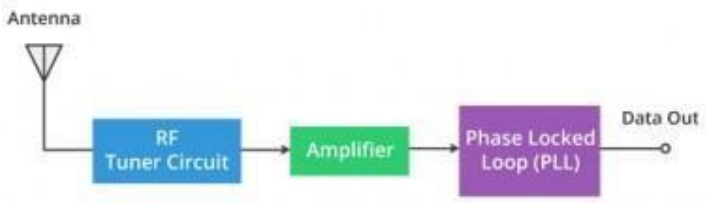
- The SAW resonator acts as the backbone of the transmitter module, ensuring that the signals are sent out at the correct frequency for optimal communication.
- The switching transistor plays a vital role in the process, regulating the flow of current through the module to control the transmission of signals.
- When a logic HIGH is applied to the DATA input, the oscillator runs producing a constant Radio Frequency (RF) signal that carries the information to be transmitted.



The transmitter module operates by converting electrical signals into radio signals that can be transmitted wirelessly. When a logic HIGH signal is applied to the DATA input, the oscillator within the module is triggered to produce a continuous RF signal. This RF signal is then modulated to carry the information that needs to be transmitted.

Receiver Section

A receiving module is a crucial element in the world of wireless communication. It comprises an RF-tuned circuit and a pair of OP Amps, working in harmony to amplify the signals received from a transmitter. This amplification process is essential to ensure that the signal remains strong and clear despite any interference it may encounter during its journey.



Once the signal is amplified, it is then fed into a Phase Lock Loop (PLL) system. This magical mechanism enables the decoder to synchronize with the incoming stream of digital bits. This synchronization, or "locking," is instrumental in decoding the signal accurately and efficiently. By enabling the receiving module to lock onto the stream of digital bits, the PLL ensures that the final output is of superior quality with minimal noise interference.

- **GSR Skin Current Sensor V2.0**

The Galvanic Skin Response (GSR) Skin Current Sensor V2.0 is a bio-sensing module that measures the electrical conductance of the skin. This version is an upgrade from the previous one, offering higher precision, better accuracy, and more stable performance. Typically used in research, education, and personal applications, it measures the electrical conductance between two points and functions as an ohmmeter.

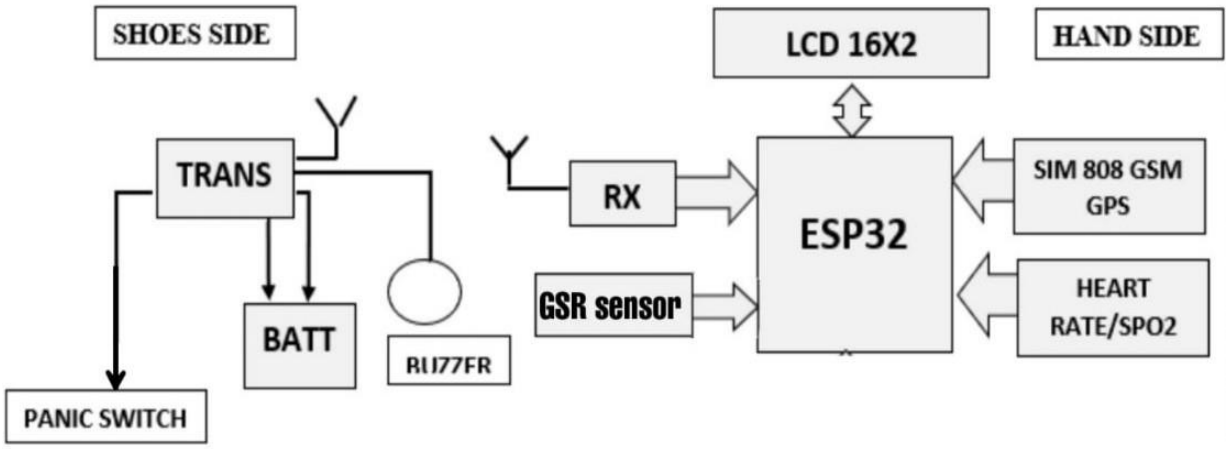
The GSR Skin Current Sensor V2.0 boasts enhanced precision and accuracy compared to its predecessor. This improvement allows for more reliable data collection and analysis in applications that require detailed

measurements. One of the key highlights of the GSR Skin Current Sensor V2.0 is its stable performance. This ensures consistent and accurate readings over an extended period, making it a trustworthy device for long-term studies and monitoring.

- **MAX30102 Pulse Oximeter Heart Rate Sensor**

The MAX30102 Pulse Oximeter Heart-Rate Sensor Module I2C Interface offers a seamless solution for integrating heart rate and oximetry monitoring into mobile and wearable devices. Operating on a low power supply and featuring an I2C-compatible interface, this module provides efficient communication and power management. The MAX30102 is designed to operate on a single 1.8V power supply for general functions and a separate 5.0V power supply specifically for the internal LEDs. This configuration ensures optimal performance and accurate readings. Communication with the module is facilitated through a standard I2C interface, simplifying the integration process for developers The module can be easily shut down through software control, consuming zero standby current. This feature enables continuous power to the device without draining the battery unnecessarily. With an upgraded design from its predecessor, the MAX30102 offers enhanced capabilities for monitoring heart rate and oximetry. This sensor is specifically tailored for wrist-based applications in smart wearables such as sports watches. The MAX30102 utilizes two LEDs - red and infrared - to emit light and measure the absorbance of blood pulsations through a photodetector. This optical sensor is optimized for fingertip measurements, providing accurate and reliable data. The sensor's digital output data is stored in a 16-deep FIFO within the device, allowing for efficient data management and analysis. The pulse oximetry subsystem of the MAX30102 includes advanced features such as ambient light cancellation, a 16-bit sigma-delta ADC, and a proprietary discrete-time filter. These components work together to deliver precise and consistent readings. Operating on low power supplies ranging from 1.8V to 3.3V, the MAX30102 is ideal for battery-operated systems used in wearable devices, fitness assistants, and medical monitoring devices.

IV. Block Diagram: Depicting the System Flow



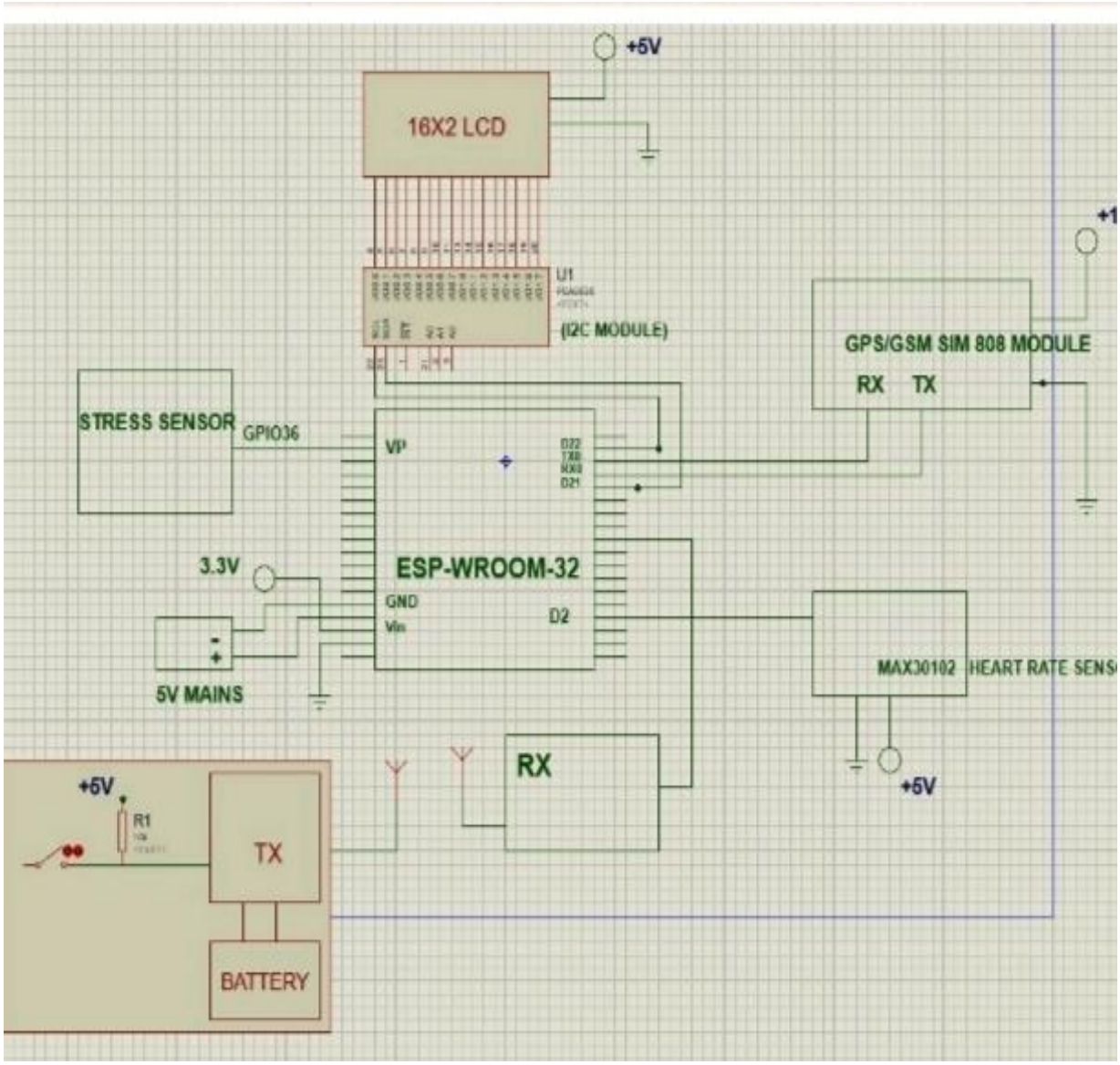
The block diagram presented above illustrates the functional architecture of our IoT-based smart notice board system. It comprises several key components that interact to achieve remote content management and dynamic information display. Here's a breakdown of the core blocks and their functionalities:

Power Supply Circuit: It includes voltage regulation components (like LM317AH or similar voltage regulators) to convert the raw input voltage into stable and well-defined voltage levels required by other parts of the circuit. Proper filtering capacitors are present to minimize voltage ripple and ensure clean power delivery.

Microcontroller Unit (MCU) AVR ATmega8: The AVR ATmega8 serves as the central processing unit of the system. It executes the program code stored in its flash memory, which governs the overall system logic and communication with other components. It communicates with the Wi-Fi module (ESP8266) to transmit and receive data wirelessly. It interacts with the LED display driver circuit to control the visual presentation of information on the rolling LED display.

Wi-Fi Module ESP8266: The ESP8266 Wi-Fi module enables wireless communication between the smart notice board and a Wi-Fi network. It receives data commands and content updates from a remote source (e.g., web application or mobile application) via a Wi-Fi connection. It transmits data (potentially including status updates or sensor readings) back to the remote source. It communicates with the microcontroller unit (MCU) to exchange information.

V. CIRCUIT DIAGRAM



The circuit diagram presented above depicts the internal hardware connections and component interactions within the smart noticeboard system. Here's a breakdown of the key components and their functionalities based on the circuit:

Power Supply Circuit (VCC and GND Rails): The circuit likely receives unregulated input power (DC) from a source like a wall adapter or battery (not shown in the diagram).

Voltage Regulator (IC1): This integrated circuit (IC) is most likely a voltage regulator, possibly the LM317AH mentioned previously. It converts the raw input voltage into a stable +5V DC voltage rail (VCC) that powers most digital components in the system.

Capacitors (C1, C2, C3): These capacitors are placed at various points in the circuit, typically near the power supply and each IC, to filter out electrical noise and ensure a clean, steady voltage supply for the components.

Microcontroller Unit (MCU) AVR ATmega8: The AVR ATmega8 microcontroller is the central processing unit (CPU) of the system.

Crystal Oscillator (Y1 and Associated Capacitors): This section provides a clock signal that regulates the timing of the microcontroller's operations. The specific frequency of this clock signal is determined by the crystal and its capacitors.

Reset Circuit (SW1 and R1): The pushbutton switch (SW1) and resistor (R1) form a reset circuit. Pressing the button momentarily resets the microcontroller, which can be useful for troubleshooting or restarting the system.

Wi-Fi Module: ESP8266: The ESP8266 Wi-Fi module enables wireless communication between the smart notice board and a Wi-Fi network.

Connection to Microcontroller (SPI): The ESP8266 likely communicates with the microcontroller using the SPI (Serial Peripheral Interface) communication protocol. Specific resistors and capacitors (not labeled in the provided diagram) are typically required for SPI communication according to the manufacturer's datasheet.

Rolling LED Display Driver Circuit (IC2 and Associated Components):

LED Driver IC (IC2): This integrated circuit (IC) is likely a specialized LED driver chip responsible for controlling the current supplied to each LED in the rolling LED display. The specific driver IC and its connections will depend on the chosen LED display technology and its current requirements.

Resistors: Resistors are connected in series with each LED (not shown in detail in the provided diagram) to limit the current flowing through each LED and prevent burnout. The values of these resistors would depend on the forward voltage and current rating of the LEDs in the display.

VI. DESIGN METHODOLOGY

In the realm of safety and security for women, the need for innovative solutions has never been more pressing. Extensive research has been conducted to understand the challenges faced by women in terms of safety, leading to the development of a unique system designed to provide real-time monitoring, distress signal transmission, and location tracking capabilities in response to potential threats or emergencies.

The first step in the design methodology was identifying the key system requirements based on the challenges faced by women. These requirements included real-time monitoring, distress signal transmission, and location tracking capabilities.

After a thorough evaluation of available hardware components, the system was equipped with the ESP32 microcontroller, heart rate sensor, stress sensor, 433 MHz transmitter and receiver modules, SIM808 GSM GPS module, and panic switch. These components were carefully integrated to form the core of the system, enabling data acquisition, processing, communication, and control functionalities.

Detailed circuit diagrams were designed to effectively interconnect the selected hardware components. Prototyping was then conducted to validate the circuit design, ensuring seamless integration while considering power consumption, signal integrity, and reliability factors.

Custom firmware was developed for the ESP32 microcontroller to interface with the various sensors and communication modules. Software applications were also designed to process sensor data, trigger alerts, manage communication protocols, and provide user interfaces for system configuration and monitoring.

The 433 MHz transmitter and receiver modules were configured to establish wireless communication between the wearable device and the base station. Standardized protocols were implemented to ensure reliable data transmission, error detection, and encryption for safeguarding sensitive information.

The system was programmed to monitor physiological parameters such as heart rate and stress levels, using the respective sensors. Upon detecting abnormal readings or activation of the panic switch, an emergency response protocol was initiated, including distress signal transmission with location information to predefined contacts or authorities.

Rigorous testing was conducted to evaluate the functionality, reliability, and performance of the integrated system under various simulated scenarios. Emphasis was placed on validating the accuracy of sensor readings, responsiveness of alert mechanisms, and robustness of communication channels.

User trials were carried out to assess the usability, effectiveness, and user experience of the system. Feedback from participants, including women from diverse backgrounds and security experts, was collected to identify strengths, weaknesses, and areas for improvement.

Comprehensive documentation encompassing the methodology, technical specifications, implementation details, evaluation results, and user feedback was compiled to provide insights and transparency into the design methodology and its outcomes.

VII. CONCLUSUION

In today's world, safety and security have become paramount concerns for individuals, especially for women who often find themselves in vulnerable situations. It is crucial to have a reliable system that can offer protection and support in times of need, whether in remote areas or bustling urban environments. This device is a revolutionary security tool that promises to enhance personal safety and provide peace of mind to users. Another crucial aspect of this security tool is its advanced GPS technology, which enables live location tracking of the user. This functionality is crucial in emergencies, as it allows authorities to pinpoint the exact whereabouts of the individual in distress. Whether lost in a remote wilderness or facing a threat in a busy city, knowing the precise location of the victim can make all the difference in ensuring a swift and effective response. Moreover, this security device is designed to be user-friendly and highly portable, making it an ideal companion in critical situations, ensuring that they have a reliable defense mechanism at all times. In moments of peril, having a security tool that is readily accessible and easy to operate can be a lifesaver. This security system offers a comprehensive solution for personal safety and self-defense. Its seamless integration of alert systems, GPS tracking, and user-friendly design makes it a versatile and indispensable tool for individuals seeking added security measures. By arming oneself with this cutting-edge device, users can navigate through both urban jungles and remote terrains with greater peace of mind and confidence.

- "Safety should never be a luxury. It should be a priority for all individuals, and this security tool is a step in the right direction towards achieving that goal."

Let's empower individuals to take charge of their safety and security with this innovative system!

VIII. FUTURE SCOPE

Familiar systems that make our own lives easier and easier are GSM and GPS
based tracking and alerts. This is a system that tracks or tracks the instant location of the victim. These technolo gies include emergency messages and more accurate Global Positioning Systems (GPS) to alert nearby authoriti es. An additional face detection feature can detect the face of a woman in danger. We can control the position of women using important sensors.

Face Detection Technology for Safety

- Incorporating face detection technology adds an extra layer of security for women in distress.
- By analyzing facial expressions, the system can identify potential danger and trigger alarms.
- This feature can be particularly useful in crowded or isolated areas where immediate action is crucial.

Position Detection with Sensors

- Utilizing sensors for position detection enables precise tracking of individuals.
- These sensors can relay important data about the person's location and movements.
- The accuracy and reliability of sensor technology enhance the overall effectiveness of the monitoring system.

In summary, future advances in GSM and GPS-
based monitoring and alerting hold significant promise for improving personal safety. By using new technologie s such as face detection and tracking-
based surveillance, we can create a safer environment for people in adverse circumstances, especially women. T his system is an example of how technology can be used to empower people and ensure peace in an ever-changing world.

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