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Smart Personal Safety Device Using IoT

Adwaith Shaji[1,*], Gayathri V.S.[2], Mithra M. Lal[3], Ashida Pradeep[4]

Abstract

Our goal is to identify a considering the rapid advancement of science and technology and our heavy dependence on technological features, a solution to this important problem for women. We are focusing to make a smart personal safety device that helps women's and all peoples who need help or an extra security. This project not only helps women's but also helps children, old age people and disabled people. The design supports a smart location and tracking system and alert notification, GPS, GSM, Audio video recording facility, and a face-recognition image capture system and to minimize the weight of the model. We implemented Li-Ion battery. The high-quality camera and voice recorder cooperate with GSM system and send the visuals and recordings to nearest police station or relatives. It not only sending it stores the visual and recording in cloud storage for legal purposes. The suggested model also includes an electric shock with a wireless system activator and a siren. The design features have been carefully considered and confirmed to provide women with the best safety tool available.

Keywords: IoT, Smart bag, Woman Safety, Li-ion battery, GPS, GSM, Video recording

INTRODUCTION

Ensuring women's safety stands out as a paramount concern across nations today. Despite contributing approximately half of the development efforts in today's competitive landscape, women face a concerning lack of security in our society. This insecurity restricts their freedom of movement, undermining their empowerment and hindering national progress. Overcoming this challenge entails addressing various issues like gender-based violence, discrimination, harassment, and inequality. Effective promotion of women's safety necessitates holistic strategies incorporating legal frameworks, social norms, education, awareness programs, and robust support systems. Prioritizing women's safety is crucial for fostering a safer and more inclusive global environment.

This project proposes a wearable carry bag as an innovative solution for enhancing women's security. Its core objective is to develop a cutting-edge system utilizing Raspberry Pi, GSM, and GPS technologies. This system empowers individuals under threat to respond promptly, significantly reducing instances of crimes against women. During emergencies such as harassment, victims can activate the system either manually through a wireless button or automatically through a pulse rate sensor, sending live location data, video, and audio evidence to nearby police stations and relatives. The integration of wireless buttons, camera modules, microphone modules, GPS modules, and GSM modules enhances the system's functionality, with the Raspberry Pi Zero 2W board serving as the central control unit. The project also introduces an IoT-based approach to assist women feeling unsafe, reflecting a novel and rapidly evolving concept. By gathering data from sensors and comparing values

***Author for Correspondence**
Adwaith Shaji
E-mail: adwaith627@gmail.com

[1-3]Student, Electrical, Department of Electronics Engineering, UKF College of Engineering and Technology, Kollam, India
[4]Assistant Professor, Department of EEE UKF College of Engineering and Technology, Kollam, India

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against predefined thresholds, this device triggers appropriate actions, providing a proactive safety mechanism for women in vulnerable situations. Many women experience fear when venturing out alone, highlighting the pervasive sense of insecurity among the female population. This reality underscores the longstanding concern for women's personal safety among Indian citizens. Despite the availability of various women's safety systems in the market, there remains a pressing need for more advanced solutions to provide enhanced safety and security [1-4]. Existing options include devices like smartwatches, the Nirbhaya app, the Vith U app, and smart belts, among others. The Nirbhaya app, launched by the Uttar Pradesh police, aims to bolster women's safety in India. With a single touch, it can call or send an SMS alert to pre-selected contacts, providing the exact location, which updates every 300 meters of movement. Additionally, the app activates when the phone is shaken. In this context, the proposal of a wearable carry bag as an alternative security measure for women is presented as a potentially superior option to existing solutions. This system utilizes IoT and GPS-based intelligence to cater to the needs of victims of crimes against women. Given the unpredictable nature of such incidents, employing an Arduino UNO microcontroller is deemed the most practical approach, ensuring women's increased security and safety.

The primary objective of the project is to develop a novel system integrating Raspberry Pi, GSM, and GPS technology to facilitate swift responses for individuals facing threats. This system has the potential to significantly reduce various crimes against women. In case of harassment emergencies, the victim can either activate the system manually through a wireless button or trigger it automatically through a pulse rate sensor, sending live location data, video, and audio evidence to nearby police stations and relatives. The integration of wireless buttons, camera modules, microphone modules, GPS modules, and GSM modules enhances the functionality of the system, with the Raspberry Pi 4B board serving as the central control unit.

PROPOSED SYSTEM

Smart personal safety device using IoT works by using some combination of components and technologies. The security system is controlled by a RASPBERRY Pi Zero 2W model board and it is programmed using c program. It has both GPS system and GSM system integrated together for compact size.

In this block diagram of Figure 1, the system is equipped with a high-definition ESP32 camera and a microphone for recording evidence of the attacker and GPS system to track the live location of victim and all these details are send using GSM system to the nearby police station and to the relatives. The most important role of this project is that it protects women, children, and old age people from attacker. There are three ways to activate the security system [5-7]. First method is by just pressing the wireless switch that is implemented using ESP8622 like a key chain, then the system activates automatically by sensing the pulse rate using pulse rate sensor and the last way is that it is equipped with electric shocker for protection from attacker while implementing a wireless switch in that electric shocker to activate. The system uses a Li-ion battery of 7.4V for power supply which is small compact and rechargeable. The system is connected to blynk application for the ease of use. The smart personal safety device using IoT is a most important tool that must be with everyone in this world.

Raspberry pi zero 2W is used for the implementation of smart personal safety device. Raspberry Pi has everything a computer needs to function – just in a tiny package. The GPU and CPU are in a single, integrated circuit. Other components, including a USB port, RAM, and SD card slot are soldered on. The SD card is typically used to hold the operating system, and potentially some more files. Here we are using integrated module for GPS and GSM which is compact in size. GPRS and GSM are technologies that deal with mobile communications services. GPS is about satellite navigation services. GPRS and GSM can be accessed via GSM-compatible mobile phones. The ESP32-CAM board comes with an OV2640 camera module by default, which is capable of capturing JPEG images and streaming

video. The OV2640 is a 2- megapixel camera sensor commonly used in embedded systems. Features of ESP32-CAM are.

- *Camera Capabilities:* It can capture images in various resolutions (160x120 to 1600x1200 pixels) and supports video streaming (QVGA resolution).
- *Storage Options:* Images and videos can be stored on an external SD card or sent over the network.
- *Low Power Modes:* The ESP32-CAM can be put into low-power modes to conserve energy, suitable for battery-powered applications.
- *Programming Interface:* It can be programmed using the Arduino IDE with the ESP32 board support package, making it accessible to a wide range of developers.

A voice recorder is an electronic device or software application designed to capture and store audio recordings. These recordings can be made using built-in microphones or external ones, depending on the device's design. A touch sensor is a type of device that captures and records physical touch or embrace on a device and/or object. It enables a device or object to detect touch or near proximity, typically by a human user or operator. A rechargeable battery known as a lithium-ion or Li-ion battery stores energy through the reversible reduction of lithium ions. It is the most common type of battery utilized in electric vehicles and portable consumer electronics. Li-ion batteries have high energy densities, low self-discharge, and no memory effect when compared to other technologies for rechargeable batteries. A pulse rate sensor measures pulse and heart rate. Here we are using it as a system activator. The system works based on an IoT platform.

The main component of this project is raspberry pi zero 2 w. The raspberry pi is used as the control panel when an incident occurs. The victim can press the wireless switch implemented on the keychain or watch [8]. When the system is activated the ESP32 camera starts recording and the file is being uploaded to raspberry pi storage for future legal evidence and for sending the video and audio recording with the victims live location to the nearby police station and to relatives there is a buzzer system that activates when the system is activated for alerting nearby peoples for help. Moreover, the system is equipped with an electric shocker. Circuit Diagram of Emergency Alert System in Figure 2.

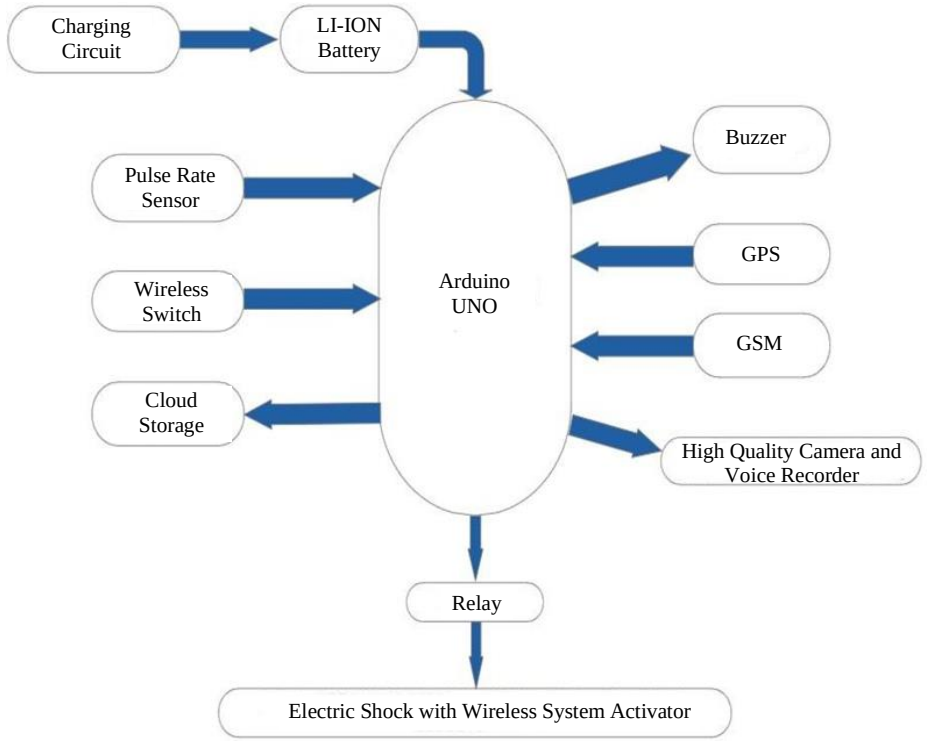

Figure1. Block diagram of proposed system.

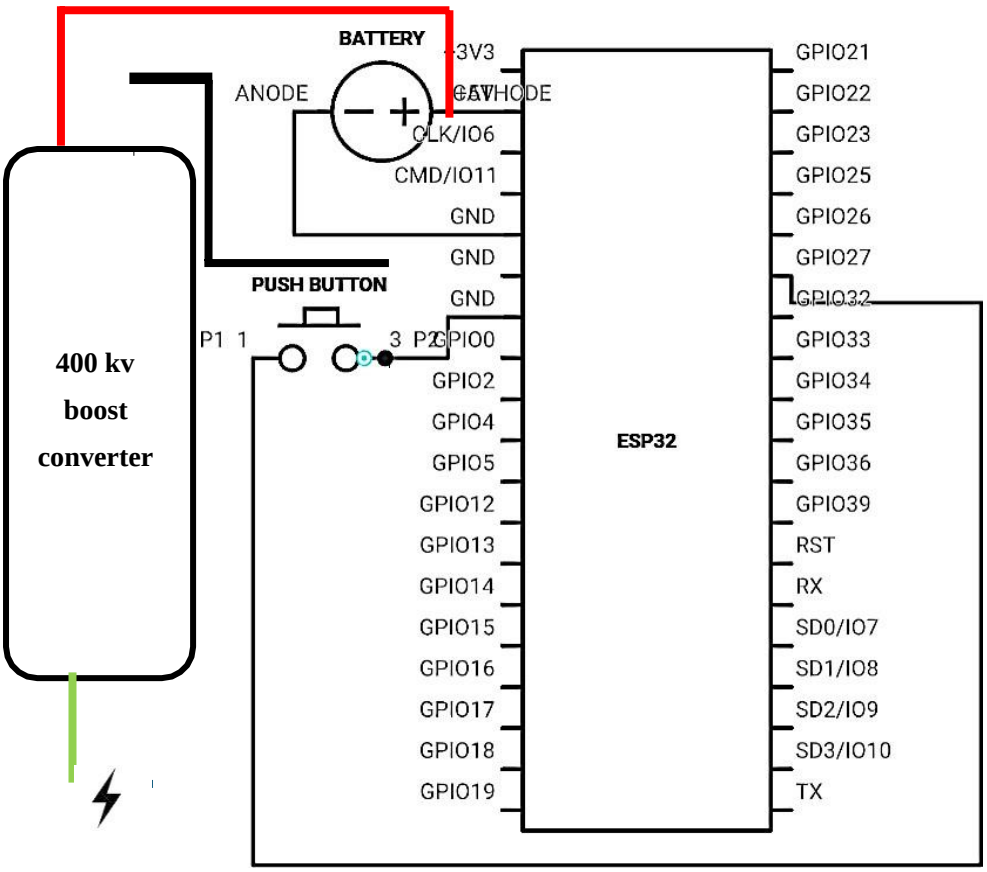

Figure 2. Circuit diagram of proposed system.

Components used are:

RASPBERRY PI ZERO 2W

Here we are using raspberry pi 4 for the implementation of smart personal safety device. Raspberry Pi has everything a computer needs to function – just in a tiny package. The GPU and CPU are in a single, integrated circuit. Other components, including 2 micro USB port, RAM, and SD card slot are soldered on. The SD card is typically used to hold the operating system, and potentially some more files.

ESP32 CAMERA MODULE

The Camera Module 2 can be used to take high-definition video, as well as still photographs. It is programmed to connect with the system wirelessly [9].

ESP32 WIFI MODULE

ESP32 is a series of low-cost, low-power systems on a chip microcontroller with integrated Wi-Fiand dual-mode Bluetooth**.** The ESP32 is highly integrated thanks to its integrated antenna switches, RF baluns, power amplifiers, receive low noise amplifiers, filters, and power management modules. The ESP32 improves the functionality and adaptability of your application while reducing the need for a printed circuit board.

LI ION BATTERY

A rechargeable battery known as a lithium-ion or Li-po battery stores energy through there versible reduction of lithium polymer. It is the most common type of battery utilized in electric vehicles and portable consumer electronics. Li-ion batteries have high energy densities, low self-discharge, and no memory effect when compared to other technologies for rechargeable batteries.

In this circuit diagram the system is equipped with a SIM800L GSM module, a GPS NEO6M GPS module, a ESP32 board and a battery package. The main goal of this circuit is to provide a fast and efficient alert system. The circuit has 2 switches assigned with 2 functions. The first switch act as an alert message sender. The other switch function as the activator for electric shocker. The system works based on an IoT platform. The main component of this project is raspberry pi zero 2 w. The raspberry pi is used as the control panel when an incident occurs. The victim can press the wireless switch implemented on the keychain or watch. When the system is activated the ESP32 camera starts recording and the file is being uploaded to raspberry pi storage for future legal evidence and for sending the video and audio recording with the victims live location to the nearby police station and to relatives there is a buzzer system that activates when the system is activated for alerting nearby peoples for help. Moreover, the system is equipped with an electric shocker [10].

EXPECTED OUTCOME

- Quick activation of system
- Undetectable camera module
- Quick response
- Quick action to threatens.
- Effective battery management
- Compact
- Effective personal security system

APPLICATIONS

- Advanced protection is provided for each one by tracking location and sending alert message with voice and video recording.
- Wireless system activator for ease of use.
- In military purpose.
- For children, women, and old aged people.

ADVANTAGES

- Compact
- Easy to use.
- Portable bags, laptop bags etc.
- Live tracking.
- Video and audio capturing.
- Storing and sending information captured to relatives and police station.
- Advanced technologies.
- Wireless switch and pulse rate sensor for system activator.
- Electric shocker for protection from threats.

DISADVANTAGE

- There is no temperature sensor.
- There is no motion detected system activator.

RESULT AND DISCUSSION

We developed the prototype of our project smart personal safety device using IoT. The personal safety device is a remarkable safety device which acts as a fast and quick response device for personal safety. This project addresses safety issues of women and children, enhancing user confidence in using personal safety device. The main goal of this prototype is to deliver a fast reliable system. The system works while pressing the emergency button provided in the electric shocker. While pressing the emergency button the system activates and sends the Ip address of esp32 camera module and raspberry pi. So that the live location and the live visual tracking can be easily done. The protype also has an

electric shocker that acts as a self- protection device. The system works on wireless connectivity. This can be more accessible while travelling because of its compact size. Security features are also emphasized with the integration of video recording facility (Figure 3).

This system facilitates women's independent and unrestricted travel. This initiative has been effectively executed to offer a contemporary self-defence solution for women's security. When the push button on the electric shocker is pressed, the system activates, transmitting location details and camera visuals to the recipient via a Telegram bot (Figure 4).

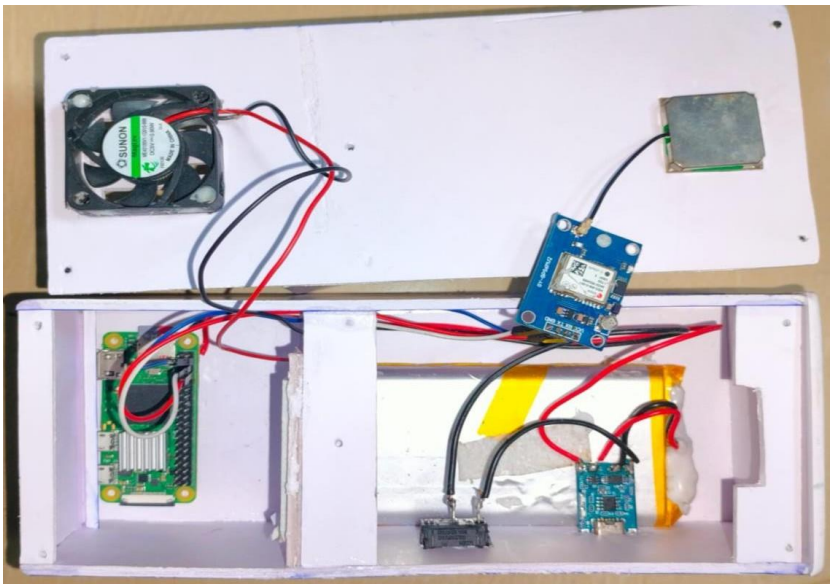

Figure 3. Raspberry pi and GPS module case.

Figure 4. ESP32 camera bag.

FUTURE SCOPE

It can include features like integration with smart home systems for automated responses, health monitoring capabilities, and even AI-driven predictive analysis to anticipate potential dangers. Additionally, advancements in IoT technology, such as improved connectivity, smaller and more efficient sensors, and enhanced data processing capabilities, will further expand the possibilities for enhancing personal safety through such devices. Moreover, integration of a 4g module will make it more convenient and faster.

CONCLUSION

The proposed system aims to reduce the incidence of crimes against women, ensuring a sense of safety and comfort for every woman in society. A recent survey revealed that 53% of employed women in India feel insecure, highlighting the need for such initiatives. This system facilitates women's independent and unrestricted travel. This initiative has been effectively executed to offer a contemporary self-defence solution for women's security. Continuous monitoring enhances its potential to safeguard all women, with future evaluations exploring advancements for greater accuracy in capturing live conditions. There are ample opportunities for further development and transformation of this project in various areas. Furthermore, its rapid processing capabilities make it ideal for real-time applications and continuous monitoring, promising enhanced safety for all women. Future assessments will explore the potential for technology to capture live conditions accurately, providing valuable insights for further development and transformation of this project.

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