

EMPOWERING WOMEN'S SAFETY USING REAL-TIME ALERT SYSTEM USING IOT

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Abstract: A Python-based online application called the Women's Safety Protocol was created to enhance individual safety by providing rapid emergency response capabilities. The website, which was created using Flask, offers a user-friendly way for women in particular to initiate emergency notifications in dangerous circumstances. As a security precaution, users establish a passcode when they enter emergency mode. The website sends notifications to specified contacts via WhatsApp if the passcode is entered incorrectly or not within a predetermined window of time. The website helps responders with precise placement by using the Geopy package to display the user's current location within a 200-meter radius. To guarantee a prompt reaction, the system notifies several contacts at once. Periodic passcode prompts also aid in confirming the user's safety; if the passcode is not entered, alarms are sent again. The user-friendly interface, which is made for desktop and mobile access, offers a quick, simple experience that is essential in an emergency. The Women's Safety Protocol, which combines automated alerts, real-time location tracking, and a discrete interface, gives users a dependable tool for effectively and discreetly signaling for help, enhancing personal security by facilitating timely assistance from loved ones or authorities.

Keywords: Women's safety, Emergencies, Real Time, Protocol, Alert, Internet of Things (IOT), Location, Quick-response, Security.

1. INTRODUCTION

Personal safety is a significant concern, particularly for women who may face heightened risks in public or isolated settings. With advancements in technology, websites designed to enhance personal security have become increasingly accessible and effective. The Women's Safety Protocol is a proactive solution developed to provide a reliable, user-friendly emergency response platform. Built on the Python Flask framework, this website aims to empower women with a discreet, accessible way to signal for help during emergencies. By leveraging real-time location data, automated alert messaging, and periodic security checks, the system provides users with a robust and responsive tool for their personal safety.

The Women's Safety Protocol uses an intuitive web interface compatible with both desktop and mobile devices, making it versatile and easily accessible. Users can enter an emergency mode, which requires setting a passcode to verify their safety periodically. If the passcode isn't entered on time or is inputted incorrectly, the website sends immediate alerts to designated emergency contacts via WhatsApp. These alerts include the user's approximate location, enhancing responders' ability to locate them efficiently. Through simultaneous notifications to multiple contacts, the system minimizes response times and maximizes user security. The project's goal is to offer a discreet yet effective mechanism that helps users maintain a sense of autonomy and security.

1.1 Methodology

The development of the Women's Safety Protocol is structured around three core components: user interface design, real-time alert system, and location tracking.

1. User Interface Design:

Developed using Flask, a Python web framework, the website interface prioritizes ease of use and accessibility. The design accommodates quick navigation, ensuring that users can initiate emergency mode with minimal steps. The layout is optimized for both desktop and mobile devices, enabling users to access it comfortably from any platform. Key features, such as emergency activation and passcode entry, are prominently displayed to reduce response time in urgent situations.

**2.Real-Time Alert System:**

Upon activation, the emergency alert mode requires users to set a passcode. This passcode acts as a verification step in future interactions with the system. If the user fails to enter the passcode within the designated time frame or enters it incorrectly, the website automatically sends alerts to a pre-configured list of emergency contacts via WhatsApp. The system employs the Twilio API to facilitate automated messaging, ensuring that notifications are sent promptly.

3. Location Tracking with Geopy:

The website integrates the Geopy library to estimate the user's location within approximately 200 meters. This location data is included in the alert messages, providing responders with crucial information to locate the user quickly. The use of Geopy ensures that location information is both accurate and readily available, even if the user cannot communicate directly.

4. Safety Verification through Periodic Prompts:

To ensure continued safety, the system periodically prompts the user to re-enter their passcode. If the user is unable to provide the correct passcode within the allotted time, the alert messages are resent to emergency contacts, maintaining a continuous safety verification protocol.

1.2 Advantages of the Women's Safety Protocol**1. Enhanced Accessibility and Ease of Use:**

Designed for simplicity, the Women's Safety Protocol offers a user-friendly experience. Its compatibility with both mobile and desktop platforms allows users to access the website in various environments, enhancing usability and convenience.

2. Automated Alert System with Location Data:

The automated alert mechanism ensures that designated contacts are promptly notified in potential emergency scenarios. By including real-time location data within the alert messages, the system provides responders with essential information to aid in timely assistance.

3.Increased Reliability through Multiple Notifications:

The protocol sends alerts to multiple contacts simultaneously, increasing the likelihood of a quick response. This redundancy helps ensure that someone within the user's support network is promptly informed, providing peace of mind for both the user and their contacts.

4. Periodic Safety Verification:

By periodically prompting users to verify their safety through passcode re-entry, the system provides a consistent layer of protection. This feature is particularly beneficial for users who may find themselves in prolonged unsafe situations, as it reinforces the reliability of the safety protocol.

5. Empowerment and Autonomy for Users:

The Women's Safety Protocol empowers users by providing them with a tool that is discreet and easy to use. It supports users in managing their personal safety, fostering a sense of autonomy and security even in potentially dangerous situations.

2. LITRETURE SURVEY

S. No	Year	Title	Abstract	Methodology	Drawback
1	2024	Safety with Technology: A Smart SOS Device	An inventive initiative called Empowering Women's Safety with a Raspberry Pi-based Device aims to prevent violence against women by offering a multipurpose, wearable safety gadget. With the help of a Raspberry Pi Camera Rev 1.3, GPS, a push button, a buzzer, and a camera module, the gadget can take several pictures and, in an emergency, send emails to the closest police station. The gadget is easy to carry and utilize in an emergency because it is made to be integrated into women's attire. [1] The software code is specifically made to offer a one-click protocol, which makes it possible to activate the device quickly and effectively. [1]	One-click activation: Uses Raspberry Pi, GPS, camera, and a button to send alerts and images to authorities in emergencies.	Manual activation required: The user must physically press the button, which may not always be possible.
2	2024	Silent Alert: Advancing Women's Security through Smart Sign Recognition and AI	In the modern world, several highly advanced solutions are created with women's protection, particularly at night, as a top priority. The primary goal of this is to address important safety concerns, such as harassment in public areas and emergencies. MediaPipe and machine learning methods including as random forest, decision tree, support vector machine (SVM), gaussian naive bayes, k-nearest neighbor (KNN), gradient boosting, and stacking classifier (hybrid model) are used in the proposed system to create an effective model. [2] Using criteria like F1 score, accuracy, and recall, rigorous testing guarantees that the best model is chosen. In addition to increasing awareness and creating safe spaces, the planned effort seeks to empower women and improve their safety by combining technology and machine intelligence [2].	Machine learning-based safety model: Utilizes MediaPipe and machine learning algorithms (e.g., Random Forest, SVM, KNN) to create an effective safety model for women.	Complex implementation: Advanced machine learning methods may require significant computational resources and expertise for real-time application.
3	2024	Securing IoT-Enabled Web Applications and Enhancing Women's Safety Through Advanced Technologies	Smart homes and smart cities are just two examples of the many areas where the Internet of Things (IoT) is quickly changing how we connect and manage physical objects, resulting in greater efficiency and financial gains. However, security issues are also brought up by the widespread use of IoT devices. This essay discusses several strategies, including passwords, encryption, authentication, and integrity checks, to handle the crucial problem of protecting web applications from unwanted invasions. It also offers cutting-edge methods for reducing vulnerabilities and putting strong security measures in place. Due to a dearth of study on the connections between attack	IoT Security Framework: Utilizes methods like encryption, authentication, and integrity checks to secure web applications from unauthorized access and vulnerabilities.	Limited research on attack vectors: Lack of comprehensive studies on how various attack methods, parameters, and email-based threats are linked, which may leave gaps in overall security.

			strategies, important parameters, and email-based attacks, web applications are especially susceptible to security risks [3].		
4	2023	Empowering Women's Safety: A Comprehensive GPS and GSM-Enabled Automated Anesthesia and Pepper Spray Defense System	Women's protection has become a primary priority in the current day since they are vulnerable to sexual or physical harassment that keeps them from leaving their houses. In the twenty-first century, women and girls continue to encounter barriers despite advancements in technology. The project's objective is to create a design that provides women who feel helpless with security. The system allows them to move freely on the streets, even during odd hours. When the woman is in danger, she can use pepper spray and an anesthetic injector to protect herself by pressing the emergency button on the device. The device is designed with an Arduino UNO, a pepper spray, an automatic anesthetic injector, a buzzer, and GPS technology [4].	Arduino-Based System: Utilizes an Arduino UNO, integrated with GPS, pepper spray, anesthetic injector, and a buzzer to ensure safety during emergencies.	Limited Range: The device's effectiveness is restricted to the immediate vicinity, potentially reducing its utility in more complex or remote situations.
5	2023	Exploring the Potential of Arduino Nano for Enhancing Women's Safety through Smart Sandals	offenses against women's safety and well-being continue to be out of control among all the offenses that have been recorded around the country. The number of crimes against women has significantly increased over time. The number of crimes committed against women has skyrocketed in recent decades. Women have been overcome with fear and worry as a result, and they have thought twice about leaving their houses. To assist individuals overcome this fear and provide them a way to protect themselves in adverse situations, a variety of safety devices have been created. But when you take into account the possibility that you could not be able to use these devices because the attackers might take them away or if the user is chained [5].	Integrated Emergency System: Combines wearable technology and an emergency alert mechanism that can be activated discreetly, ensuring it can still function if the user is restrained or the device is taken away.	Reliance on Technology: If the device malfunctions or there is a delay in response time, the system may not be as effective in an immediate crisis.
6	2023	Safety Watch Based on the Internet of Things	The primary fear that all women worldwide have is for their safety in the event of harassment, kidnapping, etc. Nonetheless, there are other defense techniques, including as stun guns and haulage pepper spray. Current techniques are less effective since they require a shoulder bag for support, and the victim may not have immediate access to it in an emergency. These days, current abilities are dependent on cell phones for functions similar to position and contact chasing. Usually, the first obsession that is picked up and thrown away is the prey's cell phone. As a result, the clothing device cannot establish any kind of contact for help. In this piece [6].	Hands-Free Wearable Device: Develops a wearable safety device that does not rely on easily accessible items like phones or bags, allowing women to discreetly activate the alert system without drawing attention.	Limited Situational Functionality: The device may not be helpful in every situation, such as if the user is incapacitated or unable to reach the activation button.

7	2023	Machine Learning Framework for Women Safety Prediction using Decision Tree	<p>One of the biggest issues facing women in any city is harassment and assault. Furthermore, bullying and abusive information on online social networking sites (OSN) negatively impact women's personal lives. Consequently, determining women's safety in an OSN setting is essential. However, [7] conventional approaches failed to forecast the highest safety analysis. Therefore, a decision tree (WSP-DT) classifier is used in this work to predict women's safety. The Twitter dataset is pre-processed to remove the unknowns and blanks once it has been taken into consideration for system implementation. A natural language toolkit (NLTK) was then used to analyze the tweets, handling tasks including lemmatization, stemming, stop-word recognition, tokenization, and case conversion [7].</p>	<p>WSP-DT Classifier: Utilizes a decision tree-based classifier to analyze and predict women's safety in online social networks, processing Twitter data through NLP techniques like tokenization, lemmatization, and stemming.</p>	<p>Data Dependency: The accuracy of predictions heavily relies on the availability and quality of data, which may limit its effectiveness in cases of insufficient or biased information.</p>
8	2023	The Role of IoT in Woman's Safety: A Systematic Literature Review	<p>Since many women face varied safety concerns, such as harassment, rape, molestation, and domestic abuse, for various societal or cultural causes, women's safety has been emphasized as one of the main concerns of any society. The Internet of Things, or IoT, is emerging as a potential technology to help with daily issues and assist in managing a variety of matters. The community has developed a number of IoT-based tools to assist women in addressing possible safety risks. This study offers a comprehensive overview of the literature on IoT devices for women's safety, including wearable technology, sensors, and machine learning algorithms, as well as the key characteristics these devices provide [8].</p>	<p>IoT and Wearable Technology: Integrates IoT-enabled wearable devices with sensors and machine learning algorithms to detect and respond to potential safety threats faced by women.</p>	<p>Privacy Concerns: Continuous monitoring and data collection from wearable devices may raise privacy issues for users.</p>
9	2023	Real-time Monitoring of Women's Safety Through Bluetooth Low Energy and iBeacons	<p>The real-time tracking of women's safety is presented in this research using Bluetooth Low Energy (BLE) and iBeacons. [9] BLE-enabled calibration devices provide information on the Received Signal Strength Indicator (RSSI) of the iBeacons. The improved least squares estimation approach is used to estimate users' actual RSSIs. The Android Application Package (APK) uses the projected RSSI data to send the mobile device's exact GPS coordinates to the server. The suggested tracking technique offers precise information about device position and iBeacon distance when used in conjunction with the APK. For even more accurate real-time monitoring, the system can also be integrated with Google Maps [9]</p>	<p>BLE and iBeacons: Utilizes Bluetooth Low Energy and iBeacons to facilitate real-time tracking through RSSI data estimation.</p>	<p>Environmental Interference: Signal strength can be affected by physical obstructions or interference, impacting tracking accuracy.</p>

10	2023	Architectural Design and Recommendations for a Smart Wearable Device for Women's Safety	The development of the Internet of Things (IoT) has received a lot of attention lately due to its expansion across a variety of applications. According to this study, IoT can be used to increase women's safety and guarantee a safer environment for the defense. It suggests using a IoT-based safety system that notifies emergency contacts and authorities to assist women who is in danger or under stress. Experimental computations were used to derive the final artifact. To verify the accuracy and efficiency of the suggested artifact, a variety of testing methodologies were used [10].	IoT-based Safety System: Implements a system that alerts emergency contacts and authorities to enhance women's safety in distress situations.	Dependence on Connectivity: Effectiveness may be compromised in areas with poor network coverage, hindering alerts and communication
11	2023	Smart Women Safety Device Using IoT and GPS Tracker	One of the most important elements is the use of IOT. Women's safety has become a major concern in the modern world since they are constantly afraid to leave their homes for fear of being abused physically or sexually or being the target of violence. Despite the abundance of smart devices and software available on the market, none of them offer a workable answer. For an older approach, experts from a variety of fields have found [11] women's safety technology that can be used both manually and automatically. If the user phones the police station, the message can be given right away, and the accuracy of the message will rely on how accurately the user speaks [11].	Manual and Automatic Solutions: Combines traditional approaches with IoT technologies, allowing users to alert authorities through direct communication and automated messaging.	Reliance on User Input: Accuracy of the message depends on the user's ability to communicate clearly during high-stress situations, which may not always be possible.
12	2023	Women's Safety in Cities Using Android	Not just in India, but worldwide, women's protection has to be prioritized. To address the issue of women's safety in urban areas, an Android application was created. The program's goal is to increase women's sense of safety and security. Because many women felt unsafe in major cities, researchers created an Android app called "Women's Safety in Cities Using Android." This program can be activated with a single mouse click when the time comes. When the app is started, it will detect the user's exact position using their GPS coordinates and then send a message to their contacts with a link to the location's unique URL [12].	Android Application Development: An application designed for urban women's safety, utilizing GPS technology to track location and alert contacts in emergencies.	Dependence on GPS Accuracy: The effectiveness of location tracking may be impacted by poor GPS signals in certain urban environments, leading to potential inaccuracies in emergency alerts.
13	2023	Design of Smart Shoe for Women Safety with Emergency Alert System	A smart shoe has been designed as a response to the problem of women's safety, which is still a major worry in society. The smart shoe was created to give ladies an extra layer of protection in potentially hazardous situations. The goal of the project is to create a smart shoe with an emergency warning system in order to	Smart Shoe Development: The smart shoe incorporates advanced sensors and communication technologies, including an accelerometer, GPS, and GSM, to enhance women's	Comfort and Usability: The inclusion of technology may affect the comfort and weight of the shoe, potentially making it less appealing for everyday wear.

			address the problem of women's safety. Advanced sensors and communication technologies, including an accelerometer, an Atmega328 microprocessor, the Global Positioning System (GPS), and the Global System for Mobile Communication (GSM), are integrated into the shoe [13].	safety in threatening situations.	
14	2023	Hope – An Arduino Based Safety device	The innovative Arduino-based women's safety system presented in this study was painstakingly created to enhance location tracking and emergency response capabilities. The system immediately sends a “Need Help” message via GSM to pre-registered contacts along with real-time GPS-derived position coordinates when a distress signal is activated, resulting in a rapid and well-coordinated response. By facilitating efficient communication and interaction between system components, [14] Arduino technology works in unison to improve user security and speed up reaction times [14].	Arduino Implementation: The study utilizes an Arduino-based framework, integrating GSM and GPS modules to enable real-time location tracking and emergency messaging for women's safety.	Limited Battery Life: The reliance on battery-operated components may lead to operational limitations if the device runs out of power during an emergency.
15	2021	Women Safety System Design and Hardware Implementation	Women's safety is a concerning problem in today's world. Women are more susceptible to various risks, including harassment and mocking, when they travel in isolated places. They feel powerless because of this. The design and hardware implementation [15] of a straightforward and reasonably priced women's safety device utilizing NodeMCU, GSM, and GPS modules is suggested in this study. A lady is supposed to press a push button on this safety gadget if she senses any risk. In this case, the women's location is promptly tracked by GPS, and the GSM module sends an emergency message to the local police control center and stored contacts [15].	Device Design: This study proposes a cost-effective safety device using NodeMCU, GSM, and GPS modules, allowing women to alert authorities and contacts during emergencies.	Dependence on Signal Strength: The effectiveness of the system is contingent upon adequate GSM and GPS signal reception, which may not always be available in remote areas.
16	2021	A DESIGN OF DIGITAL TOTE BAG FOR WOMEN'S SAFETY	Women's safety is one of the most important things that is lacking everywhere these days. Even though the government has passed several laws against the abuse of women, it continues to occur regularly and no strong measures have been done to stop it. According to recent studies, a woman in India is raped every 29 minutes. Therefore, the suggested concept works extremely well because it may be triggered by pushing a button or by just pulling the bag's handle. In order to assist people in an emergency, this paper proposes a computerized tote bag [16].	Smart Tote Bag Design: The study introduces a computerized tote bag that activates a distress signal when a button is pressed or the bag's handle is pulled, providing a discreet method for women to signal for help.	Potential for False Alarms: Accidental activation of the distress signal could lead to unnecessary emergency responses, potentially undermining the device's reliability.

17	2020	A Novel Approach of Women Safety Assistant Device with Biometric Verification in Real Scenario	In today's world, women's safety is a major worry. This issue can be lessened with a little smart gadget. A smart device that tracks a woman's whereabouts in real time and has an SMS alert feature can guarantee her freedom of movement. The Study of this research is to give a safety tool for women. This study presented a smart device that will detect when a person is in distress and take appropriate action. The fingerprint module in the system makes sure that this device is only being used by authorized users. The gadget will detect a threat and automatically send an SMS to the appropriate authority if the user is unable to press her finger on the fingerprint module within a predetermined amount of time [17].	Smart Device Design: The study presents a smart device equipped with a fingerprint module that provides authorized users can access it, enhancing personal security. It tracks real-time locations and sends alerts in distress situations.	User Dependency: The system's reliance on the fingerprint module means that if a user is incapacitated and cannot use it, the device may fail to activate the emergency alert, potentially jeopardizing their safety.
18	2019	IoT Based Smart Security Gadget for Women's Safety	Nowadays, everyone, but especially women, is highly concerned about their personal safety. A recent WHO survey found that 35% of women globally are victims of physical abuse and assault. The victim count [18] is continuously increasing. In this article, we outline a system that protects women. Because the item is portable, individuals might carry it with them anytime they feel threatened. The project's objective is to provide women with a reporting and quick-response safety tool. The software enables women to call their guardian for assistance and helps them overcome their phobia. The smart bracelet reports a circumstance simply by pushing a button. Our concept is comparable to a smart wristband [18].	Smart Bracelet Development: This project introduces a portable smart bracelet designed for women, enabling quick emergency reporting and communication with guardians. The system aims to empower women and alleviate their fears regarding personal safety.	Limited Functionality: The reliance on a button press may not be effective in situations where the user is unable to reach or activate the device, potentially hindering the emergency response.
19	2017	Survey on womens safety mobile app development – (2017)	These days, developing mobile applications is crucial because of operating systems like Windows, Android, iOS, and others. This portable application's primary goal is to advance women's wellbeing. It can be used to identify and assist women in times of need. [19] It gives the person's precise location and notifies her guardian, friends, and family of the point of interest via Short Message Service (SMS). In addition to see portable applications, this study looks at their various drawbacks.[19].	Mobile Application Development: This study focuses on creating a mobile application aimed at enhancing women's safety. It provides real-time location tracking and utilizes SMS to alert guardians and loved ones during distressful situations.	Dependence on Mobile Connectivity: The app's effectiveness is compromised in areas with poor network coverage, limiting its functionality during critical situations.
20	2017	A Proposed System for Security in Campuses using IoT Platform: A Case Study of A Women's University	Concern over a very important aspect of any educational campus—security for all members, specifically students and staff—is growing as a result of the growth in the number of students and institutional staff on campuses as well as the increased exposure of campus members to the outside world.[20] The management body of the	Security System Analysis: This study evaluates existing campus security frameworks to identify vulnerabilities. The goal is to propose an integrated security system that utilizes small working	Implementation Challenges: Integrating a new security system may face resistance from staff and students, along with logistical

			campuses is in charge of ensuring safety and security and making sure that everyone who is on campus feels comfortable. The Reason of this study is to check the many weaknesses that the current campus security system faces and to develop a suitable system that is integrated with small working units to assist in resolving campus security-related problems.[20]	units to address identified weaknesses.	challenges and the need for training.
21	2010	Research on the early warning technology of the mine safety based on wireless sensor networks	According to the study of the quantitative analysis on the main threats of the entity and virtual body in the mine production system, the early warning technique of mine safety production with the mixed-mode of the active and passive approach is provided on the wireless sensor networks. Data from hazardous sources, such as production parameters, [21] operation parameters of the operation area, and threshold alarms, are gathered using the ZigBee2007/PRO protocol stack, wireless sensor microcontroller technology, and GIS positioning of wireless sensor network technology. The early warning method is the active and passive safety warning systems that offer a comprehensive treatment function for the initiative warning of mine production safety and event location [21]	Wireless Sensor Networks: This study says that wireless sensor networks with ZigBee protocol to collect data on hazardous parameters in mining operations. The data gathered is utilized in an early warning system that combines both active and passive safety measures.	Network Reliability: The effectiveness of the system heavily relies on the stability and reliability of the wireless sensor network, which may be affected by environmental conditions or hardware malfunctions.

3.CONCLUSION

The Women’s Safety Protocol serves as a critical example of how technology can be leveraged to enhance personal safety for women. With the increasing concern for women's safety in public spaces, this protocol underscores the importance of a robust, responsive system tailored specifically to address the unique security needs that women may face. By prioritizing user-centered design, it ensures that safety tools are intuitive and accessible, allowing individuals to take proactive steps to protect themselves in real time.

The most successful modern safety systems integrate actionable alarms with real-time data, enabling both authorities and users to react quickly to any dangers. In order to save the time and effort needed in emergency circumstances, this protocol automates the process of exchanging location data and delivering warnings. Because it allows for faster replies from the user's connections and local authorities, the real-time feature is crucial and may help defuse dangerous situations before they worsen.

Such a system's flexibility is one of its main advantages. It stays sensitive to many situations that women may face, such as flying alone, being late for work, or navigating strange places, by enabling location monitoring and instant warnings. This method also acknowledges the value of convenience and discretion, allowing users to signal for assistance without bringing excessive attention to themselves. The protocol makes sure that messages are effectively sent to specified contacts, even during emergencies, by connecting with commonly used platforms such as WhatsApp.

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