



# SMART SAFETY WEARABLE: LEVERAGING IOT AND GPS FOR WOMEN'S SECURITY

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## Abstract:

This study has In today's society, women often bear a disproportionate share of responsibilities within their families. Factors such as domestic violence, sexual assault, and kidnapping have forced many women to seek refuge within the safety of their homes. However, even in the modern era, women continue to face the distressing reality of sexual harassment and assault. Recent surveys have shown that a staggering 84 percent of women have experienced harassment in various settings. The prevalence of crimes against women is alarming, necessitating the development of a comprehensive protection framework to ensure their safety and well-being. Amidst these challenges, technology offers hope for improving the living standards and safety of women. One potential avenue is the use of technology in women's safety devices. These devices come equipped with various sensors and features to address the growing security needs of our society. The primary objective of these devices is to maximize the security and protection of women without relying on technology. They are engineered to provide enhanced safety measures, encompassing a wide spectrum of potential threats women may encounter in their daily lives. These devices aim to harness technology to bolster the safety and security of women, contributing to a safer and more equitable world for them.

## I. Introduction

Motivation : Women's safety remains a pressing concern in today's world, despite significant technological advancements. Women often face vulnerability in various situations, particularly when outside their homes, especially at night, during solo travels, or in isolated areas. The erosion of women's security over the past few years can be attributed to the alarming rise in crimes against them. Shockingly, an estimated 736 million women worldwide, roughly one in three, have experienced physical and/or sexual violence from intimate partners or non-partners at least once in their lives, as per a comprehensive survey. The World Health Organization reports that approximately 30% of women globally have endured such violence, and women aged 15 to 44 face a higher risk of sexual assaults and domestic violence than of cancer, car accidents, malaria, or war-related injuries. This sobering reality underscores the urgent need for effective measures to enhance women's safety.

In response to these challenges, our primary focus is to develop a robust and dependable system that empowers women to feel secure and protected. Leveraging technology's potential for both harm and positive change, we advocate for the strategic integration of technology, specifically through safety solutions. Our project centers on creating solutions designed to assist women in averting perilous situations and ensuring that justice is served when needed.

**Objective :** Our approach prioritizes precision and intelligence in addressing women's safety concerns. We offer versatile solutions that seamlessly integrate into women's daily routines without causing disruption. At the core of our endeavor are safety features instrumental in fulfilling these requirements. With a simple press of a panic button, our system activates a sophisticated array of software components, including location tracking modules, communication modules, and user-friendly interfaces, all thoughtfully designed to swiftly and effectively summon assistance when required. The inclusion of a reliable power supply ensures longevity, making this women's safety solution an indispensable asset in our ongoing commitment to safeguard the wellbeing of women in our society.

**Project Scope:** This project aims to develop a comprehensive safety wearable for women, leveraging the Internet of Things (IoT) and GPS technology. The wearable device will be equipped with multiple sensors to detect potential threats and a communication system to alert authorities and trusted contacts. The primary components of the system include a panic button, GPS module for real-time location tracking, GSM module for communication, and various sensors to monitor environmental and physiological conditions. Additionally, the device will incorporate a user-friendly interface to ensure ease of use and quick access to emergency services.

## II. BACKGROUND STUDY

The pervasive issue of women's safety has garnered significant attention worldwide, leading to various technological advancements aimed at providing better protection and security. Historically, women have faced a disproportionate risk of violence and harassment in both private and public spaces. Data from global organizations such as the World Health Organization (WHO) and the United Nations (UN) highlight that approximately one in three women worldwide experience physical or sexual violence in their lifetime. These alarming statistics underscore the urgent need for innovative solutions to enhance women's safety and security. The evolution of safety devices for women has progressed from basic alarm systems to sophisticated wearable technology. Early devices were simple panic alarms that emitted loud noises to deter attackers and attract attention. While these devices provided some level of immediate protection, they were often limited in functionality and effectiveness. With advancements in technology, particularly in the fields of the Internet of Things (IoT) and GPS, modern safety devices have become more sophisticated. These advancements allow for real-time location tracking, automated alerts, and integration with mobile applications, significantly improving the response time and effectiveness of safety measures.

## III. LITERATURE SURVEY

**PRIYANKA KOHLI AND KAWALJEET SINGH [2]** THIS PAPER DELVES INTO THE CRITICAL ISSUE OF WOMEN'S SAFETY WITHIN THE URBAN LANDSCAPES OF BOTH SMART AND NON-SMART CITIES IN INDIA. THIS COMPREHENSIVE STUDY SHEDS LIGHT ON THE MYRIAD CHALLENGES FACED BY WOMEN IN URBAN ENVIRONMENTS, FOREMOST AMONG THEM BEING THE PERVASIVE ISSUES OF VIOLENCE, HARASSMENT, AND RESTRICTED MOBILITY. THE AUTHORS UNDERScore THE IMPERATIVE OF WOMEN'S EMPOWERMENT IN ADDRESSING THESE CONCERNS, ADVOCATING FOR THE INTEGRATION OF CUTTING-EDGE TECHNOLOGIES, SUCH AS MACHINE LEARNING AND DATA SCIENCE, TO DEVELOP EFFICIENT SAFETY SYSTEMS THAT CAN MAKE A TANGIBLE DIFFERENCE. THE PAPER NOT ONLY EXPLORES THE EXISTING PROBLEMS BUT ALSO PROVIDES A DATA-DRIVEN APPROACH TO UNDERSTANDING THE INTRICACIES OF WOMEN'S SAFETY IN DIFFERENT URBAN SETTINGS. THROUGH THE PRESENTATION OF DEMOGRAPHIC DATA AND THE INSIGHTS GARNERED FROM THE PERCEPTIONS OF WOMEN RESIDING IN BOTH SMART AND NON-SMART CITIES, THE STUDY UNVEILS SUBSTANTIAL DISPARITIES IN THEIR PERSPECTIVES REGARDING SAFETY AND EMPOWERMENT. THESE VARIATIONS IN OUTLOOK HIGHLIGHT THE COMPLEX INTERPLAY OF FACTORS THAT INFLUENCE WOMEN'S EXPERIENCES AND FEELINGS OF SECURITY IN URBAN ENVIRONMENTS. IN CONCLUSION OF AUTHOR'S WORK UNDERScores THE PRESSING NEED FOR MORE SOPHISTICATED AND USER-FRIENDLY SAFETY MEASURES, AS WELL AS AWARENESS PROGRAMS. IT IS EVIDENT THAT THE ISSUE OF WOMEN'S SAFETY IN INDIA'S CITIES REMAINS AN ONGOING CONCERN, AND ADDRESSING IT REQUIRES A MULTIFACETED APPROACH THAT COMBINES EMPOWERMENT, TECHNOLOGY, AND A DEEP UNDERSTANDING OF THE UNIQUE CHALLENGES FACED BY WOMEN IN BOTH SMART AND NON-SMART CITIES. THIS LITERATURE REVIEW SERVES AS A VALUABLE CONTRIBUTION TO THE ONGOING DISCOURSE ON WOMEN'S SAFETY AND EMPOWERMENT IN URBAN ENVIRONMENTS, ILLUMINATING THE PATH FORWARD FOR POLICYMAKERS, URBAN PLANNERS, AND RESEARCHERS ALIKE.

**Prachi Gupta et al [5]** In their paper titled "Women's Safety Device Based on Internet of Things," Prachi Gupta and her co-authors address the paramount issue of women's safety in today's society, drawing attention to the disturbing prevalence of violence against women on a global scale. At the core of their research, the authors introduce an innovative device known as "Suraksha Kawach," purposefully designed to provide women with a reliable means of protection and alert in situations that threaten their safety. This device harnesses a multifaceted approach, incorporating various cutting-edge technologies such as GPS, GSM, cloud computing, and speech recognition, to promptly trigger alerts to pre-programmed contacts and relevant authorities when activated. One noteworthy component of this paper is the literature review section, where the authors meticulously examine existing safety devices tailored for women. Within this review, they judiciously underscore the limitations and shortcomings of these devices. Common issues identified include the propensity for false alarms, which can not only undermine the efficacy of such devices but also contribute to complacency or even disregard when genuine threats arise. Additionally, the lack of discretion in these existing solutions can inadvertently put women at risk or lead to situations where their safety is compromised. In contrast, the authors contend that the "Suraksha Kawach" device represents a substantial advancement in women's safety technology. They argue that its innovative blend of features and technologies not only mitigates the problems associated with false alarms but also enhances user-friendliness. By doing so, it has the potential to significantly impact the reduction of violence and harassment against women by providing a more reliable and discreet means of protection.

**Satyam Tayal et al [4]** In this paper, "Women Safety System Design and Hardware Implementation," introduces an innovative and cost-effective women's safety device that leverages NodeMCU, GSM, and GPS modules. This device empowers women by enabling them to send emergency messages containing their precise location to pre-designated contacts and nearby law enforcement agencies when they sense danger. Notably, the device also incorporates a feature to capture an image of the potential attacker and activates a buzzer to alert nearby individuals. In the context of addressing concerns regarding women's safety, the paper thoughtfully discusses existing solutions and then presents its own straightforward yet efficient device. While the proposed safety device indeed appears promising and valuable, a comprehensive literature review in this context would necessitate a deeper examination of its real-world effectiveness. Such an analysis would involve evaluating the device's performance in practical scenarios and comparing it to other similar systems to gauge its reliability and user-friendliness. This is pivotal to ascertain whether the device can truly deliver on its intended purpose and stand up to the challenges of real-world use, ensuring the safety of women in various situations. Moreover, a robust literature review would encompass an exploration of the legal and ethical implications associated with such devices. Questions pertaining to privacy, consent, data security, and adherence to regulations and laws would be of paramount importance. As women's safety solutions become increasingly interconnected and technologically advanced, it is essential to scrutinize the potential legal and ethical ramifications and how they align with the broader goals of enhancing women's safety.

**Chandan Gautam et al [6]** In their paper titled "Wearable Women Safety Device," tackle the pressing issue of women's safety through the introduction of an innovative wearable device based on ESP32 MCU. This multifunctional device not only equips women with the means to promptly share their location details with loved ones during emergencies but also serves as a comprehensive fitness band, monitoring various health parameters. In the context of the paper's literature review, the authors thoughtfully provide an extensive overview of related works, shedding light on existing solutions such as mobile applications, IoT-based systems, and wearable devices that have been designed with the objective of enhancing women's safety. The value of this literature review lies in its ability to place the proposed device within the broader context of existing women's safety solutions. By highlighting the strengths and limitations of various approaches, it helps readers understand the unique contributions and advantages of the wearable device presented in the paper. This comprehensive understanding is critical in assessing the device's potential in effectively addressing the complex challenges related to women's safety. The distinguishing feature of the "Wearable Women Safety Device" is its holistic approach. By combining location tracking, health monitoring, and emergency alerting features within a single wearable, it offers a comprehensive solution that not only addresses immediate safety concerns but also takes into account the overall well-being of women. This integration of safety and health monitoring features not only enhances the device's functionality but also positions it as a more versatile and valuable tool for women in various situations.

**Irfanullah et al [4]** This paper that offers a comprehensive solution for kitchen safety using an Internet of Things (IoT) platform. Their work addresses the critical issue of gas leakage, smoke, and fire detection in residential kitchens, with the primary objective of preventing accidents and safeguarding lives and property. This paper showcases a sophisticated system that employs a network of sensors, including those for temperature, smoke, gas leakage, and fire detection, all interconnected with Arduino and Raspberry Pi devices, enabling continuous and real-time monitoring of the kitchen environment. The distinguishing feature of this system lies in its proactive nature. When the sensor values surpass predefined safety thresholds, the system autonomously triggers corresponding actions to mitigate potential hazards. These actions include the activation of actuators such as solenoid gas valves, alarms, and exhaust fans, thereby enhancing safety measures and reducing the likelihood of dangerous incidents. The inclusion of these actuators ensures a swift response to impending threats, further solidifying the system's effectiveness in preventing accidents. Moreover, the system offers the added advantage of providing real-time updates to users through a user-friendly graphical interface. This interface not only facilitates remote monitoring but also enables users to exercise control over the safety measures in their kitchen. Such remote accessibility is a valuable asset, as it empowers individuals to take immediate action even when they are not physically present in the kitchen, thus contributing to the overarching goal of preventing kitchen-related accidents. The incorporation of multiple sensors in this system, as opposed to relying on a single-sensor approach, underscores its commitment to accuracy and reliability. This multi-sensor strategy enhances the system's ability to detect and respond to a variety of threats, making it more robust and resilient in safeguarding smart homes.

**Priya C et al [5]** In their paper titled "Raspberry Pi based Women Safety System," Priya C and her co-authors have taken on a significant and pressing issue in today's society – the safety of women. The authors underscore the alarming increase in crimes against women and present an innovative solution in the form of an Internet of Things (IoT) based smart wearable device. This device is designed to empower women by automatically detecting potential threats and triggering alerts to relevant contacts and authorities. The device's functionality is underpinned by a variety of sensors, including pulse rate and temperature sensors, which work in conjunction with GPS and GSM technology. This combination of sensors and technologies not only allows for the detection of threats but also enables the device to rapidly communicate with the necessary parties to mitigate these threats effectively. The paper places a strong emphasis on the practicality and customizability of the device as a wearable. Its portability and adaptability make it a versatile solution for enhancing women's safety, ensuring that it can seamlessly integrate into the daily lives of its users. One of the standout features of this proposed solution is its combination of both automatic and manual mechanisms. This design choice enhances user-friendliness, allowing individuals to have an active role in their safety while also benefitting from automated threat detection. Furthermore, this dual approach contributes to the cost-effectiveness of the system, making it accessible to a wider range of users.

#### IV. METHODOLOGY

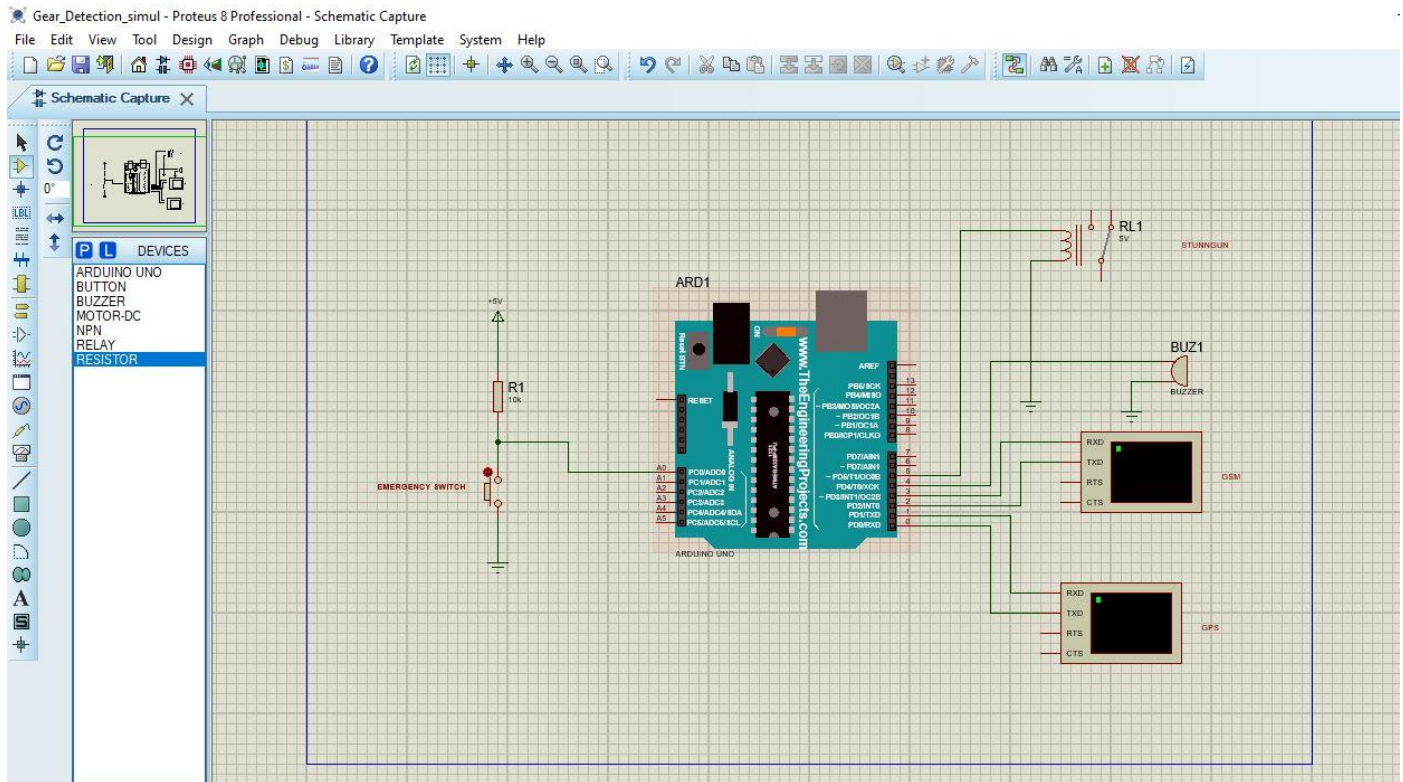
The working of this women's safety device project is a well-orchestrated system designed to provide women with enhanced security and swift assistance during emergency situations. It begins with the user's activation of the device through the emergency switch or panic button when they perceive a potential threat or danger. This action triggers a sequence of essential functions within the device.

The GPS module springs into action, tracking the user's exact location in real-time, which is crucial for providing responders with accurate coordinates. Simultaneously, the GSM module, a communication powerhouse, sends out alerts or messages to predefined authorities or trusted contacts. These messages include the user's GPS coordinates, ensuring that responders have precise location information. To further draw attention to the user's situation, the device may incorporate an alert mechanism, such as a buzzer or other auditory signal. This additional layer of alerting can be vital in emergency scenarios.

The device's power supply, typically powered by reliable batteries, plays a pivotal role in ensuring the device's continued operation for an extended duration. A user interface, which may include indicators or displays, provides feedback to the user, confirming that the emergency alert has been successfully sent. The working of this project is meticulously designed to empower women to take control of their safety in precarious situations. It offers a user-friendly, reliable, and efficient means of alerting authorities or contacts when emergencies arise, thereby contributing to women's safety and security in an increasingly uncertain world.



## V. SYSTEM ARCHITECTURE:



### HARDWARE USED:

1. Arduino uno
2. GSM Module
3. GPS Module
4. Buzzer

### Software used:

1. Arduino IDE
2. Proteus Software

### 1. ARDUINO UNO Module

The Arduino UNO is categorized as a microcontroller that use the ATmega328 as controller in it. The Arduino board is the most used board of all Arduino boards. The board contains 14 digital input/ output pins in which 6 are analog input pin, one power jack, USB connector, one reset button and other components. All components are attached in the Arduino UNO board to make it functioning and can be used in the project. The board is charged by USB port or can be directly charged by the DC supply to the board.

### 2. GSM Module

GSM/GPRS Modem-RS232 is built with the Quad-Band GSM/GPRS engine-SIM800C, works on frequencies 850/900/1800/1900MHz. The module comes with RS232 interface, which allows you to connect PC as well as microcontroller with RS232 Chip (MAX232). The baud rate is configurable from 9600-115200 through AT command. The GSM/GPRS modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. This module is suitable for SMS, Voice as well as DATA transfer application in M2M interface. The onboard Regulated Power supply allows you to connect wide range of unregulated power supply. Using this modem, you can make audio calls, SMS, Read SMS, attend the incoming calls and internet etc., through simple AT commands.

### 3. GPS Module

Here we are using the NEO6M GPS module. The NEO-6M GPS module is a popular GPS receiver with a built-in ceramic antenna, which provides a strong satellite search capability. This receiver has the ability to sense locations and track up to 22 satellites and identifies locations anywhere in the world. With the on-board signal indicator, we can monitor the network status of the module. It has a data backup battery so that the module can save the data when the main power is shut down accidentally.

The core heart inside the GPS receiver module is the NEO-6M GPS chip from u-blox. It can track up to 22 satellites on 50 channels and have a very impressive sensitivity level which is -161 dBm. This 50-channel u-blox 6 positioning engine boasts a Time-To-First-Fix (TTFF) of under 1 second. This module supports the baud rate from 4800-230400 bps and has the default baud of 9600.

### 4. Buzzer

There are many ways to communicate between the user and a product. One of the best ways is audio communication using a buzzer IC. So, during the design process, understanding some technologies with configurations is very helpful. So, this article discusses an overview of an audio signaling device like a beeper or a buzzer and its working with applications.

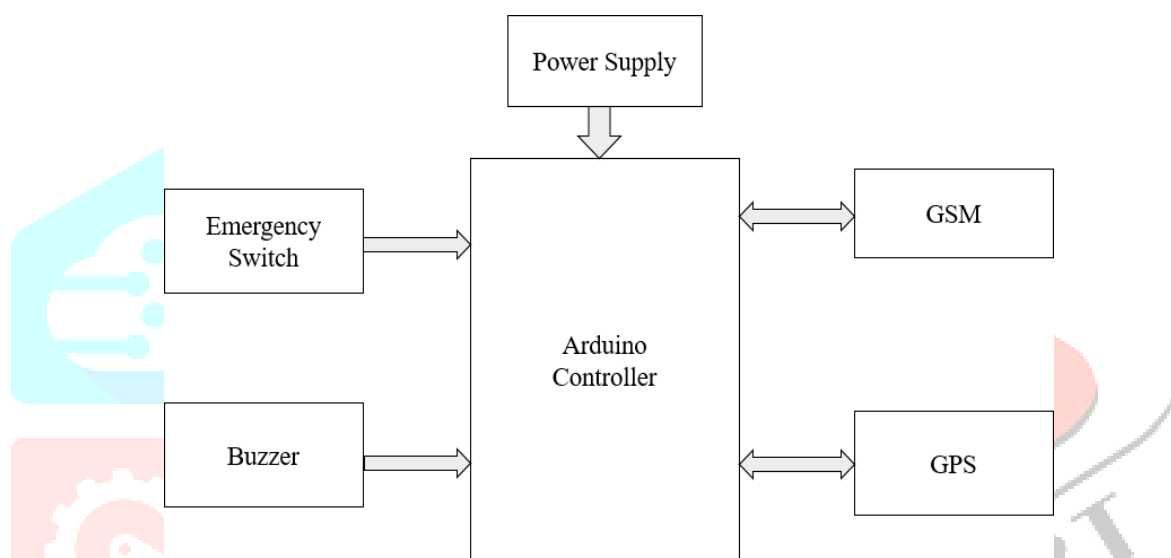
An audio signaling device like a beeper or buzzer may be electromechanical or piezoelectric or mechanical type. The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc. Based on the various designs, it can generate different sounds like alarm, music, bell & siren.

## 5. Switch

A slide on-off switch, often referred to as a slider switch, is a simple but effective electrical component used to control the flow of electricity in a circuit. It consists of a sliding lever or actuator that, when moved, physically opens or closes a pair of electrical contacts. In the "off" position, the contacts are separated, interrupting the flow of electricity and effectively turning the connected device or circuit off. When the lever is slid to the "on" position, it brings the contacts together, completing the electrical circuit and allowing current to flow, thus turning the device or circuit on. Slide on-off switches are commonly found in a wide range of electronic devices, from household appliances to power tools and even on/off buttons for various functions in consumer electronics. They are straightforward to operate, making them user-friendly for controlling power sources and functions, and their durable design ensures long-lasting performance.

## VI. SYSTEM DESIGN

Block Diagram:



- **Emergency Switch (Panic Button):** This is a critical component for users to trigger an emergency alert when they feel threatened or in danger.
- **Buzzer:** The buzzer is used to generate audible alerts or alarms to draw attention to the situation or to signal for help.
- **Power Supply:** The power supply is essential to provide energy to the device. You mentioned it twice, which highlights its importance. It can be implemented using batteries or other power sources.
- **Arduino Uno:** The Arduino Uno is a microcontroller board that can be used to control and coordinate the various functions of the device, such as processing user inputs and interfacing with other components.
- **GPS Module:** The GPS module is used for accurate location tracking, helping authorities or contacts to pinpoint the user's whereabouts during an emergency.
- **GSM Module:** The GSM module allows the device to communicate with authorities or trusted contacts by sending alerts, messages, or making calls in emergency situations.

## VII. CONCLUSION

In conclusion, this project represents a significant step towards addressing the critical issue of women's safety. By creating a comprehensive women's safety device equipped with advanced features like GPS tracking, communication modules, and a panic button, it empowers women to take control of their security. The project's core focus on user-friendly design, efficient communication, and swift response mechanisms ensures that women can seek help in emergencies promptly. The successful implementation of this project stands as a testament to the potential of technology in safeguarding the well-being of women, contributing to a safer and more equitable world for all.

This research delves into the critical issue of women's safety, welfare, and awareness in both smart and nonsmart urban environments. Despite persistent calls for action spanning decades, women continue to express concerns regarding their security in both types of cities. While smart city initiatives boast numerous safety measures, there remains a pressing need for more sophisticated technological solutions that directly address women's unique vulnerabilities.

Emergency situations often leave women with limited time and capacity to navigate complex interfaces. Instead, intuitive and effortless tools such as single-button applications can empower them to instantly transmit distress signals to designated contacts, police, and medical responders while simultaneously pinpointing their location and capturing crucial evidence.

However, existing solutions often fail to reach those who need them most. Many women lack awareness of available safety technologies, and government campaigns rarely prioritize their widespread adoption. Unlike apps providing services such as e-banking or healthcare access, which are often mandated, women's safety apps have not received a comparable level of urgency or implementation.

Furthermore, solely relying on existing infrastructure like CCTV cameras proves insufficient. While recordings may assist in investigations, they offer little to prevent incidents as they unfold. To truly advance women's safety, a comprehensive Women Safety System must be developed, drawing upon advancements in fields like Machine Learning, Android development, and Data Science.

Upon implementation, such a system should be accompanied by robust training programs tailored for women, equipping them with the knowledge and confidence to utilize these resources effectively. A collaborative approach between government and private organizations can ensure widespread adoption and maximize the impact of these life-saving measures. By prioritizing innovation and accessibility within this domain, we can move towards a future where women navigate urban environments with a renewed sense of security and empowerment.

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