

Monitoring Tool for Women's Safety in Colleges or Universities

G Akshay Kumar¹, P Mohammad Fayaz², M Lokesh Yadav³, Dr. Joseph Micheal Jerard V⁴

^{1,2,3}*School of Computer Science & Engineering, Presidency University, Bangalore, Karnataka, India.*

⁴*Professor, School of Computer Science & Engineering, Presidency University, Bangalore, Karnataka, India.*

Abstract – In recent years, the issue of women's safety has become increasingly prominent across the globe. Despite advances in technology, women continue to face threats in public and private spaces, necessitating immediate access to emergency assistance. This project presents a low-cost, compact, and efficient women safety device built using Arduino Uno, designed to provide real-time location-based alerts during emergencies with the press of a button.

The core objective of this system is to enable quick and discreet communication of a user's real-time location to a trusted contact via SMS, especially during distressful situations. Upon pressing a push button integrated into the system, the device captures the user's current latitude and longitude using a GPS module (connected via serial communication). This data is then formatted into a Google Maps URL, making it user-friendly for the recipient. The message, which includes both the coordinates and the clickable location link, is sent to a predefined phone number using a GSM module (SIMGOO) through standard AT command sequences. An I2C-based 16x2 LCD display provides user feedback at various stages of operation, such as showing startup messages, indicating GPS activity, and confirming that an emergency alert has been sent. The use of Tiny GPS++ allows precise parsing of GPS data, and Software Serial ensures that both the GSM and GPS modules can operate simultaneously with the Arduino Uno's limited serial communication ports.

This solution is highly scalable and modular, suitable for students, professionals, or individuals looking for an offline, mobile-free emergency alert system. It can function in low-network areas, without the need for smartphones or internet access, making it ideal for use in rural or isolated locations. The simplicity of its interface—pressing just one button—makes it accessible for all age groups and physical capabilities. In conclusion, this women safety system provides an effective response mechanism that is not only technically reliable but also user-friendly, with potential for real-world implementation and further development into wearable formats.

Keyword: - *women's safety, Campus security, Gender equality, Sexual harassment prevention, Empowerment*

and Prevention, Anti-Harassment policies, Safety measures.

I. INTRODUCTION

In an era marked by technological advancement, ensuring the safety and security of individuals particularly women became a global concern. Every day, reports of harassment, abuse, and violence remind us of the pressing need for responsive, real-time safety solutions. Traditional safety measures often rely heavily on the presence of smartphones, internet access, or the ability to speak or type a message, which may not always be feasible during high-stress or emergency situations.

This project proposes a Women Safety System that is designed to be both reliable and easy to use, especially under pressure. Developed using the Arduino Uno microcontroller, the system integrates a GPS module, a GSM communication module, an I2C LCD display, and a simple push button trigger. With the press of a button, the system fetches the user's current geographical coordinates and sends an emergency alert via SMS, including a clickable Google Maps link for real-time tracking.

The system bypasses the need for smartphones or internet connectivity, offering an offline, hardware-based solution that is compact, portable, and affordable. Its plug-and-play nature makes it suitable for use by women of all ages and backgrounds, even in remote or network-limited regions.

Moreover, by incorporating clear LCD feedback and using robust communication protocols like AT commands and GPS NMEA sentence parsing, the system ensures accurate location tracking and dependable message delivery. This not only boosts the chances of a timely response but also provides peace of mind to users and their loved ones.

Through this project, the aim is to showcase how accessible and open-source technology platforms like Arduino can be leveraged to build life-saving

devices, and how embedded systems can play a transformative role in enhancing personal safety and well-being.

II. OBJECTIVES

The primary goal of this project is to develop a reliable and efficient real-time emergency alert system to enhance the personal safety of women in distress situations. The specific objectives of this system are as follows:

Primary Objectives:

1. To design a low-cost, standalone safety device using Arduino Uno that does not rely on smartphones or internet connectivity.
2. To enable real-time location tracking by integrating a GPS module that provides accurate latitude and longitude coordinates.
3. To ensure fast and reliable communication through a GSM module that sends SMS alerts to predefined emergency contacts.
4. To provide a user-friendly interface using an LCD display to show system status, alerts, and location information.
5. To activate emergency communication with a single button press, allowing the user to trigger the alert system quickly and discreetly.

Secondary Objectives:

6. To format the GPS data into a clickable Google Maps link for easy access to the user's location by the recipient.
7. To minimize power consumption and improve portability, making the system suitable for continuous use in various environments.
8. To ensure modularity and expandability so the system can be enhanced with features such as buzzers, voice commands, or wearable integration in the future.
9. To build a reliable prototype that can be deployed for real-world testing and scaled into a production-ready personal safety device.

III. METHODOLOGY

The methodology for the Women Safety System using Arduino Uno, GPS, GSM, and LCD (I2C) is based on the integration of hardware and software components to build an efficient, real-time emergency response system. The system's primary objective is to ensure the safety of women by sending an alert with location information to emergency

contacts when the system is activated by a push button. Below is a description of the methodology, focusing on the components, procedures, and software logic.

System Overview

The system is built on the Arduino Uno platform, which is the heart of the project. The core components include:

- **Arduino Uno:** This is the microcontroller that controls the system, processes inputs, and manages outputs.
- **Push Button:** Used to trigger the emergency alert when pressed.
- **GPS Module:** Provides the location data (latitude and longitude) of the user.
- **GSM Module (SIMGOO):** Sends the emergency SMS with location data to predefined emergency contacts.
- **LCD Display (I2C):** Displays messages to the user, such as "Emergency Detected," and shows location information.
- **Relay (optional):** Can be used to trigger additional systems, such as lights or alarms in an emergency, but it is not actively used in the current code.

Hardware Configuration

Components Used

- **Arduino Uno:** A microcontroller that interacts with sensors, modules, and actuators.
- **GPS Module (e.g., NEO-6M):** Provides real-time location data (latitude and longitude).
- **GSM Module (SIMGOO):** Used for sending SMS alerts to the emergency contacts.
- **I2C LCD Display:** A 16x2 display for showing status messages and location.
- **Push Button:** When pressed, this initiates an emergency response.
- **Relay (optional):** Could be added for additional output control, such as activating a siren.

Circuit Design

The components are connected to the Arduino Uno as follows:

- **Push Button:** Connected to digital pin 2 (input pin), which will read HIGH or LOW when pressed or released.
- **GPS Module:** Connected to the Arduino via Software Serial pins 11 (RX) and 12 (TX) for communication.

- GSM Module: Connected to pins 11 and 12 using Software Serial for communication with the SIMGOO module, enabling SMS transmission.
- I2C LCD: Connected to SDA (A4) and SCL (A5) pins of the Arduino for communication.
- Relay (optional): If used, connected to a digital pin (e.g., pin 3) to activate an external relay or alarm system.

Power Supply

- The Arduino Uno is powered through USB or an external power supply.
- The GPS and GSM modules are powered by the 5V and GND pins from the Arduino. The GSM module typically requires more current, so it may be powered by an external 5V supply if needed.

IV. PROPOSED WORK

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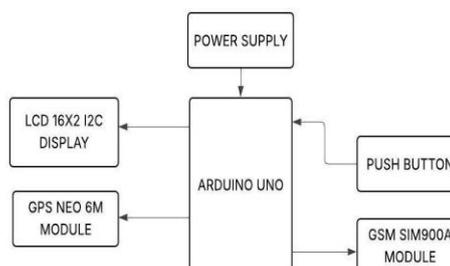
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Software Implementation

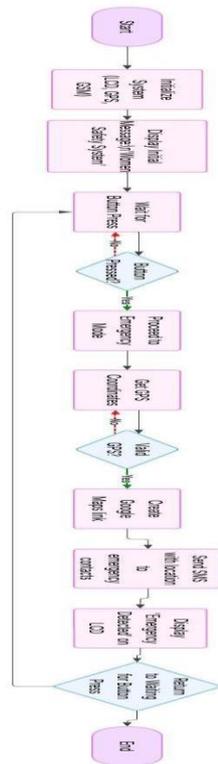
GPS Data Retrieval :

The Tiny GPS++ library is used to interface with the GPS module. The system retrieves the latitude and longitude coordinates from the GPS module and processes them to generate a URL link that can be sent via SMS.

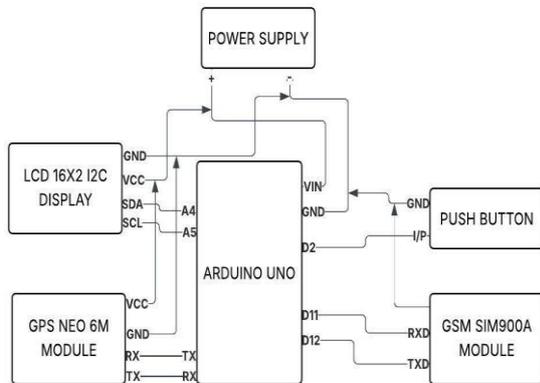
V. BLOCK DIAGRAM



VI. FLOW CHART



VII. CIRCUIT DIAGRAM



VIII. APPLICATIONS

The Women Safety System is designed to provide real-time emergency alerts using GPS and GSM technology. Its modular and cost-effective design makes it suitable for a wide range of real-life applications beyond personal safety. Here's a detailed overview of its key applications:

1. Personal Safety for Women and Girls

- Primary Application: The system is designed to help women in distress by sending their live GPS location via SMS to a trusted contact.

- Use Case: In cases of harassment, stalking, or physical danger, pressing the button instantly sends an alert to family, friends, or authorities.
- Impact: Enables quick response and increases the sense of security and independence.

2. Student Safety in Schools s Colleges

- Deployment: Worn as a badge or embedded into school uniforms.
- Function: Students can press the panic button during emergencies like bullying, abduction attempts, or health issues.
- Benefit: Facilitates prompt intervention from staff or parents.

3. Safe Travel – Taxis, Ride-Sharing, and Public Transport

- Use Case: Installed in public transportation systems or ride-sharing vehicles.
- Function: Passenger can press the button if they feel unsafe.
- SMS Alert: Sent to the authorities or app management team with real-time location.
- Impact: Enhances passenger trust and safety in shared mobility services.

4. Safety in Isolated or Remote Locations

- Target Users: Women working or traveling in remote areas (e.g., journalists, researchers, social workers).
- Purpose: In locations with limited help, this device ensures help can be notified quickly.
- Advantage: GPS works even in rural or low-network areas, and GSM ensures message delivery when network is available.

5. Elderly or Disabled Individuals

- Alternate Application: Can be adapted for senior citizens or people with disabilities who may face sudden health issues or falls.
- Use Case: Pressing the button sends a message to caregivers with the exact location.
- Benefit: Offers independence and emergency support to vulnerable individuals.

6. Emergency Alert Systems for Domestic Violence Victims

- Function: Hidden or disguised versions of this system can be provided to victims of domestic violence.
- Benefit: Enables discreet SOS messages without alerting the abuser.

- Implementation: Can be embedded in wearable items like jewelry, clothing, or keychains.

7. Base Model for Advanced IoT Safety Devices

- Academic/Industrial Use: This system serves as a prototype or base model for further development in:
 - IoT-based smart wearables
 - Smart security systems
 - Emergency response networks
- Upgrade Potential: Can be enhanced with Bluetooth, Wi-Fi, camera, or voice control features.

8. Educational Projects and Research

- Field: Engineering and technical education
- Purpose: Used in academic projects to teach students about:
 - Embedded systems
 - IoT safety devices
 - GSM and GPS integration
- Outcome: Helps students learn real-world problem-solving using electronics and programming.

IX. RESULTS

The Women Safety System was tested thoroughly to evaluate its accuracy, responsiveness, and reliability in emergency scenarios. Each module was individually verified, followed by integration testing to ensure the system works as intended when all components are connected.

Objective of Testing

Ensure that all modules (Arduino Uno, GPS, GSM, LCD, Push Button) are functioning correctly. Validate that the system can reliably detect an emergency and send an SMS with location details. Assess system responsiveness and real-time performance in real-world conditions.

Individual Module Testing

A. Push Button Test

Test Objective: To confirm that the push button triggers the emergency workflow.

Procedure: The push button was connected to digital pin 2 of the Arduino. Using INPUT_PULLUP configuration, the state change from HIGH to LOW (button pressed) was monitored.

Result: When the button was pressed, the system correctly identified the input and initiated the emergency process.

Conclusion: Button is responsive and reliable as an emergency trigger.

B. GPS Module Test (NEO-6M)

Test Objective: To verify the GPS module's ability to fetch accurate location data.

Procedure: The GPS module was tested in an open area for optimal satellite signal. GPS data was parsed using the Tiny GPS++ library and displayed via the Serial Monitor.

Result: The module provided accurate latitude and longitude values within 15–30 seconds of startup.

Sample Output:

LAT: 13.084944

LONG: 77.641331

Conclusion: The GPS module successfully and consistently provided real-time location data.

X. FUTURE SCOPE

The Women Safety System using Arduino Uno, GSM, GPS, LCD, and a push-button has been successfully implemented as a basic prototype for emergency alert communication. It effectively meets its core objective: alerting emergency contacts in real-time when a woman is in distress. However, considering the rapid advancement in embedded systems, wireless communication, and wearable technologies, the current model presents numerous opportunities for improvement, scalability, and real-world deployment. The system can evolve into a more advanced and intelligent safety platform by incorporating new features, optimizing existing components, and integrating with larger infrastructures.

One of the most promising areas for future development is miniaturization and wearability. The current system, although functional, uses multiple wired components assembled on a breadboard or prototype PCB. This makes it somewhat bulky and less practical for daily or long-term use. Future iterations of the device could leverage compact microcontrollers like the Arduino Nano or ESP32, which offer more computing power in a smaller footprint. These components can be integrated into wearables such as smart jewelry, wristbands, pendants, or even embedded into clothing. This would make the safety system more discreet, user-friendly, and accessible, especially in sensitive situations where drawing attention might not be safe. Another significant enhancement lies in the integration of the system with smartphones via

mobile applications. Currently, the GSM module is responsible for sending location-based alerts via SMS, which is effective but limited in functionality.

A custom-developed mobile app could enable Bluetooth or Wi-Fi communication with the device, offering features such as real-time location tracking on a map, push notifications, automatic periodic updates, and even audio or video logs. This app could also provide the user with options to configure emergency contact lists, toggle between silent and loud modes, or monitor battery status—thus increasing the system's usability and intelligence.

The system also has great potential for integration into the Internet of Things (IoT) ecosystem. By connecting the device to cloud-based platforms like Blynk, Firebase, or ThingSpeak, users and emergency services could remotely monitor location data and system activity in real time. For instance, a cloud-connected system can be programmed to store emergency events with timestamps and GPS data, which can later be used for legal or safety audits. Additionally, IoT integration could make it possible to send alerts not just to individual contacts but also to community platforms, police departments, or NGOs, depending on the severity of the situation.

Beyond connectivity, future developments can explore artificial intelligence (AI) and machine learning (ML) to enhance the intelligence of the system. With enough data on user movement patterns and environmental contexts, machine learning models can be trained to predict danger zones or risky behavior. For instance, if a user frequently moves through a high-risk area at night, the system can automatically send precautionary alerts or notify guardians in advance. Predictive algorithms can also detect irregular patterns, such as sudden stops or prolonged inactivity in unknown locations, and trigger alerts without needing the user to press a button.

Further improvements can be made in terms of user accessibility and interaction. For instance, the inclusion of voice activation would allow users to trigger the emergency system without physically interacting with the device—a critical feature in cases of physical restraint. Voice-controlled systems using offline recognition libraries can recognize pre-set emergency keywords. Similarly, biometric security, such as fingerprint verification, could be used to prevent unauthorized access or accidental deactivation, ensuring that only the user can control the device's functions.

Power management and portability are also critical aspects to address. While the current version operates on USB power or a 9V battery, future models can incorporate solar panels or energy-efficient power systems to ensure longer operating times. This would be particularly useful in remote or outdoor areas where access to electricity is limited. Low-power sleep modes, combined with solar charging capabilities, can make the device truly autonomous and sustainable for field use.

Another area for expansion is two-way communication. Currently, the system only sends alerts but does not provide feedback to the user. Adding a microphone and speaker would enable real-time voice communication with emergency contacts or authorities. In some advanced scenarios, the device could even stream live audio, giving listeners context about the environment and improving situational awareness for responders.

Finally, there is strong potential for this system to be integrated into official government and emergency response infrastructures. If deployed on a large scale and supported by a central monitoring system, alerts from such devices can be routed directly to the nearest police station, women's help center, or emergency dispatch service. This can enable real-time tracking, incident logging, and faster response times. Such systems can also be supported by NGOs working in women's welfare, enabling a community-driven response system.

XI. CONCLUSION

The development of the Women Safety System using Arduino Uno addresses a critical and pressing need in society—ensuring the safety and well-being of women through technology. The system is designed to respond quickly and effectively in emergency situations by capturing the user's real-time location via GPS and sending an SMS alert through the GSM module to pre-defined contacts. With the addition of a simple push-button interface and a user-friendly LCD display, the system offers a straightforward yet powerful solution for personal security. Through rigorous testing and implementation, the project has demonstrated that a low-cost, accessible, and portable safety system is achievable using widely available electronic components. Each module—whether it be GPS for tracking, GSM for communication, or the LCD for feedback—works in harmony to provide a reliable emergency response mechanism. The system's ability to generate a

Google Maps link with accurate coordinates enhances its practicality and real-world applicability, allowing caregivers or authorities to respond promptly to emergencies. Moreover, this project not only meets its core functional objectives but also lays a solid foundation for future advancements. The potential to enhance this model with IoT, mobile integration, machine learning, and wearable design means it can evolve into a more intelligent, proactive, and user-centric safety solution. It serves as an important step toward harnessing the power of embedded systems and automation to create safer environments for women, especially in places where immediate assistance is not readily available. In conclusion, the Women Safety System is a valuable innovation that combines technology and social responsibility. It empowers users to take immediate action in distressing situations and provides a sense of security that can make a tangible difference in their daily lives. With continued research, development, and societal support, this system can play a vital role in building a safer and more responsive world for women and vulnerable individuals.

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