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# Empowering Women With Smart Safety Solutions

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***Abstract*** **:** In today's fast-paced world, women often face increasing safety concerns, especially in technology-driven sectors where they contribute significantly. Unfortunately, harassment and assaults are becoming more common, raising serious concerns about their security. In Pakistan's patriarchal society, crimes against women are frequently overlooked, and authorities may manipulate official records to hide these issues.

A recent survey revealed that 84 percentage of women aged 25-35 experienced workplace harassment, with students and full-time employees being the most affected. This highlights the urgent need for improved safety measures.

To address these concerns, Safe Walk has been introduced a smart, user-friendly device designed to enhance women's security. With a simple button press, it delivers an electric shock to deter attackers while simultaneously alerting emergency contacts via GSM. Additionally, its GPS tracking feature ensures the user's location is shared for immediate assistance during emergencies, offering enhanced protection and peace of mind.

***Index Terms*****— women safety, IoT devices, emergency alert system, GPS tracking, shock system, smart security solutions, real-time monitoring, safety technology, threat detection.**

## I. INTRODUCTION

Women face significant discrimination at various stages of their lives despite their substantial contributions to the economy. While women once primarily managed domestic duties, they now actively participate in various professional sectors. However, this shift has also increased their exposure to harassment in public spaces such as streets, parks, public transportation, workplaces, and educational institutions.

Studies indicate that single women are particularly vulnerable to such incidents. Therefore, developing effective systems that empower women to seek help, especially when alone, is crucial. A device that alerts both family members and nearby individuals about the victim's location can greatly improve response times and increase the chances of timely assistance.

In addition to workplace safety measures, organizations should provide flexible work hours for pregnant employ- ees, along with comprehensive healthcare and financial support. However, ensuring women's safety requires more than just policy changes. Equipping women with portable safety devices can offer real-time protection and ensure help is available when needed.

Our project introduces an IoT-based mobile safety de- vice designed to help women avoid dangerous situations and ensure they receive justice when incidents occur. The Internet of Things (IoT) is an emerging technology known for its precision and efficiency, making it ideal for such applications.

This compact device can be easily carried or worn, and when the panic button is pressed, it emits an electric shock to deter attackers while simultaneously sending an emergency alert via GSM. Additionally, the device's GPS functionality tracks the user's movements, ensuring location details are promptly shared with emergency contacts.

As women increasingly take on diverse roles worldwide, concerns about workplace safety have grown. Unfortunately, harassment is often inflicted by coworkers, making this issue even more complex. Since women's rights have historically been overlooked, society must now take collective responsibility for their protection.

Continuous efforts and innovative solutions are essential to ensuring women's safety. By developing smart devices that provide immediate support and real-time tracking, we can create a safer environment for women and empower them to navigate the world with confidence.

This paper is structured as follows: Section provides details on the **Problem Statement**. Section explains the **Methodology of the Safe Walk**. Section presents the **System Requirements Specification**. Section describes the **System Design** of the project. Section discusses the **Programming Framework, Hardware, and Applications**. Section outlines the **System Flow**, while Section covers the **Implementation** of the project. Section presents the **Results**, and finally, Section provides the **Conclusion**.

## II. Problem Statement

Women's safety remains a growing concern due to various risks faced in public and private spaces. The following key issues highlight the need for an effective solution:

1) **Increasing Incidents:** Rising cases of harassment, assault, and kidnapping create fear and insecurity for women.
2) **Unreliable Safety Measures:** Existing solutions like mobile apps may be difficult to access during emergencies.
3) **Lack of Immediate Response:** Delay in notifying emergency contacts often reduces the chances of timely help.
4) **Complex Systems:** Some safety devices are costly, difficult to use, or require constant internet connectivity.
5) **Real-Time Performance:** Process inputs and execute actions with minimal latency for real-time responsiveness.

## III. METHODOLOGY

The project development is divided into three key stages:

### 1. *Hardware Design Stage*

This phase focuses on selecting appropriate components and ensuring compatibility with the circuit design. The transducer is chosen based on essential factors such as accuracy, precision, environmental conditions, and performance under pressure.

### 2. *Software Design Stage*

This phase involves creating the system's operational flow. The software development is further divided into two parts:

- **Sequence Programming:** Ensures the correct sequence of operations.
- **Interface Programming:** Manages interactions between hardware and software components.

### 3. *Testing, Tuning, and Troubleshooting Stage*

This final stage ensures the combined hardware and software system functions as intended. Testing verifies functionality, tuning optimizes performance, and troubleshooting resolves potential issues. By effectively combining these stages, the developed system achieves its primary goal — enhancing women's safety by providing a reliable and responsive alert mechanism.

## IV. SYSTEM REQUIREMENTS SPECIFICATION

This chapter describes the requirements. It specifies the hardware and software requirements that are to run the system properly. The Hardware Requirement Specification is explained in detail.

### A. *Hardware Requirements*

The hardware components required for the safe walk include the following:

- Arduino Nano
- GSM
- GPS
- Connecting Wires
- Resistors
- Power Supply
- Recharging Module

*1) **Arduino Uno**:* The Arduino Nano is a compact microcontroller board powered by the ATmega328P or ATmega628 microcontroller. It shares similar connectivity features with the Arduino UNO but is notably smaller, making it ideal for projects that require a compact design. Known for its flexibility, consistency, and sustainability, the Arduino Nano is widely used in various electronic applications.

The Nano board operates at voltages ranging from **5V to 12V** and includes **22 input/output (I/O) pins**, with **14 digital pins** and **8 analog pins**. Among the digital pins, **6 PWM (Pulse Width Modulation) pins** are used to generate analog signals by adjusting the pulse width.

Additionally, the Arduino Nano can be integrated with Wi-Fi modules, enhancing its capabilities

for IoT-based projects. Its combination of flexibility, eco-friendly design, and powerful features makes the Arduino Nano a preferred choice for developing efficient and space-saving electronic solutions.

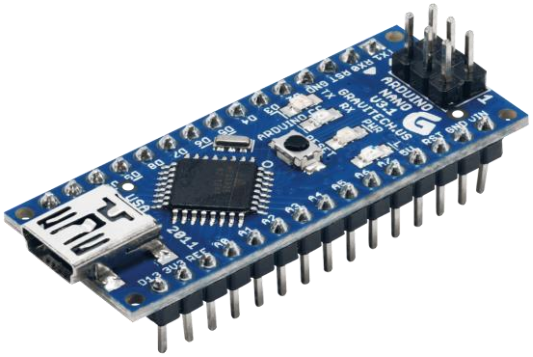

*Fig. 1. Arduino Nano Boar*

*2)* ***GSM****:* The GSM (Global System for Mobile Communications) module is a crucial device that enables electronic systems to communicate wirelessly over the GSM network. As a widely adopted standard for digital cellular communication, GSM provides a reliable and se- cure platform for transmitting data. This makes it an ideal choice for various applications, including security devices like Safe Walk. GSM technology supports international roaming, ensuring seamless connectivity across different regions. It is known for delivering clear voice quality, making communication more effective. Additionally, GSM efficiently handles multiple handheld devices while maintaining spectral and frequency efficiency. Designed for low-powered devices, it extends battery life, making it suitable for portable safety solutions. GSM networks are also compatible with international ISDN standards, ensuring global communication support. With its low service cost and continuous introduction of new features, GSM remains a widely preferred solution in modern communication systems.

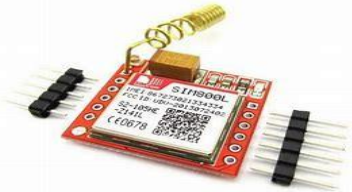

*Fig. 2. GSM*

*3)* ***GPS****:* The Global Positioning System (GPS) is an essential technology that has revolutionized various sectors, including transportation, logistics, and outdoor activities. At the core of this system is the GPS module, an electronic device designed to communicate with GPS satellites and provide precise geographical location data.

GPS modules operate using a network of satellites that orbit the Earth and transmit accurate microwave signals. By receiving these signals, the GPS module determines the user's exact location through a method called trilateration. This process involves calculating distances to at least three satellites and using these measurements to pinpoint the device's position on the globe.

To simplify GPS integration into various projects, GPS modules are designed as compact units containing a GPS receiver, an antenna, and a processing unit. The processing unit decodes satellite signals, calculates location data, and transmits this information to an external microcontroller, such as an Arduino. One widely used GPS module in such applications is the NEO-6M, known for its reliability and accuracy in delivering location-based information.

*Fig. 3. GPS*

*4)* ***Resistor****:* A resistor is a passive electrical component designed to introduce resistance into a circuit, playing a crucial role in controlling current flow, adjusting signal levels, and dividing voltages. Resistors are essential for ensuring proper biasing of active components and terminating transmission lines, making them indispensable in electronic circuits.

In high-power applications, resistors capable of dissipating significant electrical energy as heat are widely used in motor control systems, power distribution networks, and generator test loads. Fixed resistors provide a stable resistance value, showing minimal variation due to factors like temperature, time, or voltage changes. Contrarily, variable resistors offer adjustable resistance, making them ideal for controlling elements such as volume dials or light dimmers. They can also act as sensors for detecting heat, light, humidity, force, or chemical activity.

Resistors are commonly found in electrical networks and electronic devices, either as standalone components or integrated within microchips. Their primary characteristic, resistance value, determines their function and is specified with a nominal value and tolerance range. Avail- able in various resistance values across multiple scales, resistors provide versatile solutions for a wide range of applications, ensuring stability and reliability in modern electronic systems.

*Fig. 4. registers*

*5) **Recharging Module**:* The Type-C USB 3S BMS 15W 8.4V 12.6V 1.5A Lithium Battery Charging Boost Module is a specialized device designed to efficiently charge 3S lithium-ion or lithium polymer battery packs. Equipped with a Type-C USB interface, this module supports fast charging with a maximum power output of 15 watts, ensuring quicker and more effective energy transfer. One of its standout features is its balancing functionality, which ensures that all three cells in the battery pack are charged evenly, promoting enhanced battery performance and longevity. The module is designed for user convenience, featuring indicator lights that provide visual feedback on the charging status. Additionally, it incorporates a boost converter that steps up the voltage, ensuring efficient and stable battery charging. With compatibility for 18650 lithium-ion cells, the module delivers an output voltage of 12.6V and a current rating of 4A, making it suitable for various battery-powered applications. Compact in size, measuring 38 x 18 x 5 mm and weighing just 4 grams, this module offers a reliable and efficient solution for lithium- based power systems.


*Fig. 5. Recharging Module*

### *B. **Software Requirements***

The software required for the self-driving car system include the following:

Arduino IDE

*1) **Arduino IDE**:* The **Arduino IDE (Integrated Development Environment)** is an essential software tool designed for writing, compiling, and uploading code to Arduino boards. It offers a user-friendly interface that simplifies the programming process, making it accessible to both beginners and experienced developers. The IDE is compatible with multiple operating systems, including Windows, macOS, and Linux.

The Arduino IDE uses a simplified version of C/C++ programming language and follows a straightforward structure that includes functions like ‘setup()‘ and ‘loop()‘ to define the board’s behavior. The **setup()** function runs once when the board is powered on, while the **loop()** function continuously executes the main program logic.

One of the key features of the Arduino IDE is its built- in library manager, which allows users to easily import libraries that expand the board’s capabilities, such as controlling sensors, motors, or communication modules. Additionally, the IDE provides a **Serial Monitor** for real- time data visualization, aiding in debugging and monitoring the performance of connected devices.

The IDE’s open-source nature encourages continuous improvement, and its intuitive design ensures smooth development, whether for simple LED projects or com- plex IoT systems. Its versatility, combined with extensive community support, makes the Arduino IDE a powerful tool for electronics development.

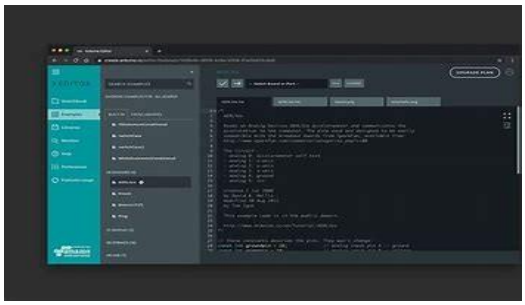

*Fig. 6. Arduino IDE*

## V. SYSTEM DESIGN

*1) Block Diagrams:* The diagram illustrates an ESP8266 microcontroller connected to a GPS module (Neo6m) and a power supply.

- **ESP8266:** Main microcontroller responsible for processing data.

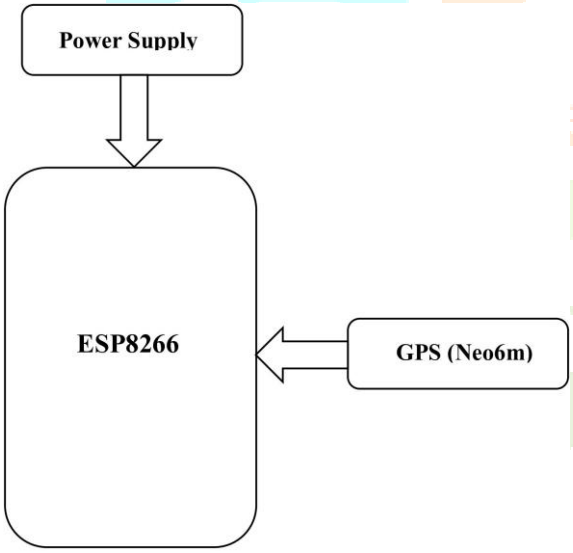


*Fig. 7. Block Diagram of ESP8266*

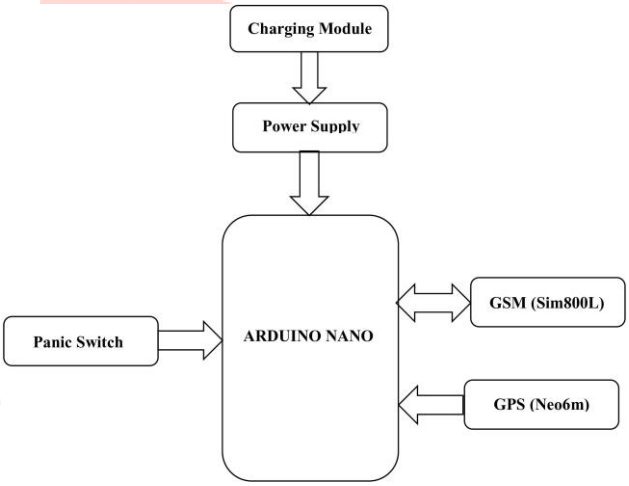


*Fig. 8. Block Diagram of Arduino Nano*

- **GPS (Neo6m):** Provides location data to the ESP8266 for tracking purposes.
- **Power Supply:** Provides the required voltage and current to power the ESP8266 and GPS module.

***Connections***

- Power supply is connected to the ESP8266 to ensure stable operation.
- The GPS module is connected to the ESP8266 with:
- TX (transmit) of GPS to RX (receive) of ESP8266.
- RX (receive) of GPS to TX (transmit) of ESP8266.
- Power and ground connections to ensure proper functionality.

This setup allows the ESP8266 to efficiently process and transmit GPS data over Wi-Fi, ensuring real-time location tracking and improved connectivity.

The diagram illustrates an Arduino Nano connected to various essential components that ensure efficient functionality and communication. The key components and their roles are as follows:

- **Charging Module:** Provides power to the power sup- ply.
- **Power Supply:** Powers the Arduino Nano.
- **Panic Switch:** Allows the user to send an alert by pressing a button.
- **GSM Module (Sim800L):** Enables communication over the cellular network.
- **GPS Module (Neo6m):** Provides location data.

The connections between these components are as follows:

- The charging module is connected to the power supply.
- The power supply is connected to the Arduino Nano.
- The panic switch is connected to the Arduino Nano.

This setup enables the Arduino Nano to process and transmit GPS data over Wi-Fi, ensuring reliable communication and location tracking during emergencies.

## VI. SYSTEM FLOW

### A. *Algorithm*

The following algorithm outlines the step-by-step process for the system's operation:

1) **Start** - The process begins.
2) **Initialize System (GSM and GPS)** - The system initializes both GSM and GPS modules.
3) **Check Panic Button State** - The system continuously monitors the state of the panic button.
4) **If Panic Button Value = High** - The system evaluates whether the panic button has been pressed.
   - **No** - If the button is not pressed, the system loops back to check the button state again.
   - **Yes** - If the button is pressed, the system proceeds to the next steps.
5) **Fetch GPS Coordinates** - The system retrieves the current GPS coordinates.
6) **Send Location Using GSM** - The system sends the retrieved location via GSM.
7) **Make Call Using GSM** - The system initiates a call using GSM to alert emergency contacts.
8) **End** - The process concludes.

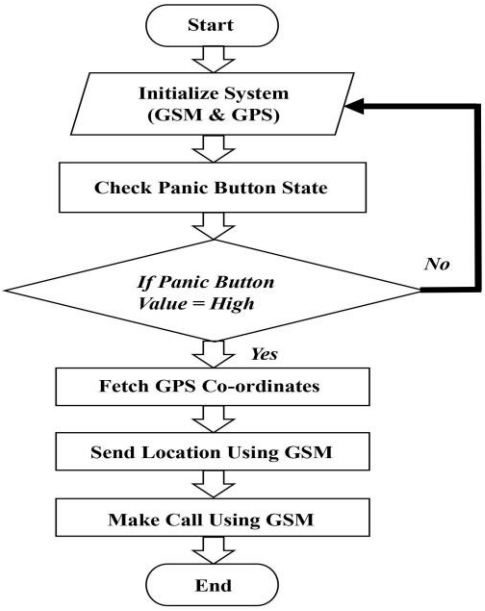


*Fig. 9. Flowchart of Self Walk shoe*

## VII. IMPLEMENTATION

### *A. Circuit Diagram*

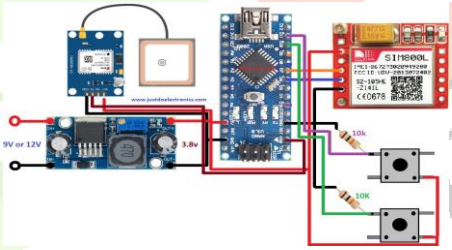


*Fig. 10. Circuit Diagram*

## *VIII. Result*

*Fig. 11. Final Prototype 1*


*Fig. 12. Final Prototype 2*

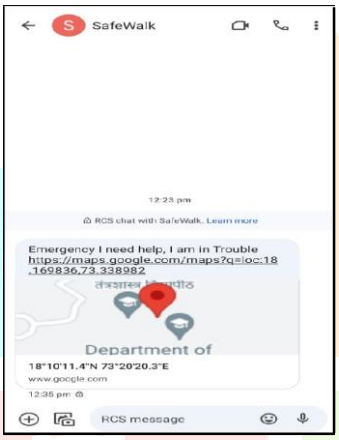


*Fig. 13. Final Prototype 3*

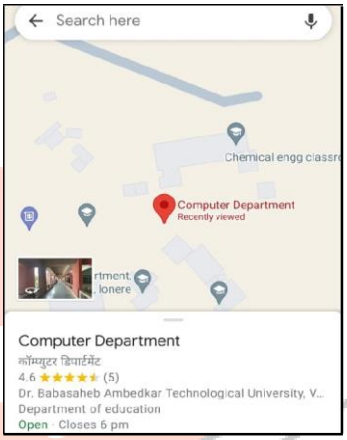


*Fig. 14. Final Prototype 4*

## IX. CONCLUSIONS

The Safe Walk project represents a significant advancement in enhancing personal safety and community wellbeing. By providing a reliable and secure means for individuals to travel, particularly during vulnerable times or in high-risk areas, Safe Walk addresses a critical need for safety and peace of mind. Throughout the development and implementation of Safe Walk, we have demonstrated the potential for technology and community collaboration to create safer environments. The project not only offers immediate benefits, such as reducing incidents of crime and providing emergency assistance, but also fosters a greater sense of trust and empowerment among users. Finally, Safe Walk is more than just a safety service; it is a step towards creating more resilient, connected, and safe communities. The positive impact of Safe Walk on individual safety and community cohesion underscores its importance and the value of continued development and support. We are confident that with ongoing innovation and collaboration, Safe Walk will continue to make significant strides in personal and public safety, contributing to a safer and more secure future for all.

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