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# GPS Enabled Women's Safety Device with SMS and Calling Alert

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***Abstract***

*Increasing urbanization and industrialization in India have raised significant security concerns for women in urban areas. To address this, the study introduces a women's safety device aimed at enhancing personal security through real-time location tracking and swift emergency communication. The system incorporates an ATmega328 microcontroller, a GPS module for continuous location monitoring, and a GSM module to transmit SMS alerts during emergencies. Additionally, it includes a sound sensor that identifies distress signals and a manual panic button for instant activation. This integrated setup ensures that in a threatening situation, help can be summoned quickly and accurately. The design focuses on being user-friendly, dependable, and efficient, providing timely support and potentially preventing harm. Overall, the proposed solution seeks to offer women a practical and effective safety tool in urban environments, where immediate response is critical. This approach contributes to creating a more secure atmosphere for women, addressing growing concerns about personal safety in rapidly developing cities.*

**Keywords:** GPS tracking, GSM alerts, wearable device, ATmega328 microcontroller, sound sensor, panic switch

## INTRODUCTION

Internet of Things (IoT) and GSM technology have enabled the development of paired equipment using real world sensors and actuators. The need for increased safety for women, especially under weak conditions, inspires the production of portable safety equipment. While many existing wearables provide placement and activity tracking via Wi-Fi and Bluetooth, these technologies can be incredible. The project benefits from SMS text communications through GSM networks, and provides a more strong communication medium [1–3].

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Women's safety equipment integrates several components to provide a comprehensive security solution. ATMEGA328 acts as the original of the microcontroller system, and manages GSM modules and GPS modules for sending emergency alerts and for tracking real-time. A sound sensor detects high-scream sounds, and a buzzer provides a sound alarm. In addition, a panic switch though which the user can trigger the readiness manually.

## LITERATURE

In this project, the integration of ATMEGA328 microcontrollers, GSM and GPS modules, sound sensors, buzzer and panic switches forms a compact, responsible safety device. Main findings from

previous studies suggest the use of a microcontroller to handle real-time alerts, site tracking (via GPS) and immediate communication (via GSM), as well as the response time in emergency. In addition to sensors such as sound sensors and panic switches, an introduction of reliable emergency triggers is making these devices more efficient and user response [4–6].

The purpose of the literature review is to understand the efficiency, limitations and technological advances in the portable safety equipment, and explain how the proposed system Arduino and GSM/GPS modules can offer integration reliability and ease of use through integration with easily accessible components. This review also considers the effect of additional properties as a sum and manual panic button, which can attract the help of passersby consulting external contacts, at the same time, providing a double-level protective mechanism [2].

A female safety equipment explores existing research and technologies developed considering literature review for the project to increase personal safety, focusing on portable equipment such as foot units and IoT-based systems. When you take advantage of one leg four times behind, a warning is sent to the framed phone via Bluetooth. Existing systems have utilized various sensors and communication technologies to notify emergency contacts, to prevent the user area and prevent potential threats [3, 7].

## METHODOLOGY

### Hardware Devices

#### *ATmega328 (Microcontroller)*

ATMEGA328 Microchip (East ATMEL) has an 8-bit microcontroller in the AVR family. Figure 1 shows core of the Arduino Uno platform. Microcontrollers are used to control and manage the operation of a system, such as obtaining inputs, processing data and sending results. ATMEGA328 has a low power consumption mode, making it ideal for battery-powered or energy-efficient projects. It works with a frequency up to 20 MHz and has a 32 kb flash memory for program storage [8].

#### *SIM 900D GSM Module*

The SIM 900D GSM/GPRS module is a small low-power communication tool that allows the system to send and receive SMS messages, create voice calls and receive and even connect to the Internet via GPRS. It uses GSM networks for communication. It is often used in IoT projects, to remove monitoring and site-based services. The "D" variant supports double band GSM (900/1800 MHz), which makes it versatile for use in different fields.

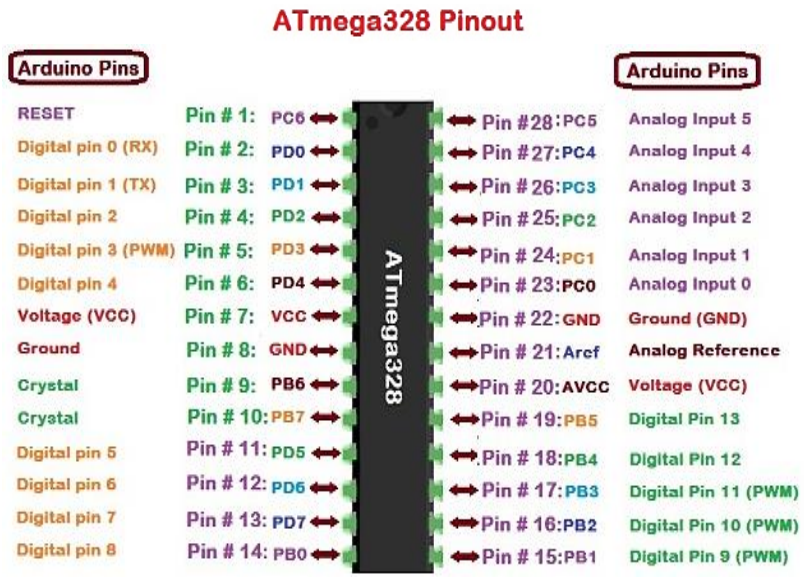



**Figure 1.** ATmega328.

***NEO-6MV2 GPS Module***

Figure 2 shows NEO-6MV2 which is a GPS module from U-Block that provides accurate position data by communicating with satellites in the sky. There are many types of functions in the module, such as latitude, longitude, height and time. It is popular in GPS modular, tracking systems and IoT-based applications.

***LCD (Liquid Crystal Display)***

Figure 3 shows LCD display. An LCD is a flat screen display technique that uses liquid crystals to create images. It is used in a variety of electronic projects to view text or simple graphics. The most common form in microcontroller-based projects is 16×2 characters LCD, which can display up to 2 lines of 16 characters. This screen is widely used in a built,-in system to display the system, output or users of the system [6].

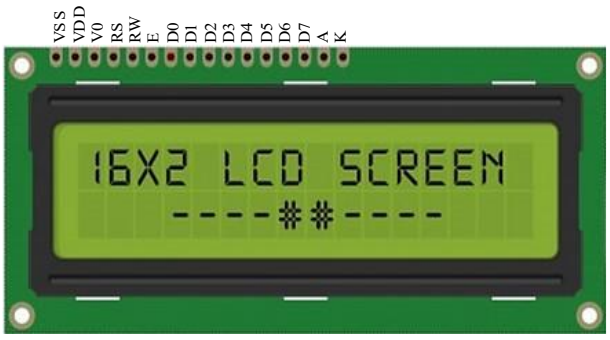
***Sound Sensor***

Figure 4 shows the sound sensor. The sensor usually works by detecting vibrations in the air and converting them into electrical signals. These sensors are often used to trigger safety systems, noise monitoring applications or alarms when suddenly there is a high noise (for example, glass breaks or a door becomes narrow).

***Buck Converter***

Figure 5 shows buck converter which is a type of DC-DC converter that steps down the voltage from a higher level to a lower level with high efficiency. It is commonly used in power supply circuits to convert the voltage from a battery or a higher voltage source to a level suitable for other components, like microcontrollers or sensors. Buck converters are efficient because they use switching regulators rather than linear regulators, which minimize energy loss. They are essential in battery-powered devices to extend operational time [5].

**Figure 2.** NEO-6MV2 GPS Module.




| No | Symbol | Function |
|---|---|---|
| 1 | VSS | Ground |
| 2 | VDD | 5V+ |
| 3 | VO | Contract |
| 4 | RS | Register |
| 5 | RW | Read/Write |
| 6 | E | Enable |
| 7 | D0 | Data bus |
| 8 | D1 | Data bus |
| 9 | D2 | Data bus |
| 10 | D3 | Data bus |
| 11 | D4 | Data bus |
| 12 | D5 | Data bus |
| 13 | D6 | Data bus |
| 14 | D7 | Data bus |
| 15 | A | Anode (5V+) |
| 16 | K | Cathode (GND) |

**Figure 3.** LCD.

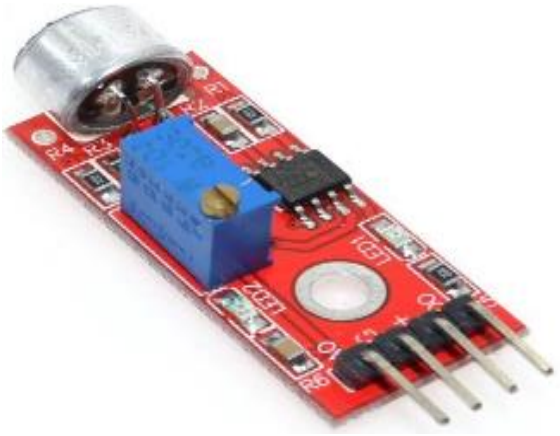


**Figure 4.** Sound sensor.

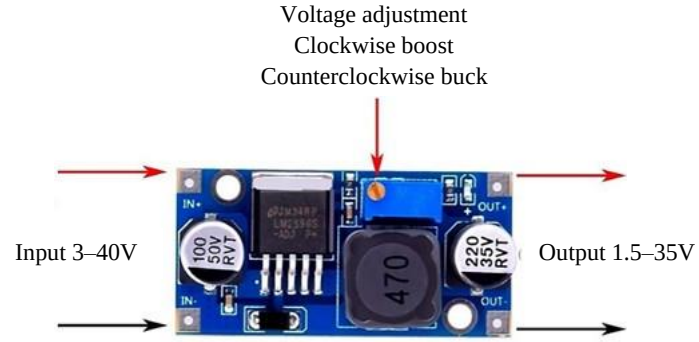



**Figure 5.** Buck converter.

**Software Required**

***Proteus (Simulation Software)***

- Proteus is an electronics simulation software that is mostly used to design and test the circuit.
- It supports microcontroller simulation, including Arduino, Pic and AVR.
- You can make full skiing and simulate hardware without physical components.
- Proteus is widely used for testing built-in system design.
- This helps identify and fix circuit problems before actual implementation.
- This includes a large library of components such as LED, sensor, motors, etc.
- You can simulate the circuit's real-time behavior with virtual instruments.
- Proteus is useful for students, hobbies and professionals.
- It also allows PCB design and design construction.
- Usually used with Arduino for virtual prototype.

**Arduino IDE (Development Environment)**

- Arduino IDE is a software used to write, collect and upload codes on Arduino boards.
- It supports C/C++ based programming using Arduino libraries.
- Users write "sketches" (program) and upload them via USB.
- It is user friendly and open source.
- The IDE includes a serial monitor for communication with the board.
- Library and example codes are available for sensors, engines and more.
- You can test your code on physical Arduino boards.
- Works on Windows, Mac and Linux.
- It is often used in electronics, robotics and IoT projects.
- Proteus can export the code (.HEX file) collected for simulation in devices.

## SYSTEM IMPLEMENTATION

Figure 6 shows system implementation of a women's safety device based on ATmega 328 microcontrollers. The system is powered by a power supply and provides the necessary voltage to microcontroller and connected components.

- A panic switch allows the user to trigger an emergency alert manually.
- A GPS sensor provides the user's real-time location during the emergency.
- A sound sensor can detect high noise as a scream and automatically activate the system.
- ATmega 328 processes the input signal from the sensor and switch.
- When activated, the GSM modem sends a warning with site details to the predetermined contacts.
- *ATmega328 microcontroller:* Acts as the central processing unit of the system, managing inputs from sensors, the panic switch, and controlling the activation of the GSM and GPS modules, as well as the buzzer.
- *GPS module:* This module continuously tracks the geographical location of the device. Upon receiving a trigger from the panic switch or sound sensor, it sends the latitude and longitude coordinates to the ATmega328, which then transmits this data to pre-defined contacts via GSM [4].
- *GSM module:* This module enables wireless communication by sending SMS alerts. When triggered, it sends a distress message with the user's location to emergency contacts, providing immediate assistance through communication.
- *Sound sensor:* The sound sensor monitors for loud or sudden noises (like shouts), which may indicate distress. When activated, it sends a signal to the microcontroller to initiate the alert process.
- *GPS module:* This module continuously tracks the geographical location of the device. Upon receiving a trigger from the panic switch or sound sensor, it sends the latitude and longitude coordinates to the ATmega328, which then transmits this data to pre-defined contacts via GSM.
- *GSM module:* This module enables wireless communication by sending SMS alerts. When triggered, it sends a distress message with the user's location to emergency contacts, providing immediate assistance through communication.
- *Panic switch:* This manual switch gives the user direct control to activate the emergency alert system in a threatening situation, immediately triggering GPS data acquisition and message transmission.
- *Buzzer:* A buzzer is used to create an audible alarm in emergency situations. When the system is triggered, the buzzer sounds, potentially drawing attention to the user's location, deterring attackers, and alerting nearby individuals [9].

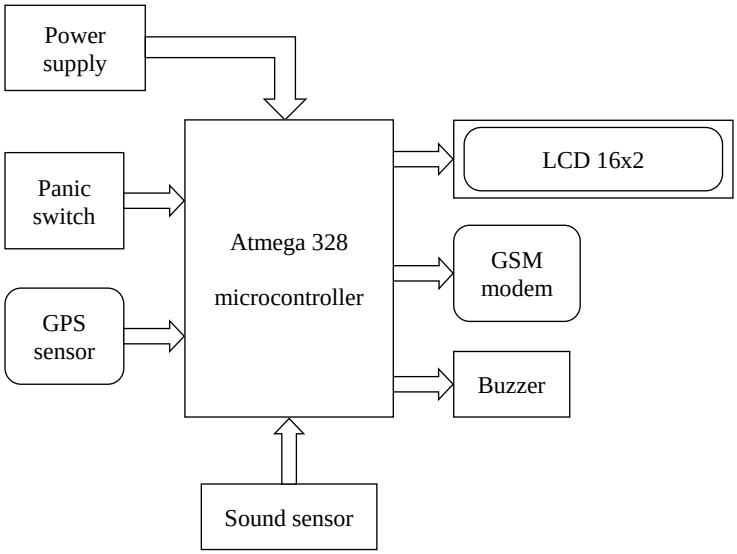



**Figure 6.** System implementation of GPS enabled women's safety device with SMS and calling alert.

## Algorithm

### *Algorithm Steps*

1. Initialize the ATmega328 microcontroller and set up communication with GPS and GSM modules.
2. Continuously monitor the status of the emergency button.
3. When the button is pressed, debounce and confirm the press with a short delay.
4. Fetch the current GPS location from the GPS module.
5. If GPS data is unavailable after a few retries, proceed without it.
6. Send an SMS containing the emergency message along with GPS coordinates to predefined contacts.
7. After sending the SMS, initiate a call to the emergency contact and keep it active for a set duration.
8. Provide visual or audible feedback (e.g., LED or buzzer) to indicate that the alert has been sent.
9. Return to idle mode and continue monitoring for further user input or emergencies

## CIRCUIT DIAGRAM

### Flow Chart

The flowchart in Figure 7 describes a women's safety device that powers on, checks for a safety button press or sound detection, activates GSM, finds the GPS location, sends an alert, and then restarts. Figure 8 shows a circuit diagram of a women's safety device that uses GPS and GSM. It indicates how the microcontroller is connected to a GPS module to get the location information and a GSM module to provide SMS alerts. An emergency message is initiated by a push button, and power supply keeps the system on. The device quickly sends alerts to pre-registered contacts if there is any kind of danger [10].

## RESULT

Figure 9 is a function prototype of the women's safety device using GSM and GPS technology. It features a microcontroller, GPS, GSM, Battery and LCD screen displaying System Status.

### Testing

Figure 10 and Table 1 illustrate emergency alert message received from the women's safety device when there is a sound detected or when the panic button is activated. The message alerts contacts, and the location available. It emphases the capability of the device to send alerts in times of emergencies.

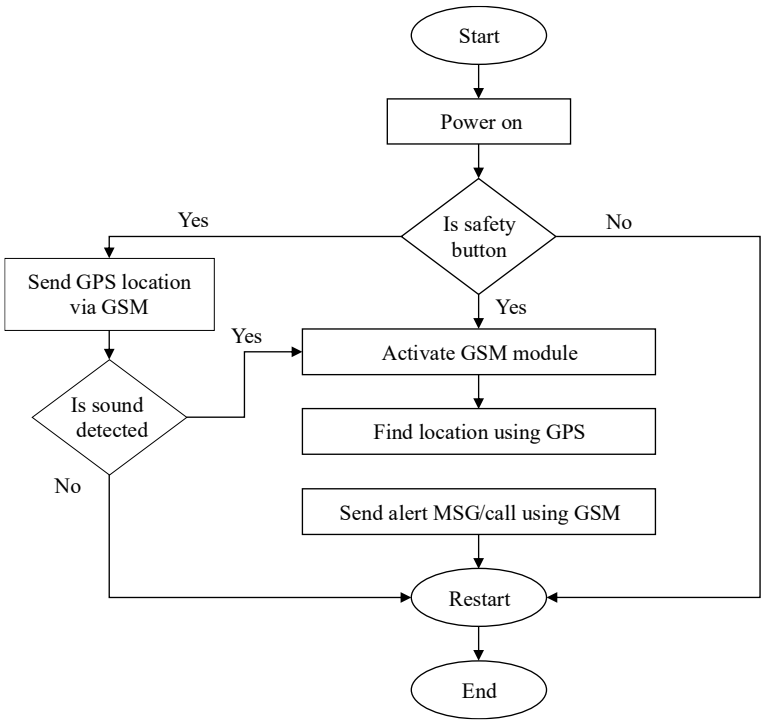



**Figure 7.** Flow chart.

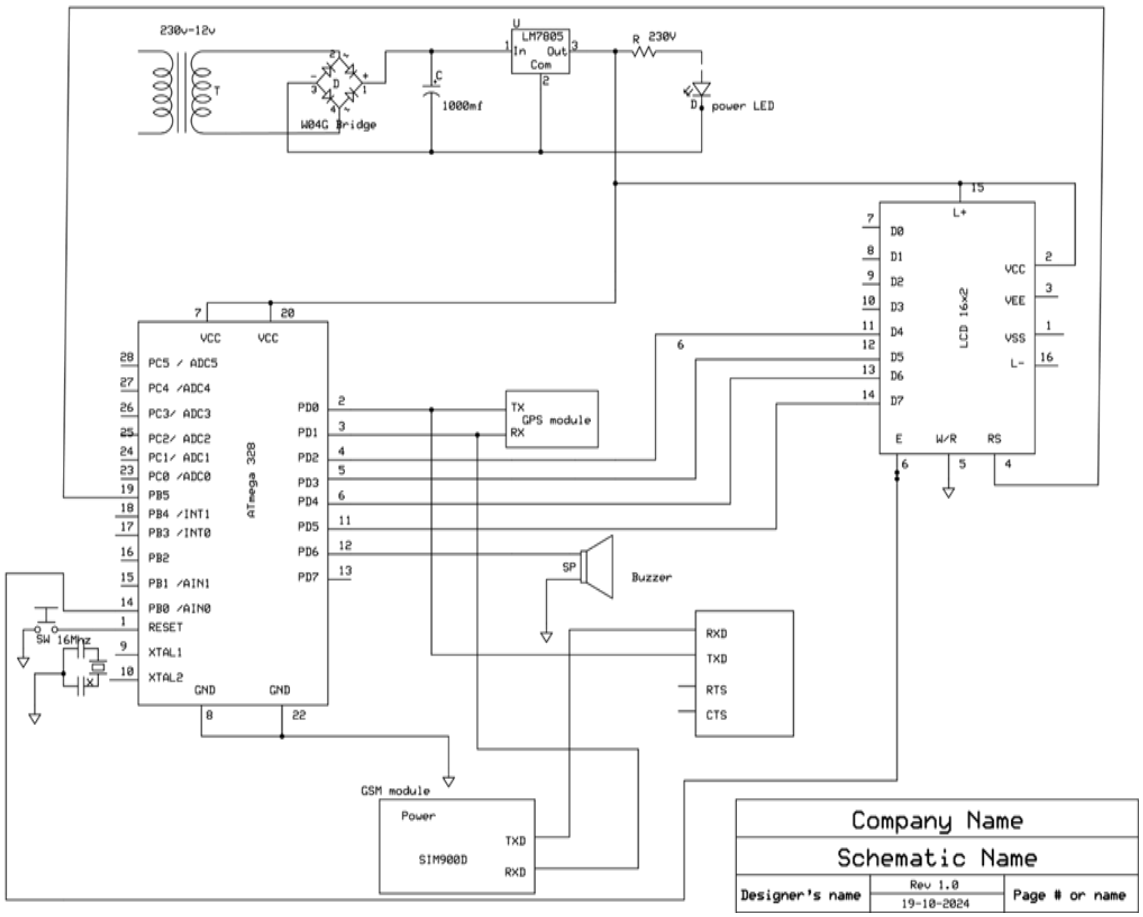



**Figure 8.** Complete circuit diagram.

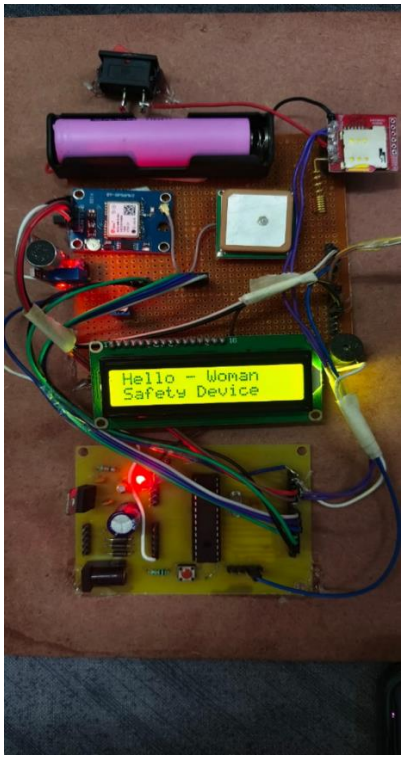



**Figure 9.** Implemented hardware.

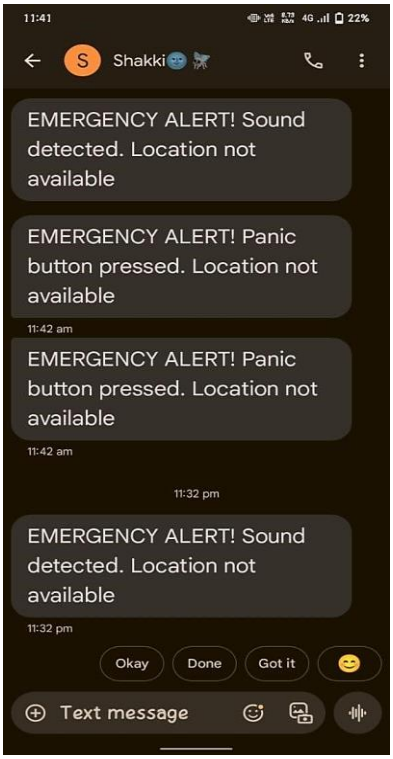



**Figure 10.** Result.

**Table 1.** Testing.

| Test scenario | Result |
|---|---|
| GPS location accuracy | 5 to 10 m |
| Time to send SMS | 5–7 sec |
| Time to initiate call | 4–5 sec after SMS |

## CONCLUSION

The Women Safety Device Project utilizing ATmega328, GSM, GPS, Sound Sensor, Buzzer, and Panic Switch successfully demonstrates a compact and effective personal safety solution for women. The device enables users to send immediate alerts to designated contacts, providing real-time location tracking through GPS, sound-based distress detection, and audible alerts using a buzzer to draw nearby attention. This system achieved the primary objective of increasing personal safety and creating a reliable means to request help during emergencies.

This project serves as an accessible and user-friendly solution that can contribute to improving personal safety and promoting peace of mind. While certain limitations such as network dependency and battery life exist, the device is highly effective within areas with good connectivity. Future improvements could include additional power-saving features, alternative communication methods, and enhanced noise filtering for the sound sensor.

### Future Scope

Future iterations could integrate Wi-Fi or BLE as backup communication options, a more advanced sound analysis for more accurate distress detection, and a longer battery life to ensure consistent operation. Overall, this women's safety device stands as a valuable tool for personal security, with significant potential to improve individual safety in emergency situations.

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