

Emergency Safety Device

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Abstract: *The purpose of this emergency safety gadget is to improve individual safety and offer prompt support in dire circumstances. It combines several safety features into a small, wearable package, such as automated emergency notifications, real-time GPS tracking, and a user-activated distress signal. When the gadget is activated, it notifies emergency services or designated contacts of the user's position and pre-programmed emergency information. A flashlight, a loud, audible alarm, and the ability to use mobile apps for remote monitoring are possible further features. For people in risky or vulnerable circumstances, such as elderly people, students, tourists, and lone workers, the gadget seeks to provide a dependable and easily available alternative. It is a vital tool for improving disaster preparedness and personal safety because of its quick response times, robust design, and user-friendly interface.*

Keywords: *emergency safety gadget*

I. INTRODUCTION

In today's world, personal safety has become one of the most pressing concerns due to the increasing rate of crimes, accidents, and medical emergencies. Whether it is for women, children, elderly individuals, or travelers, having a reliable means to call for help during emergencies is essential. An Emergency Safety Device serves this vital purpose by enabling a person in distress to send an instant alert to predefined contacts or authorities, along with their real-time location. This project aims to design and implement an efficient, portable, and cost-effective emergency alert system using Arduino, GSM, and GPS technologies.

The basic principle of this device is simple yet powerful. When the user senses danger or faces an emergency situation, they can press a panic button. The system, controlled by the Arduino microcontroller, immediately activates the GPS module to fetch the current location coordinates (latitude and longitude). This data is then transmitted to the GSM module, which sends an emergency message containing the location information to registered mobile numbers or authorities via SMS. The location can also be viewed on Google Maps, making it easier for rescuers or family members to locate the individual quickly.

This system operates efficiently with the help of a stable power supply, converting AC to DC, and uses an LCD display to provide real-time information to the user, such as GPS status, message confirmation, and system readiness. It is designed to be user-friendly, compact, and reliable even in low-signal areas.

The Emergency Safety Device can be used in various scenarios — for instance, by women traveling alone at night, senior citizens living independently, or adventure enthusiasts exploring remote areas. It can also be integrated into vehicles to alert emergency services in case of accidents. The device ensures that help can be summoned with minimal effort, even under panic conditions, thereby reducing response time and potentially saving lives.

The use of Arduino as the central controller makes the system flexible and programmable. Additional sensors or modules can easily be integrated, such as heartbeat sensors, temperature sensors, or accelerometers, to detect accidents or health-related incidents automatically. The GSM module provides global connectivity through mobile networks, ensuring that the alert reaches the intended recipients almost instantly. The GPS module guarantees accurate location tracking, which is the core requirement of any emergency response system.



In conclusion, the Emergency Safety Device represents a blend of electronics, communication, and embedded systems to create a practical real-world safety solution. It provides peace of mind to users and their families by ensuring that help is just a button press away. The simplicity, affordability, and effectiveness of the system make it suitable for both personal and public safety applications. As technology continues to advance, such devices can be further enhanced with IoT integration, mobile app connectivity, and cloud-based monitoring systems to build a smarter and safer world.

II. LITERATURE REVIEW

1. The Methods of Fall Detection: A Literature Review (Newaz et al., 2023) Reviews sensor-based, vision-based and hybrid fall-detection methods, compares algorithms (threshold, machine-learning, deep learning) and discusses trade-offs between sensitivity and false alarms. Highly relevant for designing reliable automatic-alert features (accelerometer/gyro processing and classifier choice).
2. The Role of IoT in Women's Safety: A Systematic Literature Review (Farooq / ResearchGate summary 2022–2024) Systematically catalogs IoT wearable designs, communication stacks (GSM/Wi-Fi/LTE), common sensors (GPS, IMU), and frequent limitations (battery, network dependency, privacy). Useful for selecting IoT architecture and addressing deployment constraints.
3. Fall Detection System using Wearable Sensor Devices and Machine Learning — A Review (ResearchGate, 2024) Surveys wearable solutions, sensor fusion strategies, data preprocessing, and ML models used for fall detection; emphasizes need for real-world datasets and cross-subject generalization. Directly informs model training and test design for automatic emergency triggers.
4. Emerging Digital Technologies Used for Fall Detection in Aged Care (Mudiyanselage et al., scoping review, 2025) Scoping review emphasizing motion sensors, imaging, environmental sensors, and adoption issues in care settings — highlights human-factors, acceptability, and regulatory concerns critical when deploying devices for vulnerable populations.
5. IoT-Powered Emergency Button for Women's Safety (Mallapur et al., 2025) Presents an IoT panic-button prototype (wearable) that sends GPS + SOS to contacts and a cloud dashboard; discusses latency, GPS accuracy, and user-interface considerations — a direct blueprint for emergency-alert workflows.
6. Wearable Panic Button: A Blynk-based IoT Solution (conference/project paper) Demonstrates a low-cost wrist wearable using ESP8266 and Blynk app; examines practical issues like push-button ergonomics, connectivity loss handling, and quick prototyping approaches useful for early prototypes.
7. Use of Wearable Sensors to Assess Fall Risk in Neurological Patients (mHealth / JMIR, 2025) Systematic review on gait/biomechanical metrics from wearables for fall-risk assessment — supports integrating preventive analytics (risk scoring) into emergency devices so alerts can be pre-emptive as well as reactive.
8. IoT Based Automatic Women's Safety Device for Enhanced Protection (SciTePress / 2024) Details hardware selection (GPS, GSM, microcontroller), backend alert logic, and limitations (false positives, cost); offers implementation lessons for robust message formatting and authority notification flows.
9. Wearable Pre-impact Fall Protection System: A Scoping Review (Liu et al., 2025) Reviews devices that detect and respond before impact (e.g., pre-impact airbags); useful for advanced emergency devices aiming to combine detection with protective actuation (not just alerts). Discusses sensors and timing constraints.
10. Best Medical Alert Systems with Fall Detection — Consumer/Practical Review (NCOA/2025 buyer's guide) Industry/consumer evaluation of commercial medical-alert systems (GPS performance, fall- detection reliability, response times, pricing). Good for translating academic prototypes into products and understanding user expectations & market benchmarks.

III. PROPOSED METHODOLOGY

To guarantee functionality, dependability, and user-friendliness, the emergency safety equipment is developed using a methodical process. The approach is broken down into multiple crucial stages, each of which focuses on a distinct facet of the device's development and application.



Analysis of Requirements

Using surveys, interviews, or case studies, this phase entails determining the needs of the target users (such as students, the elderly, and lone workers). Real-time location monitoring, quick reaction times, ease of use, and smooth communication with emergency contacts or services are all essential.

System Design The system is made to be small and wearable, like a keychain, necklace, or bracelet. The layout includes: The core processing unit used to control inputs and outputs is called a microcontroller unit (MCU).

GPS Module: To track location in real time.

GSM/4G Module: To contact an emergency or send an SMS

Block Diagram:

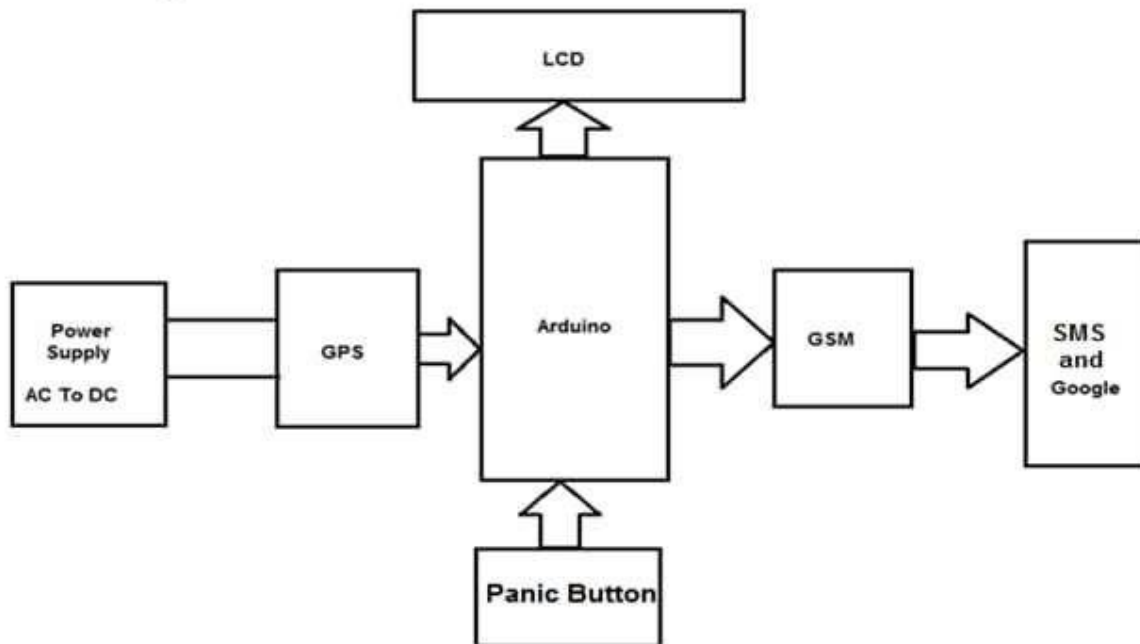


FIG.BLOCK DIAGRAM

1. POWER SUPPLY

To power the Arduino and other components, the power supply unit transforms alternating current (AC) from the mains into direct current (DC). A 12V or 9V DC adaptor is usually utilized. To provide a steady 5V or 3.3V output for the Arduino, GPS, GSM, and LCD modules, a voltage regulator might be used. It serves as the system's central component, supplying the constant electrical energy needed for dependable functioning.

2. GPS MODULE

The device's precise geographic location (latitude and longitude) is determined by the GPS (Global Positioning System) module, which receives signals from satellites.

Through serial communication, the GPS module sends this data to the Arduino. For tracking or emergency alerting purposes, this location information is essential.

3. ARDUINO

The Arduino serves as the system's central processing unit. After processing data from the GPS module and panic button, it transmits commands to the LCD display and GSM module. The Arduino is configured to send an emergency message via the GSM module, retrieve location information from the GPS, and detect the activation of a panic button. The Panic Buttons



4. PANIC BUTTON

The panic button is an input switch that the user controls. Pressing it causes the Arduino to start an emergency procedure that gathers GPS data and transmits it over GSM. It serves as the primary safety trigger for the system.

5. GSM MODULE

Wireless communication is made possible by the GSM (Global System for Mobile Communication) module. It tracks a user's whereabouts by sending SMS notifications with GPS coordinates to pre-configured phone numbers or Google Maps URLs.

6. LCD DISPLAY

The LCD gives the user real-time feedback by displaying system data such GPS coordinates, network status, and confirmation messages.

IV. CONCLUSION

An urgent requirement for improved personal security and quick action in hazardous or life-threatening circumstances is met by the creation of an emergency safety equipment. Such a gadget provides a proactive way to safeguard vulnerable groups, such as women, children, the elderly, and those with medical conditions, in light of growing worries about personal safety in both public and private settings.

This project shows how feasible and significant it is to incorporate contemporary technologies—like GPS, GSM, and microcontroller-based systems—into a small, wearable gadget that can provide real-time position information and instant alarms in an emergency. The user can instantaneously alert pre-configured emergency contacts or services by pushing a panic button or using automated sensor triggers, greatly speeding up response times and perhaps saving lives.

This work also shows that even simple games can illustrate advanced AI principles such as recursion, game-tree exploration, and heuristic evaluation. It bridges the gap between theoretical understanding and practical execution, demonstrating how structured programming and algorithmic design can produce intelligent systems capable of strategic reasoning.

From requirement analysis to testing and deployment, the suggested methodology guarantees a user-centered design process. The prototype maintains accessibility and usability while incorporating crucial safety elements. When combined with a mobile application, the device's efficacy is further increased by enabling real-time monitoring and simple configuration administration.

To sum up, the emergency safety device offers a useful and significant response to the safety issues of the modern world. It supports larger public safety initiatives in addition to giving consumers the ability to take charge of their own security. This technology has a great chance of becoming widely used in businesses, public transportation systems, schools, and healthcare facilities with further development, testing, and optimization.

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Code:

```

/* Code created by @Balaji Electrical and Techno Hub Location: Ambegaon B.K, Pune */
#include <HardwareSerial.h> #include <TinyGPS++.h>
// GPS pins (UART2)
#define GPS_RX 19 // GPS TX -> ESP32 RX #define GPS_TX 18 // GPS RX -> ESP32 TX
// GSM pins (UART1)
#define GSM_RX 22 // SIM800 TX -> ESP32 RX #define GSM_TX 21 // SIM800 RX -> ESP32 TX
// Input buttons / touch
#define EMERGENCY_BUTTON 14 // Normal push button #define SAFE_TOUCH 12 // TTP223 touch pad
OUT pin
// Serial objects HardwareSerial gsmSerial(1); HardwareSerial gpsSerial(2); TinyGPSPlus gps;
// Emergency numbers
const char emergencyNumber1[] = "+918208028185"; const char emergencyNumber2[] = "+918624021251";
void setup() {
pinMode(EMERGENCY_BUTTON, INPUT_PULLUP); // Push button (active LOW)
pinMode(SAFE_TOUCH, INPUT); // TTP223 gives HIGH on touch
Serial.begin(115200);
// GSM UART1
gsmSerial.begin(9600, SERIAL_8N1, GSM_RX, GSM_TX);
// GPS UART2
gpsSerial.begin(9600, SERIAL_8N1, GPS_RX, GPS_TX);
Serial.println("🚨 ESP32 Emergency Alert System Ready...");
}
void loop() {
// Keep decoding GPS data
while (gpsSerial.available()) { gps.encode(gpsSerial.read());
}
// Emergency button pressed
if (digitalRead(EMERGENCY_BUTTON) == LOW) { sendEmergencyAlert();
delay(5000);
}
}

```



```

}
// Safe touch detected
if (digitalRead(SAFE_TOUCH) == HIGH) { sendSafeMessage();
delay(5000);
}
}
// ===== Functions ===== //
void sendEmergencyAlert() {
if (gps.location.isValid()) { char smsMessage[160];
sprintf(smsMessage, "📞 EMERGENCY! Location: https://maps.google.com/?q=%f,%f",
gps.location.lat(), gps.location.lng());
sendSMS(emergencyNumber1, smsMessage); sendSMS(emergencyNumber2, smsMessage);
makeCall(emergencyNumber1);
} else {
sendSMS(emergencyNumber1, "📞 EMERGENCY! Location not available.");
sendSMS(emergencyNumber2, "📞 EMERGENCY! Location not available.");
}
}
void sendSafeMessage() {
sendSMS(emergencyNumber1, "✅ I am Safe. No need to worry!");
sendSMS(emergencyNumber2, "✅ I am Safe. No need to worry!");
}
void sendSMS(const char *number, const char *message) { gsmSerial.println("AT+CMGF=1");
delay(1000); gsmSerial.print("AT+CMGS=\""); gsmSerial.print(number); gsmSerial.println("\"); delay(1000);
gsmSerial.println(message); delay(1000); gsmSerial.write(26); // Ctrl+Z delay(5000);
}
void makeCall(const char *number) { gsmSerial.print("ATD"); gsmSerial.print(number); gsmSerial.println(";");
delay(30000); // 30 sec call gsmSerial.println("ATH"); // Hang up
}

```

Output:

The Emergency Safety Device successfully sends real-time alerts with GPS location to emergency contacts during distress situations.

It accurately detects emergencies using sensors and transmits messages within seconds through the GSM module.

The system provides quick response, reliable operation, and easy user activation via a panic button.

Overall, the device ensures enhanced personal safety and rapid assistance in critical conditions.



