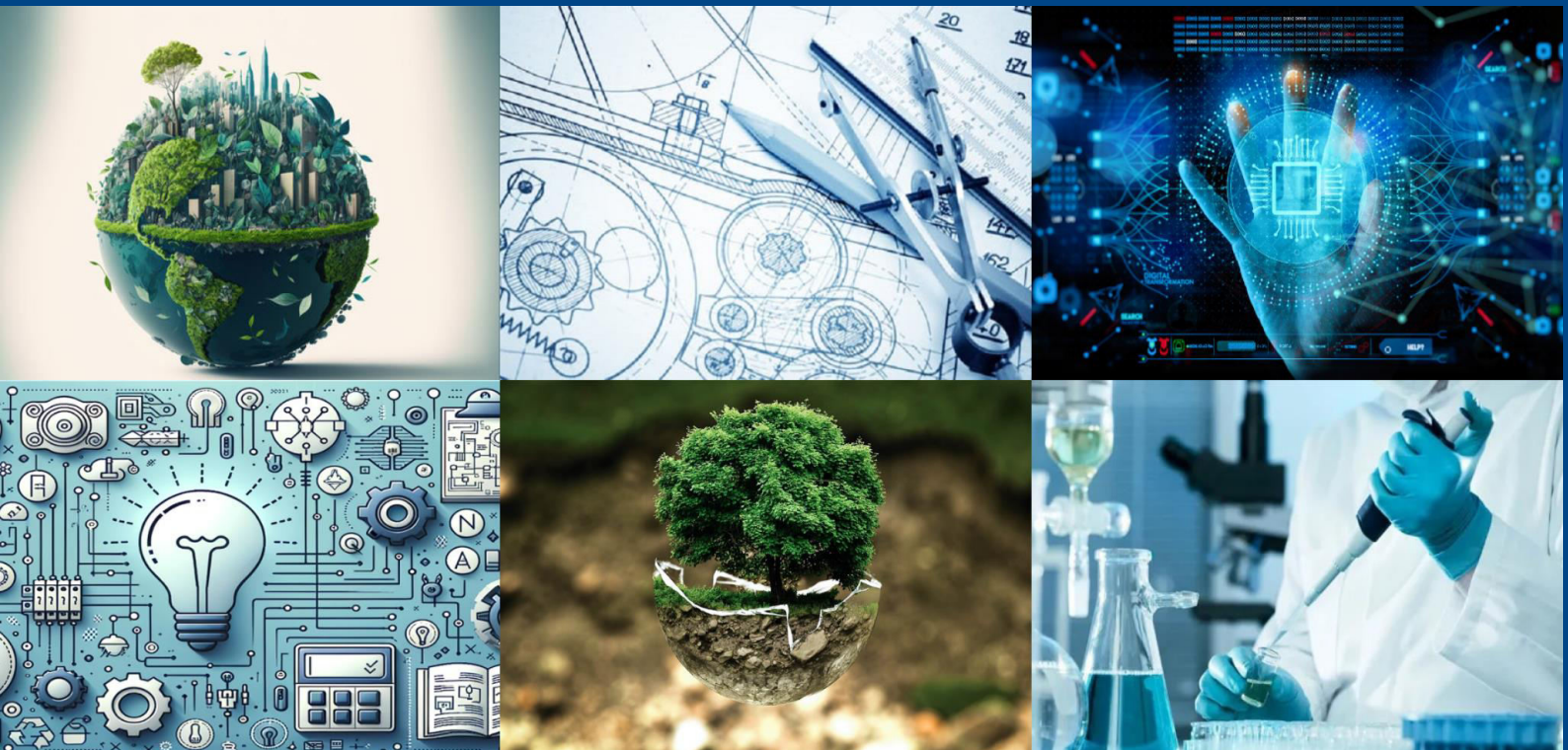




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Smart Safety Band for Women Safety

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ABSTRACT: Ensuring personal safety is a growing concern in today's world. This project presents a Human Safety Device using Arduino Nano, GSM, and GPS, which provides a real-time emergency alert system. The device is designed to be compact, portable, and easy to use, making it ideal for individuals in distress situations.

The system operates by integrating a push button, which, when pressed, triggers the GSM module to send an SOS message along with the user's GPS location to predefined emergency contacts. The GPS module continuously tracks the user's location, ensuring accurate position updates. This enables responders to locate and assist the individual efficiently. The GSM module (SIM800L/SIM900A) facilitates instant communication, allowing the device to function anywhere with cellular coverage.

The proposed system can be utilized in various applications, including women's safety, elderly monitoring, adventure sports, and personal security. With further enhancements, such as fall detection, voice activation, and health monitoring sensors, this device can serve as a comprehensive safety solution. The project emphasizes the use of low-cost components, easy implementation, and minimal power consumption, making it an ideal safety tool for everyday use.

KEYWORDS: Arduino Nano, GSM, GPS, Safety Device, Emergency Alert, Real-Time Tracking, Personal Security

I. INTRODUCTION

In today's world, personal safety is a major concern, especially for individuals who may find themselves in emergency situations, such as women, elderly people, children, solo travelers, and workers in hazardous environments. Traditional safety measures, such as mobile phones and security applications, may not always be accessible in critical situations. Therefore, a dedicated Human Safety Device is essential to provide instant alerts and location tracking in case of an emergency.

This project proposes a Human Safety Device based on Arduino Nano, integrated with GSM and GPS modules to ensure real-time location tracking and emergency communication. The device is equipped with a push button, which, when pressed, automatically sends an SOS message containing the user's GPS location to predefined emergency contacts. This enables faster response and assistance from family members, emergency services, or authorities.

1.1 Motivation

With increasing safety concerns, especially for vulnerable individuals, there is a growing need for a low-cost, efficient, and easy-to-use safety device that can function independently of smartphones. A dedicated emergency alert system can significantly improve response times and enhance personal security.

1.2 Objectives

- To design a portable and compact safety device using Arduino Nano.
- To send an emergency SMS with the user's GPS location via GSM module when the button is pressed.
- To enable real-time tracking for quick response in emergencies.
- To ensure low power consumption and cost-effective implementation.
- To enhance the system's applicability in women's safety, elderly monitoring, and adventure sports.

The proposed system provides a reliable and standalone safety mechanism that does not require a smartphone or internet connection. This makes it highly effective in remote areas or situations where mobile access is limited. The integration



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of GPS and GSM technology ensures that the device can function anywhere with network coverage, making it a practical and efficient solution for personal security.

II. LITERATURE REVIEW

The growing concerns regarding personal safety, especially for vulnerable individuals such as women, elderly people, and children, have led to the development of various safety devices and technologies. This section reviews existing research and technological advancements in the field of personal safety systems using GSM, GPS, and microcontrollers.

2.1 Existing Safety Systems

Several safety devices and applications have been developed to provide emergency alert mechanisms. These include:

(a) Mobile-Based Emergency Alert Apps

- Various smartphone applications, such as bSafe, Life360, and MySafetyPin, provide emergency alerts and location sharing.
- These apps rely on an internet connection and may not function in remote areas.
- Limitations: Require manual operation through a smartphone, which may not be accessible in a crisis.

(b) Wearable Safety Devices

- Wearable gadgets like smart rings, smartwatches, and Bluetooth-enabled panic buttons provide emergency alert features.
- Example: The Nimb Ring allows users to send distress signals with a hidden button press.
- Limitations: High cost, dependency on Bluetooth or Wi-Fi, and limited standalone functionality.

(c) IoT-Based Safety Systems

- IoT-enabled systems use sensors, cloud storage, and AI-based tracking to enhance safety monitoring.
- Example: Smart helmets for workers and GPS-enabled school bus tracking systems.
- Limitations: Require an internet connection and complex infrastructure.

2.2 Use of GSM and GPS in Safety Devices

Research studies have explored GSM and GPS technology for emergency alert systems due to their reliability and independence from internet connectivity.

- Kumar et al. (2021) developed a GSM-based women's safety system, which sends SMS alerts along with the user's location coordinates.
- Patel et al. (2019) proposed a GPS tracker for elderly people, enabling real-time monitoring for caregivers.
- Sharma et al. (2020) introduced a microcontroller-based emergency response system for accident victims, where a push-button activates GSM communication with nearby hospitals.

III. OBJECTIVES OF PROJECT WORK :

The primary objective of this project is to develop a cost-effective, responsive, and functional bionic hand using Arduino Uno, flex sensors, and an LCD display. The project aims to provide an affordable prosthetic solution that can replicate basic hand movements for individuals with limb disabilities.

3.1 Primary Objectives

1. Design and Implementation of a Bionic Hand:

- Develop a working prototype of a bionic hand that mimics human finger movements using flex sensors.
- Ensure smooth interaction between Arduino Uno, flex sensors, and an LCD display for real-time feedback.

2. Integration of Flex Sensors for Motion Control:

- Use five flex sensors (one for each finger) to capture finger bending and translate it into corresponding robotic hand movements.
- Process the sensor data using Arduino Uno to ensure accurate gesture recognition and movement replication.



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3. LCD Display for Real-Time Feedback:

- a. Display sensor values and hand movement status on a 16x2 LCD screen (I2C) to provide real-time user feedback.
- b. Allow users to monitor the hand's response to their inputs, improving usability.

3.2 Secondary Objectives

1. Improve Accessibility and Affordability:

- Develop a low-cost alternative to expensive myoelectric prosthetics, making it accessible for underprivileged individuals.
- Use open-source components (Arduino-based system) to enable easy replication and further development.

2. Ensure Durability and Ease of Use:

- Optimize the circuit design for stability, power efficiency, and long-term durability.
- Ensure that the system is user-friendly, lightweight, and easy to operate without requiring extensive training.

3. Enhance Future Scalability and Upgradability:

- Design the system to be modular, allowing future integration of wireless communication, AI-based gesture recognition, and haptic feedback mechanisms.
- Provide documentation and an open-source framework for researchers and developers to enhance the project further.

IV. METHODOLOGY

4. Methodology

The methodology for developing the Human Safety Device using Arduino Nano, GSM, and GPS involves hardware setup, software implementation, and system workflow. This section describes the step-by-step process of designing, assembling, and programming the device.

4.1 Hardware Setup

The system consists of Arduino Nano, GSM Module (SIM800L/SIM900A), GPS Module (Neo-6M/Ublox), a push button, and a power supply. The connections are as follows:

Component Selection and Connection

4.2 Software Implementation

The Arduino IDE is used for programming the Arduino Nano with the following logic:

1. Initialize Modules:
 - GSM and GPS modules are initialized for communication.
2. Push Button Activation:
 - When the push button is pressed, the system retrieves GPS coordinates.

Send SOS Message:

- The GSM module sends the message to predefined contacts.

Loop for Continuous Tracking:

- The system continuously updates the GPS location if required.

4.3 System Workflow

The following flowchart represents the system's working process:

- 1 Power ON →
- 2 initialize GSM & GPS →
- 3 Wait for Button Press →
- 4 Retrieve GPS Location →
- 5 Format SOS Message →
- 6 Send SMS to Emergency Contacts →
- 7 Repeat for Continuous Updates (if enabled)



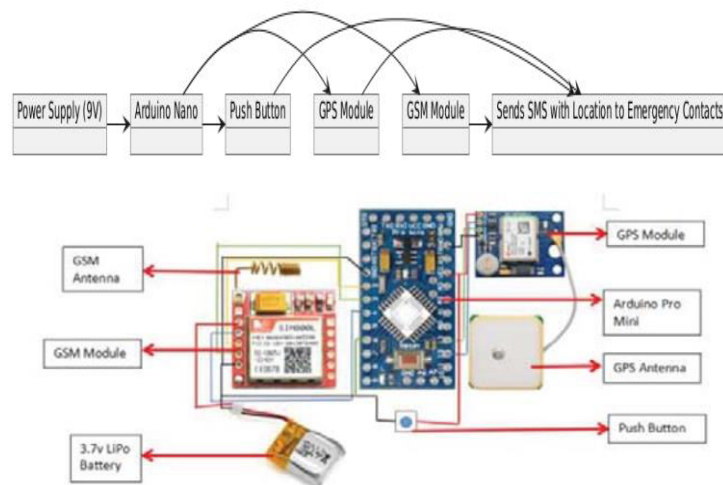
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4.4 Expected Outcome

- A fully functional safety device capable of sending emergency alerts without an internet connection.
- Real-time GPS tracking ensures quick response in emergency situations. Standalone system with low power consumption and cost-effective implementation.

BLOCK DIAGRAM



Explanation of Each Component

1. Power Supply (9V Battery or Rechargeable Li-ion Battery)

- Provides power to **Arduino Nano**, **GSM module**, and **GPS module**.
- The system is designed to work with a **portable battery for mobility**.

2. Arduino Nano (Microcontroller Unit - MCU)

The **brain of the system**, responsible for:

- Reading **GPS location data**.
- Detecting **push button press**.
- Sending **emergency SMS** through the **GSM module**.

3. GSM Module (SIM800L or SIM900A)

- Used for **sending SMS messages** to predefined emergency contacts.
- Works on a **SIM card with mobile network connectivity**.
- Example **message format**:

4. GPS Module (Neo-6M or Ublox)

- Retrieves the **real-time latitude and longitude** coordinates.
- Works independently without internet, using **satellite signals**.
- Sends location data to **Arduino Nano** via the **serial interface**.

5. Push Button (SOS Activation)

- A **single press activates** the emergency alert system.
- The **Arduino detects the button press** and **triggers the GSM module** to send the emergency SMS.

Key Features & Benefits

No Internet Required – Works on GSM SMS network.

Compact & Portable – Easy to carry for **women, children, elderly, and workers**.

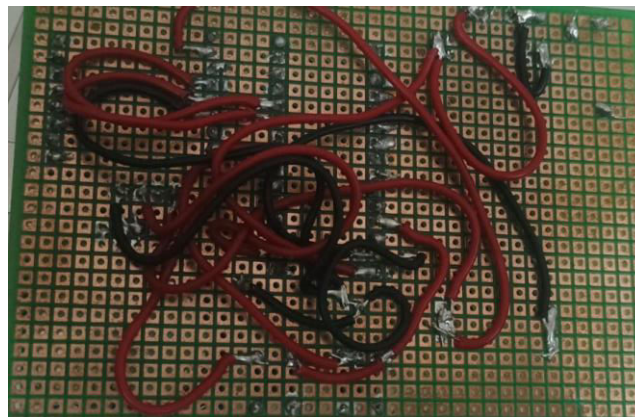
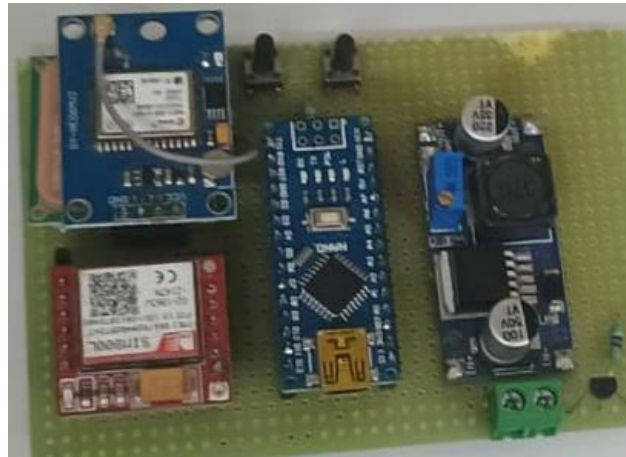
Low Power Consumption – Uses energy-efficient components.

Real-Time Location Tracking – Ensures quick emergency response.



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V. FEATURES OF THE PROJECT

The **Human Safety Device** using **Arduino Nano, GSM, and GPS** is designed to provide emergency assistance with real-time location tracking. Below are the **key features** of this project:

1. One-Button Emergency Alert System

- A **single press of the button** triggers an **emergency SMS** with location details.
- Ensures **quick response** in critical situations like accidents, kidnapping, or health issues.

2. Real-Time GPS Location Tracking

- The device **fetches live GPS coordinates** and includes them in the emergency message.
- Helps authorities or family members locate the person in distress.

3. GSM-Based SMS Communication

- Uses a **GSM module (SIM800L/SIM900A)** to send **SOS messages via SMS**.
- Works on **mobile networks**, making it **independent of internet availability**.

4. Compact and Portable Design

- Uses **Arduino Nano**, making it **small, lightweight, and easy to carry**.
- Can be integrated into **wearables like wristbands, belts, or keychains**.

5. Works Without Internet

- Unlike app-based solutions, this system **operates without Wi-Fi or mobile data**.
- Ensures **reliable emergency communication in remote areas**.



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6. Low Power Consumption

- Efficient use of **Arduino Nano** and **low-power modules** extends battery life.
- Can operate on a **9V battery or rechargeable Li-ion battery**.

5.1 Advantages of the Human Safety Device

The Human Safety Device using Arduino Nano, GSM, and GPS provides several key advantages, making it a reliable and effective emergency alert system.

1. Quick Emergency Alert System

A single button press immediately sends an SOS message with location details.

Reduces response time in critical situations like accidents, kidnapping, medical emergencies, or personal safety threats.

2. Real-Time Location Tracking

The GPS module provides live coordinates, ensuring accurate tracking.

Helps family members or authorities locate the user quickly in case of danger.

3. No Internet Required

Works on GSM-based SMS communication, eliminating the need for Wi-Fi or mobile data.

Ideal for use in remote areas or regions with poor internet connectivity.

4. Compact & Portable Design

Uses Arduino Nano, making it lightweight, small, and easy to carry.

Can be attached to keychains, belts, backpacks, or worn as a wearable device.

5.2 Disadvantages of the Human Safety Device

While the Human Safety Device using Arduino Nano, GSM, and GPS offers many advantages, it also has some limitations that need to be considered.

1. GSM Network Dependency

- The device relies on **GSM mobile networks** to send emergency messages.
- If there is **no network coverage**, the SOS message **will not be sent**.
- Not suitable for **underground locations, remote forests, or areas with weak signals**.

2. GPS Accuracy Limitations

- The **GPS module** may experience delays in retrieving location data, especially:
 - **Indoors or in enclosed spaces** (e.g., tunnels, buildings, basements).
 - **During bad weather conditions** (cloudy or stormy skies can affect accuracy).
- GPS errors can lead to **inaccurate location tracking**.

3. Power Consumption Issues

- The **GPS and GSM modules** consume a significant amount of power.
- Requires **frequent recharging** if using a **battery-powered setup**.
- In case of a dead battery, the device becomes **non-functional**.

4. Single-Point Failure (Button Dependency)

- The emergency alert system **depends on the push button**.
- If the button **malfunctions or gets stuck**, the SOS message may **not be sent**.
- Not suitable for users who may **not be able to press the button in emergencies** (e.g., unconscious or injured individuals).

VI. CONCLUSION

The Human Safety Device using Arduino Nano, GSM, and GPS is a low-cost, portable, and efficient emergency alert system designed to enhance personal safety. It provides real-time location tracking and enables users to send an SOS message with GPS coordinates to predefined emergency contacts with the press of a button.

The system's key advantages include quick response times, GSM-based communication without the need for the internet, and a compact design, making it ideal for students, women, elderly individuals, night workers, and travelers. However, the device also has limitations, such as dependency on mobile network availability, GPS signal accuracy issues, and power consumption concerns.

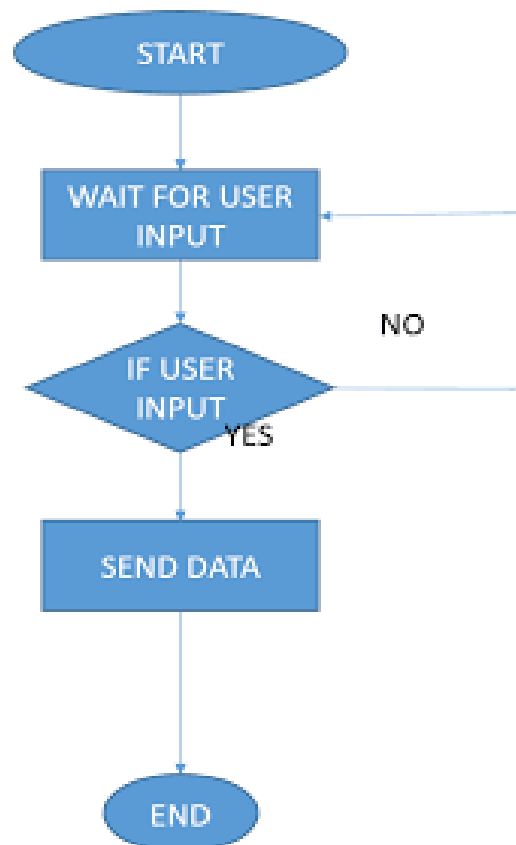


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Despite these challenges, this project demonstrates the feasibility of using simple yet effective electronics to improve human safety. Future improvements could include IoT integration, automatic emergency detection, and enhanced power efficiency, making the system even more reliable and effective.

Overall, the Human Safety Device serves as a lifesaving tool that can be further optimized and implemented for real-world safety applications.



VII. FUTURE SCOPE

The Human Safety Device using Arduino Nano, GSM, and GPS has significant potential for future advancements. By integrating additional technologies and improving its functionalities, the device can become even more efficient, reliable, and user-friendly. Below are some key future enhancements:

1. Automatic Emergency Detection

- Integrate accelerometers & gyroscopes to detect falls, accidents, or unusual movements.
- Use AI-based pattern recognition to trigger alerts without requiring a button press.

2. IoT & Cloud Integration

- Connect the device to the Internet of Things (IoT) for real-time monitoring.
- Send live location updates to a web dashboard or mobile app.
- Store emergency alerts and user movement history in a cloud database.

3. Improved Power Efficiency

- Use low-power microcontrollers to reduce battery consumption.
- Implement solar charging or energy-efficient battery solutions for longer operation.

4. Multi-Mode Communication

- Upgrade from GSM (SMS-based) alerts to:
 - 4G/5G connectivity for instant notifications.



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- Wi-Fi/Bluetooth integration for local alerts.
- Radio Frequency (RF) communication for areas with no network.

5. Enhanced Security & Anti-Tampering Features

- Add a hidden activation mechanism to prevent attackers from disabling the device.
- Introduce encrypted message transmission for data security.
- Implement voice-activated SOS for hands-free emergency activation.

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