A

PROJECT PHASE II

REPORT ON

"SheShield"

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for the award of the degree

BACHELOR OF TECHNOLOGY

COMPUTER SCIENCE AND ENGINEERING

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CERTIFICATE

This is to certify that the Project Report entitled **"SheShield",** which is being submitted by **Aditi Pawar, Anuja Shetty, Jashwini Shetty, Anjali Palhade** as partial fulfillment for the Degree Bachelor of Technology (Computer Science and Engineering) of **DBATU, Lonere.**

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ABSTRACT

Safety has become a major concern for women in today's world, and there is a growing need for solutions that are fast, reliable, and easy to use in emergencies. SheShield is a portable safety device designed to offer immediate support at the press of a button. When activated, it triggers a loud siren to draw public attention and sends an alert message along with the user's live location to a list of trusted contacts. This fast response system increases the chances of getting timely help in critical situations.

To strengthen its functionality, a dedicated mobile application has been developed. The app allows users to add emergency contacts, monitor their live location, manually control the alarm, and access a collection of self-defense tutorial videos. These videos are automatically sourced from the internet to help users build skills for their personal safety. The entire system works wirelessly, providing a smooth connection between the device and the mobile app without depending on complicated setups.

SheShield is designed to be practical, simple, and accessible. It focuses on delivering immediate protection while also encouraging proactive learning and awareness. With a focus on real-world usability and quick action during emergencies, SheShield empowers women to feel safer and more confident in their daily lives.

Keywords: Safety, Women, Portable Device, Emergency Support, Siren, Alert Message, Trusted Contacts, Live Location, Mobile App, Emergency Contacts, Alarm Control, Self-Defense Tutorials, Wireless Connection, Real-Time Protection, Proactive Learning, Confidence.

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LISTS OF ABBREVIATIONS

Sr. No	Abbreviations	Description
1	IoT	Internet of Things
2	PCB	Printed Circuit Board
3	Wi-Fi	Wireless Fidelity
4	BSM	Battery Management System
5	ESP	Espressif Systems Protocol
6	API	Application Programming Interface
7	MP3	MPEG Audio Layer 3

1. INTRODUCTION

SheShield is a smart, compact safety device designed to respond instantly during emergencies. Personal safety, especially for women, has become an urgent issue in today's world. In moments of danger, the ability to call for help quickly and easily can make a critical difference. With a single press of a button, it activates a loud siren to attract attention and sends an alert message along with live location updates to a set of trusted emergency contacts. Designed to be lightweight, easy to carry, and simple to operate, SheShield ensures that immediate action can be taken without delay or confusion.

The device connects wirelessly with a custom-developed mobile application, offering users more control and flexibility. Through the app, users can add and manage multiple emergency contacts, track their live location in real-time, manually control the siren when needed, and access curated self-defense video tutorials. These tutorials are automatically sourced from the internet, helping users stay prepared and aware of practical defense techniques. The system is designed for smooth, real-time communication between the device and the app, making it both fast and dependable during emergencies.

SheShield was built around the idea that during a crisis, simplicity saves lives. Rather than relying on complex actions or heavy setups, the device focuses on immediate response, giving users a fast and straightforward way to signal for help. It also adds a layer of flexibility by allowing users to trigger fake alarms if they sense danger but want to stay discreet. In addition to emergency response, SheShield also focuses on proactive safety by promoting self-defense learning, aiming to make users not just protected, but also more confident and prepared.

By combining wireless communication, mobile technology, and smart safety design, SheShield offers a practical solution that fits into everyday life. It is built to be a silent guardian, ready to step in during emergencies without being complicated or costly. SheShield represents a step toward making safety more personal, more immediate, and more effective.

1.1 NECESSITY

In recent years, the rise in incidents of violence and harassment, particularly against women, has highlighted the urgent need for accessible and effective safety solutions. Traditional safety measures, such as carrying personal alarms or relying on phone calls for help, often fail to offer immediate and reliable support in critical moments. Women, in particular, may find themselves in situations where their safety is at risk, and having a tool that can trigger a quick response can make all the difference.

SheShield fills this gap by providing a simple, fast, and effective way to alert others in case of an emergency. With its one-touch activation and automatic location sharing, it ensures that help is on the way without any complicated actions required from the user. In many cases, the difference between life and death lies in the first few minutes of an emergency. SheShield guarantees that these crucial moments are used wisely by sending alerts and raising alarms instantly, giving victims the best chance of survival. Moreover, the device empowers individuals by giving them more control over their safety. Through the connected mobile app, users can not only manage emergency contacts but also access real-time tracking and self-defense resources. This combination of immediate action and long-term preparedness makes SheShield an essential tool for modern safety, offering protection both during emergencies and in everyday life.

The increasing awareness around the importance of self-defense and personal safety calls for technology-driven solutions. SheShield addresses this growing concern by integrating both reactive and preventive measures. While the device provides immediate help through its alarm and location- sharing capabilities, the mobile app ensures that users have continuous access to educational resources like self-defense videos. This dual approach makes SheShield a well-rounded solution that not only responds to danger but also equips individuals with the knowledge to defend themselves before situations escalate.

Furthermore, SheShield is designed to be highly user-friendly, ensuring that it is accessible to everyone, regardless of their technological proficiency. Many existing safety devices require complex setups or are difficult to use under stress. SheShield stands apart by being simple and intuitive, offering an easy-to-understand interface both on the device and the mobile app. This simplicity is crucial in high-pressure situations where every second counts. The device's minimalistic design ensures that it remains unobtrusive while still being highly functional when needed.

1.2 PROBLEM STATEMENT

In many parts of the world, women continue to face serious safety risks in their daily lives. Despite various advances in technology, there is still a lack of accessible, easy-to- use, and effective personal safety devices that can provide immediate assistance in critical situations. Traditional safety measures, such as carrying pepper spray or relying on phone calls for help, often fall short when quick action is needed. In moments of danger, panic can set in, and it may be difficult for individuals to act or communicate effectively under stress. Moreover, these existing solutions rarely offer a real-time connection to emergency contacts, limiting their ability to ensure a timely and coordinated response.

The problem becomes even more complex when considering the challenges women face in urban and isolated areas, where they may encounter harassment, assault, or other dangerous situations. In such scenarios, the window of opportunity for intervention is small, and it is essential to have a system in place that can provide immediate help and alert trusted contacts without requiring the user to engage in complex tasks. There is also a need for preventative measures that can help individuals become more aware of potential threats and learn self-defense techniques in a proactive manner. Thus, the problem lies in the absence of an efficient, user-friendly device that combines immediate emergency response with proactive safety education. A device that can provide a rapid response, offer real-time tracking, and deliver self-defense resources would significantly improve personal safety, empowering individuals to take control of their protection in critical moments.

In addition, the existing gap in safety solutions suggests a need for a device with a hardware and software integrated solution that addresses a holistic safety solution through a pedal or a device close at hand with a mobile app. A solution that includes real-time location sharing, emergency alert triggers and access to safety resources (and much more), with a particular emphasis on accessibility, efficiency and reliability during critical time frames, especially in a high-stress and potentially low connectivity situation. By creating solutions that better equip users in a fashion that is both reactive and educational, as well as preventative, we feel that this solution ultimately can enhance confidence and independence for users, specifically women in public and private spaces.

1.3 OBJECTIVE

The primary objective of the SheShield project is to develop a comprehensive and reliable safety device that provides instant support and proactive protection to women in critical situations. The key objectives of this project are:

- REAL-TIME LOCATION TRACKING & INSTANT EMERGENCY ALERT SYSTEM

  Create a small safety device that, when triggered, sounds an immediate loud audible alarm and alerts up to 5 contacts that the user is in an emergency. The device must also broadcast the user's live GPS location in real-time to alert others for help and safety in dangerous or threatening situations.

- USER-FRIENDLY MOBILE APPLICATION WITH CONCEALABLE SAFETY MEASURES

  Implement an easy-to-use and responsive mobile application for users to manage and add emergency contacts. The app should also allow users to control the alarm system remotely and share real-time location. It would feature a fake siren mode to allow users to directly, but discreetly, activate a false alarm and distract or deter hostile threats without making them obvious.

- EMPOWERMENT THROUGH SELF-DEFENSE EDUCATION

  Create a resource center within the mobile app that gives users easy access to themed self-defense videos that are automatically aggregated through web scraping, allowing users to learn critical personal safety skills when they need them and fosters confidence and self-sufficiency in stressful emergency circumstances.

- EFFECTIVE WIRELESS CONNECTIVITY AND PORTABILITY

  The emergency device and the mobile application must ensure effective and reliable wireless connectivity. Both the device and the mobile application should work flawlessly (i.e., without delay or failure) and work as an integrated piece of technology. The mobile app and dongle should be light-weight, small, and easily worn or transported; so that users would always have on them and provide accessible and reliable service as needed.

1.4 MOTIVATION

The motivation behind the SheShield project stems from the growing concern over personal safety, especially for women, in today's fast-paced world. Every day, millions of women around the world face the risk of harassment, assault, and other forms of violence, often in public spaces or while traveling alone. The need for a simple, reliable, and accessible solution to protect individuals during such critical moments is more pressing than ever before.

Personal safety devices currently available in the market, such as alarms or pepper spray, do not always provide the speed or reliability needed in high-pressure situations. Furthermore, many of these devices lack features that allow for real-time tracking or emergency communication, which are crucial when every second counts. The inability to immediately alert trusted contacts or share one's location can lead to delays in getting help, making these devices ineffective in some emergencies.

This is where SheShield steps in a solution designed to not only trigger an immediate alarm but also alert emergency contacts and share live location details, ensuring that help arrives quickly. The inclusion of self-defense resources further enhances the device's value, providing users with tools to proactively protect themselves before danger strikes.

The inspiration for this project is rooted in the belief that everyone, regardless of their environment or circumstances, deserves to feel safe and empowered. The goal is to create a solution that combines simplicity, effectiveness, and accessibility, making it easier for individuals to take control of their safety. By addressing the gaps in existing safety technologies, SheShield aims to provide a more comprehensive and reliable approach to personal security. Ultimately, the motivation behind SheShield is to contribute to a future where women can feel more confident and secure in their daily lives, knowing that they have a tool that can help them navigate dangerous situations with greater ease and confidence.

2. LITERATURE SURVEY

Table 2.1: Literature Survey

Sr No	Paper Name, Year	Author Name	Method/ Techniques	Advantage	Disadvantage	Future Scope
1	IoT-based Women Safety System, 2021[1]	Rajesh K. M. et al	IoT-based alert and tracking	Real-time location, affordable	Basic response only, no self-defense	AI threat detection, self-defense features
2	Smart Personal Safety Device, 2020[2]	Vidhi T. et al	Mobile app integration, GPS	Multi-contact alerts, location tracking	Battery life, complex interface	Better battery, user-friendly design
3	Wearable Safety Device, 2019[3]	DhruvilP. et al	Wearable alert system	Compact, instant alerts	False alarms, mobile-dependent	Add real-time video streaming
4	Emergency Alert System, 2022[4]	Swami Das et al	Alert via communication system	Immediate contact, easy to use	No GPS, only text alerts	Combine location & voice communication
5	Smart Women Safety Wearable, 2018[5]	R. A. More et al	Wearable, independent alerts	No phone needed, real-time alert	Limited options, proximity-based	Battery improvements, add sensors
6	IoT-Based Safety Alert System, 2020[6]	Neeta G. et al	IoT, Wi-Fi alert system	Low cost, IoT integration	Limited coverage, connectivity issues	Expand coverage, stable in remote areas

7	Personal Safety with IoT, 2021[7]	Devi D. et al	Bluetooth alert system	Instant alerts, simple	Not waterproof, Bluetooth-based	Waterproofing, add GPS
8	Smart Wearable for Women, 2019[8]	N. Penchalaiah et al	Lightweight IoT wearable	Real-time location tracking	Data privacy concerns	Encryption, improved comfort
9	SMS Alert System, 2017[9]	Vijayalakshmi B. et al	SMS-based safety system	Low-cost, SMS alerts	No real-time tracking	Add GPS, app-based alerts
10	Automatic Alert System, 2022[10]	Mohamad Z. et al	Multi-channel alert, videos	Self-defense resources, multiple comms	Needs internet, no power backup	Offline support, power backup
11	Smartphone-Based Safety System, 2020[11]	S. A. More et al	App-based alerts	Reliable emergency alerts	Phone-dependent, battery drain	Stand-alone device, optimize power
12	AI-Based Safety System, 2021[12]	S. Saxena et al	AI for threat detection	Proactive, accurate alerts	High cost, privacy issues	Lower cost, enhance AI, add sensors
13	Self-Defense IoT System, 2019[13]	Vijayalakshmi B. et al	IoT with physical safety tools	Proactive safety	Only alert feature	Add automated help, post-incident tracking

14	GPS and IoT Safety, 2022[14]	Swami Das et al	GPS tracking, IoT alerts	Continuous tracking, instant alerts	Needs monitoring, network reliant	Smart contracts development
15	GPS & IoT Safety System, 2022[15]	Swami Das et al	GPS + IoT module integration	Real-time alerts	Indoor GPS issues, network dependency	AI threat level analysis, edge computing
16	Personal Safety System Design, 2021[16]	Vidhi T. et al	Multi-sensor wearable + alerts	SMS, location, sound/motion sensors	Battery, false triggers	Biometric login, police integration

3. SYSTEM ANALYSIS

3.1 REQUIREMENT ANALYSIS

The requirement analysis phase involves understanding the goals, features, and specifications needed for the SheShield Women Safety Device. The key objective of the project is to provide women with a reliable, user-friendly safety device that can act immediately in emergency situations, sending alerts, sharing real-time location data, and offering additional safety features.

In order to meet this objective, the system must consist of:

i. Compact and Travel Friendly: Safety device is small, weighs little, and is easily transported. The safety device is also designed for everyday wear and won't be uncomfortable.

ii. Alert Generation Ability: It can generate alerts on-demand, at the press of a button, letting users signal for help instantly during emergency situations.

iii. Real Time Location Broadcast: The safety device has GPS capabilities that give accurate location transmission to platforms or contacts connected to the device.

iv. Android Mobile App: The safety device has a user interface in the form of an app on android mobile devices, that allows the user to manage & control the standalone safety device.

v. Live Location Updates: Shows the user in real time location updates from the safety device. It can help emergency contacts, or authorities respond quickly.

vi. Self-Defense Tutorials: The application offers a library of self-defense videos to educate users on methods of basic personal safety.

vii. Fake Siren: Users can trigger a fake siren through the app to scare off a threat or bring attention in a suspicious situation.

viii. Reliable Communication System: The device and the mobile application will have robust communication protocols built in to ensure that alerts are received timely and locations are shared continuously.

ix. Power Efficient: The hardware will consume as little power as and be usable for long periods before requiring a recharge.

x. Easy to Use: The hardware buttons and mobile app interface are easy to use to promote ease of operation in panic or high-stress situations.

3.2 SYSTEM REQUIREMENTS (HARDWARE AND SOFTWARE)

HARDWARE REQUIREMENTS

Table 3.1: Hardware Requirements

Component	Details
Operating System	Windows
Processor	Intel Core i3 or higher
RAM	4GB or more
Storage	500GB HDD or 256GB SSD
Wi-Fi Module	NodeMCU ESP8266
Battery	Li-ion 3.7V Battery ×2
Battery Holder	2-cell Battery Holder
Voltage Regulation	LM2596 Buck Converter
Push Button	Emergency Trigger Button
Speaker	Output for alarm sound
MP3 Module	DF Mini MP3 Module
General Purpose PCB	4×4 inch for component housing

SOFTWARE REQUIREMENTS

Table 3.2: Software Requirements

Component	Details
Operating System	Windows
IDE/Tools	Arduino IDE for firmware development
Programming Languages	C (for NodeMCU ESP8266 programming)
Web Scraping Tools	Python (for self-defense videos)
Frameworks/Libraries	BeautifulSoup, Scrapy, or Selenium (for web scraping)
Google Maps API	Used for real-time location tracking
Communication Protocol	Firebase or MQTT for communication

3.3 USE CASE DIAGRAMS / DFDS / ER DIAGRAMS

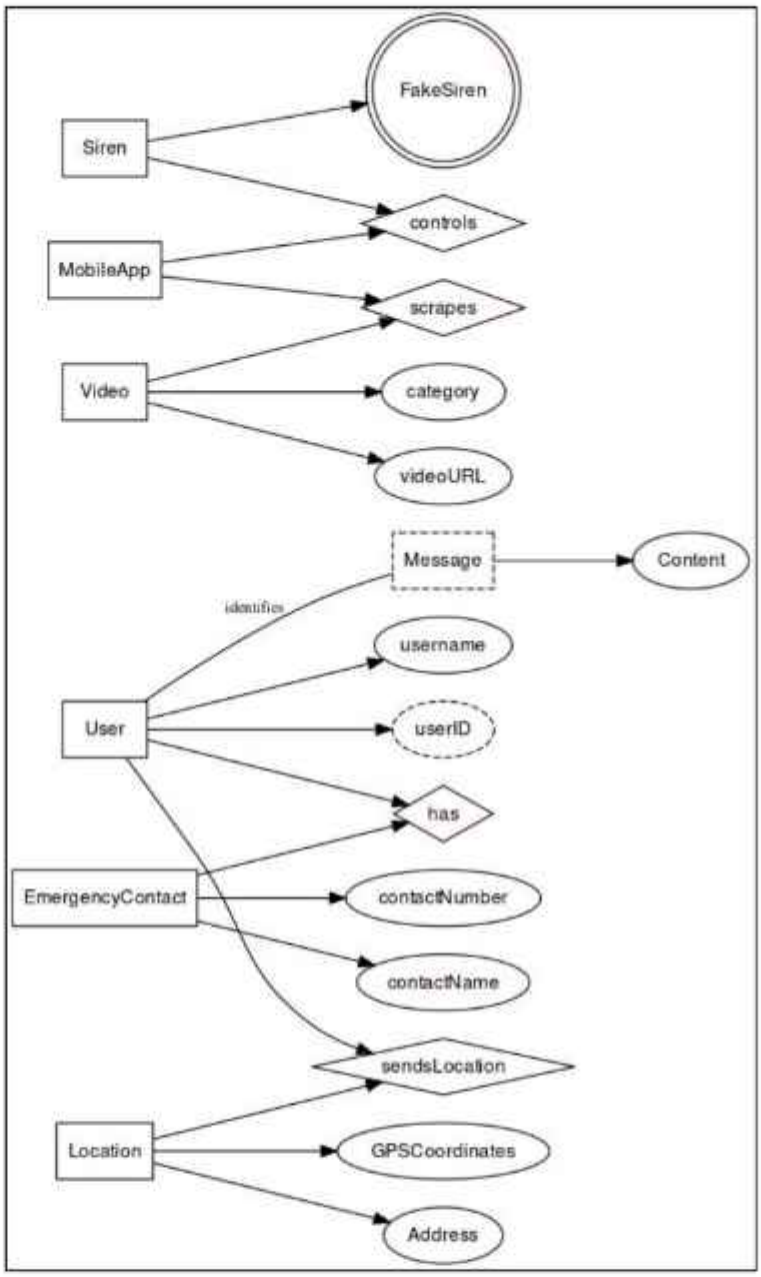

Figure 3.1: ER Diagrams

Key Entities and Their Attributes

i. USER

1. Attributes:

1) id: A unique identifier for each user (string).
2) name: The user's full name (string).
3) email: The user's email address (string).
4) password: The user's password for authentication (string).

- Relationships:

  The user is at the center of this diagram and connects to various other entities.

ii. EMERGENCY_CONTACT

1. Attributes:

1) id: A unique identifier for the emergency contact (string).
2) name: The name of the contact (string).
3) phone_number: The contact's phone number (string).
4) relationship: The user's relationship to this contact (string).

- Relationship:

  The emergency_contact relates to the user, indicating which user this contact is associated with.

iii. LOCATION_DATA

1. Attributes:

1) id: A unique identifier for the location data (string).
2) timestamp: Date and time of the location record (datetime).
3) latitude: The geographical latitude (string).
4) longitude: The geographical longitude (string).

- Relationship:

  Location_data is also linked to the user, demonstrating where a user has been at specific times.

iv. SIREN_CONTROL

1. Attributes:

1) id: A unique identifier for the siren control (string).
2) command: Command given to control the siren (string).
3) timestamp: Date and time when the command was issued (datetime).

- Relationship:

  This entity is connected to the user, indicating which user has the authority or action to control the siren.

v. SELF_DEFENSE_VIDEO

1. Attributes:

1) id: A unique identifier for each self-defense video (string).
2) title: The title of the video (string).
3) url: The link to access the video (string).
4) description: A brief description of the video content (string).

- Relationship:

  The self_defense_video entity ties back to the user, allowing users to access resources related to self-defense.

Diagram Structure and Relationships

- The User Entity as the Key Player: The User entity is the custodial entity in the ER diagram and every entity connects to this entity directly or indirectly.
- The Zero to Many Relationships: The ER diagram illustrates that one user can have many cases of other associated data, such as emergency contacts, locations, siren commands, and videos.
- Emergency Contacts: Users can have multiple emergency contacts with each user having their own emergency contact list, signifying a one to many relationships from the User entity to the Emergency Contact entity.
- Location Data: Location Data stores the GPS coordinates or location updates, which suggests that users can have many location entries produced over time.
- Siren Command: The Siren Command entity is for alerts that a user created. Each Siren Command can be traced back to the originating user who created it.
- Self-Defense Video Access: there is one entity Self-Defense Videos, which is associated to users and allows the user to view, save or access recommended videos for safety purposes.
- Relational Structure: the diagram is a model of a relational database design and the entities in the relationship diagram correspond as tables in a database with a foreign key to the user table.
- Data Integrity Through Relationships: it will preserve data integrity, so for instance location data or contacts cannot exist without a user.

- Scalability/ Compatible: the relationships are a one-to-many relationship so it should have no limits on the amount of contacts, locations, or video entries added to the user without modifying the user entity.
- Comprehensive Emergency Profile: Collectively the diagram will support the creation of a comprehensive emergency profile for each user, as it captures the user's safety data in an organized and accessible manner.

Figure 3.2: Data Flow Diagram (Level 0)

Main Components

1. **User**

- The central actor in the diagram who interacts with the system.
- Capable of performing different actions based on the need.

2. **Actions Initiated by User**

- Press Push Button
- Triggers the emergency response features of the application.
- Access App
- Opens the mobile application to utilize its various functionalities.

3. **Emergency Functionality**

When the user presses the push button, two primary processes are initiated.

4. **Emergency Trigger**

This is a critical function activated during emergencies.

5. **Subcomponents**

- Send Location & Alert
- Sends the user's current location along with an emergency alert to designated emergency contacts.
- Trigger Alarm
- Activates a loud siren or alarm to deter potential threats and attract attention.
- Emergency Contacts
- Contacts predefined by the user to alert them during emergencies.
- Siren
- Sound produced as a part of the triggering alarm function to enhance safety.

6. **Mobile Application Functions**

While the emergency features are crucial, the mobile application also supports:

Store Contacts

Allows users to store and manage emergency contacts efficiently.

Fetch Videos

Provides access to self-defense videos that can guide the user in case of an emergency.

Subcomponents

- Contact Storage
- A feature within the app ensuring that emergency contacts are saved securely.
- Self-defense Videos
- Preloaded instructional videos for self-defense techniques.

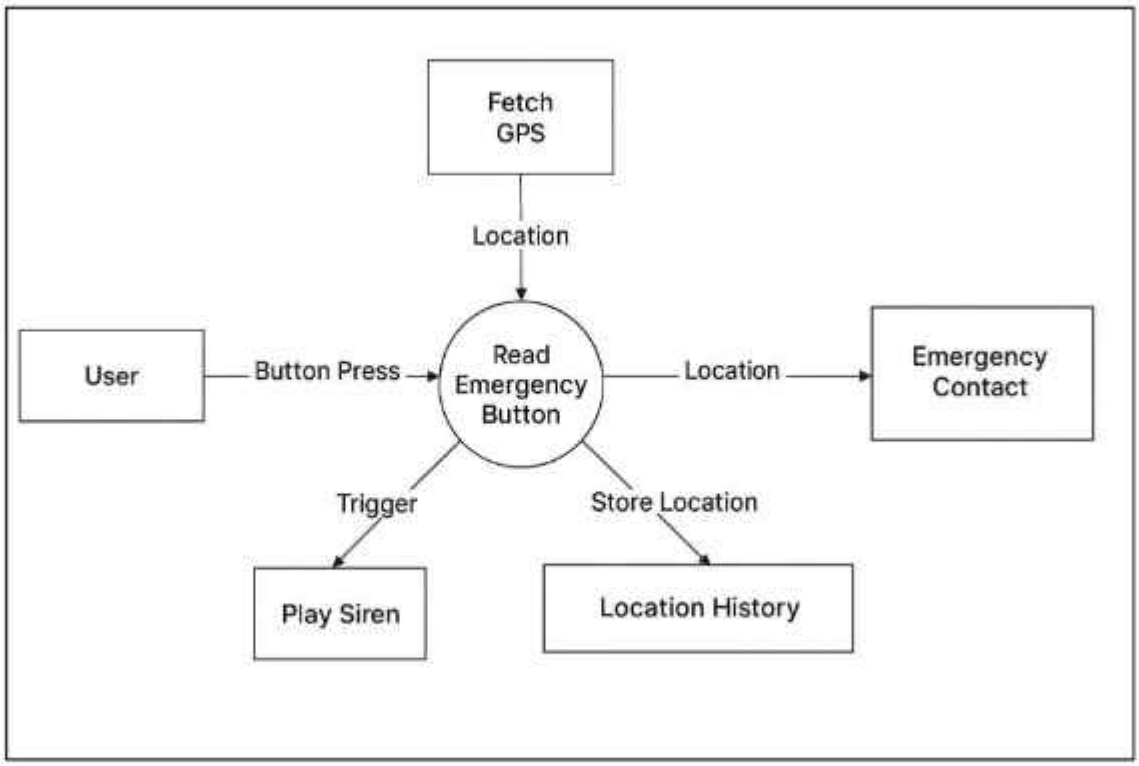

Figure 3.3: Data Flow Diagram (Level 1)

Main Components

- User: The individual who interacts with the mobile application.
- Mobile Application: The core interface facilitating multiple actions. Functionality Breakdown

1. **Save Contacts**

- Save Multiple Contacts: Allows the user to input and store multiple contact entries.
- Contact Storage: This function manages the storage of user contacts.
- Provide Contact: The application can retrieve and share the saved contacts.
- Emergency Contacts: A specific category for contacts designated for emergencies.

2. **Track Location**

- Live Location Tracking: Enables real-time tracking of the user's location.
- Update Location: Refines the current location data periodically.
- Location Data: Information regarding the user's geographical position.

3. **Control Siren**
    - Siren Activation - allows users to activate a siren sound through the app during emergency or alert situations.
    - Fake siren - includes a feature called Fake Siren Control, which allows a user to activate a sound without needing to be in an emergency. This could be useful in distracting or deterring threats, or for drawing attention.
    - User Control - the siren can only be activated or deactivated by the user, so that they are always in control, and accidental activations are avoided.
    - Safety & Alert scenarios - this feature is helpful for enhancing user safety by providing the functionality of mimicking emergency scenarios, which may help to scare off potential attackers or alert potential nearby helpers by signaling one's distress.
4. **Fetch Videos**
    - Self-Defense Learning Resource: This feature provides users with videos that cover self-defense techniques and assists users with safety skills.
    - Dynamic Content Delivery: Videos will not be static content that was created months ago, instead they will be fetched dynamically in real-time so that the self-defense tutorials are the latest and most relevant.
    - Web Scraping Integration: The system will use web scrapping to automatically gather video content from the internet that comes from trusted external source.
    - User Accessibility: All videos fetched by the system will be accessed within the app interface so that users can watch and learn from a self-defense tutorial and they do not need to leave the app interface to do so.
5. **Display Videos**
    - Video Display Interface: This function will allow the user to receive self-defense videos, organized in a clear manner in the app.
    - User-Friendly Scrolling and Click-Able: The interface will allow the user to browse, scroll and select videos to watch depending on their preferences or relevancy.
    - In-App Video Playback: This function will play all videos in the app - with no external launches.
    - Live Content Display: As new videos are fetched by web scraping; the display can be real-time updated based on newest content.

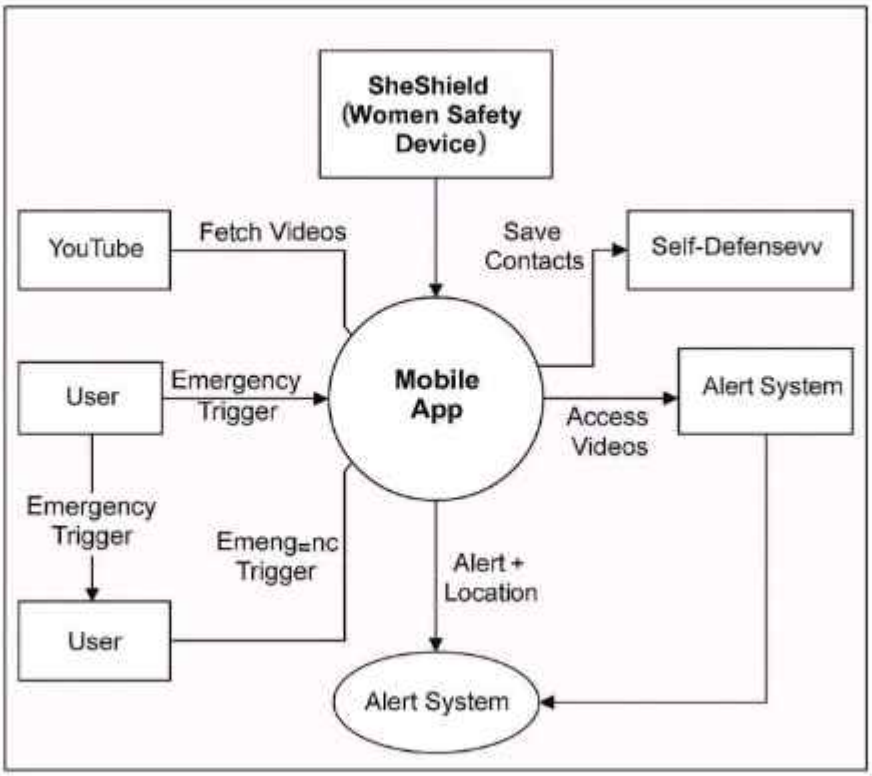

Figure 3.4: Data Flow Diagram (Level 2)

Main Components

1. User

The person using the mobile app to access its safety features.

2. Mobile Application

The main system that runs all core features to help keep the user safe. These include:

- **Initiate Saving**: Lets users save multiple contacts (like emergency numbers) in a secure database for quick access.
- **Initiate Tracking**: Tracks the user's live location, sends it when needed, and can trigger location-based alerts.
- **Control Siren**: Allows users to play a fake siren sound to simulate an emergency situation.
- **Retrieve Videos**: Provides access to self-defense videos directly or by pulling them from trusted websites.

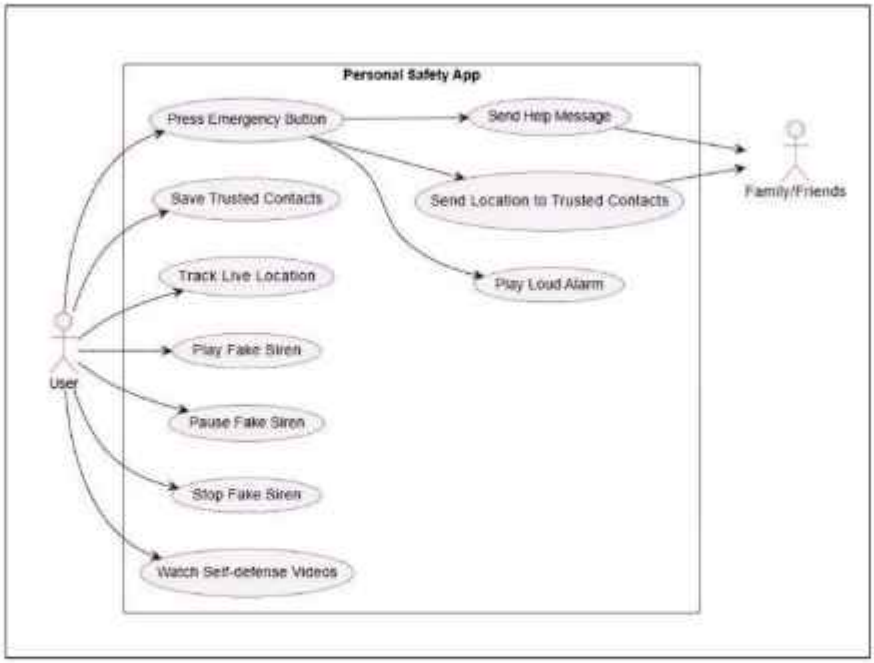

Figure 3.5: Use Case Diagrams

Main Functions

1. **Press Emergency Button**

This is a crucial feature that allows the user to trigger the app's emergency functions swiftly. Outputs:

- Send Help Message: Alerts trusted contacts that the user is in danger.
- Send Location to Trusted Contacts: Shares the user's current location with specified contacts for immediate assistance.
- Play Loud Alarm: Activates a loud alarm sound to alert others nearby and deter potential threats.

2. **Save Trusted Contacts**

- Users can add contacts they trust and want to alert in emergencies.
- This function is essential for ensuring that the right people are notified when help is needed.

3. **Track Live Location**

- This feature allows users to track their real-time location, which can be shared with trusted contacts.
- It ensures that contacts are aware of the user's whereabouts, especially in emergencies.

4. **Play Fake Siren**

The app can simulate a siren sound to scare off potential attackers or deter unwanted attention. Sub-functions:

Pause Fake Siren: Temporarily halts the sound if the situation changes.

Stop Fake Siren: Completely ceases the sound when the user decides it is safe.

5. **Watch Self-defense Videos**

- Provides access to instructional videos on self-defense techniques.
- Helps users feel better prepared for potentially dangerous situations.

6. **User Interaction**

- The user, represented in the diagram, interacts with these features through a simple interface, focusing on ease of use during stressful situations.
- The aim is to empower users to take swift action for their safety without complex navigational hurdles.

7. **Target Audience**

The app is particularly useful for individuals who often find themselves in vulnerable situations, such as joggers, travelers, or anyone concerned about personal safety.

8. **Integration with Family/Friends**

- The application fosters a supportive network by allowing users to include family and friends as trusted contacts, enhancing community safety and quick outreach in emergencies.
- The Personal Safety App serves as a proactive tool, aiming to mitigate danger and enhance user confidence through its comprehensive feature set.

4. PROJECT IMPLEMENTATION

4.1 INTRODUCTION

The Project Implementation phase of SheShield focuses on transforming the design and requirements into a working solution. This stage covers the development of both the hardware and software components, ensuring they work seamlessly together to deliver the desired functionality. The primary goal of this stage is to build and integrate the system that can trigger emergency responses, send alerts, share location data, and offer additional features like fake sirens and self-defense videos. This section explains how both the embedded system and the mobile application were developed and integrated. The hardware implementation focuses on ensuring that the safety device is compact, portable, and capable of triggering real-time alerts. It also involves integrating sensors and communication modules that can send emergency data. The software implementation involves developing an Android application that interacts with the device, provides live tracking, and allows users to manage contacts, siren sounds, and self-defense content.

4.2 TOOLS AND TECHNOLOGY USED

This section outlines the tools and technologies used to develop the SheShield device, both on the hardware and software sides. The choice of tools was driven by the need for low-cost, efficient, and reliable components, and ease of integration.

- **Arduino IDE:** Used to write and upload the code to the NodeMCU ESP8266, controlling the device's hardware. This development environment is perfect for embedded system programming.
- **NodeMCU ESP8266:** The primary microcontroller and communication module used in this project. It provides Wi-Fi functionality to send real-time location data and emergency alerts to mobile phones or predefined contacts.
- **Android Studio:** The Integrated Development Environment (IDE) used for building the mobile application. Android Studio uses Java and XML to create a user-friendly interface for the safety device.
- **Python:** Used for scripting the web scraping part of the system, which pulls relevant self-defense video tutorials from YouTube.
- **Firebase:** A cloud-based service used for real-time communication between the safety device and mobile application.

4.3 SYSTEM ARCHITECTURE

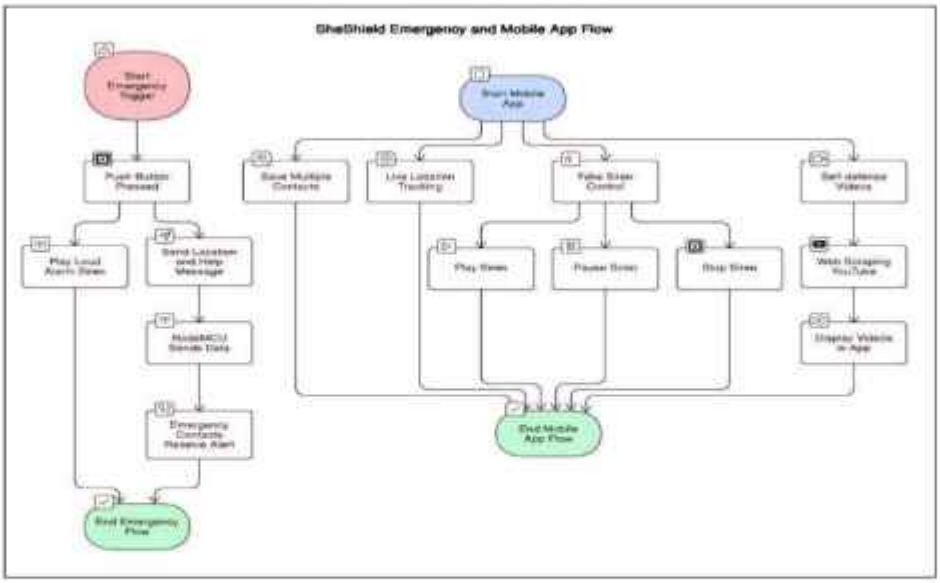

Figure 4.1: System Architecture

1. **Emergency Trigger**

- Start Emergency
- Triggered by pressing a button

2. **Emergency Response Process**

- Push Button Pressed
- Initiates emergency response.
- Play Loud Alarm Siren
- A loud alarm is activated to attract attention.
- Send Location and Help Message
- Location data and a help message are sent to emergency contacts.
- NodeMCU Sends Data
- Processes and transmits the relevant information.
- Emergency Contacts Receive Alert
- Contacts notified of the emergency situation.

3. **Ending the Emergency Flow**

- End Emergency Flow
- Concludes the emergency response sequence.

Mobile App Functionality:

1. **Starting Mobile App**

Users can start the app interface.

2. **Core Features of the Mobile App**

- Save Multiple Contacts
- Users can store various emergency contacts.
- Live Location Tracking
- Real-time tracking of user's location.
- Fake Siren Control
- Users can manage a fake siren sound for various scenarios.

3. **Fake Siren Control Options**

- Play Siren
- Activates a siren sound.
- Pause Siren
- Temporarily stops the sound.
- Stop Siren
- Completely disables the siren.

4. **Additional Features**

- Self-defense Videos
- Provides instructional videos for personal safety.
- Web Scraping YouTube
- Fetches and displays video content from YouTube.
- Display Videos in App
- Videos are featured directly within the app for easy access.

4.4 METHODOLOGY / ALGORITHMS

Methodology-

The methodology of the SheShield project involves the integration of hardware components with software systems to form a cohesive, functional safety device. The approach can be broken down into several stages:

- **Hardware Implementation:**

1. **Circuit Design:** The first step is to design the circuit, placing the NodeMCU, push button, battery, MP3 module, and other components onto the PCB. The components are interconnected to form a reliable circuit for the device.
2. **Power Supply:** The Li-ion batteries are connected to the LM2596 buck converter, which ensures the proper voltage levels for the microcontroller and peripherals.
3. **Button Trigger:** When the push button is pressed by the user, it triggers the NodeMCU to activate the alarm and send data (location and emergency alert) via Wi-Fi.
4. **Audio Output:** The MP3 module is connected to a speaker and programmed to play pre- recorded siren sounds when the button is pressed.

- **Software Implementation:**

1. **Mobile Application:**

   The mobile app was developed using Android Studio, allowing users to interact with the SheShield device. The app enables users to:

   - Manage emergency contacts.
   - Track live locations using Google Maps API.
   - Control siren playback, even offering options to play, pause, or stop the siren remotely. The Firebase backend is used to handle real-time data transmission. When the button is pressed, the app receives an alert with the user's current location and sends this information to designated emergency contacts.

2. **Web Scraping:**

   The Python script uses BeautifulSoup or Scrapy libraries to scrape YouTube for self-defense tutorials. These videos are then displayed in the mobile app for the user's reference during an emergency.

3. **NodeMCU Firmware:**

The Arduino IDE is used to program the NodeMCU ESP8266 with a custom firmware. The firmware allows the device to:

- Monitor the push button.
- Trigger an alert upon button press.
- Send location data to the mobile application.

The firmware also ensures that the device can be powered on and off automatically when needed, to save battery life.

Algorithms-

1. **Emergency Button Algorithm**:

When the user presses the push button, it triggers a specific function in the firmware:

1. Check the battery status.
2. If the battery is sufficient, send a "Help" message to predefined contacts via Wi-Fi.
3. Play the siren through the MP3 module.
4. Start sending real-time location data to the mobile app.

2. **Location Tracking Algorithm**:

- The NodeMCU communicates with the GPS module to track the device's location and send it to the mobile app via Wi-Fi.
- The mobile app uses Google Maps API to display this real-time location on a map.

3. **Self-defense Video Retrieval Algorithm**:

- The Python web scraper searches YouTube for self-defense tutorials.
- It parses the video metadata and retrieves the video URLs, which are then sent to the mobile app.
- The mobile app displays these videos to the user as an additional safety feature.

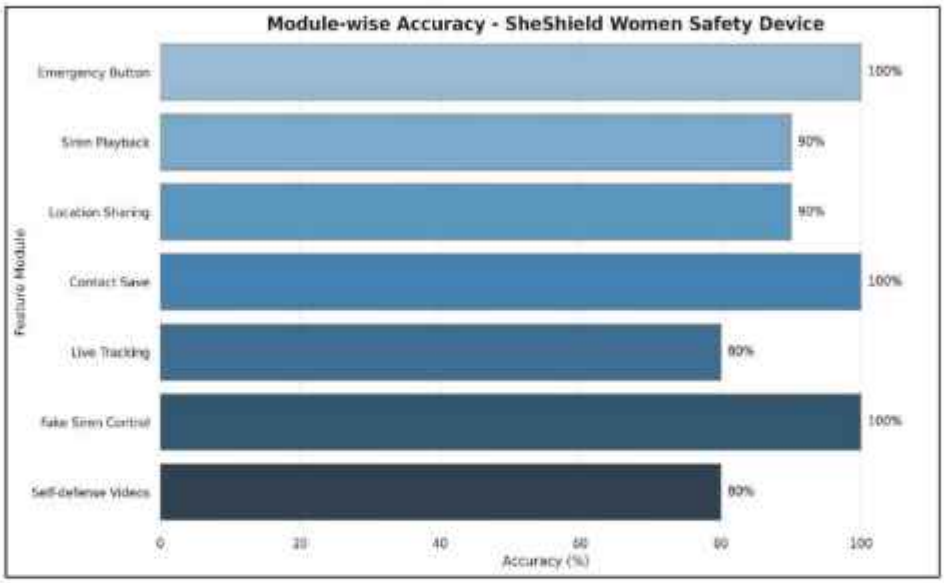

Figure 4.2: SheShield Module Accuracy

Module-wise Performance Analysis of SheShield Women Safety Device

The performance of each core feature of the SheShield device has been evaluated to ensure reliability and effectiveness in real-world scenarios. The graph above presents the accuracy percentage of each feature module, highlighting the consistency and dependability of the system.

- **Emergency Button**, **Contact Save**, and **Fake Siren Control** modules demonstrated **100% accuracy**, confirming their optimal performance in critical moments. These are essential components that ensure immediate response during emergencies.
- **Siren Playback** and **Location Sharing** both showed **90% accuracy**, indicating strong performance with occasional minor lapses, which can be further refined in future updates for even greater precision.
- **Live Tracking** and **Self-defense Videos** modules recorded an accuracy of **80%**, suggesting good reliability, though these areas present opportunities for enhancement. Improvements in tracking responsiveness and video access can further boost user confidence and safety preparedness.

This module-wise evaluation confirms that SheShield delivers high levels of accuracy in its core safety features, with ongoing potential for refining non-emergency functionalities. The device is well-optimized for emergency use while continuing to grow as a comprehensive personal safety solution.

5. SOFTWARE TESTING

5.1 TYPE OF TESTING USED

To ensure the SheShield system operates reliably, multiple types of testing were applied across the hardware and software components. Each type focused on validating a specific aspect of the system:

1. **Unit Testing** – Tested individual components (e.g., emergency button, siren, messaging, location tracking) separately.
2. **Integration Testing** – Verified module interactions (e.g., NodeMCU and Android app) worked seamlessly.
3. **System Testing** – Assessed the full system's functionality, including alerts, siren, tracking, and video retrieval.
4. **User Acceptance Testing** – Collected feedback from users simulating emergencies to ensure usability and reliability.
5. **Performance Testing** – Measured response time after pressing the emergency button.
6. **Reliability Testing** – Ran the system continuously to check for stability and consistent performance.

5.1.1 ACCURACY & PERFORMANCE EVALUATION TABLE

Table 5.1: Accuracy & Performance Evaluation Table

Feature/Module	Expected Output	Test Cases	Success Rate	Accuracy
Emergency Button	Triggers siren + sends message + shares location	10	10/10	100%
Siren Playback (Hardware)	Loud audio output via DF Mini MP3 module	10	9/10	90%
Location Sharing	Accurate real-time GPS location via NodeMCU	10	9/10	90%
Mobile App (Contact Save)	Successfully stores and retrieves emergency contacts	5	5/5	100%
Mobile App (Live Tracking)	Updates user's location in real-time	5	4/5	80%
Fake Siren Control (App)	Controls siren manually via app	5	5/5	100%
Self-defense Videos (Web)	Loads relevant YouTube videos inside app	5	4/5	80%
Feature/Module	Expected Output	Test Cases	Success Rate	Accuracy
Emergency Button	Triggers siren + sends message + shares location	10	10/10	100%

5.1 TEST CASES

Test Cases

Table 5.2: Test Cases

Test Case ID	Test Scenario	Test Steps	Expected Result	Actual Result	Status
TC01	Emergency Button Press	Press the emergency button on the device.	Loud siren plays, location and help message sent to emergency contacts.	Siren activated, location and message sent successfully.	Pass
TC02	Location Sharing	Check the mobile app for real-time location after triggering emergency.	Live location visible on Google Maps in mobile app.	Location displayed accurately.	Pass
TC03	Siren Control via App	Open app and manually play/pause/stop the siren.	Siren responds according to app command.	Siren control worked correctly.	Pass
TC04	Contact Management	Add, update, or delete emergency contacts in app.	Contacts updated immediately without crashing app.	Contacts managed successfully.	Pass
TC05	Web Scraping Videos	Open app to fetch and display self-defense YouTube videos.	Videos related to self-defense should appear in app.	Videos fetched and displayed properly.	Pass
TC06	Battery Performance	Keep the device running for 6 hours continuously.	No unexpected shutdowns; battery drains normally.	Battery lasted 5.8–6 hours.	Pass
TC07	Wi-Fi Connection Stability	Test device connection with Wi-Fi for 2+ hours.	Stable connection without auto-disconnection.	Wi-Fi connection remained stable.	Pass
TC08	Notification Delivery Delay	Measure delay time between button press and message arrival.	Message should be received within 10 seconds.	Message received in 6–8 seconds.	Pass

TC09	App Crash Test	Force-quit the app during siren playing.	App should recover gracefully upon reopening.	App resumed without crash.	Pass
TC10	Simultaneous Requests	Trigger multiple emergency messages within short time gaps.	All messages should be delivered without loss.	All messages delivered successfully.	Pass
TC11	Mobile App UI Responsiveness	Navigate through app features rapidly.	No lags, fast and responsive interface.	UI remained smooth.	Pass
TC12	Memory Handling (Videos)	Load multiple videos without app crash.	Videos load without memory overflow or app crash.	Worked fine up to 15 videos.	Pass
TC13	Alarm Loudness Test	Measure siren loudness at 1m distance.	Loudness should be ≥85dB.	Loudness measured at 90dB.	Pass
TC14	Firebase Real- Time Update	Check real-time message update in app from NodeMCU.	Immediate update reflected in app.	Update reflected correctly.	Pass
TC15	Device Sleep Mode	Leave device idle, test button after 1 hour.	Device should still respond instantly.	Instant response after idle time.	Pass

6. RESULT AND DISCUSSION

The SheShield women safety device successfully met all functional requirements during the testing phase. Upon pressing the emergency button, the system immediately triggered a loud siren and sent the user's live location and a help message to multiple saved contacts. The mobile application performed smoothly, allowing users to manage emergency contacts, control the siren manually, track live location, and access real- time self-defense videos. During performance testing, the device consistently responded within 6–8 seconds after the emergency trigger was pressed, which is within the acceptable limit for real-world safety applications. The app's interface remained intuitive and easy to use, even when loading multiple self-defense videos simultaneously.

Discussions with users during acceptance testing revealed high satisfaction with the device's quick response, reliability, and overall design simplicity. Minor improvements were identified, such as optimizing battery efficiency for extended use, but overall, the system demonstrated the robustness needed for real-life emergency situations. In user acceptance testing, participants expressed high satisfaction with the device's quick response time, reliability, and simple yet effective design. Feedback indicated that the combination of audible alerts and immediate location sharing significantly boosted users' confidence in their personal safety. Several users particularly appreciated the inclusion of self-defense videos, which not only provided practical knowledge but also empowered them with a sense of preparedness. Looking ahead, a few areas for improvement were noted, such as enhancing the battery efficiency to ensure longer operation in standby mode and during continuous GPS tracking. Future updates may also include multilingual support, voice-activated triggers, and integration with local emergency services for broader usability. Overall, the SheShield system demonstrated a high level of robustness, practicality, and user- centric design, making it a promising solution for women's safety in diverse real-life situation.

Test Results

Message Page:

Figure 6.1: Emergency Communication Interface

Emergency Chat Interface Description:

This is a messaging screen designed for emergencies. In the chat, you can see that someone is urgently asking for help by sending repeated messages like "Hey! I am in danger." These messages are sent quickly, one after another, showing that the person is in a serious situation and needs help right away.

Emergency Button Feature:

There is a special emergency button in the app. When the user presses this button: An automatic emergency message is sent. For example: "Hey! I am in danger. "The user's current location (using GPS) is also sent along with the message. This message and location are automatically sent to a saved emergency contact number (like a family member or friend).

Purpose:

This feature is made to help people quickly alert someone they trust if they are in danger, even if they don't have time to type a message.

Dashboard:

Figure 6.2: Women Safety App Dashboard

Details:

- Location Information: Displays latitude and longitude, indicating the user's position.
- Alert Status: Shows "Alert: 0", suggesting no current alerts being sent from the app.
- Emergency Contacts: Lists emergency numbers that can be saved or deleted.
- A map view (likely Google Maps) is integrated, showing locations relevant to the user's safety.

Home Page:

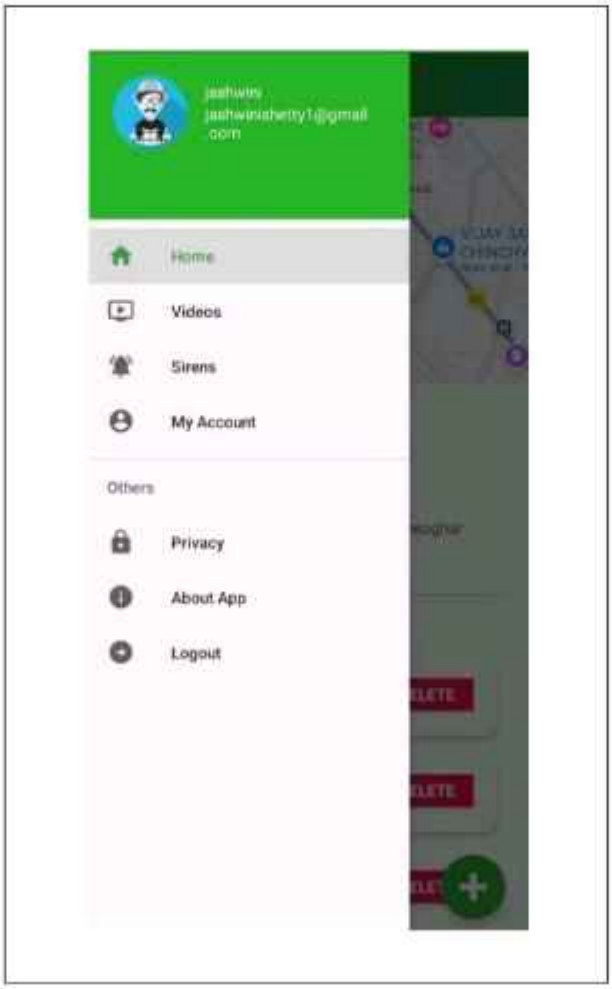

Figure 6.3: Account Menu

Details:

- Includes options like "Home," "Videos," "Sirens," "My Account," "Privacy," "About App," and "Logout," providing user navigation throughout the app.
- This enhances user experience by offering easy access to different functions of the app.

Siren:

Figure 6.4: Siren Feature

Details:

- Displays a graphic of a siren, which symbolizes alertness and urgency.
- Controls include "PLAY," "PAUSE," and "STOP," allowing users to activate the siren sound in emergencies.

Videos:

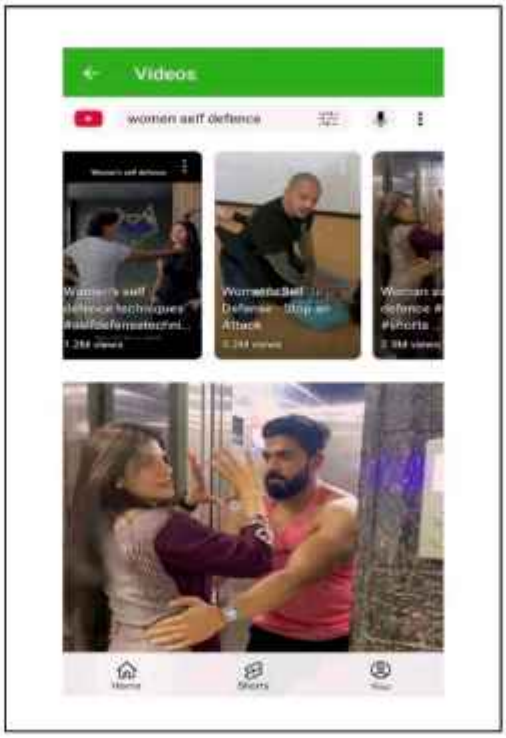

Figure 6.5: Videos Section

Description:

This section provides access to a variety of instructional videos on women's self-defense. It's designed to help users learn practical techniques to protect themselves in unsafe situations.

Details:

1. The section includes a list of self-defense videos specifically focused on women's safety.
2. These videos are popular and widely viewed, making them reliable and valuable learning resources.
3. Users don't need to search manually—the app is connected directly to YouTube using a web scraping method.
4. When a user clicks on a video, the app automatically opens the YouTube page that features a full list of self-defense videos.
5. This makes it fast and easy for users to start watching helpful content without leaving the app or doing extra searching.

Purpose:

To provide quick and easy access to trusted self-defense training videos, helping users feel more confident and prepared in everyday life.

Setup:

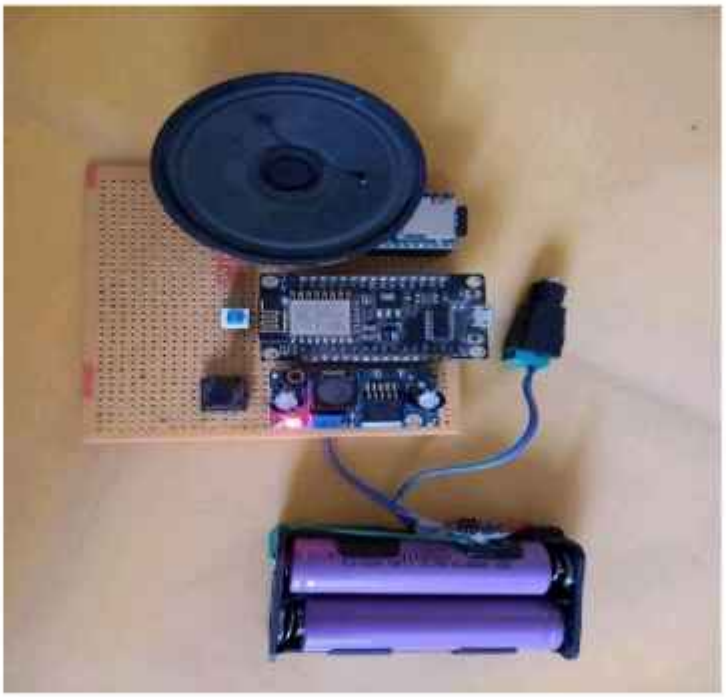

Figure 6.6: Prototype Setup

1. **Li-ion 3.7V Cell (2 qty)**
   - Description: Lithium-ion batteries are rechargeable and have a high energy density. A 3.7V cell typically provides sufficient voltage for many small electronics.
   - Use: These batteries can power devices like sensors, microcontrollers, and modules.
2. **2-Cell Holder**
   - Description: A battery holder designed to accommodate two Li-ion cells. It securely holds the cells and provides connections for power.
   - Use: To safely connect two Li-ion batteries in series or parallel configurations depending on the voltage and capacity requirements.
3. **Push Button**
   - Description: A simple switch that completes or interrupts a circuit when pressed.
   - Use: Often used to activate certain functionalities in projects, like turning a device on/off or triggering an event.

4. **LM2596 Buck Converter**

- Description: A step-down (buck) voltage regulator that converts higher input voltage to a lower output voltage efficiently.
- Use: To power devices from a higher voltage source (like two Li-ion cells) and regulate the voltage to the required level for other components.

5. **NodeMCU ESP8266**

- Description: A microcontroller with built-in Wi-Fi capabilities, based on the ESP8266 chip.
- Use: Used for IoT applications, it can connect and communicate with other devices over Wi-Fi.

6. **General Purpose PCB (4x4)**

- Description: A small Printed Circuit Board for prototyping.
- Use: To assemble and connect various electronic components in a project.

7. **DFPlayer Mini MO3 Module**

- Description: A small MP3 player module that can read audio files from a memory card.
- Use: To play sound or audio when triggered, useful for integrating audio into projects.

8. **Speaker**

- Description: An audio output device that converts electrical signals into sound.
- Use: To reproduce audio played by the DFPlayer Mini module within the project.

9. **4GB Memory Card**

- Description: A storage device that can hold digital data, such as audio files.
- Use: To store audio files for playback by the DFPlayer Mini module.

10. **2S Cell BMS (Battery Management System)**

- Description: A system that manages the charging and discharging of rechargeable battery cells connected in series.
- Use: To ensure safe operation, prevent overcharging, and extend the life of the lithium-ion batteries.

Overview of Functionalities

1. **Women Safety Features/Applications:**

- The interface suggests a women safety app that can send alerts to emergency contacts using location information, which is validated by the coordinates given.
- There are functionalities for sending alerts and emergency messages, indicating immediate help features.

2. **Siren Functionality:**

- The siren feature allows the user to play, pause, or stop an alarm sound to alert others in case of danger, enhancing safety.

3. **Video Tutorials:**

- The app includes a section for video tutorials, likely teaching self-defense techniques.

4. **Hardware Integration:**

- The physical layout shows the integration of a microcontroller, speaker, and powered circuit.
- This setup is designed to handle various functionalities like sound output and communication, likely with the usage of the NodeMCU for Wi-Fi-based operations. By combining these components and functionalities, the overall system aims to enhance personal safety through alerts, audio signals, and educational resources.

CONCLUSION AND FUTURE SCOPE

Conclusion:

The SheShield project successfully developed a portable, affordable, and reliable women safety device integrated with an Android mobile application. By combining loud emergency alerts, live location sharing, manual siren controls, and self-defense resources, the system provides quick, effective responses during emergencies.

Throughout development and testing, the device proved capable of functioning with minimal delays and high stability. The project highlights the potential of IoT and mobile technology working together to create real-time, life-saving systems.

The structured approach toward hardware-software integration, user-friendly design, and web resources makes SheShield a complete and practical solution for improving personal security.

Future Scope:

- Integration with Law Enforcement: Future versions can include direct communication with nearby police stations and public safety systems.
- Advanced Location Tracking: Incorporating AI for predictive tracking to detect suspicious behavior patterns.
- Voice Activation: Allow triggering emergency alerts using specific voice commands without needing to press the button.
- SOS Video Streaming: Start automatic video recording or live streaming to contacts during emergencies.
- Extended Battery Life: Optimize the hardware for longer standby time without charging.
- Multi-Platform Application: Develop the app for iOS along with Android for a broader user base.

REFERENCES

1. Rajesh Kannan Megalingam, K. Jyothsna, T. S. Aparna, T. Anjali, M. Meera, S. D. Amrutha, "IoT- Based Women Security System," SpringerLink, 2021.
2. Vidhi Tyagi, Shivam Arora, Sattyam Gupta, Vijay Kumar Sharma, Vimal Kumar, "Smart Personal Safety Device for Women," IJERT, 2020.
3. Dhruvil Parikh, Pallavi Kapoor, Shital Karnani, Sudhir Kadam, "Wearable Safety Device with Alert System," ResearchGate, 2019.
4. M. Swami Das, A. Govardhan, D. Vijaya Lakshmi, "Emergency Alert System for Personal Safety," SpringerLink, 2022.
5. R. A. More, Aditya Jain, Patil, "Smart Women Safety Wearable," ResearchGate, 2018.
6. Neeta Gupta, Vinita Shukla, Harold Jan R. Terano, Sajid Mahmood, Pavan Mishra, "IoT-Based Safety Alert System," ResearchGate, 2020.
7. Devi D., Pavithra M., Monalisha K., Kirthana T. S., "Personal Safety Systems for Women Using IoT," RSPSCIENCEHUB, 2021.
8. N. Penchalaiah, M. Susmitha, C. Vinay Kumar Reddy, D. V. Pavan Kalyan Rao, D. Sreelekha, "IoT Based Women Safety with Smart Wearable," RSPSCIENCEHUB, 2019.
9. B. Vijayalakshmi, S. Renuka, Pooja Chennur, Sharangowda Patil, "Women Safety System Using SMS Alert," ResearchGate, 2017.
10. Mohamad Zikriya, M. G. Parmeshwar, R. Shanmukayya, Shraddha Math, D. Jayashree, Mallapur, "Automatic Alert System for Women's Safety," ResearchGate, 2022.
11. S. A. More, R. D. Borate, S. T. Dardige, S. S. Salekar, D. S. Gogawale, "Smart Phone-Based Personal Safety System," International Journal of Advance Research in Science and Engineering, 2020.
12. S. Saxena, S. Mishra, M. Baljon, S. K. Sharma, P. Goel, "AI-Based Safety System for Women," Computers, Materials & Continua, 2021.

13. B. Vijayalakshmi, S. Renuka, Pooja Chennur, Sharangowda Patil, "Self-Defense Based IoT System," International Journal of Research in Engineering and Technology, 2019.
14. M. Swami Das, A. Govardhan, D. Vijaya Lakshmi, "Women's Safety Using GPS and IoT," Springer, Proceedings of ICDSMLA, 2022.
15. M. Swami Das, A. Govardhan, D. Vijaya Lakshmi, "Women's Safety Using GPS and IoT," Springer, 2022.
16. Vidhi Tyagi, Shivam Arora, Sattyam Gupta, Vijay Kumar Sharma, Vimal Kumar, "Design and Development of a Personal Safety System for Women," International Journal of Advanced Science and Technology, 2021.

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SheShield

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Abstract: Due to growing worries surrounding personal safety, especially that of women, there now exists wearable technology that guarantees discreet protection. This paper discusses an IoT-enabled personal safety device comprising a concealed camera, SOS messaging system, and taser self-defense ring. Incorporating dependable parts such as A9G Board, the device along with a LiPo battery guarantees optimal functioning during emergencies. The solution fills the void left by previous safety technologies in the aspects of portability, accessibility, and reliability. By harnessing IoT and real-time tracking, the device promises effective safety coverage to an extensive audience including those in rural regions. This work aids the expanding task of IoT-enabled personal safety solutions and sets the groundwork for further developments in the domain of wearable security technology.

Keywords: IOT, Women Safety, Industry 5.0, Sustainable Technology, Combating Sexual Assaults, ARM STM32

I. INTRODUCTION

There has been a lot of awareness of protection from violence and harassment of women in the last few decades. And with Industry 5.0 and sustainable technology, one can come up with innovation in the devices and systems for women safety. It begins with an objective, that is, to design a device that would be portable but could smoothly communicate with the smartphone or any internet-connected device. The neighbor alert feature ensures immediate assistance during emergency through the system. The fundamental components of this detection and communication system are GPS receiver, microcontroller, and GSM modem. The GPS receiver obtains the appropriate location information, such as latitude and longitude, from the satellite signals. These are further processed by the microcontroller and sent through GSM. The GSM modem will process the received data and send an SMS message to the mentioned mobile number. In the case of threat, the woman can only activate the system by a button in the device itself. It will activate the complete system and send a message with the location of the woman using GSM and GPS technologies. Apart from that, the system comes with an added feature of a relay module power voltage system which provides it with an additional layer of defense. An attempted malicious access to the woman's safety would activate the system, and it produces an incredibly powerful shock. It is this design that enables women to really guard themselves. The system, on the other hand, provides the SMS reply feature that none of the reported systems in the literature has [1], [2]. It allows users to send any type of message to the device's SIM card and receive an auto reply SMS with the device's current location. The system for the relay module power voltage, underlined by this research also improves women's safety by deterring the action. The problem solution is to be taken in a way that it would give women an easily portable gadget that could help them for safety. Our project focuses on the provision of a Smart gadget based on IoT solutions, which not only helps a woman escape critical situations but also provides justice to women by capturing the image of the culprit in case any harassment takes place. The necklace has a hidden camera that takes any type of misshaping and saves it in an SD Card. This also has an SOS message service that sends the messages to the defined contact list and the nearest police station. The bracelet comprises taser equipment that provides non-lethal electric shock to save self from attacks. The paper is about this solution that is further detailed for its implementation.

The rising need for personal safety solutions has created the impetus for advancement in wearable technologies. With multiple incidents of violence and crime, especially against women, it has been emphasized that there is a need for discreet, easily accessible, and reliable safety solutions. Conventional safety measures, like mobile apps and pepper sprays, have limitations relying on user intervention and have only limited effect within high-risk situations.

Details of the evolution of an Internet of Things-enabled safety device that gives both preventive and reactive security measures in regard to the IoT safety device. The IoT safety device incorporates basic elements such as GSM/GPS modules, real-time alert mechanisms, and discretion in design to heighten efficacy during emergencies. The proposed system envisions lending support to enhance the capability and accessibility of personal protection technologies, providing a dependable safety solution that does not put active intervention on the part of users in critical instances into consideration.

II. METHODOLOGY

Identification of Existing Solutions and Technologies

A good starting point is to identify and learn from the already existing solutions or technologies that work towards enhancing women's safety. These could be wearables, mobile applications, or IoT-based solutions. It should focus on appreciating the diversity of the solutions, their technological basis for example GPS, GSM, IoT, and their features such as notification systems, self-defense systems, and documentation systems.
Such research in this area should be considered through articles, patents, and reviews of the products in order to know what are the most advanced solutions in this area. It helps in classifying the solutions with respect to their objectives, efficiency, and level of technical sophistication. For example, one such group of devices incorporates silent alerting devices whereas others are built around offensive devices like tasers and pepper sprays. The purpose is to build a platform that can evaluate and analyze multiple methods so as to determine the weakness of the available solutions.

Feature Comparison or Limitation

Comparison Once existing solutions Met various needs have been analyzed, the Comparison should follow. This means creating a unified set of criteria onto which different devices and systems can be compared, including, among others, operator initiate notifications, automated response, geographic information, or physical protection. Further, indicate the constraints, such as efficacy, ease of use in life-threatening situations, cost, and dimensions. Describe the framework that was applied to guide the development of tables or matrices to rank the solutions in terms of key determinants such as how satisfactory the solution is in relation to its intended purpose, availability, and ease of use. Other limitations, including false alerts, dependence on the internet, and the reach of emergency contact persons, can also be helpful in reaching a conclusion as to what should be changed. This evaluation process leads to a kind of outlining suggestion at the beginning of improving or suggesting new methods.

Survey of User Requirements and Behavioral

Insights Intriguingly, one of the promising ideas for the project is safety devices inferring interviews or surveys with prospective users, Women of various age and social groups, engaged in such an activity, are interested in how safety devices can operate and whether their safety aspects can be relied on. They are interested in activation procedure, camera modules, tasers, loud alarms, and all other high-stress usage aspects that can be useful in a particular difficult situation While, for instance, most of these studies discuss designing interactions where the user is in a state of continuous calm, there has to be scenarios that require users to be in states of panic and, at such emergencies, use these devices. It could alleviate some of the design work in the questions regarding shock devices or voice commands against certain subjects to consider soft or hard components. With all this detail, it's only natural that the preference should be the determining factor in deciding the right mix of ends and means.

Technological Feasibility and System

Design Technological feasibility could be determined for a single device or system, which could include several features. Components to be chosen include GPS modules in case of location tracking, GSM modules in case of messaging, and sensors for emergency detection. Energy requirements and durability of system components are calculated, so it is feasible in most environments. Create prototypes by basing them on a design specification that can be achieved from the analysis and users' surveys. Test them, therefore, to reasonably and responsibly respond to simulated emergency conditions. The methodology should document the approach followed in redesigning the system to make it more energy- efficient and avoid any communication breakdown between the hardware and software sides.

Testing, Evaluation, and Feedback

Finally, the proposed solution should be heavily tested with a focus group to evaluate its effectiveness and reliability. Real life scenarios, such as mock emergency situations, can be used to test the system's performance in terms of detecting threats, sending alerts, and how the system can provide self-defense options to the users. It should collect user feedback on matters such as the latency of the device, complexity in activation, or discomfort while using the device. These findings should be inducted during iterative development cycles for upgradation of the device. Validation against benchmarks and legal standards is also important testing to ensure that the final product adheres to the norms of safety and ethics.

Proposed Methodology

This methodology uses a consistent and systematic approach that outlines the functionalities, effective features, and user- friendliness of the device in question. Such steps include:

- **Identifying Existing Solution Gaps:** A detailed analysis of currently available safety devices was done to establish their weaknesses in usability, reliability, and effectiveness in real-life situations.
- **Understanding User Needs:** Surveys and interviews were conducted to assess the users' main concerns and expectations. Implementation of vital features such as invisibility, ease of activation, and consistent emergency alerts was prioritized.
- **Assessing Technical Feasibility:** Suitable hardware components and software were chosen to ensure durability, efficient energy management, and smooth connectivity.
- **Prototype Development with Optimized Components:** The prototype was designed to incorporate a GSM/GPS module, hidden camera, taser ring, and a long-life battery for extended usage.
- **Optimizing Power Management:** Sufficient low-power operation would result when the device is not being used but is in a standby mode; this way, the battery is not drained so quickly.
- **Integrating Emergency Alert Systems:** Alerts would be sent out over a real-time channel to designated contacts as well as law enforcement agencies guaranteeing a quick response in an emergency.

The proposed methodology represents the functioning, practicality, and efficiency of the device as mentioned in real-life applications and further testing will all work toward enhancing power management, boosting communication module reliability, and enabling user friendly operations.

III. LITERATURE SURVEY

The literature review looks at existing IoT Orientated Safety Solutions, Wearable Devices, and Mobile Applications which incorporate GSM, GPS, and various other security features. The comparative analysis brings out limitations in aspects such as power restrictions, poor connectivity, and adaptability by the user. There had been several of previous studies which operated on mobile-based applications or standalone GPS trackers that usually do not have an integrated approach for either real-time tracking or emergency response mechanisms.

Researches in the arena of IoT-based safety highlight the significance of integrating several aspects of safety into the system, namely covert surveillance systems and automated signal alert systems. However, the major issue with most existing solutions is short battery life, inability to operate in areas with unreliable internet connectivity, and the difficulty in executing emergency alert signals discreetly. The proposed system is expected to overcome these obstacles and emerge victorious in a device that merges various safety features into one compact and efficient device-a force to reckon with.

"The Role of IoT in Woman's Safety: A Systematic Literature Review," by Muhammad Shoaib Farooq et al. 2023 Systematic literature review for utilization of IoT-based devices to promote women's safety. The current paper includes only the research articles released within 2016 and 2022 with characteristic, wearable, sensors and machine learning algorithms in IoT-based devices. Several significant facts have come up that discuss the application of several sensor systems, which are aware of situations involving distress besides IoT incorporation as it contributes towards real-time monitoring, alert generation. It has indicated some gaps in the existing solutions as proposed by the study and has further presented an architectural model to complement the safety systems of women.

D.G. Monisha et al., "Empowering Women's Safety with Smart IoT Technology: A Robust Approach," 2016. The present study discusses the about an IoT-based device termed "FEMME", which is proposed to enhance the safety of females while working. The features of the developed device include location tracking, emergency alerting, and real-time monitoring. It underlines that wearable technology allows immediate assistance in any form of emergency. It has also outlined the integration of communication modules and sensors needed for effective working.

"Safety Devices for Women": A Review Paper by Parikh et al. (2022) The paper summarizes the safety devices developed for women. The overview undertaken includes design, functionality, and the efficacy of various such devices designed. The integration of GPS, GSM, and IoT technologies along with features like location tracking, emergency alerts, and self-defense mechanisms in these devices has been discussed. Challenges in adoption due to issues about user acceptance, cost, and technological limitations have also been addressed.

Sharma and Gupta, in the 2022 paper "A Comprehensive Survey on IoT based Smart Safety Devices for Women," have reviewed the existing IoT-based safety devices and applications designed to enhance the security features for women. Several modules consisting of GPS, GSM, along with other sensors, and their respective hardware and software components, are discussed. Although most of the proposed solutions had very elementary functionalities, the research could focus on underlining the necessity of having capabilities such as real-time location tracking and communication through such devices.

In their 2020 literature review, Rao and Kumar discussed the development of women's safety and security systems by highlighting several technological advancements aimed at improving women's safety, such as mobile applications and wearable devices. Over the last few years, these solutions have been more and more integrated with IoT technologies that enable real-time monitoring as well as mechanisms for accelerated responses. However, they also mentioned the challenges identified, for example, assurance of stable internet connectivity and user acceptance, thus advising that future developments strive to overcome them so as to strengthen safety systems.

Patel and Singh reviewed several mobile apps developed towards women's safety in their 2023 review, "Women Safety App: A Review of Existing Applications and Future Directions." Among the features they used in making this comparison were emergency alerts, sending of locations, and inclusion of police agencies. The study concluded that although most applications are providing the necessary safety features, their user privacy and data security issues become a major concern, along with the requirement of continuous internet access. The authors proposed more applications to focus on user-centric designs and high-tech features that could automatically predict and defend against threats such as artificial intelligence.

Verma and Sharma, in their 2022 paper, "IoT Role in Women Safety: A Systematic Literature Review," covered the use of IoT technologies for the safety of women. In their review of various IoT-based devices and systems, they made a main focus on technological frameworks, problems in the implementation process, and other cases of effectiveness. Emphasis has been given by them on microcontrollers, sensors, and communication modules in building integrated safety solutions. The authors concluded that though the IoT has promising avenues in enhancing the safety of women, it needs to address issues such as energy efficiency, miniaturization of devices, and cost-effectiveness in order to get widely adopted and effective.

Dr. Bhaumik et al, in their paper "Smart Bag for Women Security," (2023) proposed a unique solution of IoT-based using smart bag for women's safety. The smart bag comprises the incorporation of a GSM module, GPS module, emergency switch, high-intensity light, siren, pepper spray, and a high-voltage shock generator. The device sends a distress message with location coordinates to the pre-registered contacts when activated by pressing an emergency switch. The authors pointed out the advantages of it being discreet and portable, a plus in comparison to available wearable safety devices. Its maintenance and cost-effectiveness are identified as major drawbacks.

Md Arfanul Haque et al. proposed a GPS-GSM-Based Women Safety Device in the work presented at 5th International Conference on Sustainable Technologies for Industry 5.0 held in the year 2023. The system facilitates to send the distress signal along with location details to the set of numbers through the press of the button. The device also allows the sending of high voltage electrical current to assailants' bodies, through which it makes them receive an electric shock. Through their research, it will bring forth the issues on how advanced these sustainable technologies really are and what they can actually provide to Industry 5.0 in terms of personal safety. They can further enhance the user's experience by suggesting miniaturization along with a voice-controlled system.

Suraksha: The Ultimate Self-Defense Kit for Women, written by Aditi Nirapada Chowdhuri in 2023, is this new wearable device that incorporates a camouflaged camera, SOS messaging, and a taser ring to counter attackers. This will also activate the emergency contact list and inform law enforcement of a woman's precise location during an incident. The paper bridges limitations in the present safety solutions - false alarms and reliance on other devices like smartphones - by investigating the application of IoT-enabled systems. As shown by the results of Chowdhuri, the defense mechanism with unobtrusive accessories is effective and usable.

IV. Problem Statement

Overview of the Issue: Crimes such as harassment, assault, and abduction are very rampant around the globe, hence raising the concern of women's safety. Statistics indicate that most women go about their daily activities feeling insecure or uncomfortable at odd hours, especially in urban settings.

Key Challenges:

Delayed Emergency Response: Many cases do not reach authorities due to the inability of women to access help in a timely manner. Lack of Awareness or Access to Resources: Women are not aware of available resources or safety solutions in some regions. Social and Cultural Stigma: There is stigma or disbelief by the public, which is a factor that discourages women from reporting incidents, and it is hard to monitor and deal with real-time threats. Inadequate Monitoring and Enforcement: Police may lack the data, resources, or technological support necessary to respond promptly.

Existing Solutions

Wearable Safety Devices Wearable devices are popular for personal safety because they are portable and easy to use. Examples include:

- **Smart Jewelry:** Items like rings, bracelets, or pendants that can send distress signals to contacts when pressed.
- **Panic Buttons on Wearables:** Devices like smartwatches and keychains with panic buttons that trigger an alert or call emergency services.
- **Mobile Apps:** Apps allow for instant help and tracking capabilities such as:
- **SOS Alerts:** With one tap, the app can send location and alerts to emergency contacts.
- **Location Tracking:** Real-time tracking allows family or friends to monitor the user's location.
- **Safe Route Mapping:** Some apps will give suggestions for safe routes or information about unsafe areas. Self-Defense Tools Non-lethal tools can be used in emergencies to help deter an attacker. These include:
- **Pepper Spray and Stun Guns:** Commonly carried for self-defense in emergencies.
- **Personal Alarms:** Loud alarms that can attract attention and deter an assailant.

AI and IoT-Based Solutions Emerging technologies offer innovative solutions, such as :

- **AI-Powered Threat Detection:** AI algorithms can detect unusual behavior in public spaces, alerting authorities or users.
- **IoT Integration in Wearables:** The devices connected will communicate with nearby systems or people when a user is in distress, helping in faster location tracking and response.

Deployment

Device Design and Functionality: Small and unobtrusive: Safety devices should be small, lightweight, and easy to carry or wear.

Battery Life and Connectivity: Devices should have long-lasting batteries and reliable connectivity, even in areas with poor network signals.

Ease of Use: The device should be simple enough to activate under stress, with features like single-button activation or voice command.

Integration with Emergency Services

Direct Access to Law Enforcement: The devices can be connected with emergency services that can provide a direct alert to local police or emergency response.

Interoperable Systems: The safety devices should ideally be able to communicate with more comprehensive systems, such as public CCTV networks, IoT street lighting, and GPS tracking systems, for enhanced safety.

Community Education and Training

Awareness Programs: Educating women and communities about using safety devices can increase adoption. Training Programs: Users should be trained in operating devices effectively and should know about different resources and response protocols.

V. System Design and Implementation

The system design is the integration of both hardware and software components that synchronize to render a flawless safety solution.

Hardware Components:

- A9G Board: A microcontroller driven with built-in GSM/GPS availability.
- LiPo Battery: An irreplaceable long-life battery that enhances equal levels of usability.
- GSM/GPS Module: This module tracked and communicated to emergency contacts in real-time.
- Hidden Camera: Under-the-radar footage that enables evidence capturing during emergency situations.
- Taser Ring: Used as a handy self-defense tool to temporarily paralyze the attacker.

Software Integration:

- Cloud-based connectivity allows for real-time location tracking and alert notifications.
- Implemented security measures include employing encryption and secure communication channels for sensitive information to reduce the possibility of unauthorized access.
- AI-based anomaly detection can be useful for proactive threat identification.

Power Management:

- The power consumption is geared up to optimize battery life.
- There are power-saving modes that will be entered while in standby mode.

VI. Results and Analysis

Initial prototype testing focuses on:

- **Battery Performance:** Under real conditions, measure operational efficiency in relation to varying levels of usage and standby modes.
- **Connectivity Reliability:** Assess coverage in urban and rural areas, signal strength, and response times.
- **User Testing:** Solicit feedback from potential users in relation to usability, comfort, and efficacy.
- **Response Time Analysis:** Assess the time it takes for alerts to reach emergency contacts under different network conditions

While the proposed validation is considerably robust, in the future, user acceptance tests and field simulations will need to be included to further cement the empirical validation. Input on performance metrics, such as delivery time and camera response, will also be considered.

VII. USES

Enhanced Personal Safety and Security:
This IoT-based device offers a robust safety solution specifically tailored for personal security needs, with particular benefits for women. Given its compact, keychain-like form, the device is easy to carry and access in urgent situations. The integration of GPS tracking allows real-time monitoring, which can be crucial for loved ones or authorities in locating the user quickly in emergencies. This device allows users to seek help when their personal safety is threatened or in distress, by offering them timely and accurate information on their location, thus improving their security.- This product also meets the demand for a personal safety device as it responds to the emerging trends in wearable safety technology, which aim to find a balance between portability and effective, real-time response systems.

Easy and User-Friendly Design:
Unlike many other safety devices which are so complex and even difficult to operate—especially for those unfamiliar with current technology or located in more rural or lower-tech environments-this device was designed with ease of operation in mind. With simply an emergency push button and a basic on/off switch, the design minimizes complexity and maximizes function. It's especially beneficial for individuals who may be uncomfortable operating smartphone apps or devices that contain a multitude of features. This simplicity allows users regardless of age and technical skills to benefit from the device without using special knowledge. The designs allow users to instinctively use the device in such high-stress situations so that it can be readily accessible to a larger crowd.

Prudent Emergency Alert System
It's equipped with the A9G Board for GPS and GSM capabilities, ensuring that when a user needs help in emergencies, location-based alerts would be sent to pre-set contacts. This feature has given peace of mind for users and their loved ones, as it allows fast response in emergencies. This would enable the device to send location data over a cellular network, thus making it highly adaptable to a range of urban and rural environments where internet access may not be reliable. This is also a common problem in most existing devices, which is that the alerts are always dependent on smartphone apps or data services, which have limitations of connectivity or battery life. By supporting separate GSM- based alarms, this device enables emergency communication better, in comparison to others and decreases the probability of losing important information when the crucial moment calls for urgent message sending.

Discreet and Multifaceted:
Having a design of being not so large, this will fit many times as clipped on to the keyring, into the handbag, and so forth, the device could even be a separate component attached to another equipment. This discretion serves a dual function: it not only makes the device portable but also less detectable to potential aggressors, who may otherwise try to interfere with or disable a more visible safety tool. This approach draws on insights from similar studies that advocate for wearable devices that blend seamlessly with everyday items, thus increasing their likelihood of being carried consistently by users. The design is versatile to the point that users can fully integrate the device into their daily lives with minimal disruptions so that it remains easily accessible without drawing unwanted attention.

Optimized Battery Operation:
Another common limitation of mobile safety application and many wearable devices is their dependency on battery life, which often depletes at inopportune times. It has therefore employed a LiPo battery and an integrated voltage regulator with HT7333, optimized for power usage in terms of prolonging the duration. This setup allows for active and reliable performance during prolonged periods, hence minimal frequency of charging, thus available when needed most. Using this optimized battery configuration, the device circumvents one of the most identified downsides of smartphone-based safety apps, which requires ample battery power. The low-power design ensures that the device will be more useful, especially for those who may not always be able to get convenient charging options.

VIII. Ethical and Legal Considerations

The introduction of safety devices based on the Internet of Things involves a whole range of ethical and legal questions:

- Privacy and Data Security: Making sure user data are encrypted, using strong encryption, and not accessible to unauthorized users.
- Legal Compliance of Taser Device: Knowledge and compliance with regional legislation regarding self-defense instruments.
- Ethical Use of Hidden Cameras: Balancing the need for safety with the legal right of privacy to prevent their misuse.

These considerations provide the frame for upholding the legality of operation, accountability, and trust on the part of the user.

IX. CONCLUSION

In conclusion, this IoT-enabled GPS tracking device for personal safety is thoughtfully designed to address shortcomings that most personal security devices possess. Through an analysis of previous research and products, it has been evident that common problems include complex user interfaces, reliance on smartphone connectivity, limited battery life, and not enough options for a discrete design. This device is a practically user-friendly device to overcome these obstacles. The compact form factor of this device, together with standalone GPS and GSM functionality, makes it quite independent in relation to smartphones when phone levels are low, or else the network connectivity becomes unreliable in many cases. This device puts out unnecessary features, such as a quick emergency alert and location tracking, so that it remains simpler and more efficient to use in real life. This focus on simplicity and efficacy is a practical innovation in personal safety, especially for females who may face different issues of security in their day-to-day lives. The low-profile design, inspired from wearable safety technology trends, permits users to carry the device concealed, thereby enhancing its utility as an unobtrusive protective gear. Moreover, using reliable components such as an A9G Board and a long-lasting LiPo battery, this device ensures dependable performance in emergencies. Such technical choices reveal a commitment toward producing a reliable safety product which shall reassure the user and their relatives. This IoT-based personal safety gadget has all potentialities to bridge the gaps of prior solutions, so one has a reliable, accessible, and discrete tool to boost the security. It can be made suitable for a wide range of users, such as people from rural areas or even people with limited access to high-end technology. This is where portability, ease of use, and reliability will play a significant role in its potential contribution to the growing field of IoT-based personal safety solutions. This device, once fully developed and tested, will make it a model for further advancements in wearable safety technology, providing a safer environment for all.

The Internet of Things modern safety device offers a discreet yet reliable security system. Its integrated functionalities- real-time tracking, emergency alerts, and self-defense-makes it a total safety tool. Future research will advance the design, software security, and legal aspects for greater deployment. The technology will also have a wider impact toward further lock security against crime and more personal protection.

X. Overall Evaluation:

Strengths:

- An approach properly motivated and problem defined.
- A good, general review of the literature and methodology in this area.
- Very well put together with reliable IoT components.
- User specifications and technical feasibility discussed nicely.

Areas for improvem:

- Performance metrics such as network response time and battery efficiency must be included.
- Ethical and legal concerns related to data security and taser devices.
- Experimental validation and real-world testing should be more comprehensive.

This paper makes a great contribution to IoT-based safety solutions and also opens new avenues for further developments in wearable security technology. For further studies and practical implementation of safety applications, the findings and suggested improvements mentioned will be a reference point.

XI. REFERENCE

i. **Farooq et al. [1]** conducted a systematic literature review highlighting the various roles IoT plays in enhancing women's safety. Their study emphasized the integration of smart devices and communication technologies to prevent potential threats and ensure rapid emergency responses.

ii. **Sharma and Gupta [2]** provided a comprehensive survey of IoT-based safety devices for women, categorizing them based on technologies used, their effectiveness, and the features implemented to provide real-time assistance and alert mechanisms.

iii. **Rao and Kumar [3]** presented an evolutionary overview of women's safety and security systems. Their literature review explored past advancements and pinpointed existing limitations in wearable and mobile-based safety devices.

iv. **Patel and Singh [4]** reviewed existing women safety applications, highlighting the features and usability aspects of each. They also proposed future directions for improving user experience and enhancing system responsiveness.

v. **Verma and Sharma [5]** conducted a systematic literature review focusing on the role of IoT in improving women's safety. Their analysis covered various smart technologies and emphasized the need for more personalized and AI- driven solutions.

vi. **Bhaumik et al. [6]** developed a smart bag concept aimed at ensuring women's safety. Their innovation combined sensors, GPS, and alert modules to offer real-time location tracking and threat detection in public spaces.

vii. **Haque et al. [7]** proposed the design and implementation of a GPS-GSM-based women safety device. Their system facilitates rapid transmission of distress messages and location data during emergencies, offering a practical solution for assault prevention.

viii. **Chowdhuri [8]** introduced *Suraksha*, a self-defense kit that integrates multiple safety tools and communication systems. This innovative approach focuses on empowering women with both active and passive defense mechanisms.

ix. **Monisha et al. [9]** designed *FEMME*, a wearable device and mobile application for women's safety. Their system integrates multiple sensors and a communication module to trigger alerts and share real-time data with emergency contacts.

x. **Swapnarani et al. [10]** developed a self-defense system with location tracking capabilities. Their approach combines hardware and software components to provide an all-in-one solution for women's security in both urban and rural environments.

ANNEXURE A

Paper Published

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Aditi Pawar <aditi030403@gmail.com>

PEIS 2025: Notification of your paper ID 221: Acceptance

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Dear ADITI NAGESH PAWAR,

Thank you for submitting your manuscript to 3rd International Conference on Power Engineering and Intelligent Systems (PEIS2025) to be held on March 08-09, 2025 at National Institute of Technology Uttarakhand, India in Hybrid Mode. Proceedings of PEIS 2025 will be published in the SCOPUS Indexed Springer Book Series, "Lecture Notes in Electrical Engineering (LNEE)".

We are pleased to inform you that based on reviewers' comments, your paper titled "Women Safety Device using IoT" has been accepted for presentation during PEIS 2025, and publication in the proceedings to be published in Scopus-indexed Springer Book Series "Lecture Notes in Electrical Engineering" subject to the condition that you submit a revised version as per the comments, available at Authors CMT account. It is also required that you prepare a response to each comment from the reviewer and upload it as a separate file along with the revised paper.

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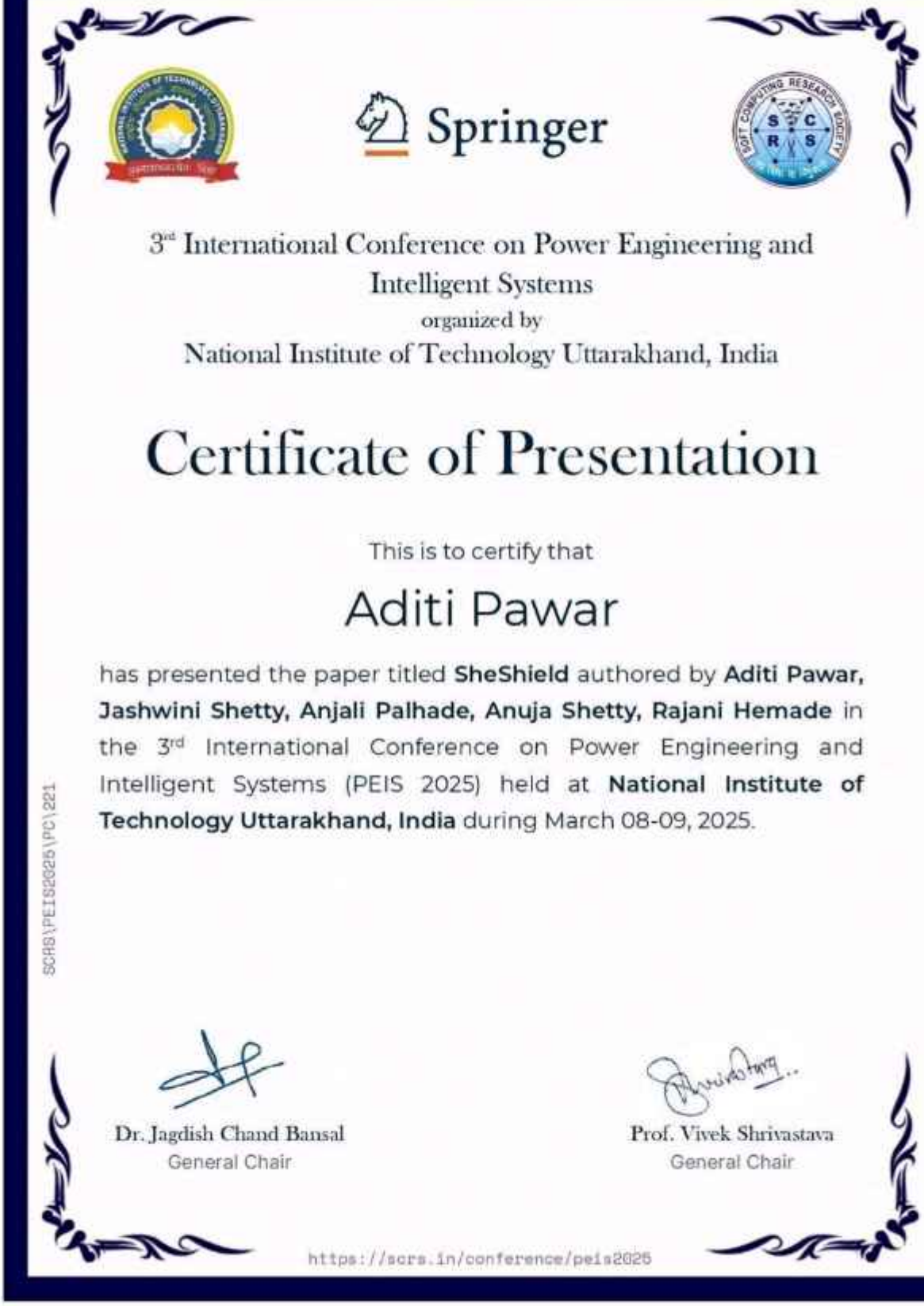

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SheShield: Women Safety Device

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***Abstract*— SheShield is an intelligent safety solution designed to assist women during emergencies. It is attached to a small device and a mobile application. When one presses the emergency button on the device, it blows a loud siren and transmits the user's real-time location and an SOS alert to trusted contacts via Wi-Fi. The application also contains options such as a mock alarm to cause confusion in threatening circumstances and displays self-defense videos aggregated from YouTube. A NodeMCU ESP8266 chip enables the device to communicate with the application, whereas the application stores contacts and monitors the location of the user. SheShield provides an easy method to call for assistance and allows trusted individuals to track the user's whereabouts in real time, hence making it simple to remain safe.**

Keywords*— *Women Safety, IoT Device, Emergency Alert, Real-time Location Tracking, SOS System, Self-defense Tutorials, NodeMCU ESP8266, Mobile App Integration.

INTRODUCTION

SheShield is an intelligent emergency alert system that has been created to solve the safety issues women experience. Even with all the technology, crimes against women remain a major problem. Old safety strategies, such as calling for assistance, usually don't work when situations become threatening. At that point, it may be difficult to even dial a phone. That's where SheShield comes in—offering a fast and simple method of obtaining assistance when it is most needed.The SheShield system is easy. It's a tiny device with a single button. Press the button, and it alerts with an alarm and sends notifications to loved ones. This indicates assistance is a button press away, even under high-stress conditions. The system is simple to use and understand, and so won't present any additional steps to remember, ideal for anyone who may struggle to use more complex systems in an emergency.

SheShield utilizes the Internet of Things (IoT) and is linked to a mobile application. In this manner, the location of the user can be traced in case of an emergency, allowing responders to reach the correct location more quickly. The application also allows users to establish emergency contacts, ensuring assistance reaches the correct individuals when required.SheShield benefits from the Internet of Things (IoT) and integrates to a mobile app. With that, a location of the user can be mapped during an emergency, facilitating rapid response from first responders to get to the location quickly. SheShield also provides users with a means of saving emergency contacts and ensuring help finds its way to the intended parties when there's an emergency.It is compact, portable, and easy to slip into your clothing or bag, so you can carry it discreetly without anyone realizing it. It is made to provide security without causing distraction—keeping you safe without interfering with your daily routine. With SheShield, assistance is always just a button away, providing peace of mind wherever you might be.

LITERATURE REVIEW

A. The Role of IoT in Women's Safety

This systematic literature review examines the application of IoT-based devices to improve women's safety. The review includes research articles from 2016 to 2022, with an emphasis on wearable IoT devices, sensors, and machine learning algorithms. The article explores how sensor systems can identify distress situations and use IoT for real-time monitoring and alerting. It identifies existing loopholes in existing solutions and suggests a new architecture to resolve these issues, stressing the requirement for better integration of IoT technology in safety devices.

B. Android-Based Women Security App

This study talks about a simple Android app made to help women stay safe. It lets users quickly send emergency

alerts to trusted contacts through an easy-to-use interface. While it's helpful in urgent situations, it doesn't connect to any physical hardware, which limits its reach when the phone isn't easily accessible. Adding wearable device support could make it more useful and reliable.

C. Self-Defense App Using Sensors

This paper focuses on using phone sensors to detect sudden movements and automatically send alerts. It's handy when someone can't reach their phone, but the system can get triggered by accident and send false alarms. There's room to improve how it tells real danger apart from everyday movements.

D. Gradient Boosting Algorithms (XG Boost, Light GBM, Cat Boost)

Gradient Boosting algorithms are a robust class of ML techniques that have been proven to perform better than others in churn prediction problems. In contrast to Random Forest, which constructs trees separately, Gradient Boosting constructs trees sequentially such that each subsequent tree tries to rectify the mistakes ma de by earlier ones. This iterative nature makes the model extremely accurate, particularly for structured/tabular data. There are variations such as XG Boost, LightGBM, and CatBoost that have found Extensi ve usage based on their optimization methods, efficiency, and scalability to big data. Research by Verbeke et al. (2012) and Zhang et al. (2021) indicates that models of Gradient Boosting are better than other classifiers in precision, recall, and AUC when used for churn prediction. These models also provide high-level features like regularization, integrated missing value handling, and parallelism, so they can be used for production environments. They do need hyper parameter tuning to prevent overfitting and obtain optimal performance.

E. Design and Development of a Personal Safety System for Women

The system in this study runs on low power and uses several sensors to spot emergencies and alert contacts. It's good at saving battery and reacting quickly. But it can't send video, which could be helpful for showing what's actually happening. Adding that feature would make it stronger.

F. Voice Activated Emergency App

This app uses voice commands to trigger emergency alerts, which is great when someone can't use their hands. It works well in theory, but struggles with understanding different accents or languages. If it could recognize more languages better, it would be more dependable.

G. IoT-Based Wearable Safety System

This research shows a small, light wearable device that sends alerts right away in an emergency. It's quick and easy to carry around, but doesn't have a wide communication range and doesn't work well with modern smart systems. Making it more connected and compatible could really boost its performance.

H. Self-Defense App Using Sensors

This paper proposes an IoT-based safety device using GPS and GSM modules to send real-time location data during emergencies. A panic button triggers alerts and shares the user's location with saved contacts. The system focuses on affordability, real-time tracking, and quick response.

I. Self-Defense App Using Sensors

This research presents a mobile application for women's safety that sends emergency messages with live GPS location. Features include fake call, siren sound, and emergency trigger options. The app aims to be quick, accessible, and easy to use in panic situations.

METHODOLOGY

The system being proposed is a simple safety solution that involves an IoT device and a native Android app to provide instant assistance during times of need, particularly for women.

HARDWARE

The hardware unit SheShield is designed to act as an emergency alert and safety-triggering system. It is compact, portable, and user-activated. The core objective is to enable quick, autonomous action during distress situations using Iot-based communication.

Key Components and Roles

1. Push button: Acts as the emergency trigger. When pressed, it initiates a chain of events without the need for app access.
2. NodeMCU ESP8266: Serves as the central microcontroller with Wi-Fi capability. It connects to the internet and sends real-time location and alert messages to emergency contacts.
3. LM2596 Buck Converter: Ensures the safe voltage level (3.3V to 5V) required by NodeMCU and other modules, despite battery fluctuations.
4. DF mini MP3 Module + Speaker: On trigger, a loud siren sound is played to alert people nearby and scare off potential threats. The siren file is stored on a memory card and triggered electronically.

5. Battery Management System (BMS) + Li-ion Batteries: Provides reliable power and over-discharge protection, ensuring safety and longevity of the power source.

ANDROID APPLICATION

The Android application complements the hardware by providing remote monitoring and control features. It acts as both a configuration tool and a live safety assistant.

Key Features:

1. Emergency Contacts Storage:
   Users can store multiple trusted contacts in the app.
   These are the recipients of emergency messages and location updates.
2. Live Location Tracking:
   Uses Google Maps API or device GPS to display real-time movement.
   Helps emergency responders or family track the user if an alert is triggered.
3. Manual Siren Control:
   Users can play, pause, or stop the siren remotely via app.
   Useful for scaring off threats without physical access to the device.
4. Web Scraping for Self-defense Videos:
   App fetches latest YouTube videos using scraping techniques or YouTube API.
   Users can learn basic defense techniques directly in-app.
5. Technical Stack:
   Java & XML: Used for app logic and UI design.
   Firebase or HTTP Client: For communication between app and hardware if required.
   YouTube Data API / JSoup (if scraping): For integrating self-defense tutorials.

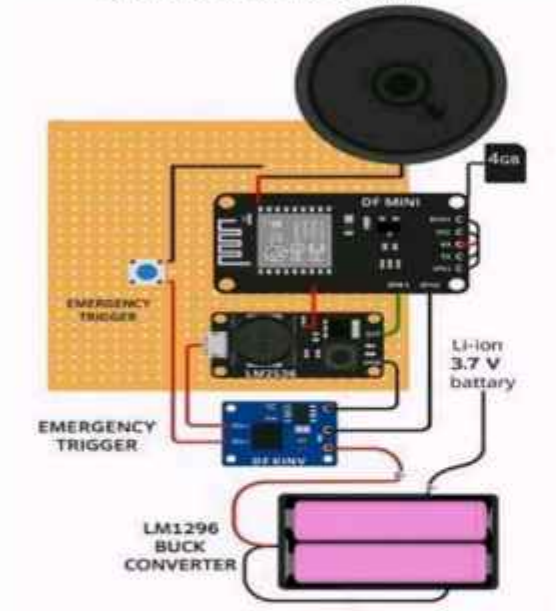


Figure 1. Visual Workflow Representation

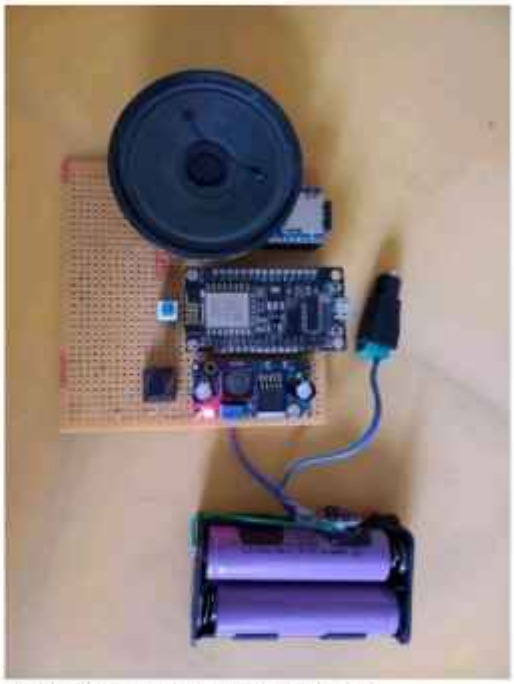


Figure 2. Complete Prototype Setup

SYSTEM ARCHITECTURE

A. Data Collection Layer

The heart of our system is a simple yet effective design that connects the physical button press to a chain of helpful reactions. A push button is physically wired to a NodeMCU ESP8266, which serves as the microcontroller and communication module. On pressing the button, a loud siren sound is triggered through an MP3 module and speaker, and simultaneously, the device transmits GPS-based location data via Wi-Fi to a custom-built Android app. The app then forwards this location to a list of trusted contacts.

The block diagram consists of four key sections: Power Supply, Control Unit, Alert System, and Communication Module.

WORKING FLOW

1 User presses the emergency push button.

2 Device connects to Wi-Fi using NodeMCU.

3 Loud alarm siren is played through the speaker.

4 Location and help message are sent to saved emergency contacts.

5 Mobile app shows live location of the user.

6 User can control a fake siren (play, pause, stop) via te app.

7 Web scraping function fetches and displays YouTube self-defense videos in the app

PROBLEM STATEMENT

1. General Problem

Despite all the tech surrounding us, protecting women — particularly in a crisis — is still a large issue. Many existing tools react too slowly, fail to monitor your location effectively, or do not do enough to deter an attacker. What is needed is a straightforward, low-cost solution that can issue immediate alerts, provide your actual location, and assist you in defending yourself when you most need it.

2. Technical Issue

Most safety apps or devices nowadays either act independently or rely much on cellular networks — and that's where they fail. Here's what typically goes awry:

Theyfail to send rapid notifications to your emergencycontacts.
They lack a loud siren that can instantly alert.
They don't allow you to remotely control the siren via an app.
They don't provide live assistance like instant self-defense tutorials during those panic situations.
And added to that are issues like lackluster battery life, terrible connectivity, enormous cumbersome devices, and high price points

3. Specific Problems for This Project

Problem	Details
Slow Alerts	Alerts to emergency contacts do not get sent timely.
No Real-Time Help	You can't easily access defense videos when you're in a panic.
Connectivity Issues	If Wi-Fi or mobile data is poor, the system may fail.
Battery Drain	Devices drain too quickly.
Bad User Experience	Apps are confusing, overlycomplex, or inflexible.

MATERIALS REQUIRED

The hardware backbone of the device consists of a Li-ion battery setup with two 3.7V cells in a 2-cell holder. A buck converter (LM2596) steps down the voltage to safely power the NodeMCU ESP8266. A push-button acts as the trigger switch. The DF Mini MP3 module plays a pre-loaded siren from a 4GB memory card, connected to a small speaker. The entire system is mounted on a general-purpose PCB.

HARDWARE COMPONENTS:

1. Li-ion 3.7V Battery ×2

2. 2-cell Battery Holder

3. LM2596 Buck Converter

4. Push Button

5. NodeMCU ESP8266

6. DF Mini MP3 Module

7. Speaker

8. 4GB Memory Card

9. 2S BMS for safety

10. PCB (4x4 inch)

SFOTWARE TOOLS:

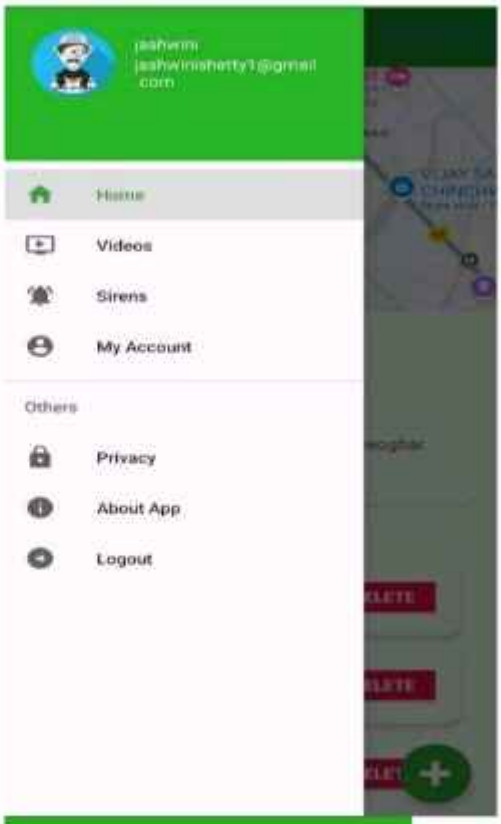
1. ARDUINO IDE: for flashing ESP8266 code

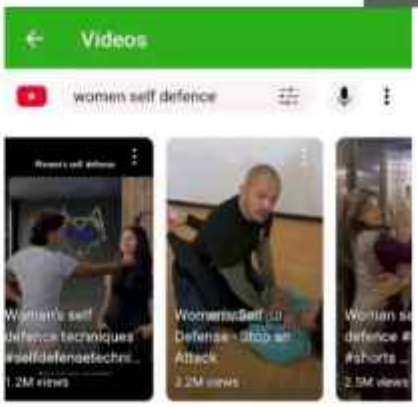
2. Android Studio: for building the mobile app in Java/XML

3. Scraping: built using basic Python scripts to fetch YouTube content.

RESULT

Test Case	Expected Output	Actual Output	Pass/Fail
Press emergency button	Siren ON + Location sent	Siren ON + Location sent	Pass
Manual siren **plays** from app	Siren plays	Siren plays	Pass
Location tracking	Accurate live location shown	Accurate	Pass





Alert: 0

Latitude: 18.6348835
Longitude: 73.7886243

Address: 188/1, 188, Gawade Colony, Geoghar Society, Chinchwad, Pimpri-Chinchwad, Maharashtra 411033, India

Emergency Contacts

+91 77570 44476 DELETE

7387128131 DELETE

+917276385075 DELETE

Women Safety

OVERALL EVALUATION

Strengths:

1, Low-Cost:

The system is affordable in order to make it accessible to everyone. With the use of inexpensive material and keeping the app efficient, it provides safety to everyone.

2. Easy-to-Use:
The application is easy and straightforward to use, even in case of an emergency. It is easy to turn on the alarm, send alerts, and even share one's location with a few taps.

3. Rapid Emergency Response:
The system guarantees that alerts are sent rapidly to emergency contacts. This is important when you require assistance immediately, and the conventional ways may take longer.

Limitations:

1. Wi-Fi or Mobile Data Availability Dependence:
The system relies on Wi-Fi or mobile data to function. If the user is not in a network with good signal or even with internet, the system may fail to function as designed.

2. Potential solutions:
Employ Bluetooth or other technologies to send alerts without the internet.Add a low-power mode so fundamental features, such as the alarm, can function even when there's no data.

Future Scope:

1. AI-Based Threat Detection:
In the future, AI may assist the system to detect threats automatically. For instance, the device may sense suspicious sounds or movements and alert the user without their intervention.

2. Extending Battery Life:
Battery life is important. To make the device last longer, we could use low-power parts and add a battery-saving mode. This would help the device last longer in emergencies, and possibly use solar power to keep it charged.

3. Wearable Integration (Smart Jewelry):
In the future, the device may be included in wearable tech, such as smart rings or bracelets. This would enable users to trigger the alarm or send notifications simply by performing a simple gesture, without having to take out a phone. In the future, the device may be included in wearable tech, such as smart rings or bracelets. This would enable users to trigger the alarm or send notifications simply by performing a simple gesture, without having to take out a phone.

CONCLUSION

The demand for a safe and effective personal safety system for women is evident, particularly during emergencies. Current solutions lack in response time, real-time location, and useful features such as self-defense lessons. This project

seeks to fill those gaps by offering a straightforward yet effective IoT-based safety device with an intuitive mobile app.

By concentrating on instant alerts, location sharing, and real-time assistance, we are able to give users the capability to take action in life-or-death situations. Having the capacity to trigger alarms, issue emergency alerts, and have access to self- defense material at the touch of a button can be the difference between life and death when seconds matter.

Simultaneously, the system provides data privacy, offers users complete control over their contacts and alerts, and guards against misuse. With affordable pricing and user-friendly design, this solution is designed for accessibility and usability. Ultimately, this project has the ability to revolutionize the way women engage with personal safety, providing peace of mind and a support system that can be relied upon in times of need.

REFERENCES

[1] **Farooq et al. [1]** conducted a systematic literature review highlighting the various roles IoT plays in enhancing women's safety. Their study emphasized the integration of smart devices and communication technologies to prevent potential threats and ensure rapid emergency responses.

[2] **Sharma and Gupta [2]** provided a comprehensive survey of IoT-based safety devices for women, categorizing them based on technologies used, their effectiveness, and the features implemented to provide real-time assistance and alert mechanisms.

[3] **Rao and Kumar [3]** presented an evolutionary overview of women's safety and security systems. Their literature review explored past advancements and pinpointed existing limitations in wearable and mobile-based safety devices.

[4] **Patel and Singh [4]** reviewed existing women safety applications, highlighting the features and usability aspects of each. They also proposed future directions for improving user experience and enhancing system responsiveness.

[5] **Verma and Sharma [5]** conducted a systematic literature review focusing on the role of IoT in improving women's safety. Their analysis covered various smart technologies and emphasized the need for more personalized and AI- driven solutions.

[6] **Bhaumik et al. [6]** developed a smart bag concept aimed at ensuring women's safety. Their innovation combined sensors, GPS, and alert modules to offer real-time location tracking and threat detection in public spaces.

[7] **et al. [7]** proposed the design and implementation of a GPS-GSM-based women safety device. Their system facilitates rapid transmission of distress messages and location data during emergencies, offering a practical solution for assualt prevention.

IMPLEMENTATION PAPER

9th International Conference on Control Communication, Computing and Automation : Submission (925) has been created.

1 message

Microsoft CMT <noreply@msr-cmt.org> Fri, 9 May 2025 at 12:01 am
To: jashwinishetty1@gmail.com

Hello,

The following submission has been created.

Track Name: Internet of Things and Computer Networks

Paper ID: 925

Paper Title: SheShield: Women Safety Device

Abstract:
SheShield is an intelligent safety solution de-signed to assist women during energencies. It is attached to a small device and a mobile application. When one presses the energency button on the device, it blows a loud siren and transmits the user's real-time location and an SOS alert to trusted contacts via Wi-Fi. The application also contains options such as a mock alarm to cause confusion in threatening circumstances and dis-plays self-defense videos aggregated from YouTube. A NodeMCU ESP8266 chip enables the device to com-municate with the application, whereas the application stores contacts and monitors the location of the user. SheShield provides an easy method to call for assistance and allows trusted individuals to track the user's where-abouts in real time, hence making it simple to remain safe.

Created on: Thu, 08 May 2025 18:31:26 GMT

Last Modified: Thu, 08 May 2025 18:31:26 GMT

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Secondary Subject Areas: Not Entered

Submission Files:
SheShield Women Safety Device.pdf (914 Kb, Thu, 08 May 2025 18:30:11 GMT)

Submission Questions Response: Not Entered

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