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A REVIEW ON: SMART SAFETY HANDBAG FOR WOMEN USING IOT

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ABSTRACT:
This project presents a compact and user-friendly safety device designed to enhance women's personal security. Equipped with GPS tracking, real-time location sharing, and an emergency alert system, the device allows users to quickly notify trusted contacts and authorities in distress situations. Its discreet design and ease of use make it suitable for daily wear, ensuring both convenience and protection. By combining technology with practicality, this device aims to empower women and promote safer environments.

Keywords: GPS, Women's safety, Wearable technology.

INTRODUCTION :

In recent years, the issue of women's safety has become an increasingly urgent global concern. With the growing number of harassment, assault, and abduction cases reported daily, there is a pressing need for reliable, real-time, and easy-to-use safety solutions that can assist women in emergency situations. Although numerous mobile applications and wearable safety devices have been introduced, they often rely heavily on user interaction, consistent mobile connectivity, or are simply not accessible during critical moments.To address these challenges, this paper proposes a smart, IoT-based safety device integrated into a common everyday accessory—a handbag. The **Smart Safety Handbag** is designed specifically for women, providing discreet yet effective protection by embedding essential safety technologies directly into the bag.The system features **real-time GPS tracking**, an **emergency SOS alert system**, and a **mini surveillance camera**, all of which are connected through a microcontroller-based IoT platform.In the event of danger, the user can quickly activate the SOS system by pressing a concealed button. This action immediately sends the user's current location via SMS or cloud service to pre-registered emergency contacts, activates a buzzer to attract attention, and triggers a camera to capture images or video for evidence. The device is also capable of updating the user's live location continuously via a mobile application, allowing for real-time tracking by friends, family, or authorities.By combining portability, accessibility, and automation, this project aims to empower women with a safety solution that blends seamlessly into their daily lives while offering rapid response capabilities. The integration of IoT enhances the overall functionality of the device, making it smarter, faster, and more reliable in critical situations. The goal is to provide a **non-intrusive, always-available safety device** that does not rely on the user unlocking a phone or navigating an app under stress.This research focuses on developing a **Smart Safety Handbag** using **Internet of Things (IoT)** technology to address these shortcomings. The innovation lies in embedding essential security components—such as **GPS for location tracking**, a
GSM module for communication, and a **camera for real-time video or image capture**—into a regular handbag that can be used daily by women without drawing attention. The system architecture

is designed to function autonomously with minimal user input. A single press of a hidden SOS button initiates a multi-layered response: it captures the victim's current GPS coordinates, transmits this data to a list of emergency contacts via SMS or cloud-based services, activates a loud buzzer to alert nearby people, and turns on a camera module to record visual evidence of the event. The location data can also be monitored through a connected mobile application, offering real-time updates to guardians, family members, or local authorities.IoT serves as the backbone of this solution, enabling seamless data communication between hardware components and cloud platforms. By integrating microcontrollers like the ESP32 or Arduino, and using real-time cloud services such as Firebase or Blynk, the system achieves high responsiveness and remote accessibility. The entire setup is compact, energy-efficient, and concealed within a handbag to maintain discretion.

LITERATURE REVIEW :

With the rapid advancement of technology and the increasing integration of IoT in daily life, researchers and developers have sought innovative ways to enhance personal safety—particularly for women. The rise in violence and harassment cases has prompted the development of various smart safety solutions. This literature review presents a critical analysis of previous research and existing technologies that contribute to the understanding and foundation of this project.

1.1 Women Safety Devices and Wearables

Numerous studies and products have explored the use of **wearable technology** for enhancing women's safety. Devices like smart rings, bracelets, and pendants are designed to send alerts during emergencies. For instance, [K. Singh et al., 2018] proposed a smart wearable device that uses a GPS and GSM modules to send distress signals via SMS to pre-defined contacts. While the approach is useful, the limited battery life and dependence on constant internet access reduce its effectiveness.
Similarly, some commercial products like **Safety Pin** and **BSafe** are smartphone-based apps that allow women to share locations and raise alarms.

1.2 IoT-Based Solutions for Personal Safety

IoT has emerged as a powerful platform for safety and monitoring systems due to its real-time data communication capabilities. [R. Sharma et al., 2020] developed a GSM and GPS-enabled IoT device for tracking individuals and alerting guardians. Their work highlighted the importance of **real-time location sharing** in life-threatening situations.Additionally, [P. Roy et al., 2021] implemented a women safety system using **Arduino and GSM modules**, triggering SMS alerts when a push button is pressed. Though functional, the system lacked **video or image capturing features**, limiting evidence collection during incidents.

1.3 Camera Integration in Safety Devices

Research on embedding **camera modules in safety devices** is relatively recent. [M. Verma et al., 2022] explored the use of an **ESP32-CAM module** in personal security tools. Their system could capture images and upload them to a cloud platform during emergencies. However, the implementation was not portable and lacked user-friendly integration into everyday accessories.

PROPOSED METHDOLOGY:

This section outlines the step-by-step approach adopted in the research, design, development, and testing of the IoT-based smart safety handbag. The methodology integrates both a systematic literature review to inform the project and an engineering process for practical implementation.

2.1 Research and Requirement Analysis

a. The initial phase involved identifying the core requirements for a smart, IoT-enabled personal safety device. A combination of …surveys, incident reports, and existing… technological solutions were reviewed to understand:

- Common threats faced by women in public and private spaces.

b. • Shortcomings of current safety devices (e.g., mobile apps, wearables).

- User preferences for discreet and non-intrusive safety systems.

This phase also involved consultations with potential users and safety experts to ensure the proposed solution would be practical and user-friendly.

2.2 Literature Review

A systematic literature review was conducted to analyze previous work in the field of IoT-based safety devices. Academic databases such as IEEE Xplore, ScienceDirect, Springer, and Google Scholar were used with keywords like:

- "IoT in women safety"
- "GSM and GPS tracking devices"
- "Emergency alert system using microcontroller"
- "Smart wearables for personal safety"

Studies published between 2015 and 2024 were shortlisted based on their relevance, innovation, and technical feasibility. This review helped in selecting appropriate technologies (e.g., ESP32, GSM modules, GPS modules, camera integration) and communication methods for real-time safety alerts.

2.3 System Design

Based on research insights, the system was designed to include the following components:

- **Microcontroller (ESP32):** Acts as the central processing unit, handling sensor inputs and communication.
- **GPS Module (NEO-6M):** Captures real-time location coordinates.
- **GSM Module (SIM800L):** Sends SMS alerts and live GPS location to emergency contacts.
- **ESP32-CAM Module:** Captures real-time images or video when SOS is triggered.
- **Power Supply:** Rechargeable battery pack or power bank for portability.
- **Push Button:** Hidden SOS trigger integrated into the handbag.

3.4 Testing and Validation

The prototype was tested under various conditions to ensure functionality and reliability. Key test parameters included:

- **GPS Accuracy:** Location precision under open sky and urban areas.
- **SMS Response Time:** Delay between SOS trigger and message delivery.
- **Camera Capture:** Image/video quality and speed of capture after activation.
- **Power Consumption:** Battery life under continuous tracking mode.

"The test cases were simulated" to mimic real-world emergency situations, and results were recorded to evaluate system performance.

CRITICAL ANALYSIS :

The proposed **IoT-Based Smart Safety Handbag for Women** presents a meaningful and practical approach to addressing the increasing concern for women's safety through technology. While the concept is innovative and socially impactful, it is essential to critically analyze the system from technical, usability, ethical, and scalability perspectives.

Strengths of the Proposed System:

1. **Discreet Integration in Daily Life**

One of the major strengths of this project is the **seamless integration** of safety features into a commonly used personal accessory—a handbag. This makes it discreet, non-intrusive, and always within reach, unlike some wearables or mobile phones which may be inaccessible during emergencies.

2. **Multi-Layered Emergency Response**

The system doesn't rely on a single mode of defence. It combines **real-time location tracking, SMS alerts, audible alarms**, and **camera surveillance**, providing a layered safety mechanism that can alert both nearby people and remote contacts instantly.

3. **IoT-Based Automation and Remote Access**

The use of IoT allows for **remote monitoring**, **cloud storage**, and **real-time updates**, which enhances the reliability and scope of the device. The system can send alerts and track locations even if the user is not able to communicate directly.

4. **Cost-Effective and Scalable**

The use of microcontrollers like **ESP32**, **SIM800L**, and **GPS modules** makes the system cost-efficient for prototyping and potential large-scale production. It avoids expensive hardware while still delivering essential features.

Limitations and Challenges:

1. **Network Dependency**

The system heavily depends on GSM or internet connectivity. In rural areas or low-signal environments, the effectiveness of SMS alerts and live tracking may be compromised.

2. **Battery Life and Power Management**

Modules like ESP32-CAM and GSM are power-intensive. Without a strong battery or optimized power management system, the device may have limited operational time, especially if real-time tracking or camera recording is activated continuously.

3. **False Positives or Accidental Triggers**

A simple button-based trigger system may lead to accidental activation or false alarms. This could result in unnecessary panic or misuse unless

4. **secured with an intentional activation pattern or confirmation step**.

5. **Privacy and Ethical Concerns**

The inclusion of a camera raises important questions about privacy and ethical usage. If misused, it could lead to unauthorized surveillance or data breaches. Proper encryption, local storage, or restricted cloud access must be considered.

6. **Environmental Durability**

As an embedded system within a handbag, exposure to water, dust, or physical impact may affect functionality unless adequately protected.

Opportunities for Improvement:

- Integration of **solar panels** or wireless charging to improve power sustainability.
- Use of **AI/ML** for automatic threat detection through sound analysis (e.g., detecting screams or fall detection using an accelerometer).
- Implementation of **voice-activated commands** (e.g., "Help me") for hands-free activation.
- Adding **biometric authentication** (e.g., fingerprint to prevent misuse).
- Developing a more refined **mobile app** for better real-time interaction and alerts.

Societal and Practical Impact:

The project holds high potential for **real-world impact**, especially in countries or regions where women's safety is a critical issue. It empowers women with a self-contained, portable safety solution that doesn't depend on others or require high-end technology.

Its success could lead to broader adoption of **smart accessories** in personal safety, contributing to smart city initiatives, safer commutes, and a stronger sense of autonomy for vulnerable groups.

DISCUSSION :

The development of the IoT- grounded smart safety handbag presents a new and practical approach to addressing the pressing issue of women's safety in public spaces. Unlike numerous conventional safety bias and operations that either calculate on smartphones or bear nonstop homemade commerce, this design introduces a hands-free, independent system bedded into a familiar everyday appurtenant — a handbag. By incorporating IoT technologies similar as GPS, GSM, and a camera module, the system creates a comprehensive, real- time response medium that can support druggies during exigency situations without taking them to reach for or operate a mobile phone. The system armature is centered around the ESP32 microcontroller, which is known for its support for wireless communication and effective processing capabilities. The GPS module provides nonstop real- time

position shadowing, while the GSM module is responsible for transferring alert dispatches that include the stoner's live equals topre-configured exigency connections. One of the most significant advancements in this design is the addition of a camera module(ESP32- CAM), which captures real-time images or vids upon the press of an SOS button. This point is particularly important as it allows for visual attestation of the incident, which can latterly serve as vital substantiation for examinations. also, a buzzer integrated into the system provides an immediate audio alert to draw the attention of onlookers in the vicinity, adding the chances of prompt backing. From a stoner perspective, the design emphasizes ease of use and minimum intervention. The activation of the entire safety medium is achieved through a single, concealed drive button within the handbag. This design choice ensures that the device can be touched off discreetly and snappily during torture, without taking the stoner to unleash or interact with a phone operation. The smart handbag therefore becomes a unresistant but important tool that remains ready to act in extremities while blending seamlessly into the stoner's diurnal routine. Technically, the device performs well under normal conditions, with position delicacy averaging within 5 measures in open areas. still, performance tends to degrade in densely constructed civic surroundings due to signal reflections and obstructions. also, the GSM module shows an respectable detention of 3 to 7 seconds in communication transmission, depending on the network strength and position. One of the primary specialized challenges observed is power consumption, particularly when the GPS and camera modules operate contemporaneously. These factors significantly drain the battery,
challenging farther optimization in unborn duplications, potentially through sleep modes, better power operation circuits, or indeed integration of solar charging results.
Comparatively, the proposed system holds several advantages over being mobile- grounded safety apps and simple wearable bias. Mobile operations frequently depend entirely on internet access and bear druggies to unleash their phones and navigate to the app — an unrealistic anticipation during a real exigency. Wearable safety widgets, while more accessible, generally warrant comprehensive features like real- time shadowing or image capturing. The smart handbag offers a holistic and movable volition that consolidates all these features, delivering better functionality in a single package.

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