WOMEN HAWK

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Women's safety remains a critical social issue worldwide, demanding innovative and proactive technological solutions. This research (i.e. Women Hawk) presents the design and development of a women safety application leveraging Internet of Things (IoT) devices to enhance personal security and provide rapid emergency response. The proposed system integrates wearable sensors (such as GPS) with a mobile application to detect distress signals through physiological and behavioral data. Upon identifying abnormal patterns—such as sudden changes in location, elevated heart rate, or abrupt movements—the system triggers automatic alerts. These alerts, containing real-time location and health data, are sent to pre-defined emergency contacts and nearby authorities via cloud connectivity. The application also includes manual emergency activation options such as an SOS button or voice command. This paper discusses the system architecture, communication protocols, data security considerations, and real-world implementation results. The research demonstrates how IoT-enabled solutions can provide a scalable, real-time, and reliable approach to improving women's safety in various environmentsBuilt using the MEEN stack, including MongoDB, Express.js, React.js, IOT tracking device. Women Hawk ensures high performance, scalability, and efficiency.

INTRODUCTION

Women's safety continues to be a major concern in societies worldwide, with increasing incidents of gender-based violence, harassment, and abuse occurring in both public and private spaces. Traditional methods such as emergency helplines and safety apps often fall short due to delayed responses or lack of accessibility during critical situations. Women Hawk uses the technology, the Internet of Things (IoT), offers promising solutions for enhancing personal safety and enabling timely intervention during emergencies. The Internet of Things refers to the interconnection of physical devices embedded with sensors, software, and communication technologies that enable them to collect and exchange data. When applied to women's safety, IoT can provide real-time location tracking, automatic alerts, remote monitoring, and intelligent response mechanisms,

all of which contribute to a more effective safety infrastructure. This research paper proposes a women safety application that utilizes IoT-enabled wearable devices integrated with mobile applications to provide a comprehensive, responsive, and user-friendly system. This report will outline the design and implementation of Women Hawk, followed by an evaluation of its performance**,** usability, and security features. Furthermore, insights from real-world testing and user feedback will be discussed to highlight its effectiveness and potential future improvements.

RELEVANT STUDIES

1. Herd Routes: A Preventative IoT-Based System for Improving Female Pedestrian Safety on City Streets

This study proposes "Herd Routes," a system designed to improve female pedestrian safety by generating busier pedestrian routes through societal incentivization. The approach aims to create safer public environments by encouraging more foot traffic in certain areas, thereby reducing the likelihood of harassment. The system utilizes distributed ledgers for security and trust, recording users' locations and IDs, and a platform for token exchange. A proof-of-concept was developed using the SUMO simulation package and an Android smartphone app, demonstrating the technical feasibility and desirability of the system

2. NIRBHAYA: IoT-Based Women Security Vehicle

The "NIRBHAYA" project introduces an IoT-based security vehicle equipped with a speech recognition module, GPS, GSM, camera, and panic button. Upon activation, the system captures images and sends alerts to emergency contacts and the nearest police station, enhancing the response time during emergencies .

3. IoT-Based Wrist Band for Women Safety

This research develops a wristband equipped with sensors to monitor vital signs such as pulse rate and temperature. The device updates this information to designated contacts through the Blynk app, allowing for real-time monitoring and prompt assistance in case of emergencies.

4.Smart Women Safety Device Using IoT (2021)

This study presents an IoT-based safety device that utilizes fingerprint authentication to activate the device. Upon detecting an unsafe situation, the device automatically alerts nearby people, parents, and police. Additional features include sending messages,

audio recording, and capturing images of the situation, enhancing the responsiveness and effectiveness of the safety measures.

5.Automatic Prediction and Identification of Smart Women Safety Wearable Device Using Dc-RFO-IoT

This research focuses on a wearable device that utilizes IoT technology to predict and identify potential safety threats to women. The system aims to provide critical thinking and suggestions to women in rescue situations, enhancing their safety through advanced technology .

These studies and projects highlight the diverse applications of IoT in enhancing women's safety, ranging from wearable devices to autonomous systems and infrastructure improvements. Integrating such technologies can significantly contribute to creating safer environments for women.

DESIGN AND IMPLEMENTATION

Women Hawk provides a user-friendly website interface with IoT-enabled devices to provide a comprehensive real-time safety monitoring and alerting platform. The core idea is to develop a responsive website that acts as the central control unit, training for women,communicating with wearable IoT devices carried by users to provide instant location tracking, emergency alert dispatch, and status monitoring.

Website Interface: A secure, mobile-responsive web portal is developed using HTML5, CSS3, JavaScript, and a backend framework like EJs, React Js . The site allows:

User registration and login

Real-time tracking of registered users

Viewing user and trainers

Admin dashboard for law enforcement access

Notification panel for emergency contacts

Implementation Details

IoT Hardware Used: The system uses a ESP32 microcontroller for compact integration. GPS, GSM (SIM800L), and pulse sensors are connected to monitor vital signs and send SMS alerts along with coordinates.

Data Communication: Data from the device is sent over HTTP POST or MQTT protocol to a cloud-hosted API, which then updates the status on the website.

Alert System: When an emergency is triggered, the system sends:
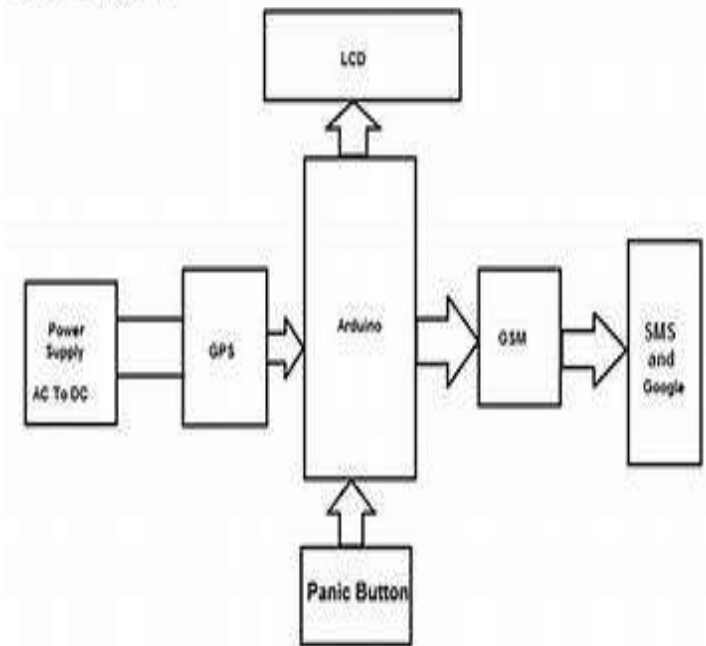SMS with real-time coordinates to emergency contacts

Notification to the website dashboard

Optional integration with Google Maps for live tracking

Security & Privacy: The website uses HTTPS, role-based access control (RBAC), and encrypted communication to ensure data privacy and prevent unauthorized access.

METHODOLGY

Block Diagram:

IOT DEVICCE AND ITS INTEGRATION

The integration of IoT devices with a women   safety application plays a critical role in enhancing real-time monitoring, emergency response, and user safety. Wearable IoT devices such as smart bands or pendants are embedded with sensors like GPS, accelerometers, and panic buttons, which are directly linked to the mobile application via Bluetooth, Wi-Fi, or GSM. When the user presses the panic button or when the device detects abnormal conditions such as   sudden movement, fall detection, or elevated heart rate, the wearable instantly communicates with the mobile app. The application, in turn, collects the data, sends real-time location updates, and triggers SOS alerts to emergency contacts or law enforcement through secure cloud APIs. This seamless communication ensures that help can be dispatched quickly and accurately. The integration also allows the app to manage device pairing, monitor device battery status, and control settings such as alert sensitivity, thereby creating a unified, responsive, and secure ecosystem for   women's safety .

WOMEN HAWK
USER PROFILE

Fig. 4. User profile Section

The User Profile module in Mint-Verse serves as a personalized dashboard where users can conveniently track and manage their NFT assets within the platform. By leveraging the power of Ethereum's smart contract infrastructure, this section offers a transparent and real-time view of each user's digital portfolio. Upon accessing the User Profile page, Mint-Verse automatically communicates with the deployed smart contract to extract data linked to the connected wallet address. This includes vital information such as the user's wallet ID, the total number of NFTs they own, and the cumulative estimated value of their NFT collection. All this information is presented through a clean and intuitive user interface, enabling users to get insights into their asset holdings at a glance. Moreover, Mint-Verse dynamically displays a visual collection of all NFTs owned by the user. The application fetches this information by querying the blockchain for the NFT token IDs associated with the user and subsequently retrieving the corresponding metadata stored securely on IPFS. Each NFT is presented along with its image, description, and other metadata, ensuring users have easy access to detailed information about their assets. Through seamless integration with smart contracts and decentralized storage, the User Profile feature offers Mint-Verse users a secure, transparent, and user-friendly way to manage and monitor their NFT ownership directly on the blockchain.

TEAM WORK AND CONTRIBUTION

The successful development of Mint-Verse was the outcome of collective efforts from all four team members, each contributing their individual expertise in different domains. To ensure timely and efficient delivery, we followed the Agile methodology, which helped us divide the tasks into manageable sprints and maintain a smooth development workflow.

Each member played a significant role in the development process, covering essential aspects of the project, such as frontend development, AI-powered NFT generation, smart contract implementation, backend API development, marketplace functionality, and wallet integration. Regular team meetings, sprint reviews, and testing sessions were conducted to ensure consistency, security, and quality throughout the project. The table below illustrates the distribution of tasks among the team members:

Team Member	Contribution
chandan	Frontend Development, IOT device,
Aryan, Abhinav	AI powereds, Integration, Backend ,API Development
Muskan	Frontend, Iot device,

Table. 1. Team Work

With effective collaboration, communication, and dedication, the team was able to successfully implement all planned features and deliver a fully functional Mint-Verse platform.

SUBSCRIPTION

The Subscription module in Mint-Verse was designed to enhance user engagement and retention by allowing users to stay updated with the latest NFT drops, marketplace activities, and exclusive platform announcements. This feature acts as a communication bridge between the platform and its user base, ensuring that users never miss any important updates or events related to the NFT ecosystem. The implementation of the subscription system was done using a combination of React.js for the frontend and Express.js for the backend.

Fig. 5. Subscription Page

When a user enters their email address on the subscription page and submits the form, the data is securely transferred to the backend server, where it is validated and stored in a protected database. We ensured that the subscription form is simple, accessible, and responsive, allowing users to easily subscribe from any device. To make the subscription system efficient and scalable, the backend was integrated with a notification and mailing system that can send real-time updates to all subscribed users. Whenever a new NFT is listed, a featured collection is launched, or platform updates are rolled out, subscribers receive notifications through automated emails. This not only improves user interaction but also helps drive traffic back to the platform regularly. The entire process was secured by implementing proper validations, form handling mechanisms, and avoiding spam or bot subscriptions. By integrating this system, Mint-Verse ensures that users are always informed, resulting in better user experience, loyalty, and active participation within the marketplace.

SECURITY ANALYSIS
Security of Women Hawk:
The integration of Internet of Things (IoT) technology into women safety applications has significantly enhanced the ability to respond to emergencies in real-time. However, as these systems handle sensitive personal data, ensuring security and building user trust becomes paramount. The security and trust mechanisms in such systems must cover multiple layers, including device security, communication protocols, user privacy, and authentication.
Device-Level Security:
IoT-enabled wearables such as smart bands, pendants, or

watches are often equipped with sensors, GPS, and communication modules. These devices must be:

Tamper-resistant to prevent misuse or manipulation.

Embedded with secure firmware to avoid unauthorized access.

Regularly updated through secure OTA (Over-The-Air) updates to patch vulnerabilities.

Secure Communication Protocols:

All communication between the wearable device and the mobile application or cloud platform must be encrypted. Mechanisms include:

TLS/SSL encryption for data in transit.

End-to-end encryption for location and alert data.

Low-latency communication for real-time responsiveness without compromising security.

User Authentication and Authorization:

To prevent unauthorized access to the application and data:

Multi-factor authentication (MFA) is recommended.

Role-based access should ensure only emergency contacts or verified authorities can access user data.

Data Privacy and Storage:

Handling sensitive data like live location, contact lists, and distress alert requires .

Minimal data retention – only necessary information should be stored.

Data must be stored in encrypted databases, preferably on secure cloud services.

Users must have full control over their data, with the ability to delete or manage permissions at any time.

Trust Mechanisms:

For the user to trust the system:

Transparency in data handling policies and app permissions is essential.

User feedback systems should be available to report false alarms or feature abuse.

The app must provide audit logs or activity history for verification of alerts sent and received.

Anomaly Detection and Auto-Response:

IoT devices can be enhanced with machine learning models to detect unusual patterns such as sudden movement, prolonged inactivity, or high stress:

Alerts can be automatically generated if the user is unable to act.

Trust models can be built using behavioural data to improve accuracy and avoid false positives.

Integration with Authorities and Services:

Trust is reinforced when the application is:

Verified or endorsed by local authorities, police, or NGOs.

Able to automatically connect to official helplines, ensuring legitimacy and faster response.

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LIMITATIONS AND FUTURE WORK

Government Mandates and Policy Support

Several state governments have initiated self-defense program for women. For instance, the Uttar Pradesh government launched the "Rani Laxmibai Self-Defense Training" program,

aiming to train over 2 lakh girls across 45,000 schools. Similarly, the Maharashtra Directorate of Higher Education has made karate training mandatory for female college students to enhance self-defense and confidence .

International programs like the "Guardian Girls" initiative, supported by the World Karate Federation and the United Nations Population Fund, focus on self-defense education for women of all ages and cultures, emphasizing prevention, self-assertion, and self-defense techniques .

Integration into Educational Curriculam

Educational Institutions: The University Grants Commission UGC in India has encouraged colleges and universities to introduce self-defense programs for women, viewing them as essential components of extracurricular activities aimed at addressing contemporary concerns related to women's safety .

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Curriculum Development: Organizations like the Skill Development and Entrepreneurship Ministry have approved national curricula for self-defense training, which are delivered by certified trainers, aiming to make self-defense a mandatory part of school programs, akin to sports and yoga .

6.2.3 Expanding Training Programs

Diverse Offerings: Develop a range of training modules catering to different age groups and needs, including school girls, college students, working professionals, and senior citizens.

Specialized Courses: Introduce programs focusing on specific threats like cyberbullying, acid attacks, and domestic violence, incorporating legal education and awareness.

6.2.4 Community Engagement and Awareness

Workshops and Seminars: Organize events to raise awareness about women's safety, legal rights, and available support systems.

Collaborations: Partner with local law enforcement, educational institutions, and NGOs to reach a broader audience and enhance program effectiveness.

6.2.5 Digital Transformation

Online Training Platforms: Develop digital platforms offering online self-defense courses, making training accessible to women in remote areas.

Mobile Applications: Create apps providing safety tips, emergency contacts, and real-time alerts to users.

Public Campaigns: Launch campaigns to promote the importance of women's safety and the role of self-defense in empowerment.

CONCLUSION

Empowers women by providing practical self-defense skills and boosting confidence.

Plays a crucial role in addressing gender-based violence and personal safety concerns.

Encourages mental and emotional strength alongside physical training.

Promotes awareness, independence, and assertiveness in daily

life.

Supports the broader goal of gender equality and women's rights. Helps build a safer, more inclusive society through education and preparedness.

Acts as a catalyst for systemic change in how women's safety is perceived and prioritized.

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