



# Smart Emergency Response System for Disabled Individuals

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**Abstract.** This project proposes a wearable health monitoring device aimed at supporting individuals with physical and mental disabilities through real-time monitoring and direct alert capabilities. The primary objective is to create a reliable system that enhances user safety and independence by continuously tracking critical health indicators and swiftly notifying caregivers during emergencies. The device will be equipped with pulse and sound sensors to detect heart rate irregularities and sound disturbances, identifying potential health or safety concerns. In the event of an alert, the device will send an SMS notification directly to caregivers or family members, enabling quick responses without the need for a mobile application. Our approach envisions integrating signal processing and real-time data analysis with a focus on user-friendly design to ensure accuracy and ease of use. By offering a scalable and practical solution, this project aims to contribute to assistive technology, improving the quality of life for individuals with disabilities and providing peace of mind to caregivers.

**Keywords:** Wearable health-monitoring device, technology, physical and mental disabilities, real-time monitoring, emergency alert system, pulse sensor, sound sensor, SMS notification, signal processing, data analysis, user safety, caregiver support, health indicators, scalable solution, quality of life improvement.

## 1 Introduction

It is clear that when individuals with physical and mental disabilities are provided with proper support and care, their quality of life improves significantly, fostering a more inclusive society. According to global health statistics, millions of people worldwide face challenges due to disabilities, and many remain vulnerable due to a lack of proper monitoring and timely assistance. This highlights the urgent need for technological solutions that ensure their safety and independence. Our proposed system introduces a wearable health-monitoring device designed to continuously track critical health indicators, such as heart rate and sound disturbances, to identify potential emergencies. In case of an alert, the system sends SMS notifications directly to caregivers or family members, enabling immediate action. Unlike mobile-based applications, this device operates independently, ensuring ease of use for individuals

with disabilities. By leveraging advancements in signal processing and real time data analysis, this device not only enhances user safety but also provides peace of mind to caregivers. As wearable technology becomes more accessible, such innovations have the potential to address significant gaps in assistive care and improve the quality of life for vulnerable populations.

## 1.1 Research Objectives

Manufacturers are improving AM operations by integrating feedback control and in-process monitoring, enhancing repeatability. 3D printing offers sustainable materials, like plastic, but research aims to develop natural alternatives.

The suggested article's main research goals are:

RO1: Analyzing significant developments in mitigating environmental deterioration and additive manufacturing.

RO2: To recognize and examine different innovations in additive manufacturing that enhance environmental sustainability.

RO3: To explore the key components necessary for establishing an environment for sustainable additive manufacturing.

RO4: To verify process workflows and enhance the sustainability of additive manufacturing practices.

RO5: To determine and investigate how applications of additive manufacturing contribute to environmental sustainability. The Basic Idea In this framework, communication of secret information between the sender and the receiver can be done by transmitting a series of images using constructed inverted index structure. An efficient hashing algorithm is used to prepare the indexing structure and also be used at receiver's side to decode the secret information [9].

## 2 Review Methodology

Vivek et al. [1] proposed a system aims to address increasing crimes against women, children, and individuals suffering from Alzheimer's. The device, a wearable smartwatch, allows users to send an emergency location alert to their family members through an in-built GPS and Twilio API. The Advantage of the model is 1.Small size, low cost, and ease of use, 2. Making it accessible for children, 3.Provides immediate response and location tracking when the user is in danger, 4.Enhances safety with real-time alerts to family members. The limitations of this device are 1.Requires the user to press a button to activate the emergency alert, which may not be possible in a panic situation, 2.Dependency on GPS accuracy and battery life during continuous tracking.

Thamaraiselvi et al. [2] proposed a system integrates multiple sensors within a smart band that communicates wirelessly with a smartphone. In case of an emergency, the band sends a distress signal, including the user's location, to pre-saved contacts and the nearest police station using GSM technology. Additionally, the band generates an electric shock and activates a loud alarm to deter the attacker. The advantages

of this model are its quick response time and the non-lethal shock feature. However, limitations include The project may be considered too complex due to the inclusion of multiple sensors and the electric shock feature, which may not be necessary for a simpler solution, potential inaccuracies in GPS tracking and the device's reliance on a stable wireless connection.

Kabir et al. [3] proposed a system uses a smart band with an emergency switch, which, when activated, sends real-time location data to the nearest police station and volunteers. It also provides information on the nearest safe zone. The device works both online and offline, making it accessible even without an internet connection. The system integrates Arduino, GPS, GSM, Bluetooth, and other hardware components, offering an affordable and user-friendly solution for women's safety. The Advantage of the model is Affordable and accessible, with both online and offline functionality, Effective real-time response with location data sent to authorities and volunteers. The Limitations are Device reliability could be an issue, especially in certain environments where sensor accuracy may be compromised, Lacks pulse and sound sensors, which could be useful in our project for disabled individuals.

Zhou et al. [4] investigated awearabledevices are gaining popularity worldwide, enhancing daily life and driving significant research growth. This study categorizes wearable devices based on their functions and usage while highlighting existing challenges. Despite their widespread adoption, issues such as usability and human-computer interaction remain. The survey explores the evolution of wearable technology and ongoing research in interaction improvements. Additionally, it discusses key challenges and potential future directions to enhance wearable device functionality and accessibility. Addressing these concerns will be crucial for advancing wearable technology and ensuring its effectiveness in various applications, including healthcare and assistive solutions.

Bisht et al. [5] reviewed nine emerging IoT wearable devices, highlighting their unique features and application-specific suitability. While these devices offer advanced capabilities, no single device meets all needs. The study also addresses security concerns, emphasizing the importance of considering these issues before purchasing. Future advancements will focus on resolving these challenges to enhance usability and safety. With an expected growth rate of 18%, the wearable IoT market shows great potential, promising further innovations and improvements in functionality, security, and adaptability for diverse applications.

Hyndavi et al. [6] developed a smart safety device for women that automates emergency alerts during hazardous situations. The system detects danger and sends location-based alerts to family members and the police without requiring user interaction. Designed to be discreetly carried in bags, it can also be customized into wearable forms like smartwatches and bracelets. The device features both automatic and manual activation, making it cost-efficient and easy to use. Future enhancements include recording audio and video during emergencies, providing crucial evidence for legal proceedings. This innovation aims to improve women's safety with real-time response capabilities.

Venkatesh et al. [7] aimed to enhance women's safety, particularly for those working night shifts, as 53% of working women in India feel unsafe. Cities like Delhi,

Mumbai, Hyderabad, Kolkata, and Pune report high risks for women. The study suggests using an IoT-based device, such as a wearable gadget, to address safety concerns. By integrating IoT solutions and collaborating with service providers, the project seeks to create a reliable security system. Further research and advancements in wearable technology can improve safety measures, offering a more effective and accessible solution for women facing security challenges.

Shalini [8] proposed an IoT-based health monitoring system for remote tracking in healthcare. The system measures blood pressure and pulse rate, displaying the readings on an LCD. The sensor data is wirelessly transmitted to a medical server, where authorized personnel can access it. Doctors can then analyze the patient's health condition and provide appropriate medical recommendations. This system enhances remote patient monitoring, allowing timely diagnosis and treatment without requiring physical hospital visits. The integration of IoT in healthcare improves efficiency and accessibility, ensuring better patient care and real-time health tracking.

Jhansi Bharathi et al. [9] proposed the HOT Watch, an IoT based wearable health monitoring device designed for real time health tracking. It integrates sensors like the MLX90614 temperature sensor, AD8232 ECG sensor, and MAX30100 oximeter to monitor ECG, body temperature, and oxygen levels. The system processes health data efficiently, using the PTA method for heart rate calculation. It connects seamlessly to a mobile application, providing real-time health updates. The HOT Watch outperforms existing devices in accuracy but may have limitations in specific user populations. Future research could focus on predictive algorithms for early health issue detection and preventive care.

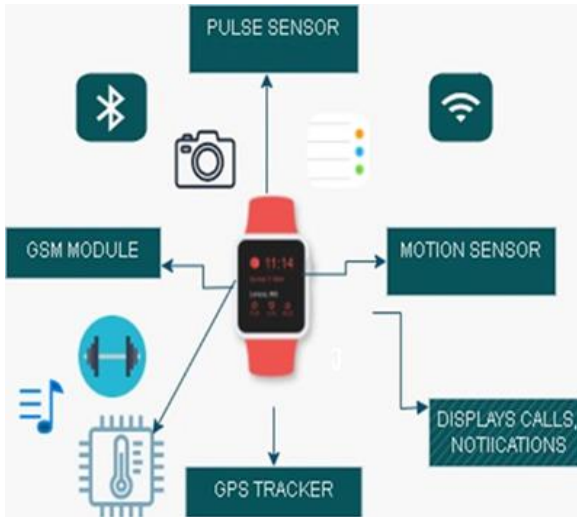
Ghosh et al. [10] introduced a smart security device designed primarily for women's safety, which can also benefit elderly citizens and children. This device stands out by enabling direct evidence collection and storing data on web storage for future use. It enhances personal security by providing a reliable and efficient safety mechanism. Future advancements aim to make the device more user-friendly by reducing its size and incorporating advanced technology. Additionally, efforts will focus on lowering production costs, making it more accessible and practical for widespread use in ensuring safety and security. insights

### 3 Existing Methodology

Several existing applications and devices aim to provide support and monitoring for individuals with physical and mental disabilities. Applications like Be My Eyes, Wheel Mate, and Seeing AI offer various assistive features. For example, Be My Eyes connects visually impaired individuals with volunteers for real-time assistance, while Wheel Mate helps wheelchair users find accessible restrooms and parking spaces. Seeing AI is designed for visually impaired individuals, providing audio descriptions of their surroundings through a smartphone camera.

There are also wearable devices such as Angel Sense and Dot Watch. Angel Sense is a GPS tracker for individuals with cognitive disabilities, ensuring location safety and enabling real-time communication with caregivers. The Dot Watch is a Braille

smartwatch that allows visually impaired users to receive notifications and access time-related features independently.



**Fig.1.**Existing system to support individuals with disabilities

Fig.1 shows a wearable device for health monitoring that aids users with both physical and mental disabilities. It facilitates tracking and reporting by incorporating various sensors and communication devices. The pulse sensor monitors the user's heart rate for any abnormalities allowing for real-time tracking of health. If unusual patterns of motion are recognized a motion sensor will monitor motion and sudden falls setting off the necessary alerts.

The GPS tracker assists caregivers in locating the user during emergencies for timely help. A GSM module allows for SMS notifications and enables real-time communication with caregivers. Additional smart devices can be paired through Bluetooth and Wi-Fi, increasing the device's capabilities. Furthermore, the display screen enables the user to receive calls and notifications, thus getting real-time information. The user-friendly design may be enhanced with features like a camera and music support, which would improve accessibility.

### 3.1 Drawbacks of Existing Methodology

- We have to spend a huge amount on manufacturing these devices, making them expensive and less accessible.
- Many devices are large in size and use multiple sensors, which makes them bulky and uncomfortable for daily use.

- Most applications and devices consume significant battery power, requiring frequent charging.
- Some applications may stop functioning due to technical glitches or low battery, causing delays in response during emergencies.
- Many existing devices and applications lack user-friendliness, especially for individuals with severe disabilities, making it difficult for them to use or operate the system effectively without assistance.

## 4 Proposed System Contributions

To study the existing challenges of people who are physically and mentally disabled.

- To create a disabled person-assistance solution to improve safety and autonomy.
- To create a smart IoT-enabled wearable device whose purpose is to constantly track the user's health parameters.
- To design a system that allows caregivers to respond to users' emergencies in real-time and improve response time and user's safety.
- To enable a large segment of the population to access an affordable and simplified system.

## 5 Proposed Methodology

Our proposed system aims to develop a wearable health-monitoring device designed to assist individuals with physical and mental disabilities. This device continuously tracks essential health indicators such as heart rate and sound disturbances, while also monitoring the user's location. By integrating advanced IoT components, including sensors for vital signs and environmental factors, the system ensures real-time health tracking.

In the event of a health concern or safety risk, the device automatically sends an SMS notification to caregivers or family members, alerting them of the situation. This feature eliminates the need for a mobile application, making it easier for both the user and caregivers to respond promptly in emergencies. The system utilizes advanced signal processing and real-time data analysis to accurately detect potential health issues. Designed with a user-friendly interface, the device ensures accessibility for individuals with varying levels of physical and mental abilities. This user-centric approach enhances usability and provides peace of mind for both users and caregivers.

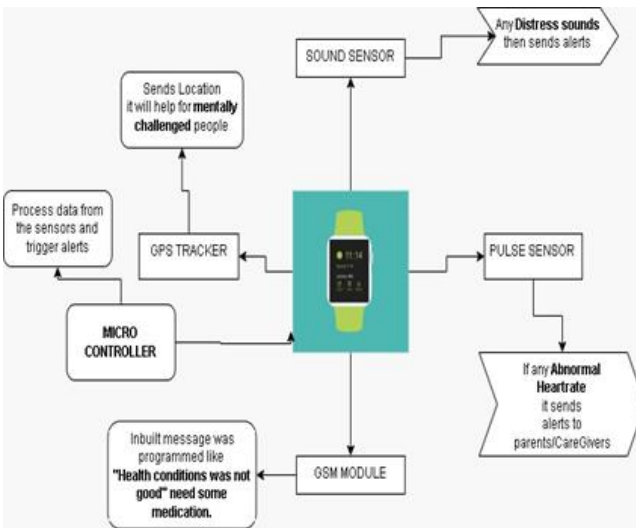
Furthermore, the system has integrated tracking capabilities, enabling guardians to find the user's location instantly in case of any emergencies. The assistive technology promotes safety and autonomy for the disabled owing to its reliable features, user-friendly operations, and portable design. This solution enables physically challenged people to live without depending on others as help is always a message away.

Justification of Proposed System is People with a range of physical and mental disabilities face problems with safety and autonomy due to the absence of passive health

supervision. Current solutions either fail to provide real-time functionality or rely too much on mobile apps, which is not convenient for all users. There is an increasing demand for an assistive device that is reliable, easy to use, and can adapt to the requirements. Such technology should be able to:

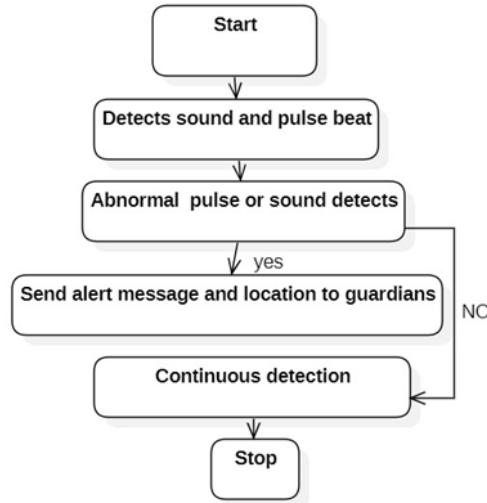
1. Track essential health parameters
2. Detect possible health or safety issues
3. Notify the responsible persons as soon as possible to ensure that they can respond adequately and in a timely manner.

This system aims to bridge these gaps, ensuring a better quality of life for both users and their caregivers.



**Fig.2.** Proposed systems to support the individuals with disabilities

Fig.2 illustrates the system designed to cater for people with disabilities. Our system description focuses on supporting and monitoring people with physical and mental disabilities through wearable integration with IoT health monitoring and emergency alerting system. The system description is a smart wearable device with several sensors and modules that help to monitor the user's health and assist in case of danger. A pulse sensor measures the user's heart rate, and in case of abnormalities, it raises an alert to the caregiver or parent using SMS alert. Likewise, the sound sensing element listens for screams or crying and alerts the supervising adult to intervene if these unusual sounds of danger or discomfort are detected.



**Fig.3.**Flowchart for our proposed methodology

The person's location can be tracked continuously using a GPS Tracker which can be extremely helpful for people with mental disabilities so that caregivers can find them during emergencies. Moreover, it increases security by sending the exact and real-time location data that the user requires. The GSM module is the most important component that allows the system to send emergency messages via SMS. For instance, if the system notices an unusual heart beat rate combined with distress sounds the inbuilt message “Health conditions are not good, need some medication,” is sent automatically to the caregivers.

The microcontroller serves as the central processing unit of the device, collecting data from the pulse sensor, sound sensor, and GPS tracker. It processes this information and triggers alerts when necessary, ensuring a prompt response to any health or safety concerns. This wearable health monitoring system offers real-time health tracking, automatic emergency alerts, and location tracking, making it an independent, user-friendly, and accessible solution. Since it does not rely on a mobile application, it is highly practical for individuals with disabilities. By integrating sensors, GPS tracking, and real-time alert mechanisms, the system enhances the safety, security, and independence of users, ensuring quick responses during emergencies, reducing health risks, and significantly improving their overall quality of life.

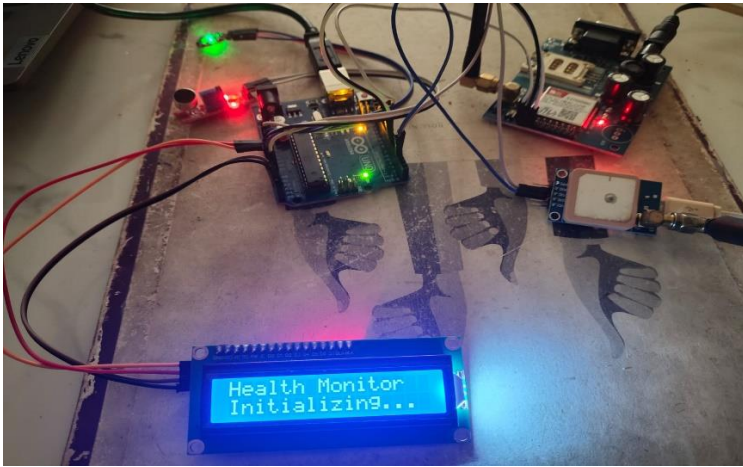
## 5.1 Detecting Pulse Sensor



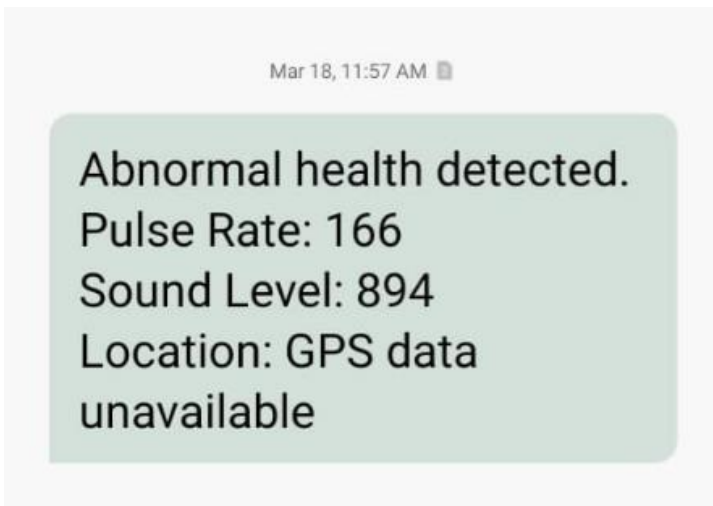
**Fig.4.** Pulse detector

Fig.4 depicts the Pulse detector. This is a tiny electronic module: a pulse sensor. This sensor senses changes in blood volume beneath the skin's surface via a method known as photo plethysmography (PPG). It has an infrared (IR) LED light source and a Module: Photodiode which captures changes in the light emitted and reflects back in relation to the heart beat. The device is self-contained – powered, data, and The signal for each heartbeat is processed through a microcontroller such as Arduino or ESP32. This information is processed to observe photoplethysmography signals during interval training. The output electrical signals measured by the sensor are used to estimate the changes in the pulse rate over time, making it ideal for use in smart device applications, fitness and medical monitoring, as well as diagnostics.

## 6 Results



**Fig.5.** The image shows an Arduino-based health monitoring system with a GPS module, GSM module, and an LCD screen displaying "Health Monitor Initializing...".



**Fig.6.** The image shows a health alert message indicating abnormal health detection with a high pulse rate, sound level, and unavailable GPS data.

## 7 Future Scope

Our intended system has considerable promise for further development to increase its efficiency and effectiveness. The integration of AI and machine learning for pre-

dictive analysis, so that health risks can be recognized before an emergency arises, is one such advancement. Moreover, the use of advanced sensors in health monitoring, like EEG for brain activities, can also improve the health assessment. And the incorporation of voice and gesture control as another enhancement will increase accessibility of the system for users that are physically disabled to a severe extent. These and other improvements will enhance the intelligence, responsiveness, and overall usability of the automated emergency response system folded towards disabled people.

## 8 Conclusion

Our innovative system integrates continuous health monitoring and emergency notifications alongside real time geographic tracking to ensure maximum safety for users. The wearable IoT technology incorporated into the system enables instant response to critical cases without user's assistance. The system becomes efficient and reliable by automatically tracking location, notifying caregivers in cases of health abnormalities, and providing real time tracking capabilities. This technology enables users with disabilities to live autonomously while staying under protection which improves quality of life. With cost effective implementation and user friendly design, the system has the potential to change life of disabled individuals significantly.

## References

1. Naga Vivek, K., et al., "PAW Patrol: IoT based Smart Wearable Device for Protection Against Violence on Pedophile, Alzheimer's, Women," ICICCS2022.
2. Thamaraiselvi, K., et al., "Internet of Things (IOT) based smart band to ensure the security for women," ICSSIT 2019.
3. Tahmidul Kabir, A. Z. M., et al., "Safety Solution for Women Using Smart Band and CWS App," ECTI-CON2020.
4. Zhou, Q., et al., "A Survey of the Development of Wearable Devices," ICARM 2020.
5. Bisht, R. S., et al., "Study of Wearable IoT devices in 2021: Analysis & Future Prospects," ICIEM2021.
6. Hyndavi, V., et al., "Smart Wearable Device for Women Safety Using IoT," ICCES 2020.
7. Venkatesh, K., et al., "IoT based Unified approach for Women safety alert using GSM," ICICV 2021.
8. Shalini, V. B., et al., "Smart Health Care Monitoring System based on Internet of Things (IOT)," ICAIS2021.

9. Jhansi Bharathi, M., et al., "HOT Watch: IoT-Based Wearable Health Monitoring System," IEEE Sensors Journal 2024.
10. Ghosh, P. et al., "Smart Security Device for Women Based on IoT Using Raspberry Pi," ICREST 2021.

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