



# Sensor-Based Smart Wireless Emergency Pendant

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## ABSTRACT:

Smart wireless emergency pendants represent a technological advancement in personal safety devices, offering an innovative solution for rapid access to emergency assistance. This paper explores the evolution, functionalities, applications, benefits, and challenges associated with these wearable devices. Through an extensive review of existing literature and technological developments, this research elucidates the pivotal role played by smart and wireless emergency pendants in revolutionizing emergency response systems, particularly in healthcare settings. The analysis encompasses the technological components, such as sensors and connectivity, highlighting their capabilities in detecting emergencies, triggering alerts, and facilitating prompt communication with emergency services or designated contacts. Moreover, this paper discusses the broader implications of these devices, including their impact on emergency response times, user safety, and the challenges related to adoption and implementation. Future trends and potential societal implications are also deliberated upon, laying the groundwork for further advancements and applications of these devices in diverse contexts. This research underscores the significance of smart and wireless emergency pendants in augmenting personal safety and enhancing emergency preparedness in an increasingly interconnected and technology-driven world.

**Keywords:** Arduino, Sensors, Fall detection, Emergency Button, Wireless emergency pendant, GPS-enabled and wearable pendant, GSM Module.

## I. INTRODUCTION

In recent years, technological advancements have revolutionized the way we approach personal safety and emergency response systems. Among these innovations, smart and wireless emergency pendants have emerged as crucial tools designed to provide immediate assistance and peace of mind, particularly for seniors, individuals with medical conditions, or those living alone. These devices, often compact and wearable, offer a seamless connection to emergency services or designated contacts, leveraging cutting-edge technology such as GPS tracking, fall detection, and real-time communication capabilities. This introduction explores the significance, functionalities, and benefits of these modern emergency pendants in ensuring swift and effective responses during critical situations. These are innovative devices designed to enhance personal safety and provide immediate assistance in emergency situations. These devices are often worn as accessories allowing individuals to call for help or notify their emergency contacts with a simple activation button. These devices are equipped with various sensors such as the fall detection sensor, GPS-tracking, sweat sensor, temperature sensor, heart rate and oxygen sensor. The primary objective of the intelligent, smart and wireless emergency pendant is to enhance personal safety and security, ensuring immediate help in emergency situations, allowing individuals to lead an independent life with the assurance that support is so easily accessible whenever needed.

## II. LITERATURE SURVEY

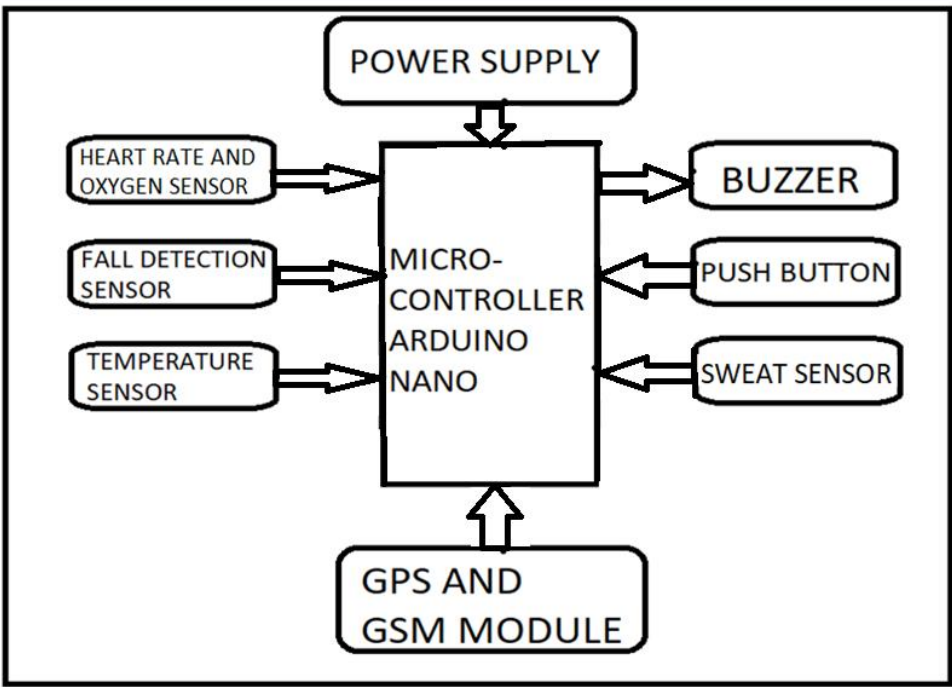
M. Arabboev, Sh. Begmatov (2022). The paper titled "Development of a wearable device for monitoring and predicting human health in emergencies" discusses about the wearable device for health monitoring and emergency alarm is developed using all the sensors and modules mentioned above interconnected. This device could perform real-time heart rate, blood oxygen saturation and body temperature monitoring. The data obtained on these three vital signs are displayed on the display of the device. The device could generate a strong alarm when a patient's health status was deteriorating. In addition, when a person needs help in an emergency, they can produce an alarm signal by pressing a button on the device. This makes it easier for rescuers to find survivors in search and rescue operations in emergencies [1].

Lee, S., Lee, S., & Park, S. (2020). The paper titled "Development of Smart Emergency Pendant with Voice Recognition and Fall Detection", presents a comprehensive exploration of the design and development of a smart emergency pendant equipped with voice recognition and fall detection capabilities. The main focus of the paper revolves around the creation and integration of technological features within the emergency pendant. These features include voice recognition, which likely enables users to trigger alerts or communicate with the pendant through voice commands. Additionally, the paper discusses fall detection technology, a critical aspect for identifying potential emergencies, particularly in scenarios where the user may not be able to manually activate the pendant [2].

Dr. K. Karnavel, J. Balathanusan, X. Joeal Santhana Raj (2019). “Patient Health Alert System”. This paper conducted survey for last 3 years on development of a mobile application to help providing an effective in the information of intelligent suggestion on choosing suitable hospital and finding doctor. Now people are facing the problem in not properly monitoring patient’s health activities in the hospital. So we have suggested using the patient health alert system to monitor the health of the patients continuously and providing alert to the guardian, doctor and the hospital authority for immediate taking care of the patient’s treatment by using Raspberry pi kit and generating report in the end of the treatment [3].

Benjamin Kommey, Seth Djanie Kotey, Daniel Opoku, “Patient Medical Emergency Alert System”. Heartrate and body temperature are two important vital signs which determine the health of a person. Many different systems and devices have been proposed to enable monitoring of these vital signs to ensure timely healthcare is provided to a patient. In this paper, a Patient Medical Emergency Alert System (PMEAS) has been presented. A wearable device, accompanied with an android application, monitors the temperature and heartrate of the user. The system has sensors to measure body temperature and heartrate of the user and displays them on a LCD screen. These values are then sent to the user’s phone via Bluetooth to be stored. When the values recorded are abnormal, a LED light lights up, a buzzer sounds and an alert is sent to a confidant of the user with his/her location. The alert is sent from the phone after the recorded values are received and stored on the phone. A user can view these recorded values on the application on the phone in th e form of a graph. A prototype of the device was built and an android application was written to test the system. The system performed as expected from the tests [4].

Wu, F., Yen, A. M., & Fann, J. C. (2019). “A smart emergency system for community-residing elders”, likely focuses on the implementation and evaluation of a smart emergency system tailored for elderly individuals living in the community. The paper probably describes the smart emergency system, which could include components like wearable devices, sensors, alert systems, or mobile applications designed to detect emergencies or health-related issues among the elderly population. It likely presents the findings from an initial pilot study involving a small-scale implementation or trial of the smart emergency system within a community setting. This may involve data collection, system performance evaluation, and user feedback [5].



III. BLOCK DIAGRAM

Fig.1. System block diagram

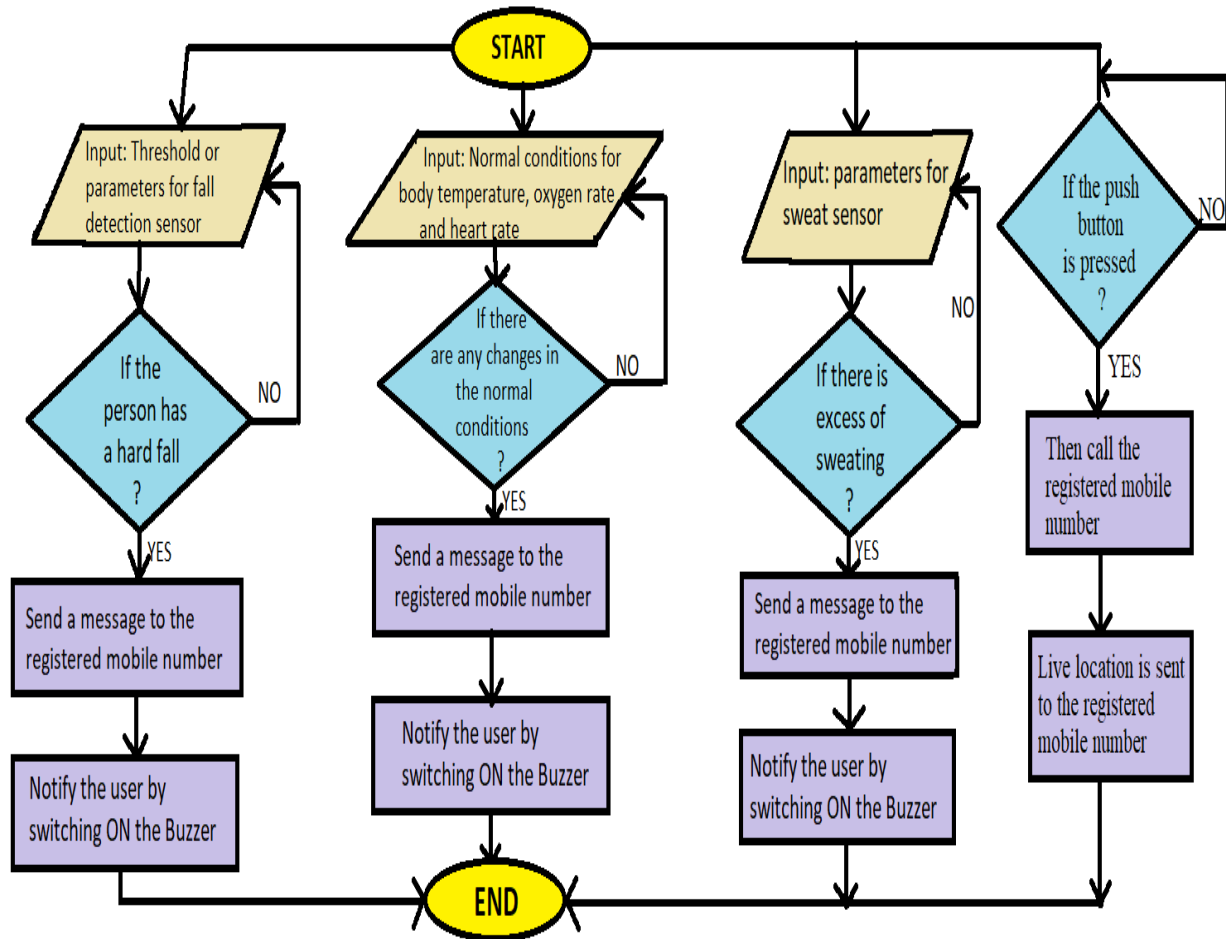


Fig.2. Flowchart

#### IV. METHODOLOGY

A smart wireless emergency pendant typically functions as a wearable device equipped with various sensors, communication modules, to assist in emergency situations.

The pendant includes sensors that detect fall, heart rate, temperature. It has GPS for location tracking and GSM module to provide communication between the user and the registered number.

All the sensors, GPS and GSM module are interfaced to the Arduino. Analog output signals (changes in voltage if occurs) are received by the Arduino. Then the Arduino reads analog signals from the sensors at regular intervals. Arduino processes these signals into digital values and computes the physical conditions (Ex. Heart rate, temperature, etc.) using algorithms.

In case of an emergency, the user can activate the device through a button press. For instance, pressing a push button on the pendant or the device detecting an unusual event like a fall can trigger the emergency response process and sends a quick message to the registered mobile number via GSM Module.

Once activated, the device sends an alert along with relevant information (location, vital signs, etc.) to the registered mobile number. The registered mobile number receive the message and take appropriate action. This could involve dispatching emergency services to the user's location, contacting a registered mobile number, or providing instructions for assistance.

After the alert is resolved, the system may continue to monitor the user's status or may have protocols for follow-up actions, ensuring the situation is under control and providing ongoing support if needed.

With the help of this module the patient health condition is monitored continuously and if there is any change in the condition of the health then it immediately sends that changed data as message through GSM to the person whose mobile number is already registered. In this we check the patient's health condition by monitoring the physical conditions of the person.

The heart condition is monitored with the heart rate sensor. The minute change in the functioning of the heart and other physical conditions of the user, the registered mobile number will get a message, which indicates the fault or malfunction of the heart.

It also monitors the temperature of the body with a temperature sensor, and detects and sends an alert message to the registered number with the help of accelerometer-fall detection sensor, if the person has a hard fall.

## V. HARDWARE IMPLEMENTATION:

This health device is made up of numerous different types of sensors, including the GPS tracking device for live location tracking, with a GSM Module for communication purpose, and the Arduino controller is the heart of the device. Arduino is a microcontroller that is linked to all the other components. The different hardware components included in this health device are as follows:

- 1) **Arduino Nano [ATmega328P]:** The Arduino Nano integrates all the sensors, and is responsible for all the data processing, wireless communications, and the alert mechanisms.
- 2) **Fall detection sensor [ADXL335]:** If the person has any hard-fall, the fall detection sensor senses it and it will be notified to the user by a buzzer. The buzzer gets switched ON and a message will be sent to the registered mobile number with the live location of the person.
- 3) **Temperature sensor [DHT11]:** The temperature of the body is monitored with the temperature sensor and any changes in the normal conditions of the temperature will be notified to the user by a buzzer. The buzzer gets switched ON and a message will be sent to the registered mobile number.
- 4) **Heart rate and oxygen sensor [MAX30100]:** The heart rate and the oxygen rate of the body is monitored with the heart rate and the oxygen sensor and any changes in the normal conditions of the heart and oxygen level will be notified to the user by a buzzer. The buzzer gets switched ON and a message will be sent to the registered mobile number.
- 5) **Sweat sensor:** If the person sweats profusely or if there is excess of sweating, then the buzzer gets switched ON and a message will be sent to the registered mobile number.
- 6) **GSM Module [Sim800C]:** The GSM Module is responsible for communication purpose between the user and the registered mobile number.
- 7) **GPS Location Tracker:** The GPS Location Tracker sends the live location of the user to the registered mobile number.
- 8) **Push button:** In case of any emergency situation, the user presses the button (emergency button) and a call is initiated to the registered mobile number and the live location of the person is sent.
- 9) **Buzzer:** If there are any changes in the normal physical conditions of the person, they are notified to the user by switching ON the buzzer.
- 10) **Power Supply:** To ensure continuous operation, the Arduino Nano would require a reliable power source, such as a rechargeable battery.

## VI. SOFTWARE IMPLEMENTATION:

A software application is used to transmit all the messages periodically or continuously, the messages are transmitted via the GSM module to the registered mobile number.

## VII. CONCLUSION

In conclusion, the evolution of smart wireless emergency pendants has revolutionized the landscape of personal safety, especially for vulnerable populations and individuals with medical conditions. These devices have transcended traditional emergency alert systems by incorporating advanced technologies, such as IoT, GPS, and two-way communication capabilities, into compact and wearable forms.

Throughout this research paper, it becomes evident that the benefits offered by these pendants are multifaceted. They not only provide a sense of security and independence for users but also significantly improve emergency response times, ultimately saving lives. The integration of location tracking and real-time communication empowers users to swiftly and effectively signal for help, enhancing their overall safety and well-being.

Looking ahead, the future of smart and wireless emergency pendants appears promising. Advancements in sensor technologies, AI integration, and design improvements offer vast opportunities for innovation. These advancements hold the potential to further enhance the functionality, reliability, and user experience of these devices, thus solidifying their role as indispensable tools for personal safety and emergency response.

In conclusion, while challenges persist, the continuous evolution and integration of smart and wireless emergency pendants into our daily lives have and will continue to significantly impact safety and independence for individuals in need. Further research,

technological innovation, and collaborative efforts are crucial to realizing the full potential of these devices, ultimately creating safer and more secure environments for everyone.

## VIII. FUTURE SCOPE

The future of smart wireless emergency pendants looks promising. Advancements in technology may lead to smaller, more discreet designs with enhanced features like GPS tracking, fall detection, integration with smart home systems, and quicker emergency response times. Moreover, these devices might become more accessible and affordable, catering to a wider demographic, including seniors, individuals with disabilities, and anyone needing immediate assistance in emergencies. Additionally, improvements in connectivity, battery life, and artificial intelligence could further enhance the functionality and reliability of these devices, making them an indispensable tool for ensuring personal safety and well-being.

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