



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 13, Issue 12, December 2024

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.524

9940 572 462

6381 907 438

ijirset@gmail.com

www.ijirset.com

Smart Watch for Health Monitoring System

Dr. Prathibha M. K¹, Ananya S Nayak², Anusha R³, Archana A G⁴, Harshitha S⁵

Associate Professor, Department of Electronics and Communication Engineering, ATME College of Engineering,
Mysuru, Karnataka, India¹

U.G. Student, Department of Electronics and Communication Engineering, ATME College of Engineering, Mysuru,
Karnataka, India^{2,3,4,5}

ABSTRACT: This project presents a smart device designed to enhance personal safety and health monitoring. It integrates advanced features such as fall detection using a MPU6050 gyroscope, GPS for location tracking and sharing, heart rate and temperature monitoring with the MAX30105 sensor. An emergency help request button enables quick alerts during emergency situations. Powered by an ESP32C microcontroller, the system includes an OLED display for real-time data visualization and a lithium polymer battery for portability. This device offers a compact, reliable, and efficient solution for personal safety and health management.

KEYWORDS: Fall Detection GPS Tracking, Heart Rate Monitoring, Wearable Device, Health Monitoring, Portable Device.

I. INTRODUCTION

In an increasingly connected world, the demand for wearable devices that enhance personal safety and health monitoring has grown significantly. This project introduces a smart wearable device designed to address these needs by integrating advanced sensors and communication modules into a compact, portable system. The device features fall detection using an MPU6050 gyroscope, ensuring immediate alerts during accidents. GPS tracking enables real-time location sharing, vital for emergency responses. Additionally, heart rate and temperature monitoring provide critical health data, empowering users to maintain well-being proactively.

An emergency help button allows users to send alerts in distress, making it a comprehensive solution for personal safety. Built around the ESP32C microcontroller, the system ensures seamless communication and low-power operation. Real-time data is displayed on an OLED screen for user convenience. This project aims to provide a reliable, easy-to-use device for individuals, particularly the elderly and those with medical conditions, enhancing their independence and safety.

II. LITERATURE SURVEY

The concept of situation awareness in smart healthcare was first introduced by Alkhomsan et al. [1]. This study presented a framework for Ambient Assisted Living (AAL) systems that integrates real-time monitoring and predictive analytics. By leveraging IoT sensors, the framework ensures continuous health tracking and timely emergency responses, forming the foundation for real-time monitoring and alert systems in wearable devices. Cheong et al. [2] investigated the physiological effects of environmental stressors, such as hot weather, on older adults. The authors emphasized the importance of monitoring temperature and heart rate to predict and prevent health risks. This study highlights the necessity of integrating physiological sensing features in wearable technologies, especially for vulnerable populations. In another study, the authors in [3] proposed a smartwatch-based step counter specifically designed for individuals with slow and intermittent ambulation. The algorithm effectively detects movements in challenging scenarios, showcasing the efficacy of motion sensors like the MPU6050 gyroscope, which is also utilized for fall detection in wearable systems. Rodrigues et al. [4] explored enabling technologies for the Internet of Health Things (IoHT). Their research underscored the significance of microcontrollers, such as the ESP32C, in achieving interoperability, scalability, and low-power operation. These insights are essential for the design of efficient wearable devices. Zhang et al. [5] introduced a method for privacy-preserving user clustering in IoT healthcare systems. This approach ensures secure data transmission while facilitating personalized healthcare insights. It aligns well with the GPS tracking feature in wearable systems,

where secure location sharing is crucial. Xu et al. [6] developed a computational method known as NA-MEMD for pulse signal analysis. This method enhances accuracy by delivering reliable results even in noisy environments, supporting precise heart rate monitoring, which is vital for wearable health devices. The work presented in this paper incorporates key features such as fall detection, GPS tracking, and health monitoring. These features are implemented using advanced sensors and microcontrollers, building upon the insights from the aforementioned studies to improve personal safety and health management systems.

III. METHODOLOGY

The methodology for the proposed smart wearable device follows a structured approach that combines hardware integration, software implementation, and thorough testing. The hardware design starts with the selection of the ESP32C microcontroller, chosen for its low power consumption and capabilities in Wi-Fi and Bluetooth connectivity. Various sensors, including the MPU6050 gyroscope, MAX30105 heart rate sensor, and a temperature sensor, are integrated to monitor motion, cardiovascular health, and body temperature, respectively. Additionally, a GPS module is included for real-time location tracking, while an OLED display offers a straightforward interface for data visualization. The device is powered by a lithium polymer battery, ensuring portability, and features an emergency push button for quick alert notifications.

On the software side, data acquisition and processing are implemented with algorithms designed for fall detection, heart rate monitoring, and temperature analysis. The GPS module supplies location data that can be formatted into a shareable link, and an emergency alert system is in place to trigger notifications. Communication is facilitated through Wi-Fi for remote monitoring and Bluetooth for connectivity with nearby devices. The prototype is constructed on a Zero PCB, featuring optimized circuitry for compactness and low power consumption. Extensive testing is conducted under real-world scenarios to validate the system's performance in fall detection, GPS tracking, and health monitoring. Furthermore, the power-saving features of the ESP32C, along with efficient data processing algorithms, contribute to the device's reliability and responsiveness. This comprehensive methodology guarantees the development of a user-friendly and effective wearable device aimed at enhancing personal safety and health management.

IV. EXPERIMENTAL RESULTS

Fig. 1. System Overview (a) Block diagram of the proposed smart wearable device illustrating the integration of components, including ESP32C, MPU6050 gyroscope, MAX30105 heart rate sensor, GPS module, and OLED display. (b) Prototype assembly showing the hardware components on the Zero PCB with interconnections and a lithium polymer battery.

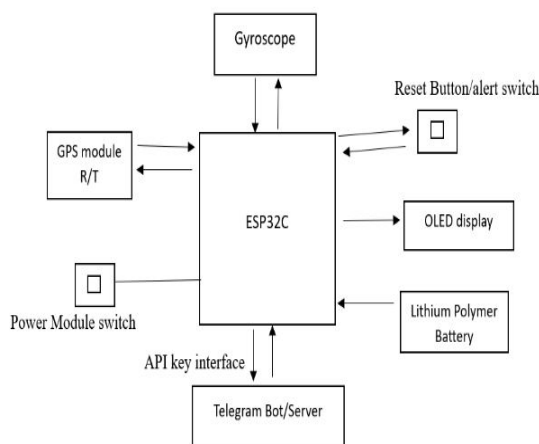


Fig. 1a: System Over View

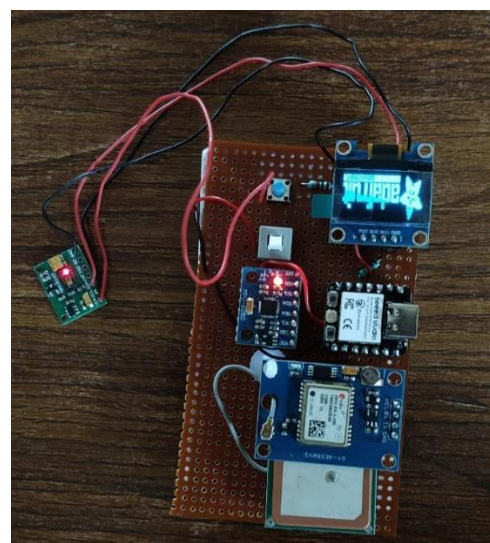


Fig. 1b: Prototype assembly

Fig . 2. Fall Detection and Alert System (a) Normal posture detected using MPU6050 gyroscope data & Fall detected based on threshold values from the gyroscope; emergency alert triggered. (b) Alert message displayed on the OLED and transmitted via Wi-Fi to the configured receiver.

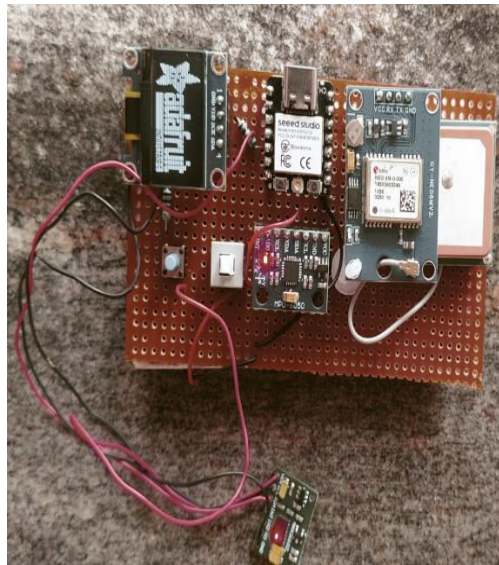


Fig. 2a: Fall Detection & Alert System

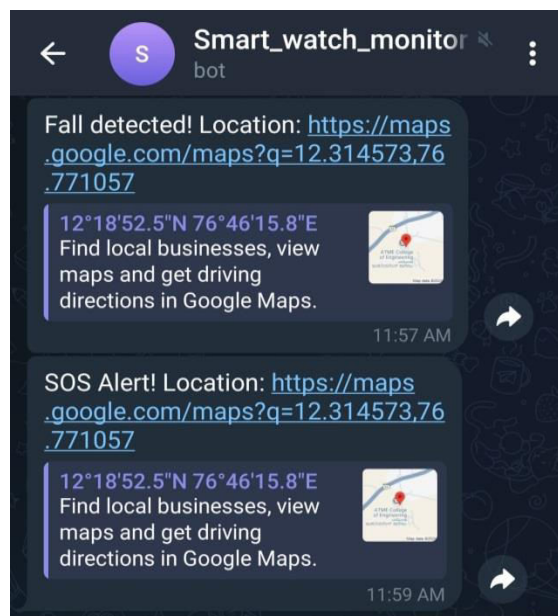


Fig. 2b: Displayed Alert message

Fig. 3. GPS Tracking System (a) GPS data displayed on the OLED in a human-readable format. (b) Generated Google Maps link for real-time location tracking, shared via communication channels.

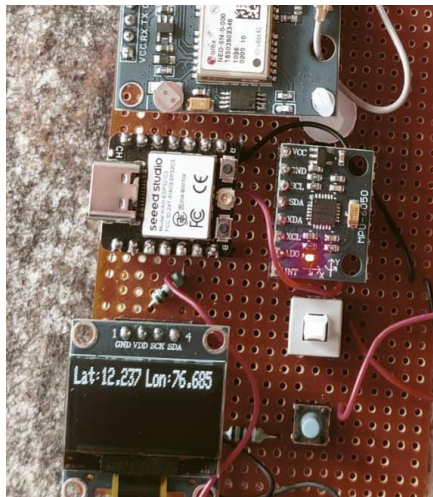


Fig. 3a: GPS Tracking System

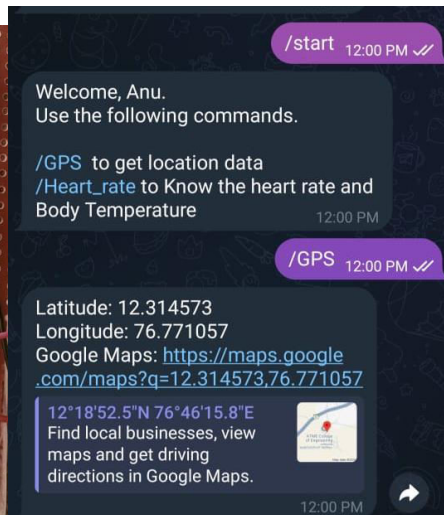


Fig. 3b: Generated Google Maps link

Fig. 4. Health Monitoring System (a) Heart rate monitoring data captured using the MAX30105 sensor. (b) Temperature readings displayed alongside heart rate on the OLED screen.

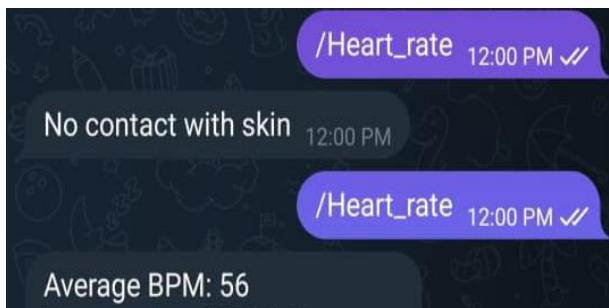


Fig. 4a: Heart rate monitoring da

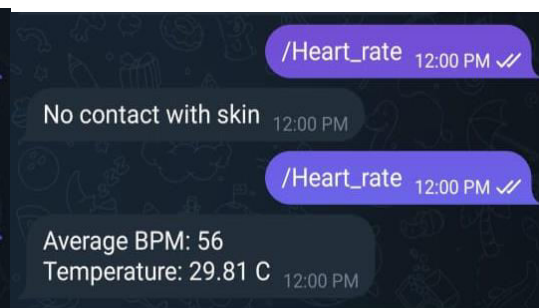


Fig. 4a: Temperature readings

These figures illustrate the functionality and outputs of the wearable device, highlighting its capability to detect falls, monitor health parameters, and provide real-time location updates with a user-friendly interface.

V. CONCLUSION

The proposed smart wearable device successfully integrates advanced sensors and communication technologies to enhance personal safety and health monitoring. With features such as fall detection, GPS tracking, heart rate and temperature monitoring, and an emergency alert system, the device addresses critical needs for individuals, especially the elderly and those with medical conditions. The use of the ESP32C microcontroller ensures efficient operation, low power consumption, and seamless connectivity. Comprehensive testing under real-world scenarios validates the device's reliability and accuracy. This project provides a practical and innovative solution for improving quality of life, empowering users to monitor their health and ensure safety effectively.

REFERENCES

1. M. N. Alkhomsan, M. A. Hossain, S. M. M. Rahman and M. Masud, "Situation Awareness in Ambient Assisted Living for Smart Healthcare," in IEEE Access, vol. 5, pp. 20716-20725, 2017.
2. S. -M. Cheong, C. Bautista and L. Ortiz, "Sensing Physiological Change and Mental Stress in Older Adults From Hot Weather," in IEEE Access, vol. 8, pp. 70171-70181, 2020.
3. V. Genovese, A. Mannini and A. M. Sabatini, "A Smartwatch Step Counter for Slow and Intermittent Ambulation," in IEEE Access, vol. 5, pp. 13028-13037, 2017
4. J. J. P. C. Rodrigues et al., "Enabling Technologies for the Internet of Health Things," in IEEE Access, vol. 6, pp. 13129-13141, 2018, doi: 10.1109/ACCESS.2017.
5. Q. Zhang, Y. Zhang, C. Li, C. Yan, Y. Duan and H. Wang, "Sport Location-Based User Clustering With Privacy-Preservation in Wireless IoT-Driven Healthcare," in IEEE Access, vol. 9, pp. 12906-12913, 2021, doi: 10.1109/ACCESS.2021.
6. H. Xu, Y. Tian, Q. Wang, X. Mao, Y. Zhao and L. Huang, "NA-MEMD Is Actually What You Need for Computational Pulse Analysis," in IEEE Access, vol. 10, pp. 93981-93991, 2022.



INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  ijirset@gmail.com



www.ijirset.com

Scan to save the contact details