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Health Monitoring and Assistance System for Wheelchair Patients

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***Abstract*—The growing burden of chronic illnesses and aging populations necessitates innovative solutions in healthcare. Remote patient monitoring offers a promising approach to continuously track health data outside of hospitals. This paper explores a novel patient monitoring system designed using STM NUCLEO and Blackpill development boards. This system captures vital health data such as SpO_2, heart rate, body temperature, and even fall detection. A load cell sensor plays a crucial role in detecting falls, which could signify a medical emergency. Upon such detection, the system leverages a GSM module to transmit an emergency notification to the patient's designated caregiver, ensuring timely intervention. This paper delves into the design, implementation, and evaluation of the proposed patient monitoring system. The research emphasizes the system's potential to revolutionize patient care by enhancing safety and enabling remote monitoring, particularly in settings where patients reside alone.**

Keywords - Remote patient monitoring, GSM module, SpO_2, heart rate

I. INTRODUCTION

The global healthcare system faces a growing burden due to the rise of chronic health conditions and an aging population. Traditional healthcare models struggle to provide adequate care for these demographics, often limited by hospital capacity and the inability to continuously monitor patients outside of clinical settings. Remote patient monitoring (RPM) emerges as a promising solution, enabling healthcare providers to collect and analyze vital health data remotely. This approach empowers patients to manage their health conditions proactively while reducing the strain on healthcare infrastructure. This research presents a novel patient monitoring system designed to address these challenges. Utilizing readily available development boards like STM NUCLEO and blackpill, the system offers a cost-effective and versatile platform for capturing critical health data. The system goes beyond traditional RPM by not only monitoring vital signs like SpO_2 (blood oxygen saturation), heart rate, and body temperature, but also incorporating fall detection using a load cell sensor. Falls are a significant concern for elderly or infirm individuals, often leading to serious injuries and complications. By detecting falls, the system can identify potential medical emergencies and trigger timely intervention. Upon detecting a fall, the system leverages a GSM module to transmit an emergency notification directly to the patient's designated caregiver. This ensures prompt response and minimizes the risk of delayed medical attention. This paper delves into the design, implementation, and evaluation of the proposed patient monitoring system. We explore the technical details of the system, its functionalities, and its potential to revolutionize patient care by enhancing safety and enabling remote monitoring, particularly for individuals residing in remote locations or managing chronic conditions at home.

II. LITERATURE REVIEW

Remote patient monitoring systems have emerged as a promising solution to address the growing burden of chronic illnesses and aging populations. A review of current state-of-the-art systems reveals their diverse functionalities and technologies utilized to improve patient care outcomes. It provides an extensive overview, discussing sensor technologies, communication protocols, and data analytics methods employed in these systems [1]. This focus on chronic disease management, detailing the integration of sensors for vital signs monitoring and the development of user-friendly interfaces [2]. Meanwhile, delve into fall detection, emphasizing the use of wearable sensors and algorithms for timely emergency notifications [3]. Additionally, highlight the role of Internet of Things (IoT) sensors in remote patient monitoring, emphasizing their potential to enhance patient care and reduce healthcare costs. Together, these studies underscore the significance of remote patient monitoring systems in revolutionizing healthcare delivery, particularly in enabling continuous monitoring and timely intervention for patients residing alone or with chronic conditions [4]. It provides a review focusing on the role of remote patient monitoring in managing chronic respiratory diseases [5]. They evaluate the effectiveness of wearable sensors, spirometry devices, and telehealth platforms in monitoring symptoms, assessing disease progression, and

Automated alerts were triggered for deviations from normal ranges, ensuring timely interventions by notifying designated caregivers or healthcare providers through predefined communication channels. This capability significantly enhanced the system's ability to monitor users' well-being continuously.

Fig. 10 Emergency SOS button

The integrated emergency SOS button played a pivotal role in enhancing user safety during emergencies. Activation of the SOS button initiated immediate calls for assistance, either to designated caregivers or emergency response teams, as per predefined protocols. The system's responsiveness and reliability were tested in simulated emergency scenarios, showcasing its effectiveness in ensuring prompt interventions and improving overall emergency response times. This feature proved invaluable in enhancing the safety of wheelchair-bound individuals.

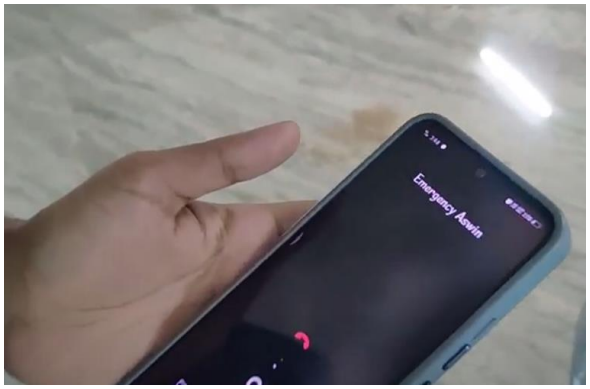

Fig. 11 Emergency call to care taker

Upon activation of the SOS button, the system successfully established emergency calls, providing precise location data and relevant health information to responders. The seamless integration with communication protocols ensured accurate and efficient communication during critical situations, enabling responders to make informed decisions swiftly. The system's ability to handle emergency calls and provide essential information highlighted its potential to improve user safety significantly. This aspect is crucial in healthcare settings where timely interventions can make a substantial difference in patient outcomes.

VI. CONCLUSION

The results demonstrate the efficacy and practicality of the developed system for wheelchair users. By integrating real-time health monitoring, emergency response functionalities, and seamless communication protocols, the system showcased its potential to enhance the quality of life and safety of wheelchair users significantly.

Future research directions may focus on refining algorithms for advanced data analysis, exploring machine learning techniques for predictive health analytics, and expanding communication functionalities for broader emergency support. Overall, the study contributes to the growing field of assistive technologies aimed at improving healthcare outcomes for vulnerable populations.

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