**Abstract**

This project proposes the development of SafeTrack, a mobile-based health tracking application specifically designed for individuals with underlying health conditions who engage in physical activity. Unlike complex AI-driven solutions, SafeTrack adopts a rule-based alert system that monitors vital indicators such as heart rate and environmental conditions to provide real-time safety feedback during exercise (Giacomelli et al., 2011; Hart et al., 2024). The system allows users to input their chronic health information, such as hypertension or asthma, and receive tailored activity recommendations and risk alerts. Drawing upon recent studies on mHealth platforms and chronic disease self-management (Ghose et al., 2021), this project aims to demonstrate the feasibility of a lightweight, personalized, and easy-to-use solution for enhancing exercise safety. The proposed app targets the gap between generic fitness apps and clinical monitoring systems, offering an accessible platform for safe self-management. This work contributes both practical value and research significance in the field of mobile health for special populations.

**Chapter 1: Introduction**

* 1. **Context**

In recent years, the global burden of chronic diseases such as hypertension, asthma, and cardiovascular conditions has increased significantly. Individuals living with these health conditions are often encouraged to remain physically active to improve their long-term prognosis and quality of life. However, physical activity may carry increased risks for such populations if not properly monitored. Simultaneously, the proliferation of mobile health (mHealth) applications and consumer-grade wearable devices has opened new opportunities for real-time health monitoring, personalized alerts, and behavior tracking.

Despite advances in AI-enabled health systems, many existing solutions are too complex, costly, or medically generalized to meet the daily needs of people with chronic illnesses. There remains a significant gap between clinical monitoring systems and commercial fitness apps, especially in terms of disease-specific customization and safety-focused exercise tracking. Addressing this gap requires the design of lightweight, rule-based mobile platforms that can support safe physical activity and self-care behaviors.

This project proposes the development of SafeTrack, a mobile application designed to help individuals with underlying health conditions track their physical activity, monitor basic health indicators, and receive safety alerts based on preset rules. Rather than relying on AI or cloud-dependent infrastructure, SafeTrack utilizes a locally deployed, customizable threshold-based system to deliver personalized feedback during exercise.

**1.2 Aims and Objectives**

**Aim:**

To develop and evaluate a lightweight, rule-based mobile health application that supports safe physical activity for individuals with chronic health conditions.

Objectives:

1. To conduct a literature review on the use of mobile apps and wearable technologies in chronic disease management and physical activity promotion.
2. To identify key features and design principles required for safe and personalized exercise monitoring.
3. To design and implement a prototype application using simple rule-based decision logic.
4. To evaluate the app's usability and potential effectiveness through user testing or simulated scenarios.
5. To propose improvements and outline future directions for personalized mHealth solutions targeting at-risk populations.

**1.3 Report Structure**

Chapter 2: Background and Literature Review

Introduces key concepts such as mobile health, chronic disease risks, and rule-based decision logic, followed by a literature review of current research on mHealth applications, wearable devices, and behavioral motivation strategies. A critical analysis compares existing approaches and identifies the need for a lightweight, personalized health tracking solution.

Chapter 3: System Design and Methodology

Describes the SafeTrack application’s system architecture, core functions, rule-based engine, and user interface design. The methodology section outlines the development tools, implementation process, and testing setup.

Chapter 4: Results and Evaluation

Presents results from prototype testing or simulated scenarios, analyzing system usability, responsiveness, and safety alert mechanisms.

Chapter 5: Conclusion and Future Work

Summarizes project findings, highlights limitations, and proposes future enhancements in rule-based mobile health systems for chronic disease management.

**Chapter 2: Background and Literature Review**

**2.1 Basic Concepts**

**2.1.1 Mobile Health (mHealth)**

Mobile health (mHealth) refers to the use of mobile devices, such as smartphones, tablets, and wearable technologies, to deliver health-related services and information. It encompasses a wide range of applications, from appointment reminders and teleconsultations to disease management and real-time monitoring. mHealth has emerged as a promising tool for promoting patient engagement, particularly for chronic disease management and preventive care.

**2.1.2 Chronic Diseases and Exercise Risks**

Chronic diseases such as hypertension, asthma, and cardiovascular disease often require long-term self-management. Physical activity is recommended for these patients to improve outcomes; however, unsupervised or excessive exercise can pose serious risks, including elevated heart rate, breathing difficulties, or cardiac incidents. Therefore, integrating safe, personalized monitoring is essential for this population.

**2.1.3 Rule-Based Decision Systems**

Rule-based systems operate on “if–then” logic to trigger specific outputs based on predefined input conditions. In the context of mobile health, these rules can monitor vital signs (e.g., “if heart rate > 130 bpm → trigger warning”) and offer actionable feedback without the need for AI. This approach ensures simplicity, transparency, and offline usability, which are especially important for older adults or users with limited digital literacy.

**2.2: Literature Review**

In recent years, the widespread rise of chronic diseases such as hypertension, cardiovascular disease, diabetes, and musculoskeletal disorders has led to an urgent need for better tools to support patient self-care and safe physical activity. Mobile health (mHealth) technologies and wearable devices have emerged as practical, scalable solutions that offer real-time health monitoring, personalized reminders, and data-driven behavior support. These tools are particularly relevant for individuals at risk of health complications during physical activity.

Gagnon et al. (2024) conducted a comprehensive systematic review of wearable technologies applied in chronic disease self-management, highlighting their utility in tracking daily physiological patterns such as heart rate, glucose levels, and respiratory function. They found that successful adoption heavily depends on personalization and user-centered design. Similarly, Eboreime et al. (2025) explored wearable devices among musculoskeletal disorder patients, finding statistically significant improvements in physical activity adherence and pain reduction.

For cardiovascular health, Chauhan et al. (2025) evaluated 42 mHealth apps and wearables in the DACH region. While they found these tools offer valuable features for remote monitoring and user engagement, concerns remain regarding clinical certification and scientific validation. Lu et al. (2025) approached the issue from a behavioral science perspective, reviewing strategies that motivate adherence to chronic care routines. Techniques such as goal setting, gamified feedback, and real-time reminders were found to be effective.

Beyond theoretical designs, real-world technical validation plays a crucial role. Singh et al. (2024) examined wearable device accuracy in detecting atrial fibrillation and fall risks, supporting the integration of threshold-based alerts into commercial health tools. Vo et al. (2024) focused on biosensor innovation, discussing how micro-sensor technologies for heart rate, respiration, and skin temperature provide reliable, low-cost monitoring. These biosensors are integral to rule-based logic systems in mHealth applications.

From a usability standpoint, Wu et al. (2024) developed a smartwatch-based COPD management application. Their pilot study revealed that older users with no prior technical experience were able to operate the app effectively, reinforcing the need for simplicity, large text, and minimal interaction complexity. Buawangpong et al. (2024) further investigated telemedicine for older adults with multimorbidity, emphasizing usability, structured communication, and tailored designs as essential components.

Several meta-analyses further validate the efficacy of digital health interventions. Zangger et al. (2023) and Bricca et al. (2023) both reported improvements in physical activity adherence across multiple chronic illness groups, with minimal adverse effects. Hamine et al. (2015), in an earlier foundational review, affirmed that mHealth interventions—like SMS reminders and telemonitoring—significantly improve adherence and patient outcomes. Hochberg et al. (2016) used reinforcement learning to encourage walking in diabetes patients with encouraging results.

The social and motivational aspects of mHealth systems are not to be overlooked. Al Ayubi et al. (2014) emphasized that peer sharing, community features, and persuasive UI design foster ongoing engagement. Likewise, Singh & Grønli (2024) argue that successful systems must balance cost-efficiency, scalability, and personalization. Grannell et al. (2023) emphasized the need to treat digital exercise therapy as a clinically valid intervention, requiring medical-grade evaluation, patient-tailored risk logic, and integration with broader healthcare frameworks.

In summary, the literature overwhelmingly supports the potential of wearable devices and mHealth applications in improving physical activity adherence and managing chronic health conditions. However, gaps remain in usability for older adults, data transparency, and disease-specific customization. Therefore, the proposed SafeTrack app positions itself as a rule-based, low-complexity system that uses threshold-driven logic to enhance safety, particularly in high-risk patients. It integrates key principles including personalized prompts, real-time alerts, and easy-to-use interfaces.

**2.3 Critical Analysis**

Current digital health technologies show strong potential in managing chronic conditions and supporting safe physical activity. However, many commercial solutions rely heavily on AI-driven personalization, which increases system complexity and reduces transparency. For example, machine learning models often require large datasets, continuous internet access, and cloud processing—factors that may hinder adoption among older adults or low-income users.

Furthermore, while many fitness apps target general populations, few are tailored to users with specific chronic diseases or health risks. This lack of customization can lead to underuse or incorrect application of health advice. The literature consistently emphasizes the importance of usability, simplicity, and real-time feedback—features often overlooked in AI-centric designs.

Rule-based approaches offer a viable alternative. They are easier to audit, implement, and maintain, while still enabling personalization through user-defined thresholds and profiles. SafeTrack aims to bridge the gap between medically passive fitness apps and overly complex AI systems by offering a focused, threshold-driven mHealth solution for individuals with chronic conditions.

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