**Ethics of New Technologies, Group Friday 9:00**

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# Health assistant and emotion regulator.

A support system for maintaining a healthy lifestyle and proper nutrition, personalized for a specific user.

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## System Description

Consist of: a smartwatch, chest band, application on a mobile phone.
It acts as a personalized assistant/companion that can identify and measure emotional states, certain body parameters, arrange menus and help with meal preparation, and communicate/advise a specific health-promoting action.
It also informs about the user's current emotional states, collects data and interprets it. For example it can give advice like: keep smiling, anger is a bad advisor, don't spend so much time sitting, walk more etc.

# Analysis

## 1. Biometric Parameters and Emotions to Measure

### 1.1. **Vital Signs**:

Blood pressure, heart rate, respiratory rate, and body temperature are crucial for health monitoring, as seen in a study by Pereira et al. (2020) on a telehealth platform for elderly hypertensive patients [1].

- Blood Pressure: Continuous or frequent monitoring of blood pressure can provide insights into cardiovascular health and the risk of conditions like hypertension. Blood pressure variability can also be an indicator of stress or other health issues.
- Heart Rate: Monitoring heart rate offers critical information about cardiovascular health and fitness levels. It can also indicate emotional arousal or stress. Heart rate variability (HRV), the variation in time between each heartbeat, is an important marker of stress and heart health.
- Respiratory Rate: This is often an overlooked parameter, but it's vital in assessing respiratory health and can indicate stress or anxiety when the rate is unusually high or low.
- Body Temperature: Changes in body temperature can be an early indicator of infection or illness. Continuous monitoring could provide valuable data for detecting health issues proactively.

### 1.2. **Physical Activity**:

Tracking physical activity, steps, and posture is beneficial for health management, as indicated by Yoo et al. (2022) in their study on a mobile cardiac telemetry device [2].

- Steps and Distance: Tracking the number of steps and the distance traveled helps in assessing the level of physical activity, which is crucial for maintaining cardiovascular health and managing weight.
- Posture and Movement Patterns: Analyzing posture can help in identifying potential issues like back pain or muscular imbalances. Sedentary behavior, like prolonged sitting, can be flagged to remind users to move or adjust their posture.
- Workout Intensity and Recovery: Advanced tracking can include workout intensity, type of physical activity, and recovery rate,

which are important for athletes or individuals engaged in regular exercise.

### 1.3. **Emotional States:**

The system should recognize and inform about stress, anxiety, happiness, and anger. These emotions significantly impact overall health [3]. The system should also measure drastic mood swings.[4]

- Stress and Anxiety: By analyzing data like heart rate, HRV, and skin conductance (sweat), the system can identify signs of stress or anxiety. This can trigger prompts for relaxation techniques or other interventions.
- Happiness and Positive Affect: Detecting signs of happiness or positive emotional states, possibly through patterns in activity levels or physiological markers, can help in reinforcing healthy behaviors and lifestyle choices.
- Anger and Frustration: Recognizing signs of anger or frustration, perhaps through sudden changes in heart rate or skin conductance, can allow the system to offer de-escalation techniques or coping strategies.
- Mood Swings: Detecting rapid changes in emotional states can be crucial for mental health monitoring. This can help in identifying underlying issues like bipolar disorder or the impact of stress.

## 2. Potential User Groups

### 2.1. Elderly:

Older adults with chronic conditions like hypertension or diabetes would greatly benefit from continuous health monitoring.

- Chronic Conditions Management: Older adults often have chronic conditions such as hypertension, diabetes, or heart disease. Continuous monitoring of vital signs can provide crucial data for managing these conditions more effectively.
- Fall Detection and Emergency Alerts: The system can be equipped with fall detection technology, which is particularly important for the elderly, notifying caregivers or emergency services in case of a fall.
- Medication Reminders: The system can remind the elderly to take their medications at prescribed times, improving adherence to medication schedules.

- Social Interaction and Mental Health: Monitoring emotional states can also alert caregivers to potential issues of loneliness or depression, common in older adults, facilitating timely interventions.

### 2.2. Athletes:

To monitor training progress and prevent overtraining.

- Training Optimization: Continuous monitoring allows athletes to optimize their training routines, ensuring they are training at the right intensity without overexerting themselves.
- Injury Prevention and Recovery: By tracking physical activity and physiological responses, the system can help in identifying early signs of potential injury and manage recovery periods more effectively.
- Performance Analysis: Detailed data on workouts, including heart rate zones, recovery, and physical exertion, can provide insights for performance improvements.
- Nutrition and Hydration Tracking: Athletes have specific nutritional and hydration needs. The system can track these and provide recommendations to ensure optimal performance and health.

### 2.3. Individuals with Mental Health Challenges:

For managing stress, anxiety, and mood disorders

- Stress and Anxiety Management: Continuous monitoring can help in identifying triggers for stress and anxiety, allowing for timely interventions such as mindfulness exercises or counseling support.
- Mood Disorder Monitoring: For those with mood disorders, the system can detect patterns or changes in emotional states, aiding in managing conditions like depression or bipolar disorder.
- Behavioral Feedback: Providing real-time feedback on emotional states can empower individuals to recognize and adjust their responses to stressors.
- Sleep Quality Monitoring: Poor sleep can exacerbate mental health challenges. Monitoring sleep patterns can provide insights for improving sleep quality.

### 2.4. Individuals interested in self-improvement

- Lifestyle Tracking: For those keen on self-improvement, tracking daily activities, sleep patterns, and nutritional intake can provide valuable data for making informed lifestyle changes.
- Goal Setting and Monitoring: The system can help in setting personal goals (like increased physical activity, better sleep, stress management) and track progress towards these goals.
- Personalized Insights and Recommendations: Based on the data collected, the system can offer personalized insights and recommendations for health and well-being improvements.
- Habit Formation and Behavior Change: Continuous monitoring and feedback can assist in forming new, healthier habits and breaking old, potentially harmful ones.

### 2.5. Expand on User Adoption Factors (after peer-review)

- To fully grasp the potential of our system in diverse settings, it's imperative to consider the cultural and sociological factors influencing user adoption.
- Different cultural backgrounds may have varying perceptions and trust levels towards technology, especially in health-related fields.
- Understanding these nuances is key to customizing our approach for broader acceptance. For instance, in cultures where technology is less trusted, focusing on building community partnerships and transparent communication could be vital.
- Conversely, in highly digital societies, leveraging advanced features and integration with existing tech ecosystems might be more effective.

### 2.6. Develop Strategies for Addressing Barriers (after peer-review)

- Building on the understanding of cultural and sociological factors, we propose targeted strategies to enhance user adoption.
- In areas with technological apprehension, conducting community-driven awareness programs and collaborating with local health practitioners can foster trust and familiarity.
- For tech-savvy users, emphasizing data security and integration with popular health apps can be key selling points.

- Additionally, adapting our communication and marketing strategies to resonate with different cultural values and norms will be crucial in promoting acceptance and usage of our system.

## 3. Risks and Benefits of Use

### 3.1. Benefits:

Improved health management, early detection of health issues, enhanced patient-physician relationship, and personalized healthcare.

- Improved Health Management: Enables proactive health management through real-time tracking.
- Early Detection: Facilitates early detection of potential health problems.
- Enhanced Patient-Physician Relationship: Provides data for informed healthcare discussions.
- Personalized Healthcare: Offers tailored health advice and interventions.
- Healthy Lifestyle Promotion: Encourages adoption of healthier lifestyle choices.

### 3.2. Risks:

Data privacy concerns, reliance on technology over traditional healthcare, and potential inaccuracies in health monitoring.

- Data Privacy Concerns: Risk of unauthorized access to sensitive health data.
- Overreliance on Technology: Potential neglect of traditional healthcare consultations.
- Inaccuracies in Monitoring: Possibility of receiving incorrect health data.
- Increased Anxiety: Constant monitoring might lead to health-related anxiety.
- Economic and Accessibility Barriers: Potential inequity in access due to cost.

## 4. Recommendation for Scope and Context of Use

### 4.1. Scope:

Focus on non-invasive, continuous monitoring of vital signs, physical activity, and emotional states for personalized health advice.

- Non-invasive Monitoring: Focus on comfortable, user-friendly methods.
- Vital Signs Monitoring: Continuous tracking of heart rate, blood pressure, and respiratory rate.
- Physical Activity Tracking: Monitor steps, workout intensity, and posture.
- Emotional State Analysis: Assess and report stress, happiness, and anxiety.
- Personalized Health Advice: Customized recommendations based on individual data.

### 4.2. Context:

Best used in home settings for elderly care, fitness tracking for athletes, and mental health management.

- Elderly Care in Home Settings: Monitor health of older adults, manage chronic conditions, and ensure safety.
- Fitness Tracking for Athletes: Optimize training, monitor recovery, and prevent overtraining.
- Mental Health Management: Aid in stress and mood management, valuable for mental health.
- Self-Improvement: Track and improve physical and emotional health for personal growth.

## Bibliography

[1] Pereira, Telmoa; Pires, Gabrielb; Jorge, Dáriob; Santos, Diogob. Telehealth monitoring of a hypertensive elderly patient with the new VITASENIOR-MT system: a case study. Blood Pressure Monitoring 25(4):p 227-230, August 2020. | DOI: 10.1097/MBP.0000000000000443

[2] Yoo, D., Bhalla, K., Manyam, H., Pubbi, D., & Lieber, I., 2022. Next-generation Mobile Cardiac Telemetry: Clinical Value of Combining Electrocardiographic and Physiologic Parameters. The Journal of Innovations in Cardiac Rhythm Management, 13, pp. 5135 - 5146. https://doi.org/10.19102/icrm.2022.130807.

[3] Li, Y., & Zhou, Y. (2022). Research on Psychological Emotion Recognition of College Students Based on Deep Learning. Scientific Programming. https://doi.org/10.1155/2022/6348681.

[4] Bai R. et al (2021), Tracking and Monitoring Mood Stability of Patients With Major Depressive Disorder by Machine Learning Models Using Passive Digital Data: Prospective Naturalistic Multicenter Study, DOI: 10.2196/24365

**Peer Review:** By Yan Mazas, Matteo Le Gall

So first: The document is clear, complete and well presented, making it easy to read and understand. You can see this right from the start with the table of contents. I really liked the precise description of future users. It allows you to project yourself into different scenarios with the product. It's also complete on a technical point of view by using a lot of precise biometric parameters and balancing well risks with benefits

Secondly, I find that the fact of grouping all the analysis via tic-points means that it doesn't link up as well. Moreover, while the analysis does good job of identifying potential user groups, there could be an opportunity to show more the cultural and sociological factors influencing user adoption.

Additionally, exploring potential strategies to address these barriers could contribute to a more robust and actionable set of recommendations.