Literature Review: Human-Centric Design in Health Tracking Software

Limitations of Mainstream Health Tracking Apps

Mainstream health tracking applications – exemplified by Apple Health, Samsung Health, and Google Fit – primarily function as data aggregators, presenting users with raw metrics (steps, heart rate, sleep hours, etc.) and simple trend visualizations. While these tools have advanced in terms of data collection and display, they still lack "that extra degree of human centric engineering," offering little in the way of personalized guidance or adaptive feedback. In their current form, these apps provide observational data rather than actionable insights. Users must interpret the meaning of a high heart rate or a decreasing step count on their own; the burden falls on them to act as health experts in translating the data into behavioral changes.

A systematic review by Chen et al. (2023) highlights this gap: among hundreds of popular exercise apps analyzed, not a single one generated an evidence-based, individualized workout plan for users with common risk factors such as heart disease. Most did not perform basic health screenings or tailor advice to chronic conditions, and fewer than 5% targeted any specific medical concern (Chen et al., 2023). This confirms that today's fitness and health apps are largely one-size-fits-all, with limited personalization for users' medical histories or individual needs.

Another key limitation is the lack of integration of formal health records into these ecosystems. Apple's Health app introduced a "Health Records" feature in 2018, allowing users to view lab results and immunization records – but only from participating institutions, and only in a read-only format (Apple Inc., 2021). Users cannot upload their own PDFs or doctor's notes. Samsung and Google's platforms have been even more limited. Until recently, Samsung Health had no ability to import or manage personal medical documents. In 2025, Samsung launched a Health Records integration in India via a government health network, allowing limited access to hospital-provided data – but users still cannot upload their own files (Samsung Electronics, 2025). Google Fit offers no mechanism to incorporate structured medical records, instead focusing solely on fitness data collected from wearables and sensors.

This lack of integration creates a fragmented user experience: vital contextual information (e.g., asthma diagnosis, prescription history, recent surgeries) is unavailable to the app. Health tracking data and clinical records remain siloed, and apps fail to "mix" the two to provide holistic or contextualized feedback. These applications lack the user functionality to upload health records thus users are able to use this information only if they are an expert at health metrics themselves.

Beyond data silos, current health apps also fall short in offering proactive or safety-aware recommendations. Because they do not deeply personalize their suggestions or account for users' clinical context, they typically avoid giving specific dietary or exercise guidance, especially in potentially risky scenarios. For instance, no major app today will warn a user with asthma or heart disease that they are nearing an unsafe exertion threshold. Instead, apps continue to encourage general goals like "close your activity rings" or "hit 10,000 steps" regardless of individual health risks.

This absence of safety-critical functionality represents a missed opportunity and a potential liability. Ideally, health apps would use individualized models to guide users with chronic conditions – for example, alerting an asthmatic user if their workout exceeds safe limits. However, Apple, Samsung, and Google do not offer such medically-informed personalization Chen et al. (2023). similarly report that none of the reviewed apps delivered evidence-based, personalized exercise prescriptions for users with cardiovascular risk, illustrating a major gap in current consumer health technology. Without integrating medical knowledge and individualized data, apps cannot coach responsibly – and so most refrain from offering guidance altogether. This underscores the need for smarter, safer, and more personalized solutions, which the proposed project aims to deliver.

AI and Predictive Analytics in Personal Health Management

Despite major advances in healthcare AI, its use in everyday health tracking apps remains limited. Davenport and Kalakota (2019) note that AI is already widely applied in hospitals for diagnostics, treatment planning, and patient monitoring. However, popular consumer apps like Apple Health or Google Fit still focus on displaying data rather than interpreting it. This is partly because health advice carries legal and safety risks. Apps need to avoid giving incorrect or overly aggressive recommendations.

Public trust in health AI is another barrier. A 2023 survey found that 75% of U.S. patients do not trust AI in healthcare, mainly due to fears of inaccuracy or data misuse (Gliadkovskaya, 2023). As a result, tech companies have been cautious, though signs of change are emerging.

Wearables and fitness platforms have started integrating AI to create personalized experiences. For instance, the American College of Sports Medicine (2023) reported that apps like Fitbit are using real-time data and user profiles to adapt exercise plans. These algorithms can adjust based on user progress, providing dynamic feedback instead of static targets.

Samsung's Galaxy Watch now includes an "AI Coach" that calculates a daily energy score and gives basic wellness tips (Samsung Electronics, 2024). Though still early-stage, it shows movement toward AI-guided health support. Apple is developing "Project Mulberry," a health coach app powered by AI that will analyze personal metrics to recommend sleep, nutrition, and fitness routines (Morris, 2024). Similarly, Google is working on an AI assistant that combines Fitbit data with its Gemini language model to generate tailored health advice

(Mordecai, 2023). A prototype called AMIE even mimics doctor-patient conversations with impressive empathy and accuracy.

The proposed system builds on these trends by applying three proven AI methods:

1. Predictive Modeling

Machine learning can forecast individual health outcomes using historical data. For example, an app could predict safe exercise zones for a user with asthma based on previous heart rate and activity data. Research shows these models are effective in spotting early signs of conditions like atrial fibrillation or fatigue (Davenport & Kalakota, 2019). Yet most mainstream apps still use one-size-fits-all goals (American College of Sports Medicine, 2023).

2. Natural Language Processing (NLP)

NLP helps apps understand unstructured text, such as user entries or doctor's notes. For instance, typing "I was diagnosed with Type II diabetes" could update the user's profile automatically. Clinical NLP tools have been used to extract medical facts from text and summarize patient records clearly (Wang et al., 2020; Kreimeyer et al., 2017). Current apps don't use this approach, missing an opportunity to turn health records into insights.

3. Image Recognition

AI can analyze photos to estimate calorie intake or identify medications. Systems like NYU's dietary AI match human accuracy in recognizing common foods and calculating nutrition (Zhou et al., 2023). In a personal health app, this could make logging meals or prescriptions much easier. Simply take a photo and let the system do the rest.

In short, while leading tech firms are starting to explore AI coaching, most features are still under development or limited to surface-level insights. The proposed platform aims to offer deeper personalization by combining real-time data, medical history, and AI reasoning in a way current apps do not

Integration of Health Records and Data Interoperability

Despite how advanced health apps appear, none of the major players truly integrate personal medical records in a meaningful or interactive way. Apple's Health Records initiative, for example, allows users to import clinical data like lab results, but only from approved providers and in a read-only format (Apple Inc., 2021). The app doesn't interpret this data or adjust its recommendations. A diagnosis of hypertension, for instance, will simply appear as a list item and it won't influence your step goals or activity guidance.

This issue reflects a broader limitation in mainstream apps: **they don't merge clinical data with lifestyle data to create personalized insights**. Measurements from wearable devices (like daily heart rate or sleep) are siloed from formal health history, even though combining

them could create a clearer picture of someone's health. Researchers have noted that this lack of interoperability prevents more personalized and effective care. Oyeniyi (2024) points out that many mobile health apps fail to integrate different data streams, which limits their usefulness. Truly personalized systems need to combine user-generated data (e.g., from wearables or journals) with contextual data like diagnoses, medications, or lab reports (Wang et al., 2020).

The proposed system addresses this gap by letting users upload and interpret structured medical records. Instead of just displaying a PDF of a lab result, the system would flag key findings—like high cholesterol—and adjust its recommendations. For example, a diabetic user with a high glucose reading might get a prompt to increase cardio workouts that week or limit sugar intake. This kind of intelligent, real-time integration doesn't exist in current consumer apps.

Samsung has taken a small step in this direction. In 2025, it launched a feature in India allowing users to store their health records via integration with the government's ABDM platform (Samsung Electronics, 2025). However, the data is still just stored, not analyzed. It's useful for reference, not decision-making.

What makes the proposed approach unique is that it closes the loop. By combining uploaded health records with wearable data, and applying analytics to both, it moves closer to the vision of a "longitudinal health record"; a full-spectrum view of a person's wellness over time. While that's been a long-term goal in digital health, no consumer-facing app has achieved it yet. This system aims to be the first to make it practical.

Human-Centric Software Engineering Principles in Health Apps

While advanced AI is critical, a truly impactful health app must also build trust, comfort, and clarity which are core principles of Human-Centric Software Engineering (HCSE). Liu et al. (2023) stress that many systems lack this human-centeredness, failing to account for user emotions, mental load, and personal context. In health tracking, where users often share sensitive data and act on app recommendations, trust becomes essential.

One key HCSE idea is *emotional trust*. It's not just about security, it's about users feeling confident that the app respects their data and communicates transparently. For instance, apps should clearly explain what they do with user data and how AI-based suggestions are made. While Apple allows users to see which apps access their health data, mainstream apps still fall short in adapting to user emotions or encouraging user participation in decisions. Techniques like *emotion-oriented requirements engineering* can help apps detect low motivation and respond with encouragement or adjusted goals (Horkoff, 2014).

Context awareness is another HCSE principle that could improve health app engagement. Instead of offering the same reminders at all times, a more intelligent system might adapt messages based on a user's environment, mood, or time of day, which is something Apple Health and Google Fit currently do not do.

Trust in AI, especially in health, remains a challenge. A 2023 Carta Healthcare survey found that 75% of patients don't trust AI, and many worry it could reduce time with doctors (Gliadkovskaya, 2023). That same study showed that transparency and education significantly improve user comfort, a result backed by HCSE findings (Liu et al., 2023). To address this, the proposed system will use *explainable AI*, showing users why specific recommendations are made (e.g., "We suggest this because your sleep averaged 6 hours this week, which is below healthy guidelines"). Research shows users are more likely to follow advice when explanations or counterfactuals are included (Binns et al., 2018).

Privacy is another major concern. Users want to feel their data is safe, not just encrypted, but handled ethically and transparently. The proposed platform will prioritize this by keeping data on-device whenever possible and letting users control what gets analyzed. For example, if someone uploads a health document, the app will ask whether to store it or run analysis, with clear reasoning behind either action.

Safety is equally vital. If the system offers health advice, it has a responsibility to avoid causing harm. It should recognize when it's out of scope and prompt the user to seek medical help instead of offering a generic or potentially harmful tip. AndroidCentral (2024) noted that for AI health coaches to succeed, they must "shoulder the responsibility" of guiding health decisions safely.

The system will include safeguards, guideline validation, and possibly even user feedback loops to flag poor suggestions. These reflect HCSE's core philosophy: protecting user well-being is not optional, but is foundational.

In short, HCSE is what makes advanced tech usable and trustworthy. By prioritizing emotional comfort, clear communication, privacy, and safety, this project aims to build a system that not only functions well, but is embraced by users. As Liu et al. (2023) put it, software that considers age, feelings, and culture creates more meaningful user experiences.

Proposed System vs. Existing Solutions: Novelty and Contributions

Current health tracking apps do some things well like step tracking or basic wellness tips but none combine data integration, AI personalization, and human-centric design in the way this proposed system does.

1. AI-Driven Personalization

Mainstream platforms like Apple Health or Google Fit offer general advice based on static goals. In contrast, this system delivers personalized recommendations using predictive modeling tailored to each user's habits, health status, and goals. While Apple and Google are planning AI-based coaching tools (Morris, 2024; Mordecai, 2023), those features are still in development. Samsung's Galaxy Watch offers simple suggestions based on sleep or activity, but it's far from comprehensive coaching (Samsung Electronics, 2024). This project aims to

be one of the first to offer a **holistic AI coach** for exercise, diet, and wellness in a unified way.

2. Integration of Health Records

Most apps treat medical records as read-only data. Even Samsung Health's recent initiative to store health records (Samsung Electronics, 2025) doesn't analyze them. Our system goes further by using NLP and pattern analysis to interpret health records and provide relevant, real-time guidance. For example, if a user has a knee injury listed in their records, the app might proactively filter out high-impact exercises. This bridge between structured health data and daily decision-making is still missing in consumer tech.

3. Human-Centric Design

The system is built using HCSE methods (Liu et al., 2023), with user needs, emotional engagement, and trust baked into every feature. While tech giants focus heavily on AI capabilities, our platform also considers how those features are delivered, using explainable AI, customizable privacy controls, and possibly adaptive interfaces that respond to user mood or behavior. Apps like Google Fit treat every user the same. This system adapts dynamically, ensuring its AI feels helpful and not robotic.

4. Safety and Trust

This project also takes the ethical weight of health advice seriously. It includes a "safety mode" that activates when risky patterns emerge. For instance, alerting users if their heart rate variability drops sharply and suggesting medical attention, with supporting context (AndroidCentral, 2024). Where other apps might stay silent or issue isolated alerts (e.g., Apple Watch's heart rhythm notifications), our system links health insights to a wider understanding of the user's data. This proactive approach aligns with calls from industry analysts for health coaches to own the responsibility of delivering safe, useful recommendations (AndroidCentral, 2024).

Even the most recent announcements from Apple and Samsung reflect only incremental improvements such as basic dashboards, mood tracking, or generic food logging (Morris, 2024; AndroidCentral, 2024). These changes are important, but still don't offer full personalization or real-time AI interpretation of health records.

This project stands apart by combining AI, personalized recommendations, health data analysis, emotional trust, and user safety into one cohesive platform. It takes insights from academic sources (Davenport & Kalakota, 2019; Liu et al., 2023), real-world product trends (Samsung, Google, Apple), and human-centered engineering practices to build something that doesn't yet exist in the consumer market.

If successful, this system could validate several important ideas: that people will trust AI when it's transparent, that combining lifestyle and clinical data improves outcomes, and that personalization drives meaningful behavior change. By bridging gaps between wearable

data and medical history, and between AI insight and human empathy, this platform sets a new bar for human-centric health technology.

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