

Buddy Run

As wearable technology becomes more and more popular, the potential to integrate physiological sensing into games and interactive experiences continues to grow. The purpose of this design proposal is to explore the integration of heart rate (HR) and heart rate variability (HRV) into a multiplatform application called *Buddy Run*. The app reimagines how runners engage with their physical fitness by combining biometric feedback, adaptive motivation, and emotional connection through a customizable AI “buddy.”

The design goal of *Buddy Run* is to transform running into an engaging, emotionally intelligent experience that leverages HR data to create a sense of companionship, motivation, and growth. The app is not merely a fitness tracker, it is an interactive ecosystem that personalizes coaching, visual feedback, and game-like progression to each runner’s physiological state and emotional needs.

Concept Overview

Buddy Run is a gamified, AI-powered running companion app available across multiple platforms. For example, if we use the Apple ecosystem then it would be available on iOS, macOS, iPadOS, and watchOS, with future expansion potential to visionOS for immersive preparation sessions (e.g., hydration guidance, mindfulness, or virtual stretches). The app introduces a digital running companion, your “buddy,” who accompanies you during runs, responds to your heart rate in real time, and evolves as you progress toward your fitness goals.

The *buddy* serves as both a motivational coach and a reflection of the user’s own effort. For example:

- If a user’s HR is too high, indicating overexertion, the buddy’s voice may encourage pacing down: “Let’s catch our breath together.”
- When HR stabilizes within the target aerobic zone, the buddy might say: “Perfect pace—let’s keep this rhythm.”
- If the user slows or stops running, the buddy visually mirrors that behavior, stopping beside the user or stretching, reinforcing biofeedback through empathy.

This direct mirroring makes HR integration active—the user is aware of and interacts with their HR data through the buddy’s responses, visuals, and voice cues. The HR information is visible and contextualized, transforming abstract numbers into meaningful feedback within the experience.

Heart Rate Integration and Benefits

Heart rate and heart rate variability (HRV) offer valuable insights into exertion, recovery, and stress regulation. Research has demonstrated that HR-guided feedback can enhance motivation and self-awareness in exercise contexts (e.g., Mueller et al., 2011; Nacke et al., 2010). In particular, Nacke et al. (2010) found that *indirect physiological feedback*—where bodily signals subtly influence the environment rather than overt game controls—creates deeper immersion and emotional engagement. *Buddy Run* builds on this principle by using HR and

HRV not as raw metrics, but as emotional drivers that shape the user's interaction with their virtual running companion, allowing the buddy's tone, animation, and pacing cues to evolve naturally with the runner's physiological state.

Buddy Run uses HR and HRV in three primary ways:

1. **Adaptive Coaching:**
The app dynamically adjusts the intensity of encouragement, pacing recommendations, and motivational feedback based on HR zones. If HR indicates fatigue or stress, the buddy might propose slowing down or switching to a lighter pace. Conversely, if HR shows the user is under-challenged, the buddy can prompt a short burst of higher effort.
2. **Emotional Synchronization:**
HR is also used to drive the *buddy's emotional state*. For example, as HR increases during effort, the buddy may display signs of excitement or exertion, creating empathetic resonance. This emotional mirroring supports intrinsic motivation by making the user feel accompanied and understood.
3. **Progress Reflection through HRV Trends:**
HRV trends are passively analyzed over time to track long-term improvements in cardiovascular health and recovery. These trends are used to adjust the buddy's personality tone, for instance, becoming more encouraging as the user's HRV stabilizes, signaling improved fitness and stress resilience.

Together, these integrations promote awareness of one's body without requiring constant data checking. Instead, users "feel" their HR feedback through the buddy's voice, visuals, haptics, and interactions, bridging physical and emotional engagement.

Evaluation Plan

To evaluate the impact of HR integration, *Buddy Run* will be tested through a mixed-methods approach involving both quantitative physiological metrics and qualitative user experience data.

1. **Physiological Data Comparison:**
We will compare HR and HRV data across runs with and without the buddy's feedback enabled. Key metrics such as average HR stability, recovery time, and pacing variability will be analyzed to determine whether active HR feedback improves endurance and pacing control.
2. **Behavioral Metrics:**
Retention rate, run frequency, and adherence to guided programs will be tracked to assess long-term engagement—key indicators of sustainable motivation.
3. **Friction and Usability Testing:**
To ensure HR sensing doesn't cause cognitive or emotional friction, think-aloud usability studies will assess whether the buddy's interventions feel natural, intrusive, or supportive. The goal is to ensure HR feedback enhances immersion rather than distracts from running.

Gamification and Monetization Design

While the physiological integration is central, *Buddy Run* also sustains engagement through a meaningful progression system. Users earn Blaze Tokens (BTs) for completing daily, weekly,

and monthly achievements—such as reaching new HR milestones, maintaining consistent HRV improvements, or completing a set number of runs.

BTs can be used to purchase cosmetic items for the buddy (e.g., outfits, accessories, room décor). These microtransactions are purely aesthetic, ensuring fairness and avoiding pay-to-win mechanics. The system mirrors motivational loops found in successful fitness and wellness games like *Ring Fit Adventure* and *Zombies, Run!* but introduces a deeply personalized companion progression system that rewards consistency and emotional connection rather than raw performance.

To maintain ethical monetization, *Buddy Run* offers three participation models:

1. **Premium Subscription:** Ad-free experience with full data access for personal or medical use; data remains private (data access in this context refers to being able to extract data to use for purposes such as we are in this course without having to jump through many hoops). Comes with monthly rewards in BTs and other cosmetic items for your buddy. Can also purchase BTs from the shop.
2. **Data-Consent Model:** Free app use in exchange for anonymized data sharing with research or corporate partners. Can also purchase BTs from the shop.
3. **Ad-Supported Model:** Free access with minimal, timed advertisements; data remains private. Can also purchase BTs from the shop.

This structure balances accessibility, transparency, and sustainability while allowing users to choose their preferred data relationship which can be changed at any time.

Using HR to Characterize Participant Experience

In addition to gameplay adaptation, HR and HRV will serve as metrics to characterize user performance and experience. HR measures intensity and pacing accuracy, while HRV offers insights into mental focus and recovery.

Planned measurements include:

- **Average HR vs. Target HR Zone:** Evaluates pacing control and physical efficiency.
- **HRV Stability Across Sessions:** Indicates improvements in cardiovascular resilience and mental composure.
- **HR-Event Coupling:** Analyzes how specific in-app moments (e.g., encouragement from the buddy) influence physiological responses, revealing emotional engagement.

By combining HR with subjective data, *Buddy Run* creates a holistic picture of performance—bridging quantitative physiology and qualitative experience.

Building on Prior Research

Prior studies have successfully integrated HR into interactive systems to enhance user engagement and self-awareness.

- Nacke et al. (2010) demonstrated that HR feedback increased arousal and immersion in game players.
- Mueller et al. (2011) used HR sensors to create social physical interactions, showing increased empathy and cooperation.

Buddy Run builds on these findings by using HR not only as a difficulty modulator but as an emotional and relational medium—transforming biometric data into a narrative of companionship and self-improvement.

Conclusion

Buddy Run represents a fusion of health technology, emotional design, and game mechanics. By actively integrating heart rate and HRV into a personalized running companion, the app transforms biometric data into empathy-driven motivation. Beyond fitness tracking, it builds a relationship—between user, body, and technology—grounded in awareness, play, and growth. Through adaptive coaching, reflective feedback, and a gamified ecosystem, *Buddy Run* demonstrates how HR sensing can evolve from a passive metric into a meaningful co-player in human experience.

References

- Nacke, L. E., Kalyn, M., Lough, C., & Mandryk, R. L. (2010). Biofeedback game design: Using direct and indirect physiological control to enhance game interaction. *Proceedings of CHI 2011*.
- Mueller, F. F., et al. (2011). Jogging over a distance: Supporting a "jogging together" experience although being apart. *CHI '10*.

Use of AI in This Assignment

AI was used as a writing partner as well as to refine my ideation and structure for better academic framing of this proposal. Specifically, AI assisted in:

- Synthesizing design ideas into coherent academic sections.
- Suggesting literature examples for HR integration.
- Clarifying distinctions between active and passive feedback models.

To verify AI output, all conceptual claims (e.g., HRV meaning, engagement effects) were cross-checked with established literature and course materials to ensure factual accuracy and conceptual alignment with the assignment's learning objectives.