A Wearable Pulse-Based Music Recommendation System for Stress Management in Athletes

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Athletes are often exposed to increased psychological and physiological stress before and during competition, which can be detrimental to performance. Typical methods of managing this stress are subjective, not consistent, and detached from current time-based physiological markers. This project is a novel wearable pulse-based music recommendation system that uses real-time biometric input to offer a timely, personalized music intervention, which addresses the shortcomings of conventional methods. The device contains an ESP32-S3 microcontroller combined with a MAX30102 photoplethysmographic (PPG) sensor to continuously monitor heart rate and categorize stress state pig physiological categories (relaxed, normal, slightly elevated, anxious). Depending on the user's instantaneous heart rate, the device then suggests or plays music appropriate to the context either via Bluetooth or uploaded to onboard storage. The overall hardware architecture of the system includes an OLED display for feedback, a rechargeable lithium-ion battery for the addition of portability, and possible MicroSD storage of music for performance without Bluetooth. Testing of the device demonstrated effective tracking of heart rate variability and music recommendations in real time, in an effort to align the user state to either a relaxed position or focus on their task. The device presents a cost-effective, portable, and autonomous means of stress regulation and mental preparedness for athletes that bridges the gap between biometric data and music based therapeutic feedback.

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