Bioimpedance and Electrocardiogram Monitor for Astronauts Using AI Integrated Technology

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Maintaining optimal hydration and health is integral for overall well-being and daily functioning, particularly for space travel (flight). This project was designed to provide accurate and continuous monitoring of specific vitals via a wearable bioimpedance (Bio-Z) and electrocardiogram (ECG) monitor combined with AI features. The project was developed as part of the NASA HUNCH initiative, and aims to provide astronauts in space as well as support on earth with more than basic health monitoring. The AI-extracted feedback provides accurate and real-time data including: hydration, predictive information regarding potential muscle atrophy, as well as heart rate. Future work integrates additional data such as sodium and potassium levels. To achieve this, AI software was developed, using platforms and microcontrollers like Google Colab and Raspberry Pi to process and analyze BIO-Z and ECG recordings (data). Initially, small datasets were utilized then progressed to larger caché server (CSV) files. However, preliminary testing through graphical user interface (GUI) indicated that skin analysis readings revealed occasional negative ohm values and unreliable feedback, suggesting potential inaccuracies. Due to regulatory constraints, store-bought chicken breast was utilized as a proxy for initial investigations. Beyond Bio-Z and ECG monitoring, the software and monitor can be adapted to assess gut health, sweat electrolyte levels, and sodium/potassium levels; potentially mitigating risks such as kidney stones aboard the International Space Station (ISS). This wearable device fosters a comprehensive AI-driven health monitoring system to enhance the overall well-being of humans in space and on Earth.

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