Paper ID: 85449
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IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (A1)
Interactive Presentations - IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (IP)

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ENHANCING ASTRONAUT WELL-BEING: A BIOFEEDBACK WEARABLE DEVICE FOR MEDITATION SUPPORT DURING LONG-TERM SPACE MISSIONS

Abstract

Today, traditional meditation practices are widely spread among the world's population to countermeasure the daily life stress, pain, fatigue, and to take a deep breathe from all of this. On the other hand, space missions expose astronauts to distinct psychological strains, such as isolation and microgravity, thereby increasing the likelihood of behavioral health concerns. It is essential to establish countermeasures in order to prevent cognitive or behavioral symptoms during long duration expeditions. Incorporating mindfulness and relaxation techniques may prove to be effective in improving both behavioral and cognitive well-being.

In light of potential hazards, this study proposes the creation of a biofeedback wearable device, tailored for the purpose of aiding in the practice of meditation in a space setting. The objective is to reduce behavioral health risks among astronauts by offering real-time physiological feedback, organizing meditation sessions, and granting access to data for analysis by a central control.

The suggested product includes advanced sensors for monitoring important biomarkers such as heart rate variability (HVR), galvanic skin response (GSR), and brainwave patterns. Providing multimodal feedback (visual, aural, and tactile) to help astronauts achieve optimal meditation states. To guide the meditation session, the biofeedback wearable product can be connected with external immersive music and video to assist with the first steps of meditation. The design will prioritize user comfort, functionality, and compatibility with the microgravity environment.

Other research found that cognitive awareness is a valuable psychological construct for reducing stress and increasing resilience in analog situations. Interventions typically need a significant amount of time for training, which is something that the device aims to reduce.

The aim is to contributes to the broader goal of ensuring the success and safety of future space exploration, prioritizing astronaut well-being. This research seek also to validate the device's effectiveness through extensive testing in space-like conditions, in order to be integrated into astronaut's health and wellness protocols for upcoming missions.