National Aeronautics and Space Administration

TECHNOLOGY SOLUTION

Information Technology and Software

Biocybernetic VR/AR Training System for De-Escalating Conflict

Adapts VR/AR environment to trainee 's or player's biofeedback signals

NASA Langley's innovative biocybernetic system employs a blend of hardware and software within a virtual/augmented/mixed reality (VR/AR/MR) environment. Its purpose is to provide psychophysiological self-regulation training, specifically geared toward helping individuals de-escalate conflicts in real-world scenarios. In this system, trainees or their avatars engage with simulated social situations involving conflict. The virtual characters they interact with are designed to present varying levels of threat or cooperation. What sets this approach apart is its continuous measurement of the trainee's cognitive and emotional states through biofeedback.

The system's feedback mechanism is distinct, and drives the behavior of the virtual characters. Trainees are rewarded when they effectively achieve the desired mental and physiological states, resulting in desirable character responses. Conversely, ineffective states lead to undesirable character behavior, effectively penalizing the trainee.

NASA has tailored this technology for de-escalation training, aiming to reduce physical responses in situations such as customer service interactions, flight attendant-passenger interactions, or police encounters. The system adapts the behavior of non-player characters based on the trainee's ability to attain the desired state, providing a dynamic and immersive training experience.

BENEFITS

- Enhances Social Skills: Professionals like law enforcement officers dealing with agitated citizens or soldiers interacting with antagonistic civilians can improve their de-escalation and self-regulation skills.

- Elevates Gaming Experience: In a VR setting, it empowers game characters/entities to adapt and respond to the player's physiological changes, making games more engaging.

- Offers Real-Time Consequences and Rewards for Self-Control: It provides immediate feedback for managing one's mental state, making it a valuable tool for self-improvement.

- Prepares for Sound Decision-Making in High-Stress Situations: Users can train to make effective decisions under extreme stress, which can be crucial in various fields.

- Measures Mental State: This technology enables the objective measurement of physiological responses to stress, allowing for accurate benchmarking and tracking of improvements.

- Proven Proof of Concept: At a Technology Readiness Level (TRL) of ¾, this technology is ready for adaptation into specific use cases, showcasing its viability and readiness for implementation.
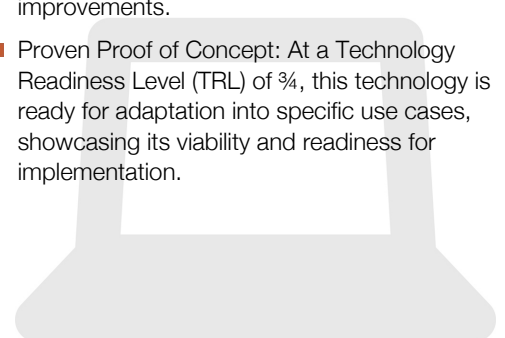
THE TECHNOLOGY

NASA's biocybernetic system is a cutting-edge technology designed to cultivate emotional regulation skills. It leverages the concept of biocybernetic adaptation, where the trainee engages with virtual entities, such as characters in VR/AR/MR environments, whose behavior dynamically responds to the trainee's physiological signals. This responsive system provides real-time feedback, incentivizing the trainee to attain a calmer physiological state.

The key components of this VR innovation include:

· Head-mounted display hardware

· Physiological monitoring hardware, tracking heart rate, breathing, sweat, breath, and brain waves

· Software, powered by the Biocybernetic Loop (BL) Engine, integrating physiological data into the VR simulation

· Character response avatars

· Integration of the trainee's biofeedback data with the VR environment

This technology relies on two functional elements working in unison to adapt the behavior and appearance of VR/AR/MR characters. Inference of the trainee's emotional state from physiological signals requires the implementation of advanced machine learning and modeling techniques. A pattern comparator stores templates of physiological patterns and continually assesses the proximity of the trainee's real-time physiological activity to the desired patterns.

The pattern comparator calculates a closeness score in relation to one or more reference patterns, transmitting this data to the VR/AR/MR environment components. Consequently, the level of threat or cooperation presented by virtual characters is dynamically adjusted in response to the closeness score, creating an immersive and adaptive training experience.

APPLICATIONS

The technology has several potential applications:

- De-escalation training: Law enforcement, military agencies for soldier training, airline training for pilots, flight attendants, and gate agents, and classroom teacher training

- Virtual and Augmented Reality gaming: Enhancing interaction and system intelligence via real-time adaptations based on detected conscious or unconscious human neurological and other biophysical states.

- Autonomous vehicles: Monitoring the psychological states of drivers to inform the design of the autonomous car experience "feeling of being safe" in their self-driving car to optimize the driver's mental state.

PUBLICATIONS

Patent No: 12,236,004

Patent Pending

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