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(57) Abstract :
This invention relates to a pre-emptive anxiety mitigation system that integrates a wearable bio-feedback device with an autonomous, context-aware environmental automation platform. The system is designed to detect and respond to early-stage physiological indicators of anxiety or panic before the user subjectively perceives symptoms, thereby enabling timely and unobtrusive intervention. The wearable device continuously acquires physiological data streams including, but not limited to, Galvanic Skin Response (GSR) and Heart Rate Variability (HRV). These signals are processed through feature-extraction and temporal-pattern analysis algorithms to identify deviations associated with autonomic nervous-system activation and stress arousal states. A predictive analytics engine incorporating machine-learning and reinforcement-learning models evaluates short-term fluctuations, baseline trends, and cross-correlated biomarker signatures to classify user states and estimate the probability of an impending anxiety episode. Unlike conventional bio-feedback systems that react only after symptom onset or require user interaction, this invention emphasizes pre-symptomatic detection and non-intrusive response execution. When the inference engine determines that the user has entered a pre-trigger stress zone, the system activates a Silent Intervention Protocol. In this mode, the wearable device refrains from issuing alerts, haptic cues, or notifications that might draw attention to the physiological condition or induce anticipatory stress. Instead, the intervention is delivered indirectly through wireless communication with a network of smart-home and environmental-control devices. The system may automatically adjust lighting intensity and spectral distribution toward warmer, low-stimulation tones; regulate ambient temperature or airflow to promote physiological calming; and introduce neutral masking or soothing background audio to reduce sensory load and environmental unpredictability. These adjustments are executed gradually and context-sensitively to maintain naturalistic environmental continuity and avoid user perception of deliberate therapeutic action. The invention further incorporates an adaptive optimization layer that continuously evaluates post-intervention physiological trajectories. Reinforcement-learning methods map specific environmental modification patterns to observed recovery responses, enabling the system to iteratively refine intervention timing, magnitude, and sequencing for each individual user. Over extended operation, the system converges toward a personalized intervention profile that maximizes recovery speed, minimizes residual stress activation, and reduces the likelihood of escalation into full anxiety or panic events. In some embodiments, the system may integrate contextual metadata such as time of day, user activity state, historical event profiles, and environmental sensing inputs to improve classification accuracy and intervention appropriateness. Data privacy and secure communication protocols are incorporated to ensure safe storage and transmission of physiological and environmental-control information. By combining autonomous physiological monitoring, predictive stress-state estimation, and environment-mediated behavioral regulation, this invention enables a proactive, unobtrusive, and self-optimizing therapeutic support mechanism. It addresses limitations of conventional anxiety-management approaches that rely on conscious user engagement, explicit cues, or reactive measures after symptom onset. The disclosed system therefore offers a technologically enabled pathway for early-stage anxiety mitigation within everyday living environments, supporting improved wellbeing, reduced cognitive burden, and seamless user experience without behavioral disruption.

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