Adaptive Neural Interface Wearable

The present invention pertains to an adaptive neural interface wearable, designed to establish non-invasive, bidirectional communication between human neural patterns and ambient intelligent systems.

Utilizing flexible bio-electronic substrates and conductive hydrogel electrodes, the device conforms to the user's cranial or cervical region, enabling high-fidelity capture of neural oscillations and electromyographic signals. Embedded AI-driven pattern decoders continuously adapt to the user's unique brainwave signatures, learning intent and emotional states over time through reinforcement learning models.

In response, a low-latency haptic and auditory feedback loop delivers real-time system responses through vibroacoustic transducers embedded in the wearable frame. This allows users to intuitively interact with connected devices, environments, and software applications using mere intent or emotional triggers.

Privacy is ensured via real-time signal anonymization, wherein the neural data is abstracted into intent vectors before cloud processing. The wearable also supports neuroadaptive authentication, granting access based on subconscious patterns, minimizing cognitive load and reducing spoofing risks.

To ensure long-term wearability and biocompatibility, the interface features a breathable nanomesh structure that adjusts electrical contact resistance dynamically based on skin hydration and temperature. Its energy needs are met through integrated micro solar strips and wireless power harvesting from ambient RF sources.

This wearable enables seamless human-machine integration across medical diagnostics, hands-free computing, mental health monitoring, and immersive entertainment platforms, establishing a new paradigm in personalized and ambient cognitive interfaces.