Audio-Neural Interface for Enhancing Memory Encoding

I propose developing a scalable audio-neural interface that enhances memory encoding by dynamically transforming incoming speech into a prosodic, rhythmically optimized format. This AI-driven interface integrates real-time auditory adaptation with neural feedback, leveraging EEG signals captured from within the ear to personalize speech processing based on the user's cognitive state. This technology can benefit a wide range of users, significantly improving the quality of life for individuals with memory impairments, including Alzheimer's patients and older adults, as well as aiding learners in retaining important information more effectively.

- **Key Objectives:**
  - ***AI-driven real-time prosody transformation*:** Convert neutral speech into a rhythmically structured format to improve memory encoding efficiency.
  - ***Personalized neuroadaptive processing:*** Utilize neural feedback (EEG signals) to optimize prosodic speech modulation based on real-time cognitive states and personal auditory history.
  - ***Scalable, non-invasive neural interface:*** A wearable earplug-based neurotechnology designed for broad deployment without requiring clinical interventions.

Unlike existing hearing aids or passive auditory tools, this real-time adaptive system creates a closed-loop interaction between speech processing and brain activity, directly influencing memory encoding efficiency. The expected outcome is measurable improvements in memory retention compared to standard auditory input methods. This project directly aligns with the UK government's strategic objectives which emphasize investments and **innovation in neurotechnology and AI-driven solutions.**