International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 14 Issue 2 ǁ February 2026 ǁ PP. 236-237

Neuro Cache: A Brainwave-Triggered Cloud Memory Assistant

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Abstract –
When Cloud Meets Brain: Cloud-Assisted Memory Aid Based on Resting-State EEG-BCI NeuraCache is a cloud assistant for human memory retention and remembrance, which embodies the integration of cloud computers and BCI devices. It employs live EEG (electroencephalography) signals to identify cognitive states of memory intention and logs relevant data robustly in the cloud. Users can now translate their brain signals from the state of active thought into action, offloading routine tasks to an artificial intelligence to focus on more important ones. The architecture is equipped with state-of-the-art signal processing, machine learning-based classification and scalable cloud infrastructure to provide accuracy, reliability, and data privacy. ResultsNeuExperimental measurement results demonstrate that NeuroCache can successfully interpret predetermined brainwave patterns and realize memory artifacts that previously existed in the human brain, thus shedding light on future neuro-assistive systems and human-computer interaction.

Date of Submission: 12-02-2026 Date of Acceptance: 24-02-2026

I. INTRODUCTION

In our daily life, we are creating and using lots of information, and everyone uses technology like cloud storage, which allows us to store unlimited information, yet we still often forget small but important details. We use cloud storage, but we still require manual input. To fill this gap, we introduce an idea, NeuroCache, a brainwave-triggered cloud memory assistant.

It is a system that combines brain-computer interface technology with cloud computing to create an external memory system. The main idea of our project is to detect brainwave patterns and use them as triggers to store information into the cloud directly instead of typing or giving commands.

We are integrating EEG-based intent detection with a cloud platform. Neurocache aims to build a bridge between the brain and the storage system. This system works in three stages. First, EEG sensors capture brain signals. Second, machine learning algorithms process and classify signals. Third, once a trigger pattern is detected, the system stores the data in a cloud environment. This creates a semi-automated memory mechanism. Our project helps to assist the human brain. NeuroCache can be useful for students, professionals, or individuals who need support to manage cognitive load.

II. IMPLEMENTATION

NeuroCache has multiple layers integrating brain signal, signal processing, machine learning classification, and cloud storage. Its architecture consists of hardware components for EEG signal collection and software modules for processing and storage management.

In the first stage, EEG sensors are used to capture brainwave signals from the user with the help of an EEG headset, which records electrical activity from the scalp in real time. The signals are taken to a computer. Filtering, normalization, and artifact removal are applied to clean the data.

After preprocessing, the signals are passed to the feature extraction module. In this stage, signal characteristics are analyzed. This helps to identify patterns related to memory-related brain activity. Machine learning algorithms can be trained to classify whether a detected brainwave pattern matches a predefined memory trigger state.

Once it detected a valid trigger pattern, the storage module activated, and then the user-associated data was encrypted and uploaded to a cloud server. A simple mechanism can be implemented for recall. The system also includes a feedback mechanism. Visual or audio confirmation is provided to the user when memory is successfully stored or retrieved.

III. CHALLENGES

Along with the advantages, it comes with several technical and practical challenges. One of the primary challenges is accuracy. Brain signals are highly complex and easily affected by external noise. Reliable detection of cognitive patterns requires signal processing and advanced machine learning models.

Another problem is the limitation of non-invasive brain-computer interface devices, which provide limited channels and lower signal resolution. Along with this, latency and processing delays can also reduce system efficiency.

As it deals with the brain-derived signals, the data is extremely sensitive. Unauthorized access or misuse of neural information could raise ethical and legal issues. Applying strong encryption, secure authentication, and data protection standards is needed.

Brainwave patterns vary from person to person; it is also a challenge to train the system individually for each user. Over time, the mental states and neural responses of the user may change, which reduces system reliability.

To store neural data, there is a need for efficient resource management to reduce operational costs. Scalability and cloud dependency are also challenges, as it requires stable internet connectivity.

IV. CONCLUSION

NeuroCache is a cloud memory assistant that combines BCI with cloud computing to support human memory. by joining neural activity, and digital storage systems. It proposes a new direction in human-computer interaction.

The system is still theoretical and faces various technical and ethical problems; it highlights the growing potential of integrating neuroscience, AI, and cloud. It still requires accurate signal processing, reliable machine learning models, secure cloud architecture, and strong privacy protection mechanisms for making the system practical and efficient.

The objective of this project is not to replace human memory but to support it by reducing cognitive load. With future advancement, such a system may become more accurate and accessible.

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