EDUCATION TECHNOLOGIES COMPETITION PRELIMINARY EVALUATION REPORT

CATEGORY NAME: Digital Educational Materials and Artificial Intelligence (University and Above)

TEAM NAME: TECHBHOS

APPLICATION ID: 3622372

TEAM ID: 742625

PROJECT NAME: NeuroVerse

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1. PROJECT SUMMARY

1.1. Project Summary and Project Scope

NeuroVerse is an AI-powered smart learning platform designed for the TEKNOFEST 2025 Educational Technologies Competition under the second category of University and above and, specifically, under the subcategory of Digital Educational Materials and AI. The platform thus uses EEG sensors and AI to analyze students' brain activity to determine attention in real time. It dynamically changes the lesson formats, including interactive content, videos, or audio. In addition, it allows for real-time reporting of performance to teachers. It merges neuroscience with AI-based digital education tools, hence complementing the competition's goal of facilitating innovative technology.

1.2. Project Topic and Objective

NeuroVerse promises to redefine digital education by coming up with an entirely new AI-based approach to personalize learning in response to students' cognitive states. It is therefore different from others as it does not have a one-size-fits-all approach toward education; rather adjusts dynamically with the real-time needs of the student. The project is aimed at defeating the challenges that cropping up due to increasing digital ineffective learning practices. The real-time analytics also add value to the teacher aspect. This disruptively transforms learning according to this competition by making it possible for AI-driven personalization.

2. TEAM STRUCTURE

2.1. Team Organization and Task Distribution

NO	TEAM ASSIGNMENT	EDUCATION LEVEL	GRADE	MEMBER ROLE
1	Advisor	PhD		ADVISOR
2	Data Scientist / AI Engineer	Undergraduate	2	CAPTAIN
3	Front-end Engineer	Undergraduate	3	MEMBER-1
4	Back-end Engineer	Undergraduate	4	MEMBER-2

3. PROBLEM/NEED SOLVED

3.1. Problem Definition and Literature Review/Research

Mostly, conventional digital education is devoid of on-demand adaptability, which results in little student engagement. Research has shown that there are variations in students' attention span is advantageous on comprehension (2021, Multimedia Learning: Principles and Applications, Mayer [4]). Consequently, several systems use behavioral as opposed to theorized evidences.

Neuroscience-researched EEG brain activity monitoring have been confirmed as measures of attention and cognitive load (2019, The Oxford Handbook of Event-Related Potential Components, Luck & Kappenman [1]; 2000, Neurophysiological Measures of Cognitive Workload During Human-Computer Interaction, Gevins & Smith [2]). Real-time neurofeedback is shown to improve learning outcomes but currently, no existing platform integrates AI-enabled EEG analysis to accommodate lessons.

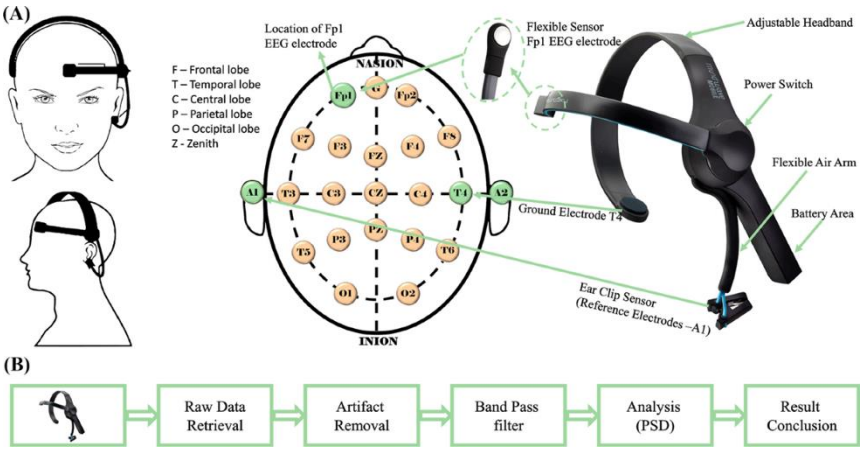
3.2. Solution Idea

NeuroVerse is an AI powered learning environment that customizes education via EEG sensors for the analysis of their brain activity. Unlike the usual systems based on the behavioral data, it helps to modify real-time lessons on cognitive engagement.

Research backed up that “learning is enhanced by EEG-based cognitive monitoring and neurofeedback” (2019, The Oxford Handbook of Event-Related Potential Components, Luck & Kappenman [1]; 2000, Neurophysiological Measures of Cognitive Workload During Human-Computer Interaction, Gevins & Smith [2]; 2017, EEG-Neurofeedback as a Tool to Modulate Cognition and Behavior, Enriquez-Geppert et al [3]). That is what NeuroVerse bridges-into making digital education so responsive.

4. METHOD AND TARGET GROUP

4.1. Method to be followed



NeuroVerse will improve student engagement through EEG-based analysis of cognitive function combined with adaptive learning driven by AI and real-time feedback.

1) Data Collection and Processing: The EEG headsets will capture students' brainwaves, measuring attention and cognitive load. The signals will be pre-processed by signal filtering techniques to eliminate noise.
2) Machine Learning Model: AI algorithms will analyze the EEG patterns to detect difficulties in the learning by deep learning models such as LSTMs or CNNs.
3) Modifying Adaptive Content: The system will change the delivery of a lesson format by real-time engagement and added elements, audio explanations, or videos as interactive activities based on the EEG analysis.
4) Web-based Platform Development: Create a web-based interface for accessing lessons by students and through which real-time cognitive

engagement reports are displayed to teachers. Frontend will deploy React.js, and backend will be employed through Django and FastAPI for AI integration.

5) Testing & Validation: It will be evaluated with feedback from students at BHOS.

4.2. Target Audience

NeuroVerse is geared towards school and university students who have trouble keeping their focus on digital learning. It benefits:

- Students with Attention Difficulties: Students unable to concentrate for suitable lengths of time-even persisting need adaptive learning assistance.
- STEM and Complex Subject Learners: Highly cognitively intensive subjects, such as engineering, medicine; benefit from personalization of content.
- Educator & Institutions: Teachers looking to gain real-time insights into their students' engagement will use this information to improve their strategy.

5. ORIGINALITY, INDIGENOUS, APPLICABILITY AND SUSTAINABILITY

5.1. Originality and Indigenous

NeuroVerse is the first AI learning platform to use EEG readings in real time, whereas other systems are set up to adjust content terrances based on past behavior. While learning platforms such as Coursera personalize the learning experience through quizzes and assessments, it adapts the lesson to the user's brain activity in real time.

Whereas existing EEG setups for brain monitoring focus on research purposes (e.g., Emotiv) or post-session insights (e.g., BrainCo), NeuroVerse dynamically modifies learning content during any session for higher engagement.

It is both innovative and adaptable, integrating local student feedback to train the AI and sourcing EEG headsets from the local market.

5.2. Applicability and Sustainability

NeuroVerse is feasible since commercial EEG headsets and AI technologies can be used. The project development is data-oriented, backed by BHOS student feedback. Software has been geared toward compatibility with existing e-learning tools. Sustainability structures for NeuroVerse could take form through a partnership with educational institutions alongside ed-tech firms. Constant improvement in AI will help keep the system running effectively and the financial sustainability can, on the other hand, be ensured by a subscription. Scalability confers wider outreach on the platform.

6. PROJECT CALENDAR

6.1. Project Schedule and Work Packages

Work Package No	WORK PACKAGE NAME	SUB-ACTIVITIES	BEGIN DATE	FINISH DATE
1	Research & Requirements Analysis	Conducting literature review, Analyzing educational platforms, Arranging research forms within BHOS	16.02.2025	28.02.2025
2	System Design & Architecture	Designing overall system architecture, Developing wireframes and UI/UX prototypes, Planning backend API structure	01.03.2025	15.03.2025
3	Hardware Integration & Data Collection	Selecting EEG headsets, Developing data collection module for brainwave signals	16.03.2025	31.03.2025
4	AI Model Development	Preprocessing EEG data, Training machine learning models, Validating AI model	01.04.2025	30.04.2025
5	Software Development	Improving frontend interface, backend logic reporting, user authentication	01.05.2025	31.05.2025
6	System Testing & Debugging	Conducting user acceptance testing with trial students, Fixing bugs	01.06.2025	14.06.2025

7. REFERENCES

[1] Luck, S. J., & Kappenman, E. S. (2019). The Oxford Handbook of Event-Related Potential Components. Oxford University Press.

[2] Gevins, A., & Smith, M. E. (2000). Neurophysiological Measures of Cognitive Workload During Human-Computer Interaction. Human Factors, 42(1), 76-91.

[3] Enriquez-Geppert, S., Huster, R. J., & Herrmann, C. S. (2017). EEG-Neurofeedback as a Tool to Modulate Cognition and Behavior: A Review Tutorial. Frontiers in Human Neuroscience, 11, 51.

[4] Mayer, R. (2021). Multimedia Learning: Principles and Applications. Cambridge University Press.

[5] https://link.springer.com/article/10.1007/s11277-022-09731-w