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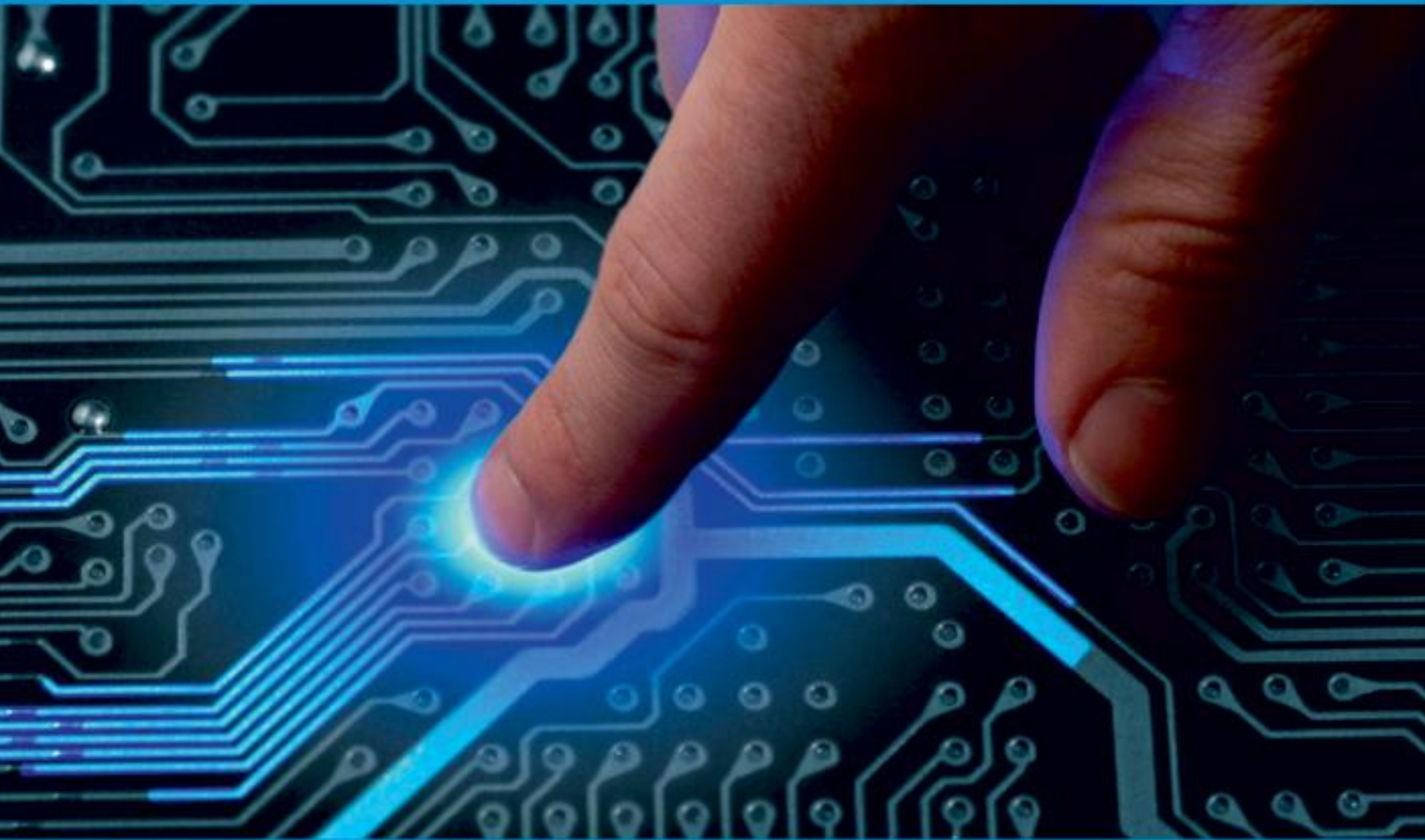

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A Review on Virtual Brain : Model Based Framework for Dependable EEG Sensing and Actuation in Intelligent Brain IOT System

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ABSTRACT: The "Virtual Brain" framework represents a pioneering approach in the realm of intelligent Brain IoT systems, introducing a sophisticated integration of model-based methodologies with EEG (Electroencephalogram) sensing and actuation. This framework goes beyond conventional EEG applications by incorporating a model-driven approach, enhancing the dependability and accuracy of brain-related data interpretation and response mechanisms. Moreover, the Virtual Brain framework extends its scope beyond EEG monitoring, incorporating the surveillance of temperature values within its system architecture. In instances where temperature values deviate from predetermined thresholds, the system initiates alert mechanisms. Alert system involves the utilization of LCD displays for immediate on-site notifications. This integration between local and remote notification systems ensures timely and efficient responses to fluctuations in temperature values, thereby enhancing the overall reliability and responsiveness of the Virtual Brain framework in monitoring brain activity and physiological parameters.

KEYWORDS: Framework, Electroencephalogram, Temperature, Physiological parameters.

I. INTRODUCTION

The "Virtual Brain" framework is a revolutionary intelligent Brain IoT system that combines model-based methodologies with advanced EEG technologies. This approach enhances the reliability, accuracy, and interpretability of brain-related data, allowing for more nuanced and informed interventions. The framework also extends its capabilities to monitor temperature values, providing a holistic view of brain activity. It triggers notifications when temperature deviations occur, ensuring immediate on-site awareness and real-time updates to mobile devices. This system represents a paradigm shift in intelligent Brain IoT systems, leveraging model-based approaches, EEG sensing, and temperature monitoring to create a robust and dependable system for understanding, interpreting, and responding to brain-related data.

II. LITERATURE SURVEY

Biomarkers have been recognized as carrying important information about the functioning of living systems. The physiological and clinical information contained in these signals can be enhanced by appropriate processing. Current qualitative and quantitative analysis of physiological systems and events relies on digital signal processing and pattern recognition techniques. The analysis and interpretation of the doctor's symptoms brings the knowledge and expertise of the analyst, but this analysis is subjective. Logically, computer analysis of medical information can lend credibility to expert interpreters by providing a second opinion. In addition, online diagnosis and monitoring of critically ill patients can be improved. Current research aims to develop an effective method of using sleep health devices. When dealing with complex classification or model identification problems, support vector machines (SVM) are the tool of choice. In this article, we will focus on using support vector machines (SVM) to identify and classify apnea. SVM performs better than other classification methods such as complex statistical methods. This work proposes an adaptive classification model and a new way to combine input-classification model decisions. Current methods rely on ensemble classification systems with multiple features, which are efficient and reliable.

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III. METHODOLOGY

A virtual smart home and a BCI system based on the P300 make up the planned VSH-EEG system. Unity is the developer of the virtual smart home. It reacts to control commands and shows a 3D P300 paradigm. BCI system uses a 32-channel QuikCapTM to record P300 signals. Additionally, a NuAmps device (Compumedics, Nebraskan, Inc., Australia) amplifies P300 impulses. Every electrode impedance is less than 5kΩ. The BCI system uses Scoket (TCP/IP) to connect to the VR system.

The proposed system, the "Virtual Brain," presents an innovative and sophisticated framework that merges a model-based approach with EEG sensing and actuation within an Intelligent Brain IoT ecosystem. At its core lies an advanced EEG sensor, tasked with capturing and transmitting brain electrical activity data. Complementing this sensing capability is a model-driven methodology, employing intricate algorithms to interpret EEG data with heightened accuracy and reliability. Concurrently, the system integrates an actuation mechanism, enabling tailored responses to identified neural patterns or stimuli. Enhancing its scope beyond conventional EEG applications, the framework incorporates temperature sensors to monitor physiological changes.

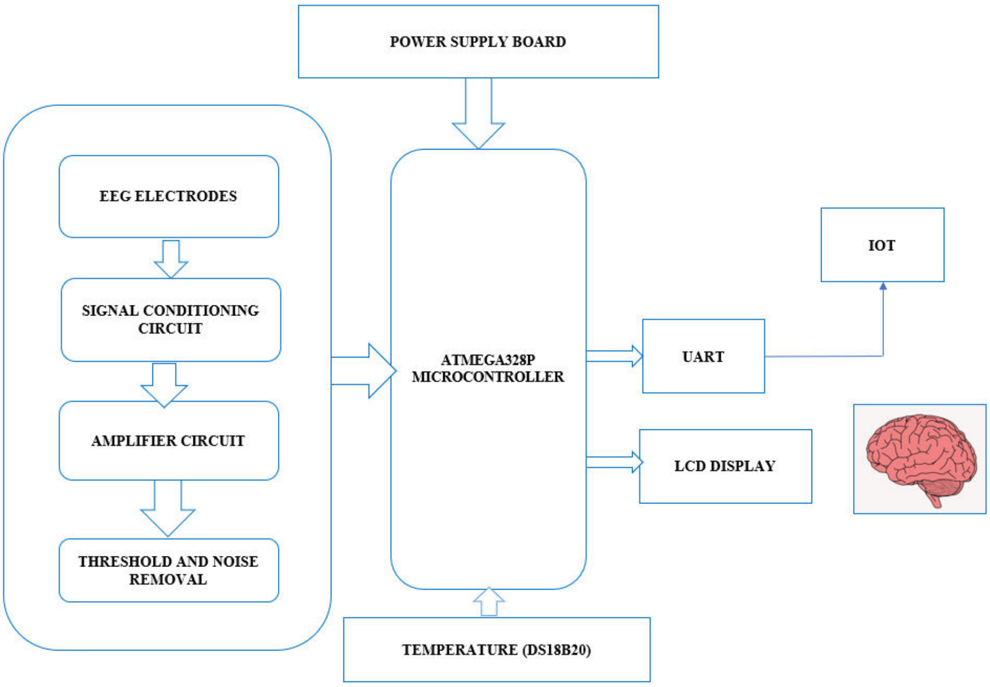

Figure 1. Proposed Block Diagram.

EEG Sensor: The foundation of the framework lies in the EEG sensor, a device capable of detecting and measuring brain electrical activity. This sensor captures neural signals and sends the data for further analysis and interpretation within the system.

Actuation Mechanism: Alongside EEG sensing, the framework incorporates actuation capabilities. This component allows the system to respond to specific patterns or stimuli detected in the EEG data. Actuation mechanisms could trigger predefined actions, interventions, or alerts based on interpreted brain signals.

Temperature Sensor: In addition to EEG sensing, the system integrates temperature sensors. These sensors monitor physiological changes by measuring temperature variations. The temperature sensor provides crucial data regarding the user's physiological state, enabling a comprehensive understanding of brain health.

Alert System: LCD and IoT Connectivity: When the system detects low temperature values beyond predetermined thresholds, it triggers an alert mechanism. The alerts are manifested via localized means such as LCD displays, offering immediate on-site notifications for users. Simultaneously, the system utilizes IoT (Internet of Things) connectivity to transmit real-time updates to mobile devices. These alerts serve as timely notifications for relevant.

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IV. RESULTS AND DISCUSSION

A simulation model in this context refers to a computational representation of the brain's electrical activity (EEG sensing) and the corresponding actuation processes within an intelligent Brain IoT system. This model aims to replicate the complex interactions and behaviors of the brain's electrical signals, providing a virtual environment for testing and optimizing EEG sensing and actuation algorithms. To implement such a project, specialized simulation software is crucial. This software should be capable of simulating neuronal activity, signal processing algorithms, IoT device interactions, and other relevant components of the Brain IoT system. Through the integration of advanced simulation models and software tools, the project can analyze, validate, and refine EEG sensing and actuation strategies, ultimately contributing to the development of dependable and intelligent Brain IoT systems.

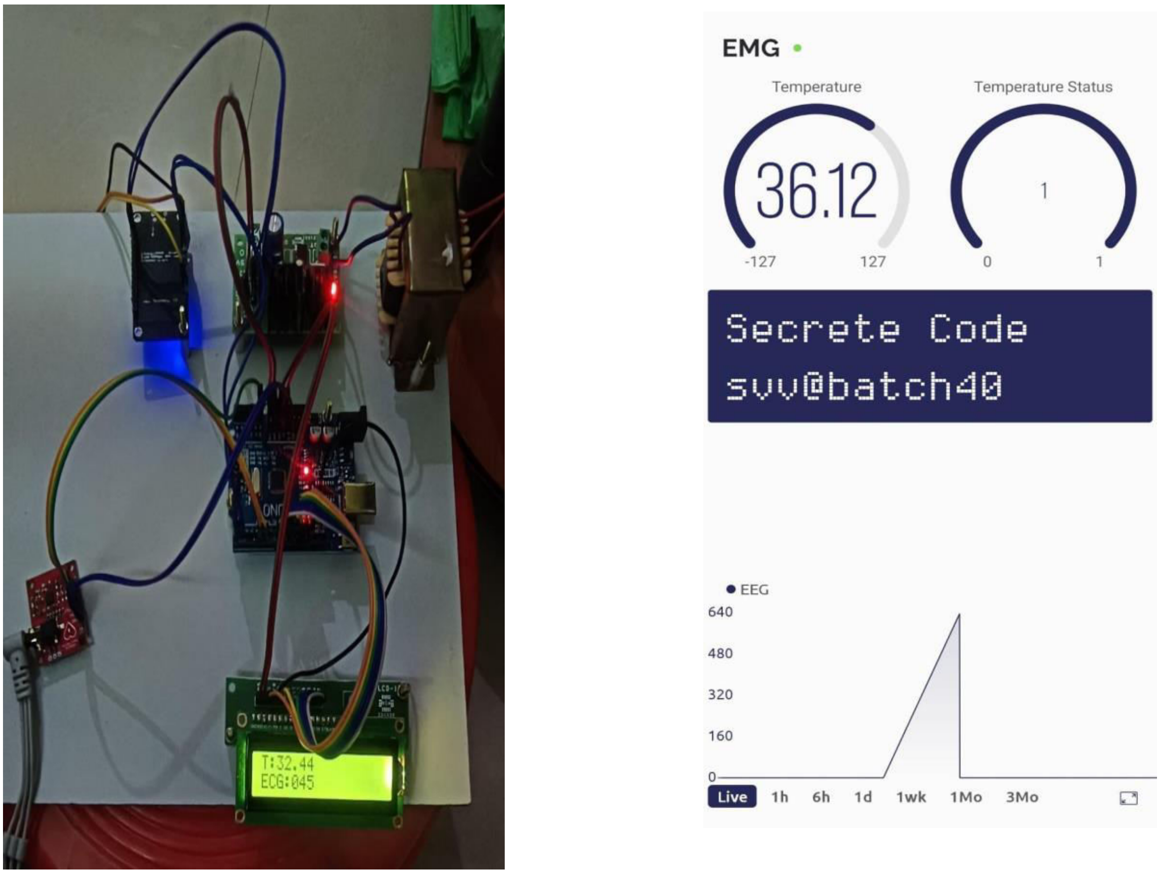

Figure 2. EEG and Temperature Low value.

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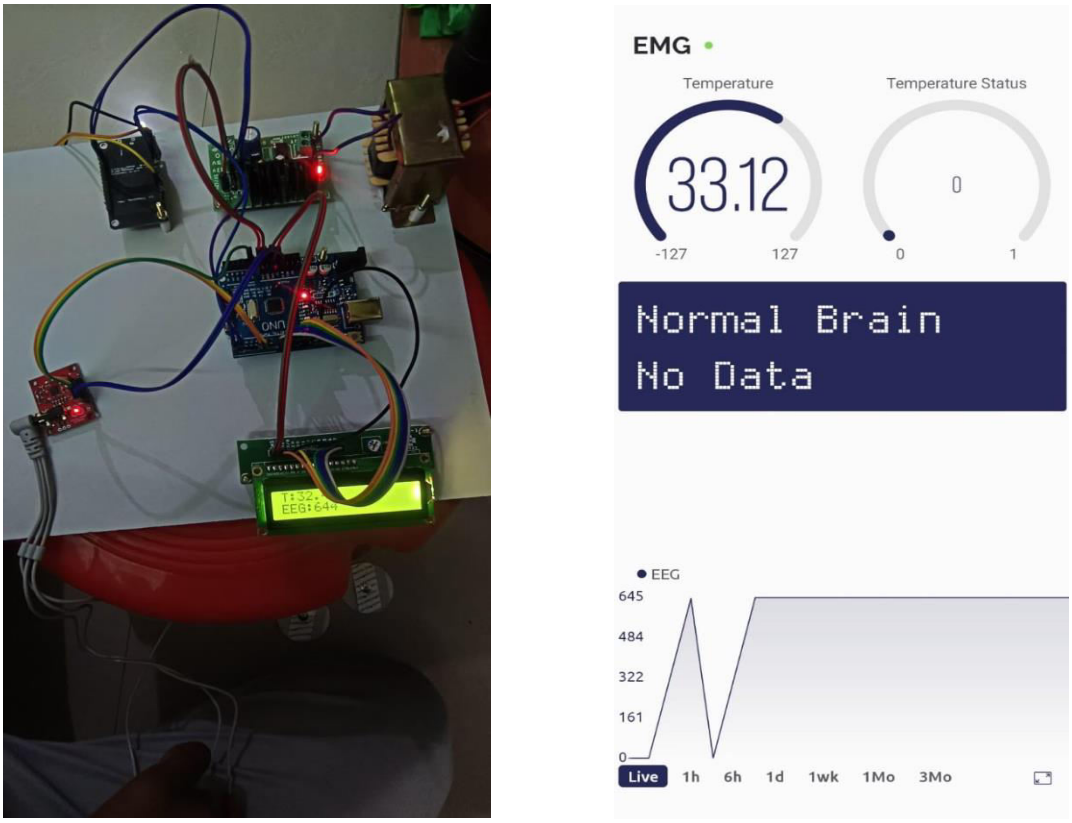

Figure 3. EEG and Temperature Normal value.

V. CONCLUSION

The "Virtual Brain" framework represents a significant leap forward in the realm of neurological monitoring and Intelligent Brain IoT systems. In addition to its advanced capabilities in EEG sensing and model-based interpretation, the Virtual Brain framework's integration of temperature monitoring is a significant advancement. By leveraging model-based techniques alongside cutting-edge EEG sensing and IoT integration, this innovative system promises unparalleled precision, responsiveness, and depth in analyzing brain-related data. Its unique strengths encompass not just precise EEG sensing and model-driven insights but also the seamless incorporation of temperature monitoring for rapid alerts and adaptive actions. This holistic approach, correlating neural activity with physiological variations, offers a comprehensive understanding of brain health, marking a transformative milestone in the field of neuroscience and IoT-driven healthcare solutions. The Virtual Brain framework thus stands as a pioneering solution at the forefront of intelligent Brain IoT systems, promising transformative impacts on healthcare, research, and technology development.

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