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Emotion Detection using EEG Signal Analysis

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Abstract: Emotion is a subjective experience-based mental state and emotive response to an event. This feeling is fundamental to everyday human behaviour and communication. Emotion is a psychophysiological process that influences a person's behaviour in a certain setting and is crucial to inter-personal communication. A person's voice, facial expressions, muscles, nervous system activity, and endocrine system activity are all influenced by their emotions. The electroencephalogram (EEG) is one technique for identifying emotions. Furthermore, EEG-based emotion identification has applications in a variety of industries, including marketing, gaming, and e-learning, and it has the potential to improve the intelligence of human-computer interfaces. This project records useful information related to various emotional states by using an EEG sensor to monitor brain waves in real-time. This raw data is transmitted to an ESP8266 micro controller by the EEG sensor. The DF Mini Player and the ESP8266 work together flaw-lessly to playback preset audio files that correlate to the identified emotions. As an Internet of Things device, the ESP8266 allows audio playback information and the detected emotional state to be communicated to the cloud or other devices that are connected. This allows for remote monitor-ing and the initiation of activities based on the user's emotions.
Keywords: EEG, ESP8266 Node MCU, BioAmp EXG pill

I. INTRODUCTION

Electrical signals are transferred between neurons in the brain to function. Re-cording the potential of the scalp encouraged by brain action is one method to study the electrical action of the brain [1]. An electroencephalogram (EEG) is the recorded signal, or the potential differences amid two places. One of the most effective ways to track brain activity, or brainwaves, is via an EEG [2,3]. The foremost humanoid EEG was recorded in 1929, and the foremost humanoid EEG report was published by Hans Berger. He was the one who came up with the phrase "electroencephalogram" as a major in the discipline. Richard Caton's work was based on his early nineteenth-century studies on animal brain function. His findings were progressively confirmed by electro physiologists and neurophysiologists, opening the door for EEG research in clinical practice [4]. The EEG signals can be studied to understand the variations in emotion. Neuronal potentials are a reflection of the functional and physiological changes that occur in the dominant nervous system. The electric activity of a bunch of neurons in the section of the brain where the EEG measuring electrode is positioned is denoted by the EEG rather than just the electrical activity of a single neuron. Because of this, the EEG signal contains a plethora of important and valuable psychophysiological data. The classification, processing, and analysis of EEG signals in medicine can provide an objective foundation for the diagnosis of certain illnesses [3]. Through neuron-engineering, disabled individuals can operate wheelchairs or robotic limbs with EEG signals generated by their thoughts or motion imagery. This is a prevalent issue right now namely known as Brain-Computer Interface (BCI). Study and dealing out of EEG signals is continually challenging in brain examine for the reason that the non-stationary of EEG in-formation and the several environmental impacts.

II. HARDWARE AND SOFTWARE REQUIREMENTS

NodeMCU is the name of an open-source IoT platform. It contains of hardware manufactured about the ESP-12 module and firmware working on Espressif Systems' ESP8266 Wi-Fi SoC.
The scripting language Lua is used by the firmware. In divergence to the ESP8266 Wi-Fi modules, this open-source hardware board has an integrated CP2102 TTL to USB chip for program designing and debugging, works well with breadboard, and can be driven through a micro USB connector.

A. EEG Sensor

An electrocardiography monitoring technique to record electrical activity on the scalp is called electroencephalography (EEG). Electrodes, which are tiny metal discs with slender wires connected to them, are applied to the scalp area during the operation. The electrodes detect tiny electrical signals generated by your brain's activity, pick up and magnify to show on the computer screen. The electrodes are usually positioned all the way around the scalp, making it non-invasive.

B. DF Mini Player

The minute and low-cost DF Player for Arduino is a module of MP3 with a forthright output that drives straight to the speaker. Equipped with a battery, speaker, and push buttons, this module functions autonomously or can seamless-ly integrate with other UART-compatible microcontrollers like Arduino, ESP32, Raspberry Pi, and more.

C. Thing Speak

Using ThingSpeak as a server in emotion detection using EEG signal analysis can be a viable option, especially in the framework of Internet of Things applications. ThingSpeak serves as an IoT platform enabling the gathering, analysis, and visualization of data sourced from sensors or devices. Here's how you might integrate ThingSpeak into your project. Data Collection, EEG devices would collect brainwave data as EEG signals.

D. Literature survey

M. Li et al [1] (2017) explored EEG-related emotion identification using a deep learning network with primary component-based covariate shift variation in their study. They provided insights into how this method can enhance the precision of detecting the emotion from EEG signals.

M. Soleymani et al [2] (2019) investigated explored EEG-related emotion identification with the help deep neural networks and transfer learning. Their work demonstrated the potential for these advanced techniques to improve emotion recognition performance.

K. Khoa Nguyen et al [3] (2020) discussed emotion identification from EEG signals by means of multimodal deep learning. Their research highlighted the effectiveness of integrating multiple data sources to enhance emotion recognition capabilities.

M. Wu et al [4] (2018) studied emotion identification from EEG signals by means of long short-term memory recurrent neural network. Their findings con-tributed to the understanding of how recurrent neural networks can be applied for more accurate emotion recognition from EEG data.

III.PROPOSED SYSTEM BLOCK DIAGRAM

This project utilizes an EEG sensor for real-time monitoring of brain waves, capturing valuable data linked to different emotional states. The EEG sensor transmits this raw data to an ESP8266 micro controller. The ESP8266 seamlessly integrates with the DF Mini Player, triggering the playback of prerecorded audio files corresponding to the identified emotions. The ESP8266, functioning as an IoT device, facilitates communication of the detected emotional state and audio playback information to the cloud or other connected devices, enabling remote monitoring and triggering of actions based on the user's emotions. A user inter-face provides real-time feedback on the detected emotional state, allowing users to interact with the system and potentially manually trigger specific emotional responses.

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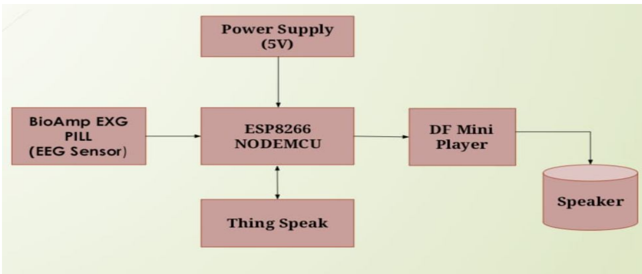

Fig.1.Block Diagram

The SD card used for storing data locally on the NodeMCU or for storing audio files, depending on your project requirements Speaker, The speaker is used for audio output, playing sounds or messages based on the detected emotions. Arduino IDE, Used for programming the ESP8266 NodeMCU You'll write the code in Arduino language, which is based on C/C++.Necessary for writing the firmware code for the ESP8266 NodeMCU using the Arduino IDE. ThingSpeak, This is an IoT platform that can be used for data storage, analy-sis, and visualization. The NodeMCU will be programmed to send EEG data to ThingSpeak for further processing and monitoring.T he EEG sensor collects brainwave data.The ESP8266 NodeMCU processes and transmits this data to ThingSpeak. ThingSpeak stores the EEG data in channels. You can set up MATLAB scripts on ThingSpeak for real-time analysis of the EEG signals. Based on the analysis results, the NodeMCU can trigger actions, such as playing .

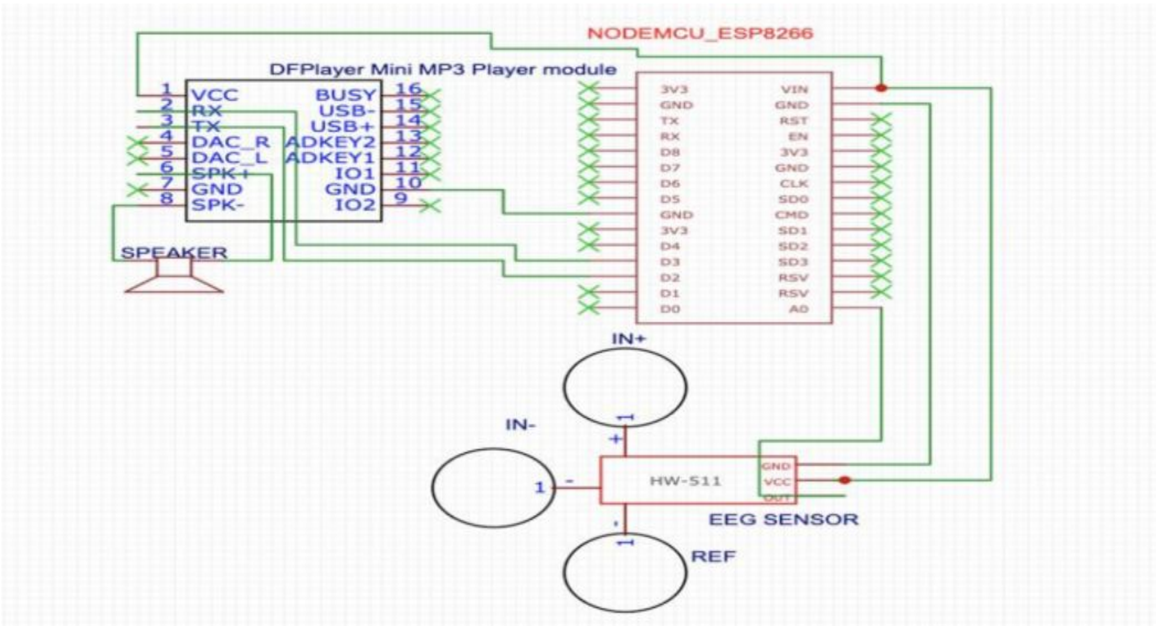

Fig.2.Pin Diagram

IV. RESULTS AND DISCUSSION

After reading up on literature and researching several EEG emotion recognition projects, we designed the top level block diagram of the suggested system to identify unpleasant emotions like sadness and rage. With the introduction of this method, which uses EEG data to accurately and instantly describe emotional states, a dramatic change has occurred. This method offers a more dependable and adaptable way to understand and identify emotions, with ramifications that cut across multiple domains such as psychology, healthcare, and human-computer interaction.

Fig.3.Connection of electrodes

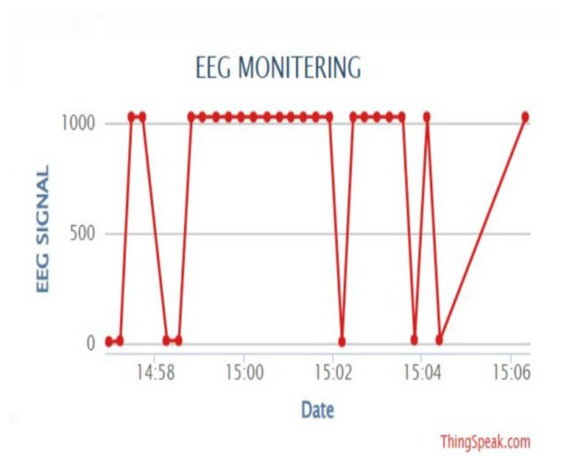

Fig.4.Waveform in Thing speak

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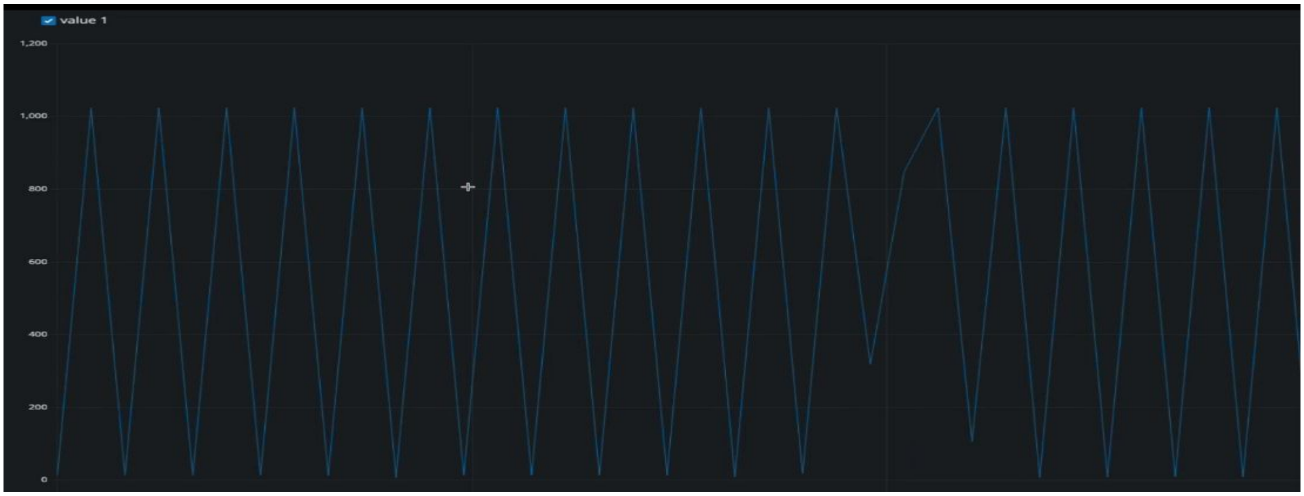


Fig.5.Waveform of Angry

Fig.6.Waveform of Sad

V. CONCLUSION

Finally, by utilizing Electroencephalogram (EEG) signals, the project "Emotion Detection Using EEG Signals Analysis" offers a fresh and promising method of emotion identification. Investigating the complex link between brain activity and emotional states aims to overcome the shortcomings of current systems that de-pend on self-reported surveys or facial expressions as external indicators. The suggested approach presents a novel paradigm shift by using EEG signals to ac-curately and directly depict emotional states. This method provides a more relia-ble and flexible way to recognize and identify emotions, and it has great promise for use in psychology, healthcare, and human-computer interaction.

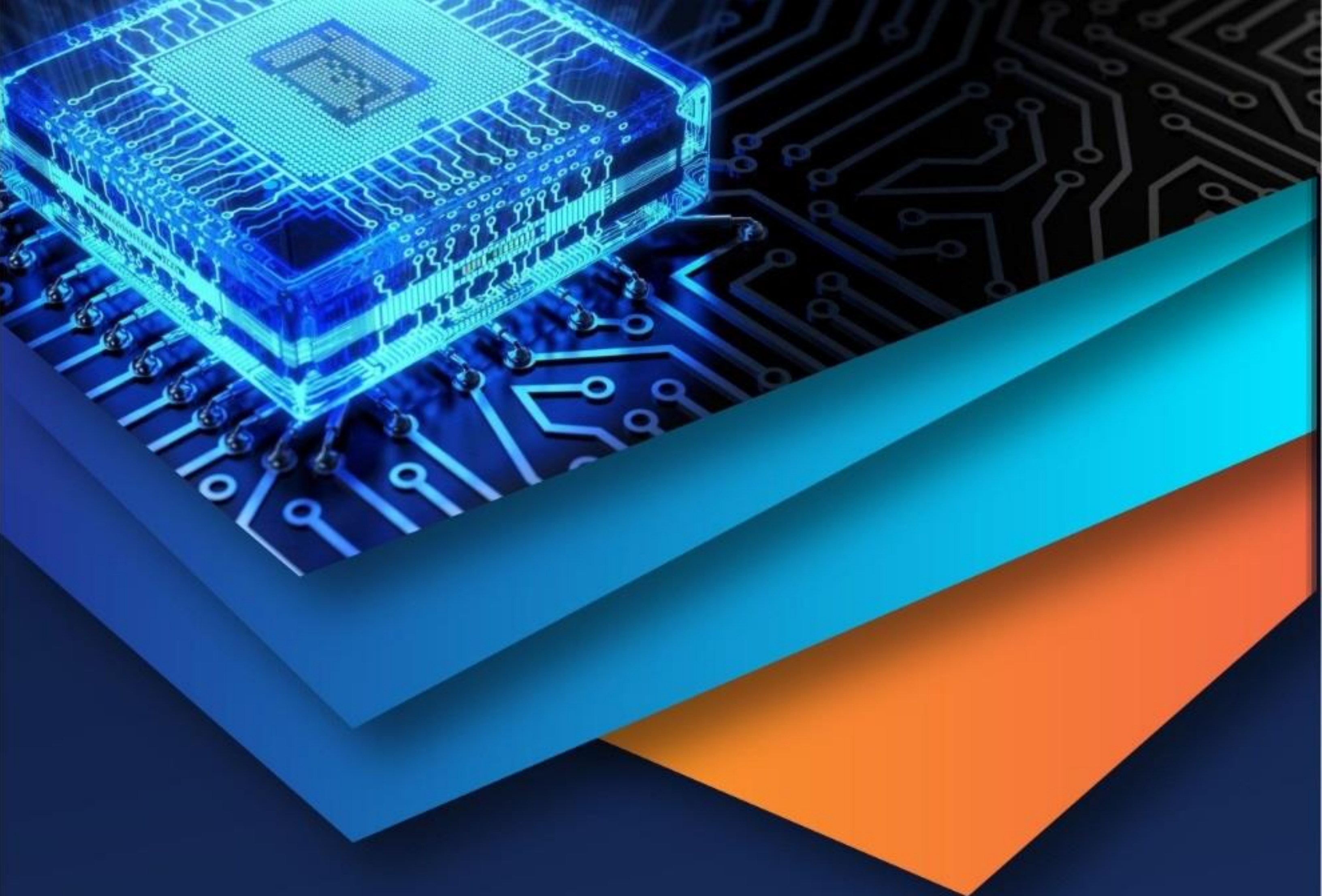
REFERENCES

[1] M. Li, M. Xu, X. Liu, and Y. Yang, "EEG-Based Emotion Recognition using Deep Learning Network with Principal Component Based Covariate Shift Ad-aptation," in 2017 IEEE International Conference on Bioinformatics and Bio-medicine (BIBM), 2017, pp. 1859-1864.

[2] M. Soleymani, S. Asghari-Esfeden, and Y. Fu, "EEG-based Emotion Recogni-tion using Deep Neural Networks and Transfer Learning," in 2019 IEEE Inter-national Conference on Multimedia and Expo (ICME), 2019, pp. 1067-1072.

[3] K. Khoa Nguyen, H. G. Jung, Y. H. Jung, and K. R. Park, "Emotion Recogni-tion from EEG Signals Using Multimodal Deep Learning," in 2020 IEEE Inter-national Conference on Big Data and Smart Computing (BigComp), 2020, pp. 334-339.

[4] M. Wu, J. Peng, H. Tang, J. Li, and Y. Wang, "Emotion Recognition from EEG Signals Using a Long Short-Term Memory Recurrent Neural Network," in 2018 IEEE International Conference on Bioinformatics and Biomedicine (BIBM), 2018, pp. 1731-1736.



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