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MEDITATION ANALYZER USING BRAINWAVES

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Abstract: **Meditation is as a practice that is performed by individuals all over the globe, where the individual focuses their mind on a particular object, thought or activity to achieve a mentally clear and emotionally calm state. Although the results of a good meditation session can only be felt and a long term goal. The project aims to show the results on digital screen for a better understanding of own results. During meditation Aanalysation and observation of brain wave is carried and data is stored and can be analysed for an enhanced performance in meditation. The raw data is live brain signal that is received by TGAM and outputs is based on sensing meters say attention & meditation that is transmitted directly to webpage where analyzation of raw data will take place with the help of various scales and factors. Process depends on the gathering and recording of brain signals through electrodes that are placed on the headgear. A Brain Computer Interface (BCI) is constructed to control the hardware component of the device. This project aims to obtain an electroencephalogram (EEG) signal from the constructed head gear containing. TGAM. The EEG signal can be achieved by using only three electrodes which are placed in the scalp location where we can compare distinguishable changes in the various wave patterns of the EEG signal. The main circuit is made of simple electronic elements such as resistors, capacitors, Quad Op-Amplifiers and Instrumentation Amplifiers. The signal which is obtained from the headgear machine can be analysed, processed and compared to a sample signal containing various human moods. After the convolution of these signals the real time EEG signal will help in depicting a person's current mood. The overall purpose of the study is to help the individual to get to know about his/her performance in meditation sessions and improve it.**

Keywords: *Neurosky TGAM chip, ESP8266 and IOT.*

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I INTRODUCTION

Meditation is important part of our life, we as a human require it more than ever. It's a practice where an individual operates or trains the mind or induces a mode of consciousness, either to realize some benefit or for the mind to simply acknowledge its content without becoming identified with that content or as an end in itself. As we know humans doesn't use the sub-conscious mind, by meditation one can use sub-conscious mind effectively and hence can also enhance memory power. The term meditation refers to a broad variety of practices that includes techniques designed to promote relaxation, build internal energy or life force (qi, Ki, prana, etc.) and develop compassion, love, patience, generosity, and forgiveness. A particularly ambitious form of meditation aims at effortlessly sustained single-pointed concentration meant to enable its practitioner to enjoy an indestructible sense of well-being while engaging in any life activity.

Meditation has been practiced since antiquity as a component of numerous religious traditions and beliefs. Meditation often involves an internal effort to self-regulate the mind in some way. Meditation is often used to clear the mind and ease many health concerns, such as high blood pressure, depression, and anxiety. It may be done sitting, or in an active way. By this project we are relating meditation with technology, by which one can see her/his meditation performance graphically and can compare it with previous sessions and with other individuals also. This will eventually help the user to enhance his/her performance. The aim of this study is to help user in meditation sessions. The project will store all previous data and compare it with next session data by a graphical representation it will be easy for the user to know about his performance in real time. Meditation is important part of our life, we as a human require it more than

ever. It's a practice where an individual operates or trains the mind or induces a mode of consciousness, either to realize some benefit or for the mind to simply acknowledge its content without becoming identified with that content or as an end in itself. As we know humans doesn't use the sub-conscious mind, by meditation one can use sub-conscious mind effectively and hence can also enhance memory power. The term meditation refers to a broad variety of practices that includes techniques designed to promote relaxation, build internal energy or life force (qi, Ki, prana, etc.) and develop compassion, love, patience, generosity, and forgiveness. A particularly ambitious form of meditation aims at effortlessly sustained single-pointed concentration meant to enable its practitioner to enjoy an indestructible sense of well-being while engaging in any life activity.

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II METHODOLOGY AND MATERIAL

Meditation analyzer system developed in this study uses brain waves for input data. Different areas of the brain control different functions within the body. Simple changes in the electrical potential across the many billions of synapses between neurons within the brain can create complex thoughts, feelings, and synchronize the thousands of muscle movements and processes that occur within the human brain during the period of meditation. The outermost layer of the brain, known as the neocortex, controls functions such as sensory perception, motor commands, spatial reasoning, thought, and language. As a person undergoes changes in their level of attentiveness or state of mind, there are slight changes in the voltage levels and frequency of the signals emanating from their neocortex. The method is known as Electroencephalography (EEG) which uses electrodes connected across the scalp to accurately measure these signals and their fluctuations as they occur across the neocortex. States of consciousness are the various stages your mind may go through in a day, from very relaxed to very alert. There are actually four different stages: Beta, Alpha, Theta, and Delta. These states of consciousness can be identified by a number of brain waves that occur in a second. States of consciousness are the various stages your mind may go through in a day, from very relaxed to very alert. There are actually four different stages: Beta, Alpha, Theta, and Delta. These states of consciousness can be identified by a number of brain waves that occur in a second. The more brainwaves per second, the higher the state of alertness. The fewer brain waves per second, the more relaxed of a state we are in. Beta waves range from about 13-30Hz and occur when a person is in an attentive and active state of mind. Waves known as high beta waves exist from approximately 30-35Hz and are triggered when a person is in a stressed or anxious state. Alpha waves range 8-14Hz and correspond to a person who is relaxed. Theta waves occur between 4-8Hz and can represent either a light sleep or meditative state if the subject is awake. Finally, delta waves occur from 0-4Hz and are seen when a person is in a deep sleep. Gamma waves, which are from 30-100Hz, correspond to the sensory processing of sound and sight. However, these signals occur deep within the brain and are not typically seen by an electroencephalograph system. Knowing the frequencies of these different kinds of brain waves will lead to a bandwidth specification for the sensor. This knowledge will also allow for focus on certain types of waves when conducting tests with our system and will help to test the accuracy of our final prototype by seeing if our test subjects are in the same state of mind as the corresponding frequency at the output of the sensor

These states of consciousness can be identified by a number of brain waves that occur in a second. The more brainwaves per second, the higher the state of alertness. The fewer brain waves per second, the more relaxed of a state we are in. In this system, we connect the neurosky TGAM chip of mind flex headset to Arduino to get the brainwave data or data packet. This data will be uploaded to a local server using ESP8266 to a website where individual keep the record of all the data received. Data received by neurosky TGAM is stored in database. Ranking and comparison is made with the help of different data received by headgear of different user. Comparison can be done with the help of real time data. Data pact received from electrode of head gear gives output after analyzation with of help of Arduino. The output is in form of meditation, attention, concentration, blinking etc. The project focus on attention and meditation parameters.

III WORKING PRINCIPLE

The project works on BCI (Brain computer interface) which is a direct communication channel between the brain and a separate device. The study is about visualization of the brain wave data of the neurosky TGAM headset. This BCI program can run on a PC. Arduino IDE used to implement the program, which is a developing

environment that supports modern object-oriented programming. We connect the neurosky TGAM chip of mind flex headset to Arduino to get the values of meditation and attention of the user. The head gear will contain only 3 electrodes that are directly in contact with the scalp of user. NeuroSky TGAM chip will send data packet continuously and Arduino analyse it side by side. For a single meditation session, two average value for each attention and meditation parameters are considered. The data packets are in parameter of meditation and attention and ESP8266 will upload the data to the database. Average of meditation and attention value is considered for final value required for comparison and ranking among different user. As we know that Human brain is complex and It is amazing to think that simple changes in the electrical potential across the many billions of synapses between neurons within the brain can create complex thoughts, feelings, and synchronize the thousands of muscle movements and processes that occur within the human brain during the period of meditation.

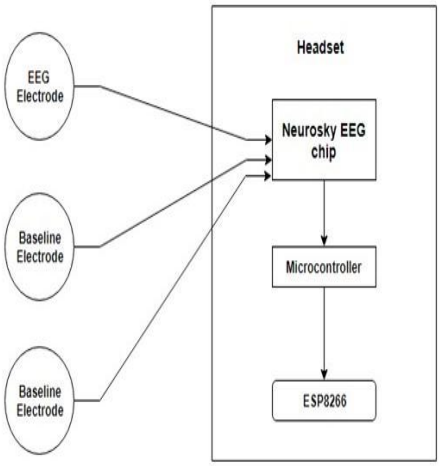

Figure 1 Electronic unit of headset

Different areas of the brain control different functions within the body. The outermost layer of the brain, known as the neocortex, controls functions such as sensory perception, motor commands, spatial reasoning, thought, and language. As a person undergoes changes in their level of attentiveness or state of mind, there are slight changes in the voltage levels and frequency of the signals emanating from their neocortex. The method is known as EEG, which uses electrodes connected across the scalp, is used by scientists to accurately measure these signals and their fluctuations as they occur across the neocortex. These signals can then be used for multiple clinical purposes, including diagnosing epilepsy, recording brain death, and measuring a person's level of stress. The headgear will transmit data packs continuously while doing yoga/meditation with the help of Arduino platform attached to it and this data will be uploaded to a local server using ESP8266 Wi-Fi module. The head gear consists of neurosky TGAM and Arduino, with the help of Wi-Fi module ESP8266 data that is received from head gear sent over to data base. The data base stores the data for past record and can store multiple user's data that is required for comparison and ranking that will eventually help the user to enhance his/her performance by improving the scores of meditation, attention and concentration, thus achieving the aim of this study. The project focus on only two brain wave signal that is meditation and attention. Different types of brain waves that can be detected and what state of mind they correspond to for example resting, awake, sleeping, deep sleep etc. The results are in shown in graphical representation for better understanding of results.

A. Visual Analyzation

Earlier after going through a meditation session there is no way to see the results. The good results of meditation are long term goals. But now using meditation analyser one can see his/her own performance in a graphical and mathematical form in a digital screen. The project gives the ability to a user so he/she can analyse his/her performance on regular bases and improve it efficiently. Yoga and meditation are now a trend in all over world. The project will help millions of people all around the globe who are interested in yoga and meditation. The project will also give a puss to the initiative taken by government of India to create awareness about yoga and give an international recognition.

B. Different Waveform of Brainwaves

The figure above shows the different types of brain waves that can be detected and what state of mind they correspond to. Beta waves range from about 13-30Hz and occur when a person is in an attentive and active state of mind. Waves known as high beta waves exist from approximately 30-35Hz and are triggered when a person is in a stressed or anxious state. Alpha waves range 8-14Hz and correspond to a person who is relaxed. Theta waves occur between 4-8Hz and can represent either a light sleep or meditative state if the subject is awake. Finally, delta waves occur from 0-4Hz and are seen when a person is in a deep sleep. Gamma waves, which are from 30-100Hz, correspond to the sensory processing of sound and sight. However, these signals occur deep within the brain and are not typically seen by an electroencephalograph system. Knowing the frequencies of these different kinds of brain waves will lead to a bandwidth specification for the sensor. This knowledge will also allow for focus on certain types of waves when conducting tests with our system and will help to test the accuracy of our final prototype by seeing if our test subjects are in the same state of mind as the corresponding frequency at the output of the sensor

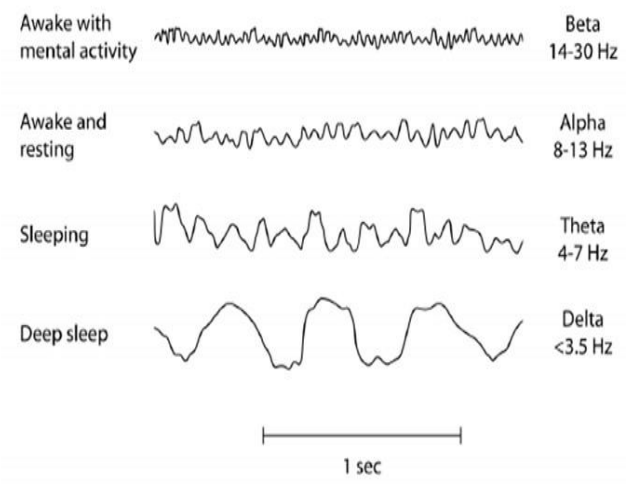

Figure 2 Waveforms of brainwaves

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IV EXPERIMENTAL PARADIGM

The user is required to wear the head gear while performing yoga / meditation session, while the user is busy doing meditation and yoga he/she has nothing to do with the head gear. The head gear containing 3 set of electrodes. The electrodes are directly connected to scalp which help in receiving small electric potential continuously. The head gear will automatically send the packet and with the help of Arduino analyzation of data packet are done where we will get value in certain parameter say meditation and attention. The head gear will continuously transmit packet data and average value is considered for a single session of meditation. This data is transmitted to the webpage database with the help of Wi-Fi module ESP8266. The data will be send continuously to webpage database. At database the average of both the parameter is considered for a single session result of a particular user.

The figure 3 show below as a block diagram which consist of basic components that are used in the study and are efficient in achieving the aim of the project.

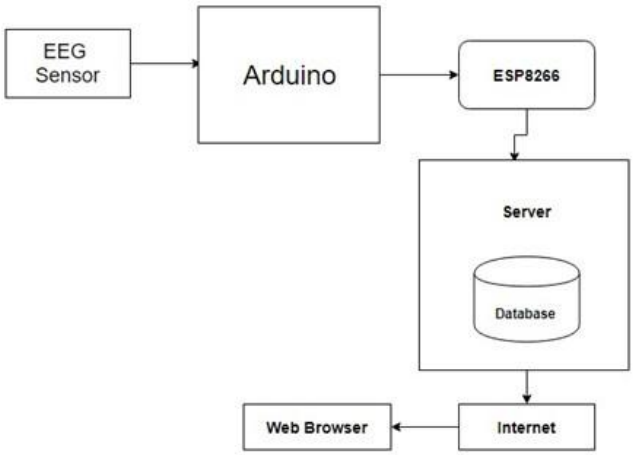

Figure 3 Block diagram

A. EEG Sensor

EEG sensor consists of NeuroSky TGAM chip. The TGAM is NeuroSky's primary brainwave sensor ASIC module designed for mass-market applications. The TGAM processes and outputs EEG frequency spectrums, EEG signal quality, raw EEG, and three NeuroSky Sense meters attention; meditation; and eyeblinks. With simple dry electrodes, this module is excellent for use in toys, video games, and wellness devices because of its low power consumption, which is suitable for portable battery-driven applications. With the help of electrodes head gear will transmit data packets continuously. The sensing parameters are attention and meditation. While doing the ranking amongst multiple user's average value of attention and meditation is considered and with the help of Arduino data packets can be analysed. The head gear will transmit data packet continuously but the average is considered for a single session of meditation and yoga.

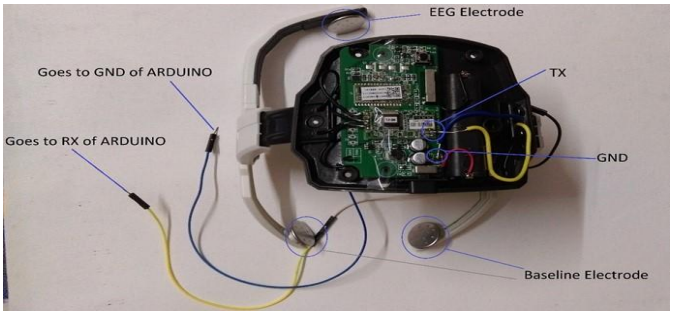

Figure 4 Headset

B. ESP8266

ESP8266 offers a complete and self-contained Wi-Fi networking solution, allowing it to either host the application or to offload all Wi-Fi networking functions from another application processor. When ESP8266 hosts the application, and when it is the only application processor in the device, it is able to boot up directly from an external flash. It has integrated cache to improve the performance of the system in such applications, and to minimize the memory requirements. Alternately, serving as a Wi-Fi adapter, wireless internet access can be added to any microcontroller-based design with simple connectivity through UART interface or the CPU AHB bridge interface. ESP826 can be interfaced with Arduino, although the logic connection between Esp8266 and Arduino is very simple. ESP-Rx goes to Arduino Tx, ESP-Tx goes to Arduino Rx. However, all ESP-8266 run on 3.3V, while Arduino pins run on 5V.

V CURRENT LIMITATIONS AND FUTURE DIRECTION

The project faces some challenges and can be rectified with the help of further research. The major challenge is to reduce the size of head set. ESP8266 can be replace with mobile SIM to reduce the size of head set. This project has a great future direction. The project will be useful in research work or experiments like to check the level of concentration of user while driving, studying, etc. The project will be very helpful to convince a user regarding his/her session performance thus the user can improve his meditation session. By looking at a digital screen user can see how much concentration he/she was able to do. The project will motivate young generation to perform and practice meditation and yoga. The results are in real time and can be stored and compared with other user's performance by which we can create a ranking in a district, locality etc.

VI RESULT

The aim of this study is to assist the user to improve his/her meditation session so that user can meditate more efficiently. With the help of graphical presentation, the result can easily perceive by the user without any problem. The project does ranking and comparison amongst multiple user in a particular locality or district. The data can be stored for all the previous meditation sessions. The session missed by user will show zero value. The final ranking is done by taking the average of attention and meditation parameters. Different user will have different id by which system will identify the users. Results can be shown in term of weeks, months and even years.

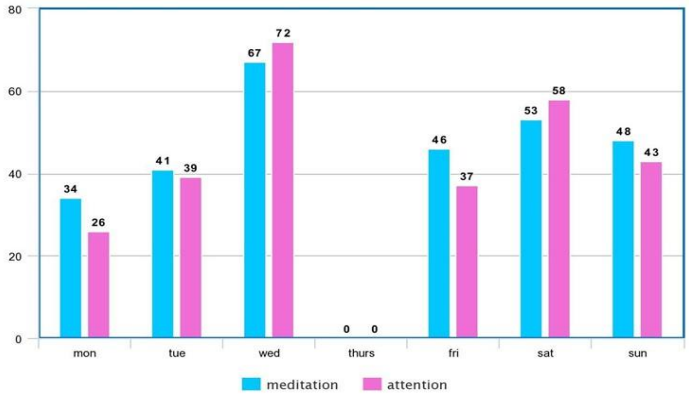

Figure 5 Weekly result of user

VII CONCLUSION

The project is achieving its aim as it assists the user to analyze his/her performance along with other users. With the help of graphical representation, it is easier to perceive the result of session with more research on this topic, the efficiency can be increase. Novelty of this development is the universal measuring, data collecting, data processing and visualizing data which could be the base of several further researches. The program described above enable users to investigate how brain wave signals - measured by the EEG headset - alternate in time and how they depend on the changes of brain activity during meditation. On the basis of the results, the data packet obtained by the processed brainwaves can be used in several research areas, for instance medical research, multimedia applications, games etc. On the other hand, the headset size can be reduce so that it will be comfortable to user.

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