



CAEE-2018

Conference on Advances in Electronics Engineering 2018

Thakur College of Engineering and Technology, Thakur

Vol. 6, Special Issue 1, February 2018



ANSUB The Brain Stimulator

Poorva Waingankar, Ratnesh N. Singh, Dishant H. Vora, Anilkumar B. Yadav

Associate Professor, TCET, Mumbai, India

UG Student, TCET, Mumbai, India

UG Student, TCET, Mumbai, India

UG Student, TCET, Mumbai, India

Abstract: The idea is to falsely invigorate the mind to different states by using Binaural Frequencies. The impact of subjecting the mind to the Binaural Frequencies can be relaxing or refreshing, contingent upon the frequency of the binaural-beat selected by the user, the purpose of this product is to analyze the situation of brain using a heart rate sensor and empower the cerebrum with a synthesized frequency state that the person desires to be in. As neural action in human brain is electrochemical, the way in which it behaves can be altered by introducing specific chemicals (drugs), by adjusting the condition of mind either through enlistment, or through resounding entrainment methods. This is offered in form of a portable product comprising of a software system in the Smart device and a wireless or wired headphone.

Keywords : Binaural, Brain, Audacity, Arduino.

I. INTRODUCTION

The Product is centred on the notion that Binaural Frequencies can be utilized to alter ones neural activity. Binaural beats are sound-related reactions which begin in the predominant olivary core of each half of the brain. They are classified into different categories namely; Gamma, Beta, Alpha Theta and Delta each having its own distinct frequency ranges lying below 100 Hz. Based on activity within the brain, the waves dissipated by brain change their frequencies. As working of brain is electrochemical, the functioning of human brain can be altered either by introducing specific chemicals (drugs) or by entrainment method. Binaural-Frequencies were used to probe the support of a person's performance and serve as a means to potentially cure many Brain disorders whose cause is deep in the chemical imbalances apart from many other factors. The speculation and exploratory outline of this investigation are built to have the capacity to answer the topic of the viability of Binaural-recurrence in encouraging memory under controlled conditions. Factually important outcomes in this examination would bolster prior non-observational research which has observed Binaural Frequencies to be helpful in encouraging enhanced scholarly execution among healthy and Attention Deficit/Hyperactive Disorder (AD/HD) populations. The consequences of the prior examinations, and all the more firmly controlled investigations with other cerebrum wave preparing strategies, propose that Alpha and Beta recurrence can to be sure be utilized to animate the mind into different Brain states; but only if the method is performed authentically and the delivery mechanism is precise within the scope of real time monitoring. Given the diverse fields, which this product encompasses; there is a huge scope of innovation both in improving the hardware, software and ergonomics aspects. Further innovations would comprise of a product in which all the features are included in the headphone's itself; with a built-in UI system utilizing the parameters and playing the frequencies accordingly. Also the



CAEE-2018

Conference on Advances in Electronics Engineering 2018

Thakur College of Engineering and Technology, Thakur

Vol. 6, Special Issue 1, February 2018



software system which would be used can be built more intuitive by adding in options such as “custom-presets” and an entire record of the usage of the software. One of the more significant usages would be in the field of medicine, where this device has the potential to replace potential anti-depressants and other drugs which can cause some undesired impacts. The sampling rate and the disposal of harmonics is a concept to improvise and adding more measurement parameters such as Blood-oxygen levels, Neural Frequencies using EEG and VO2 MAX. The scope of this product is its most critical advantage. The product encompasses diverse fields in which human cognition plays a key role. The item can be utilized for a single subject, both for the consumer or medical domain or can be scaled up and installed in large areas like hallways and rooms where it is intended for a large subset of people.

II. PRODUCT WORK

1. The Binaural Beats have been created with the help of Audio Workstation Ableton.

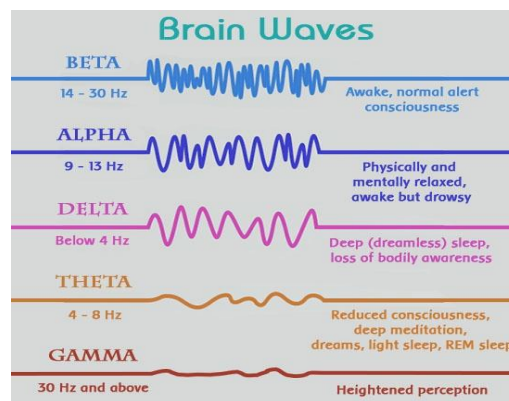


Fig.1: List of Binaural Frequencies

2. These sounds will be embedded in the memory (SD) card. This SD card will then be interfaced with the microcontroller. These Binaural sounds can be accessed with the help of a touch enabled graphic LCD panel.

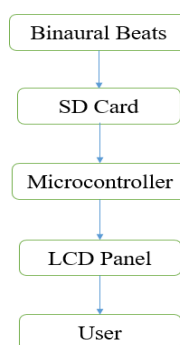


Fig.2: Flow Graph of Product



CAEE-2018

Conference on Advances in Electronics Engineering 2018

Thakur College of Engineering and Technology, Thakur

Vol. 6, Special Issue 1, February 2018



III. BLOCK DIAGRAM

The block diagram describes the significant system elements. Below is the block diagram of product.

A. User will measure his/her blood pressure and heart rate sensor with the help of mentioned sensors and will note down the readings.

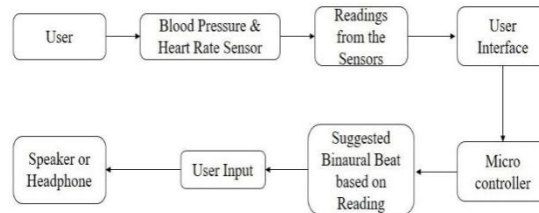


Fig.3: Block Diagram of Auditory Neuro Stimulator Using Binaural Frequencies

B. These readings will be entered by the user on a user interface like Graphic LCD which is connected with the Micro Controller.

C. Now based on these readings microcontroller will compute the optimally required binaural beat on the graphic LCD.

D. Now user has choice to choose between different binaural beats and based on his convenience he can choose the desired binaural beat.

Working:

Binaural Frequencies can be utilized to instigate a particular cortical cadence as a means of awareness administration system to alter ones neural activity. Binaural Frequencies can be utilized to alter ones neural activity. Binaural beats are sound-related reactions which begin in the predominant olivary core of each half of the brain. They are widely aggregated into different categories namely; Delta Theta Alpha Beta and Gamma each having its own distinct frequency ranges lying below 1000Hz. Based on activity within the brain, the waves dissipated by brain change their frequencies. As working of brain is electrochemical, the functioning of human brain can be altered either by introducing specific chemicals (drugs) or by entrainment method. Binaural sounds can be invoked by aurally exciting each olivary core of the brain hemispheres. The rubric to measure the Brain state would be Pulse-Rate. As the persons brain activity is in direct co-relation with the Pulse-Rate; it is effective measurement quantity of the efficiency of the product. The feedback process would work by utilizing the headphones Pulse-Rate sensor; sending the signals via-Bluetooth to the device. Traditionally, recordings are created with the help of two methods: mono and stereo. Mono uses one electro-acoustic transducer to choose a sound, whereas stereo uses two, spaced aside from one another. Stereophonic recording takes the stereo methodology one step ahead by inserting two microphones in ear-like cavities on either aspect of a stand or dummy head. since the dummy head recreates the density and form of an individual's head, these microphones capture and calculates sound precisely because it would be detected by human ears, protective interaural cues. The result is best fully fledged over headphones, with a transparent distinction between left and right views. It's a straightforward thought, however once done with high-quality microphones and compete over equally high-quality headphones, the result is eerie: it fools the brain into the basic cognitive process it's hearing the sounds primary. The software would then decide which binaural frequency to transmit to the headphones in sync with subject's Pulse-Rate.

IV. IMPLEMENTATION

Synthesizing the frequencies through a DAW (Digital Audio Workstation). This process involves making use of the sound engines and VST (Virtual Studio Template) software's to artificially create binaural audios as means of Frequency subtractive synthesis. It controls all equipment segments and gives the UI that considers recording, altering, and playback.



CAEE-2018

Conference on Advances in Electronics Engineering 2018

Thakur College of Engineering and Technology, Thakur

Vol. 6, Special Issue 1, February 2018



The product is focused to play binaural beats for two devices. One for noise cancellation head phones and other for the wired speakers. The main idea behind these two different approaches is that if the user wants to hear the binaural beats personally then he can go for noise cancellation headphones without disturbing the his surrounding environment and if he wants to play the binaural beats in acoustic proof room like the studios or in the hospitals where these frequencies could help the patients to improve their state of mind and ultimately enhancing the quality of the life.

PC based DAWs have broad account, altering, and playback abilities (some even have video-related highlights). A DAW with an examined string area emulator can be utilized to include string backup "cushions" to a pop tune. DAWs can also generate effects such as reverb, to improve or change the sounds themselves.

Features:

- Synthesize sounds add effects in a chain; including EQ, compression, limiting, reverb, distortion, etc. this must apply both to tracks and busses.
- Mix the tracks to a standalone file which can be saved on the host system.
- A way to integrate third-party plug-ins.
- Set beats and have the framework naturally make bar lines which go about as snap hubs.
- Make circles from portions of any track and rehash them effectively.

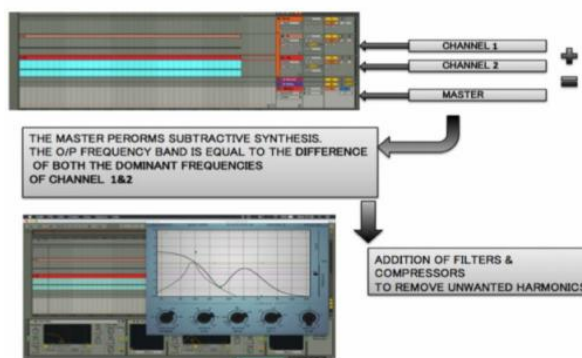


Fig.4: Generation of low frequency bands

Description:

A Digital Audio Workstation or DAW is an electronic gadget or PC programming application for recording, altering and delivering sound documents, for example, melodies, melodic pieces, human discourse or sound impacts.

DAWs arrive in a wide assortment of arrangements from a solitary programming program on a computer to a coordinated remain solitary unit, the distance to an exceedingly complex design of various segments controlled by a focal PC.

- Synthesizing the frequencies with DAW: The PC becomes a host for the sound card/sound interface, while the product gives the interface and usefulness to sound altering the sound card/outer sound interface regularly changes over simple sound signs into advanced shape, and computerized back to simple sound when playing it back. It might likewise aid additionally handling of the sound.
- Disposing of the undesirable recurrence ranges/Equalizing the Frequency Bands: This step involves mastering the obtained frequencies to remove all the unwanted Frequency Bands.
- Exporting the Frequencies at a very high sample rate: After In order to ensure that there is no additive noise induced in the exporting of the audio, the sample rate is kept of the order of 192000. This ensures the integrity of the



CAEE-2018

Conference on Advances in Electronics Engineering 2018

Thakur College of Engineering and Technology, Thakur

Vol. 6, Special Issue 1, February 2018



exported Frequencies.



Fig.5: ANSUB- The Brain Stimulator

D. Postulating the rubric for measurement: The Binaural frequencies are measured with reference to the subjects Pulse-rate, and the blood's diastolic and systolic pressure. The rubric of measurement is directly corresponding to the person's mental state. As the mental state of a person has direct interaction with the rubrics of measurement.

E. Sampling on subjects in a controlled environment: Before performing the regression analysis, sampling was done to test impact of the synthesized frequency bands. The sample space was segregated into different divisions based on different criteria's, the primary one being the most likely mental state that the subjects of the group are likely being in.

F. Running Regression models: The collected data was quantified by visual models and charts to prove the credibility of the product's claim.

V. RESULTS AND DISCUSSION

Table I: Data from sportsperson

Activity	Pulse rate before activity	Pulse rate after activity
Player 1	137	102
Player 2	120	91
Player 3	175	127
Player 4	136	107
Player 5	121	105
Player 6	132	110
Player 7	133	117
Player 8	178	129



CAEE-2018

Conference on Advances in Electronics Engineering 2018

Thakur College of Engineering and Technology, Thakur

Vol. 6, Special Issue 1, February 2018

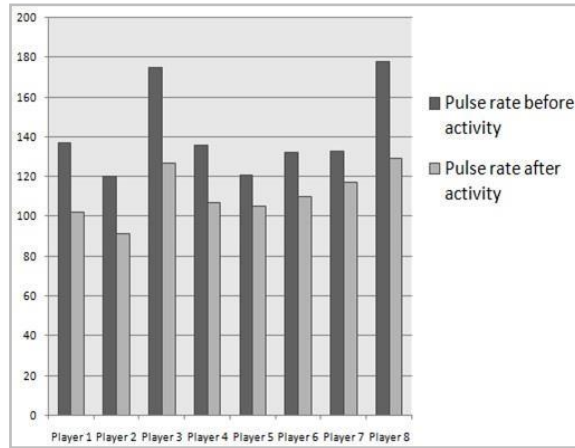


Fig.6: Result chart (Subject:Sportsperson)

Table II: Data From Student

Activity	Pulse rate before activity	Pulse rate after activity
Study	110	99
Study	102	95
Study	92	85
Study	90	83
Study	90	85
Study	107	95

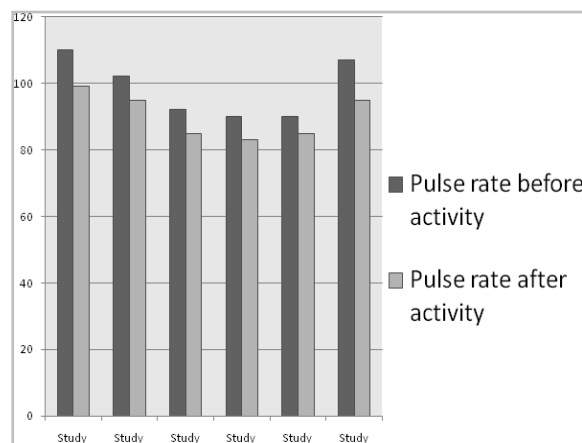


Fig.7: Result Chart (Subject:Student)

The above results were obtained with the help ANSUB- The Brain Stimulator. The participants were a group of athlete and students having eight members in each group. The results are based on the pulse rate before and after a particular activity.



CAEE-2018

Conference on Advances in Electronics Engineering 2018

Thakur College of Engineering and Technology, Thakur

Vol. 6, Special Issue 1, February 2018



VI. CONCLUSION

With the type results obtained, we can conclude that the binaural Frequencies can be utilized to incite a particular cortical mood as a method for awareness administration system to alter ones neural activity. Binaural beats are sound-related reactions which start in the prevalent olivary core of each hemisphere of the brain. Binaural frequencies can be generated by aurally exciting each olivary nucleus of the two brain hemispheres and with help these beats one can achieve the desired state in which he wants to be in.

VII. APPLICATIONS

A. Increased Relaxation

Binaural beats enables the client to take advantage of unwinding at the touch of a catch, which is extraordinary, in the event that he/she under an overwhelming schedule with negligible time. By tuning in to a theta sound, client can go from much hung to ultra-chilled in only a couple of minutes.

B. Better Sleep

The thump on impact of having the capacity to unwind on request is better rest. By tuning in to binaural beats once a day the human brain is slowly adapted to learn to relax on demand.

C. Deep Meditation

Human brains run in high activity frequency zones that center the mind for meditation is near to impossible. Binaural beats helps in accomplishing low brainwave recurrence while in the meantime keeping up an abnormal state of awareness. Regardless of the sort of reflection client is rehearsing, binaural beats will help the client to get to the domain of higher mindfulness speedier, and help him/her to remain there for longer time.

D. Mindfulness

Even when the user gets a free time for themselves it's tough to remain undistracted, even if he/she is in isolation. The mind is easily scattered, and is usually everywhere but not in the moment where user aspires to be in.

E. Increased Positivity

Studies have demonstrated that the impact of binaural beats on the cerebrum is to such an extent that it supports energy in regular daily existence. Clients reliably report sentiments of expanded positive thinking, satisfaction and bliss.

F. Increased Concentration

Binaural beats innovation is broadly known for unwinding the mind, the chronicles can likewise be utilized to build center and fixation. Binaural beats are equipped for dispensing with pressure and weight from the brain, along these lines making the client more engaged and mindful.

G. Body Healing

Binaural beats can't specifically recuperate sickness however science has since a long time ago demonstrated the inborn connection between psychological wellness and physical wellbeing. By easing the psyche of stress and uneasiness the body will normally progress towards becoming healthier and stronger.

H. Lower Stress

Binaural beats help the user enter into a state of peace. Over time this calm disposition will manifest itself in the user's everyday life experience.

I. Eliminate Anxiety

Binaural beats give alleviation to those agony nervousness and related manifestations, for example, freeze assaults and unreasonable points of view. Listening to binaural beats can assist recovery from anxiety around life situations.

J. Medical Applications

This Product can be kept as a kit in the hospitals so that the patients should get cured from the stress and anxiety.



CAEE-2018

Conference on Advances in Electronics Engineering 2018

Thakur College of Engineering and Technology, Thakur

Vol. 6, Special Issue 1, February 2018



VIII. FUTURE SCOPE

A major research is currently going in this field like mindset headphones, MICO headphones and NISSAN's project on driving with the help of your brainwaves. The way that binaural frequencies when subjected under controlled conditions and proper delivery mechanisms can indeed yield conducive results as postulated by the product. The regression model shows for a self-evident actuality that the theory and test plan of this investigation is done as such as to have the capacity to answer the subject of the viability of BBS's in encouraging memory under controlled conditions. The above figures from the regression analytics prove conducive to the fact that binaural frequencies when subjected under controlled conditions and proper delivery mechanisms can indeed yield conducive results as postulated by the product. The regression model shows for an obvious reality that the theory and test outline of this examination is done as such as to have the capacity to answer the subject of the adequacy of BBS's in encouraging memory under controlled conditions. Conclusions in this study have supported earlier experimental research which has found BBS's to be useful in improving overall performance among general and Attention Defect/Hyperactive Disorder (ADHD) populations.

IX. REFERENCES

- [1]. GAO, X., Cao, H., Ming, D., Qi, H., Wang, X., Wang, X., & Zhou, P. (2014). Analysis of EEG activity in response to binaural beats with different frequencies. *International Journal of Psychophysiology*, 94(3), 399-406.
- [2]. Pratt, H., Starr, A., Michalowski, H. J., Dimitrijevic, A., Bleich, N., & Mittelman, N. (2010). A comparison of auditory evoked potentials to acoustic beats and to binaural beats. *Hearing research*, 262(1), 34-44.
- [3]. Vernon, D., Peryer, G., Louch, J., & Shaw, M. (2014). Tracking EEG changes in response to alpha and beta binaural beats. *International Journal of Psychophysiology*, 93(1), 134-139.
- [4]. Binaural Auditory Beats Affect Vigilance Performance and Mood. James D Lane, Stefan J Kasian, Justine E Owens, Gail R Marsh. *Physiology & Behavior* Volume 63, Issue 2, January 1998, Pages 249-252.
- [5]. Erik Hoffmann. *Brain Training Against Stress. Theory, Methods and Results from an Outcome Study. Clinical EEG Journal* (2005).
- [6]. N.S.Mohd Puzi., R.Jailani, H.Norhazman and N.Mohamad Zaini. Alpha and Beta Brainwave Characteristics to Binaural Beat Treatment; In Proceedings of 9th IEEE International Colloquium on Signal Processing and its Applications (CSPA), 2013. March 8-10 2013, Kuala Lumpur, Malaysia.
- [7]. R. Saab, M. J. McKeown, L. J. Myers, and R. Abu-Gharbieh, "A Wavelet Based Approach for the Detection of Coupling in EEG Signals," in *Neural Engineering*, 2005. Conference Proceedings. 2nd International IEEE EMBS Conference on, 2005, pp. 616-620.
- [8]. Salvetti and B. M. Wilamowski, "A brain-computer interface for recognizing brain activity," in *Human System Interactions*, 2008 Conference on, 2008, pp. 714-719.
- [9]. Oster, "Auditory beats in the brain", *Sci. Am.*, vol. 229, no 4, pp. 94-102, Oct. 1973.
- [10]. Krishnan, Y. Xu, J. T. Gandour, P. A. Cariani, "Human frequency-following response: representation of pitch contours in Chinese tones", *Hear. Res.*, vol. 189, pp. 1-2, Mar. 2004.
- [11]. G Guruprasath, S Gnanavel, "Effect of continuous and short burst binaural beats on EEG signals", *IEEE Sponsored 2nd International Conference on Innovations in Information Embedded and Communication systems (ICIIECS)2015*.
- [12]. Norhazman, Zaini N. Mohamad, M.N. Taib, H.A. Omar, R. Jailani, S. Lias, L. Mazalan, MaizuraMohd Sani, "Behaviour of EEG Alpha Asymmetry When Stress Is Induced And Binaural Beat Is Applied", *ISCAIE*, 2012.
- [13]. R. On, R. Jailani, H. Norhazman, N. Mohamad Zaini, "Binaural Beat Effect on Brainwaves based on EEG", *IEEE Signal processing and applications*, 2013.
- [14]. Stastny, P. Sovka, and A. Stancak, "EEG signal classification," in *Engineering in Medicine and Biology Society*, 2001. Proceedings of the 23rd Annual International Conference of the IEEE, 2001, pp. 2020-2023 vol.2.
- [15]. Brunet and G. Young, "Co-Chair Electroencephalography Task Force," *Guidelines for Clinical Practice and Facility Standards Electroencephalography*, The College of Physicians and Surgeons of Ontario, Canada, 2000.
- [16]. S. Sanei and J. Chambers, "EEG Signal Processing, 313 p," ed: John Wiley & Sons Ltd., Chichester, England, 2007.
- [17]. Ross, T. Miyazaki, J. Thompson, S. Jamali, T. Fujioka, "Human cortical responses to slow and fast binaural beats reveal multiple mechanisms of binaural hearing", *J Neurophysiol*, vol. 112, pp. 1871-84, Oct 2014.
- [18]. W. Schwarz, P. Taylor, "Human auditory steady state responses to binaural and monaural beats", *ClinNeurophysiol*, vol. 116, pp. 658-68, Mar 2005.
- [19]. R. Draganova, B. Ross, A. Wollbrink, C. Pantev, "Cortical steady-state responses to central and peripheral auditory beats", *Cereb Cortex*, vol. 18, pp. 1193-200, May 2008.
- [20]. Walter J. Freeman, "Making sense of brain waves: The most baffling frontier in neuroscience", *Biocomputing ch. 3*, vol. 1, pp. 1-23, Feb. 2002