

Review on Brain Wave Generator

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Abstract— Depending on brain's current levels of relaxation, focus, and other mental states, brain will produced variable proportions of brain wave types. Each category of EEG (electroencephalography). Generally people's brain waves will respond to lights and sounds thuding at brain wave frequencies, and it will impact the change in state of brain— this activity called “entrainment.” We can plan our brain to follow any brain wave experience as we like by toggling sequences of pulses into eyes and ears. So here this paper summarizes the Brain Wave Generator which is used to produce various frequencies which are correlated to brain modes like Alfa, Beta, Gamma, Theta, & Delta. In this paper we are going to see the review of the articles related to Brain Wave Generator.

Key words: BWG; Binaural; dsPIC; BWG; Entrainment; Electroencephalograph (EEG)

I. INTRODUCTION

The audio and visual stimulation functions of Brain Wave Generator help you in following ways

- Have ability to handle stressful situation and challenging tasks
- Enhance learning results
- Reduce sleeping problems and headaches, etc.
- Helps in meditation
- Reduces the learning time
- Help in reducing the sleep need
- Treatment on various mental diseases/disorders
- ...and much more

In the project they produce binaural beats that would change the brain frequency as we wish, it may be relaxation or enhanced attention.

II. BASICS OF THE CONCEPT

A. Binaural Beats

In place of simply playing the entraining wave frequency through both earphone speakers, we hire a more effectual method. Binaural bit frequency is generated by playing the different frequencies into each ear of human being; it is same as, two tones near played next to each other on guitar strings. The beat results from the two tones periodically strengthening and cancelling each other at the rate that equals the difference between two frequencies.

To produce an alfa binaural beat, we play a 500Hz and a 510Hz tone in each ear respectively. The human can recognize a sound, like “wah-oo-wah-oo-wah,” that gradually grows faint in and out 10 times per second.

B. EEG & Brain's State

EEG (Electroencephalography) technology is used to detects electrical activity in your brain using small and flat metal disc attach to your scalp from. The resulting EEG pattern will contain frequency elements mainly below 30Hz.

The frequencies are categorized into four states as follows:

State	Frequency range	State of mind
Delta	0.4Hz-4Hz	Deep sleep
Theta	4Hz-8Hz	Drowsiness
Alpha	8Hz-14Hz	Relaxed but responsive
Beta	14Hz-30Hz	Highly alert and concentrated

EEG pattern decides what shall be called the current state of the brain is said to be in the alpha stage with the help of its dominant frequency. Though, there exist different frequencies and it is impossible to give any “exact frequency your brain is working on”.

C. Entraining the brain to a desired state

If outer stimulus is given to the brain, it becomes feasible to entrain the brain frequency from one state to another state. For e.g., if a person is in Theta stage(feeling sleepy) and a stimulus of 12Hz is applied stimulus. The effect will be relaxing to the person. This fact is called frequency following response.

When the brain's state is near to the applied stimulus, entrainment works more reliable. Thus, while switching one frequency to another, the initial frequency should be near to your current brain state as possible. The switch speed should be such that your brain's state changes gradually with it, so that the difference will not be larger. In day to day life, it is not possible to determine the brain frequency without extra devices(like EEG).

D. Stimulating the brain with Binaural beat frequencies

The simplest way of providing stimulus to the brain is through ears. Other senses also used as well, and vision is actually used regularly in addition to hearing. Special techniques should be used so that individual cannot hear sounds low enough to be useful for brain stimulation. Similar special technique is used in day to day life which is called as binaural beats.

If the left ear and right ear is provided with a steady tone of 400Hz and 410Hz respectively, these two tones merge into the brain. The difference, 10Hz, is sensed by the brain and is a very effective stimulus for brainwave entrainment. The result 10Hz totally produced by the brain. When using stereo headphones, both sounds i.e.the left and right sounds do not merge together until in your brain. The frequency difference, when sensed by brain in this way, is nothing but binaural beat.

E. Altered Brain States

As illustrated earlier, applying a stimulus to the brain will periodically take the brain's state nearer to the stimulus frequency. However, just listening to binaural beats does not necessarily change your state of consciousness. E.g., readiness and potentiality to relax and focus attention affects how effective the binaural beat stimulus is for developing change in state.

III. REVIEW ON BWG

Mitch Altman [1] proposed the theory on “Brain Wave Generator” in November 13, 2008. In that paper, He used MiniPOV kit for the frequency alpha, beta, theta & delta generation to stimulate the brain through the audio and visual signal. That kit can be used with a USB serial port converter on MacOSX/WIN/Linux. They'll program our SLM to follow a 14-minute series that tracks the meditation experience. Since the device generates only one frequency at a time, it phases in new brain states by changing frequencies rear and onward. For example, to go from dreamy to somewhat fully awake, we create alpha for a while, then beta, then snap between alpha and beta, decreasing the period of alpha and increasing that of beta with each repetition. Their code's brainwave Tab array defines the full sequence.

Naomaa Solutions [2] proposed the theory on “Brain Wave Generator” in October 3rd 2004. In that, they only generate the audio frequency of alpha, beta, theta & delta to stimulate the brain. They used 90 Mhz Pentium, the more complex output Brain Wave Generator can produce, Microsoft Windows 95/98/ME, or Windows NT/2000/XP operating system and A stereo capable sound card..

BriyonGysin and William Burroughs' [3] designed Dream machine in 2006, this is a device that can generate and quicken changed states of awareness without the use of hallucinogens or hours of endless meditation. In that project he only generates the alfa state. The machine is simple, it spinning cylinder with boards in the sides and a light located inside that generates a flicker patterns as it spins.

In the Mitch Altman's paper, he design the brain wave generator which generate all frequencies. But the basic kit is used, is not available everywhere.

Also the Dream Machine is only produced an alpha frequency, not all.

So an idea became in mind, why not we design the brain wave generator using above ideas, but generating the all frequencies and the basic components available everywhere in market. There is one idea to design brain wave generator using the Arduino kit or the dsPIC digital signal controller which is available everywhere in market so that anyone can redesign the brain wave generator easily.

By using the dsPIC digital signal controller it is easy to generate audio frequency from PWM method. Generate the pulse width modulation and given the output to the low pass filter so that we get the sinusoidal wave i.e. audio signal. By using this we can generate 2 different frequency signals n generate binaural bits like the brain frequency which changes the state of the mind.

As stated in earlier papers this binaural bits can give as an audio signal or video signal or both.

Also we can design the system such that it has some input port through which we can give the direct audio files like somewhat nature sound or singing of birds or anything else which we like so that it relax ourselves.

IV. APPLICATION

- Helps in meditation
- Reduces the learning time
- Help in reducing the sleep need
- Treatment on various mental diseases/disorders

- Have ability to handle stressful situation challenging tasks
- Enhance learning results
- Reduce sleeping problems and headaches, etc.

V. CONCLUSION

This review paper gives an idea to create brain wave generator which is very useful to provide a various solution for problem related to brain, also this system helps for changing the states of mind through the audio and visual signals. In future, we can design brain wave generator using the Arduino kit or the dsPIC digital signal controller which is available everywhere in market so that anyone can redesign the brain wave generator easily. All these make it ideal for medical field applications.

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