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Development of 2-Channel Eeg Device And Analysis Of Brain Wave For Depressed Persons

P.Amsaleka*, Dr.S.Mythili **

* PG Scholar, Applied Electronics, Department of Electronics and Communication, PSNA College of Engineering and Technology, Dindigul, Tamil Nadu, India.

** Associate professor, Department of Electronics and Communication, PSNA College of Engineering and Technology, Dindigul, Tamil Nadu, India.

Abstract- The EEG signal is taken from a patient and it is analyzed whether the patient is in depressed or normal state. Here the two channel EEG device is developed for getting the brain wave . The electrodes are placed on the scalp of the patient and the signals are taken then preprocessed using INA Instrumentation amplifier and filtered using notch filters and then given to pic controller and the state of the patient is displayed as normal or depressed using LCD or LED.

***Index terms:*EEG, Depression,Electrode,INA**

1. INTRODUCTION

Organ that gives capacity to a person is called brain. which is responsible for other activities includes ones personality, motion, it gives the ability to see and hear. And it is also responsible for other activity like breathing and digestion. Disorders are mainly due to some changes in the electrical and chemical activities of brain. And these disorders are identified by obtaining the brain signal and image. The disorders are Anxiety and Depression disorder. Anxiety includes nervousness, panic and phobia. Phobia continuous fear towards object or some situation. Depression is a state in which the parson feels sad or hopeless. It is a kind of illness not only involves body but also but also the mood. It also affects the persons personal activities like sleep , eating habit, and loss of interest, poor concentration. The different types are Major depression which is severe , and Dysthymia depression which is less severe and Bipolar disorder has 2 cycles depressed and manic cycle.

2.LITERATURE REVIEW

[1]EEG signal is studied and analyzed to get the required feature and using video emotion is recognized. Here the electrodes are used to obtain the EEG signal and are filtered using high pass filter and notch filter and Independent component analysis (INA) is used to remove various artifacts due to eye blink, eye movement and muscle movement.

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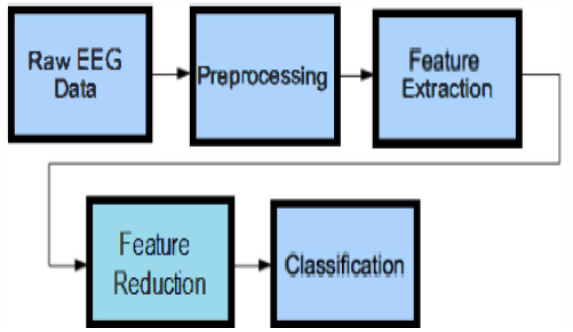
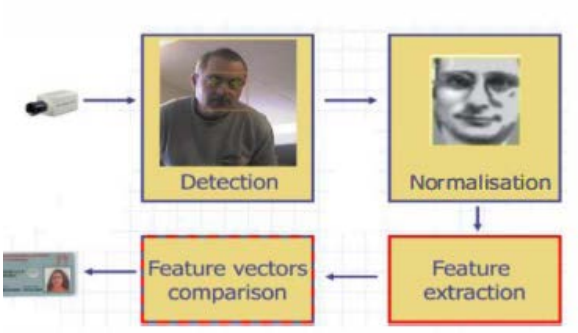


Fig(1): BLOCK DIAGRAM FOR EEG ANALYSIS



Fig(2):BLOCK DIAGRAM OF FACE RECOGNITION

Wavelet decomposition is used for feature extraction and it is used to decompose EEG signal in to high frequency component which is nothing but noise and low frequency components are the required signal. Wavelet decomposition splits the signal in to tree form the top level has time representation of signal and bottom level has frequency representation of the signal. Based on the extracted features the signals are classified in to alpha, beta, delta and theta. Then based on their standard deviation and mean the feature vector is determined. And by this the threshold is fixed if the value 1 then the person is depressed but if it is 0 then it is normal and by this we can decide whether the person is normal or depressed. For emotion recognition faces with various expression from a data base is shown and depending upon this the emotion is taken.

Otherwiesfor emotion various stimuli such as music or picture are shown to the patient. The Haar wavelet classifier is used for the indication of the current state of the patient and here also 1 is used to indicate depression and 0 is used to indicate normal condition.

[2] Analyzing of patients brain signal who are having depression and who are normal control has different methods they are Time frequency domain which use wavelet entropy and Non linear method which use Approximate entropy .Visual inspection is used to diagnosing some brain disorder. Advanced signal processing technique and non linear methods are used to explicit the depression in the obtained bio signal. EEG signal is taken from 30 patients of age group 20-30 years for 5min under different conditions and sampled at rate of 256 Hz and filtered using notch filter.

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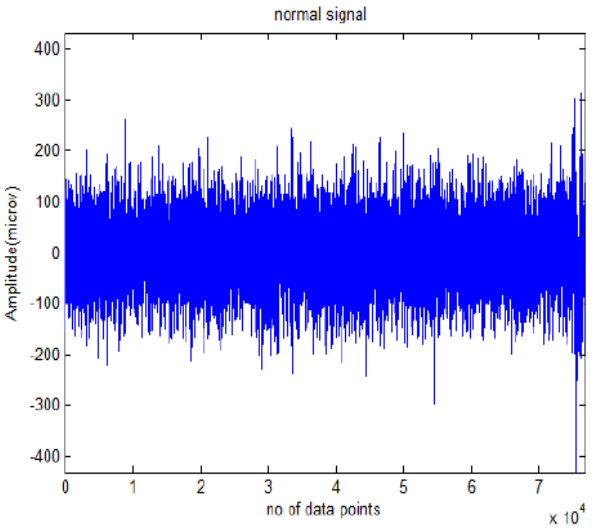
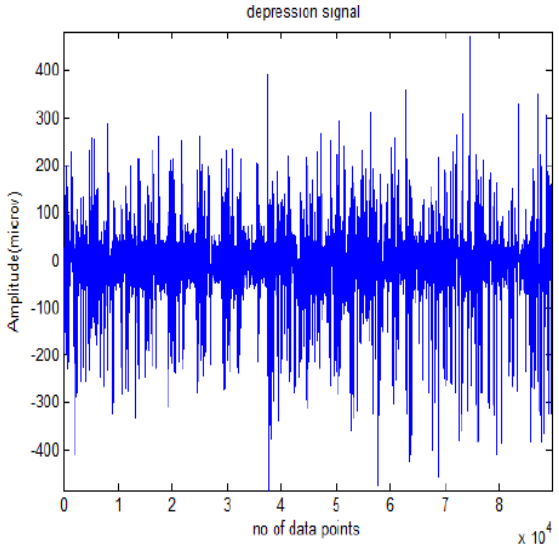
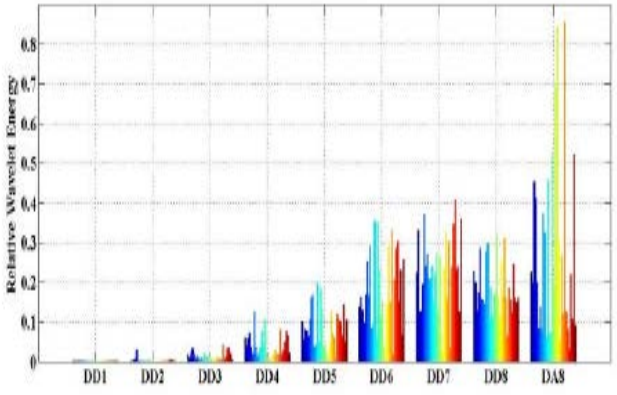


Fig(3): EEG SIGNAL FOR NORMAL PATIENT

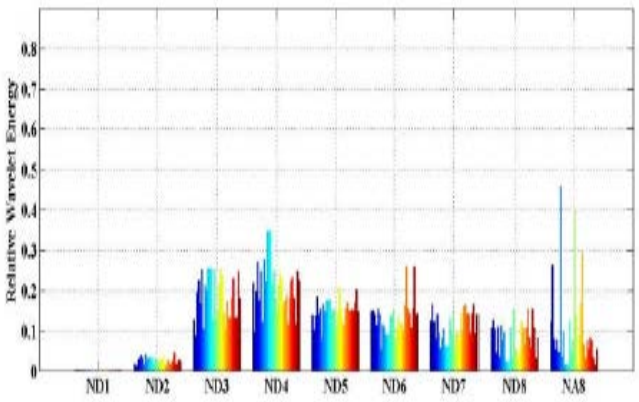


Fig(4): EEG SIGNAL FOR DEPRESSED PATIENT

Using Multilevel resolution the frequency band is converted in to detailed and approximation level by 8 level decomposition in to high and low frequency component and using Parseval's theorem energy calculation is carried out. To analyze time series data regularity and complexity Approximate entropy (ApEn) is used. Relative wavelet entropy(RWE) the alpha band having higher RWE values indicate larger mental activity and also seen clearly in delta band . If Wavelet entropy decreased then the patient is depressed. And also ApEn value is higher for normal patient and lower for depressed patients.



Fig(5):RWE OF ALL FREQUENCY BANDS OF NORMAL CONTROLS



Fig(6):RWE OF ALL FREQUENCY BANDS OF DEPRESSION PATIENTS

Hence the patients with higher RWE value and lower WE and ApEn are considered as depressed and the remaining are normal subjects.

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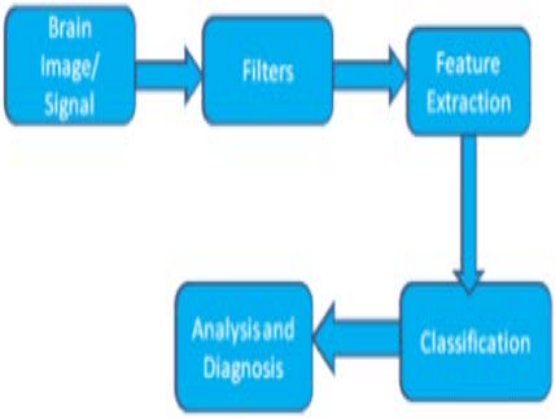
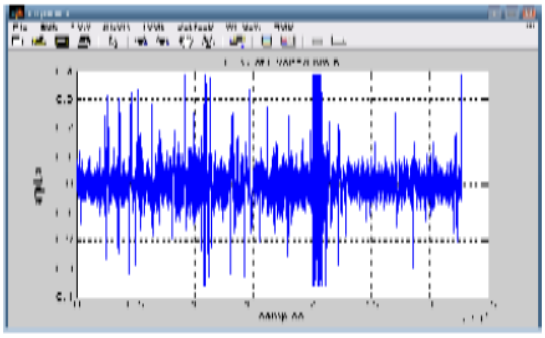
[3]The EEG signal is captured and preprocessed to extract the various features and classified and analyzed for detection of emotion disorder. By using international 10-20 system ,19 electrodes are connected in the various regions of the scalp to capture the signal.



Fig(7):BLOCK DIAGRAM FOR ANALYSIS OF BRAIN SIGNALS.

Preprocessing the EEG in EDF format should be converted to WAV format using EDF 2 WAV. In feature extraction features like mean, standard deviation , skew etc were extracted. The most commonly used features are mean, variation by comparing these features the emotion disorder is identified. The symptom is well associated with this emotion disorder is seizure.



Fig(8):SIGNAL EXTRACTED FROM .EDF FILE

It is due to anxiety of patient and identified by variation in frequency and amplitude of the waveform on EEG machine. It is observed that seizure in EEG signal is given more accurately by variance.

[4] EEG signal is used for analyzing the activity of brain and it is non stationary waveform which provides the information about the mental state of the patient. This process is done by its crucial parameter. Here a numerous techniques used for automated analysis. This analysis involves the discrete and complex nature of EEG signal. Here the EEG signal is classified in to two types based on the mental state of patients, they are normal and depressed signal. For this the well established technique for signal processing have been used they are Relative Wavelet Entropy(RWE) and Artificial Feed Forward (ANN).

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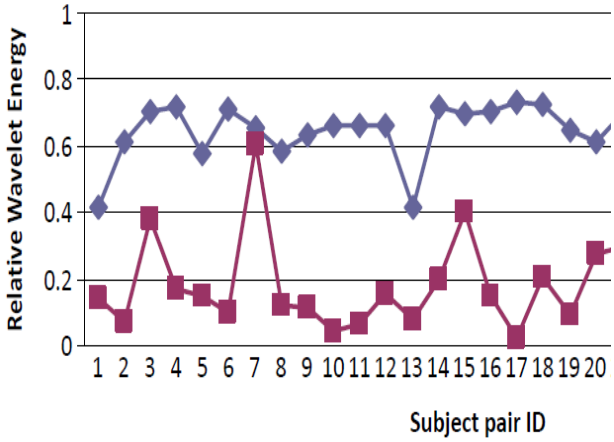
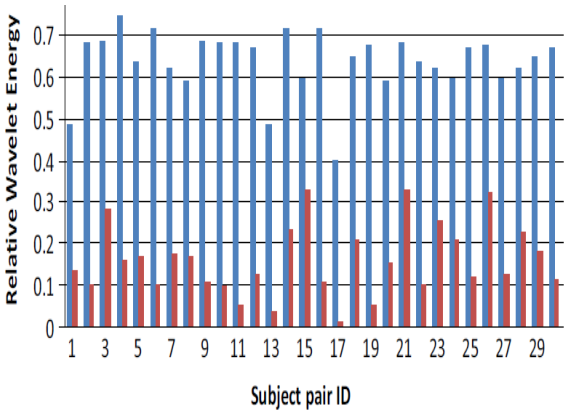
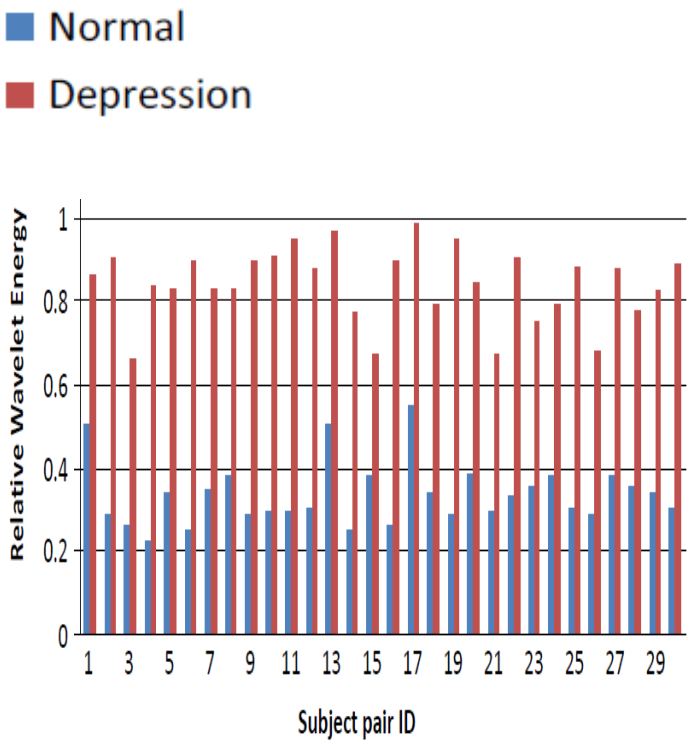


Fig(9):PLOT OF RWE FOR NORMAL AND DEPRESSION PATIENTS

Using Multilevel resolution decomposition the frequency band is converted in to detailed and approximation level by 8 level decomposition in to high and low frequency component and using Parseval's theorem energy calculation is carried out. From normal and depression patient the EEG waveforms were recorded and analyzed for the extraction of features to differentiate their states.



Fig(10): RWE FOR LEFT SIDE



Fig(11): RWE FOR RIGHT SIDE

Here 0-4 Hz and 4-32 Hz are the other features used to differentiate the signals . The low frequency range below 0-4 Hz is considered as depression. A two layer feed forward ANN using RWE is used to classify the signals and provide accuracy of 98.11%.

[5] Depression is related to several abnormal brain region. Here the classification of the healthy and the mild depressed patients is based on Beck Depression Inventory (BDI) and the movement of eye is estimated by using t-Test and for correlation of EEG activity standardized low resolution tomography (sLORETA) is used. The BDI score of >13

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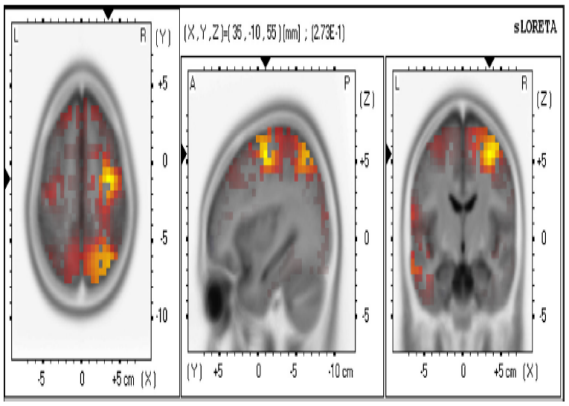
is used to denote that the person is in depressed and <9 is used to denote that the person is normal.

DEPRESSION LEVEL	N	AGE	BDI	OASIS
Mild depression	9	22	18.56±4.77	8.11±2.36
Non depressed	9	20	1.33±1.00	2.11±1.16
t-TEST		P>0.49	P<0.00	P<0.00

Table 1:SCALE SCORE OF OASIS AND BDI

The eye tracking system is used to record eye movements and gives the fixation and pupil characteristics and this analyzed using Matlab R2010a software package.



Fig(12):SLORETA ANALYSIS OF PREMOTOR

The result of eye movement gives that mild depressed patients spends more time in seeing negative images. sLORETA result gives that with respect to negative expression the theta activity becomes higher in the premotor area (PM).

3. CONCLUSION

In the summary the EEG device is developed to obtain the EEG signal and then it is preprocessed and filtered and analyzed. Based on this the depression in the patients is obtained by analysis of the brain signal and the emotion of the normal and the depressed person.

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