INTRODUCTION:

Attention Deficit Hyperactivity disorder (ADHD) is a common mental disorder that begins in childhood and can continue through adolescence and adulthood. EEG is most often used to diagnose epilepsy, sleep disorders, coma, encephalopathy, and brain death. EEG is used to be a first-line method of diagnosis for tumors, stroke and other focal brain disorders.

The present project work is mainly designed to predict the probable region of brain that shows abnormality due to ADHD syndrome. EEG data of seven normal and ADHD subjects (children) of age group 4-17 years has been collected following a protocol which contains 4 events- Eyes close, Eyes open, Visual Cue and Motor activity. The segmented data is subjected to extract features like, energy that corresponds to Alpha, Beta, Delta and Theta frequency ranges; absolute power and amplitude levels at different electrode positions. Single map analysis and Frequency map analysis is also performed and comparative analysis is done between the normal and ADHD subjects. Neural network algorithm is implemented to distinguish between ADHD and normal subjects. Finally, 3-D plotting is done for the ease of visualization and diagnosis purpose.

OBJECTIVE:

The main objective of this work is:

- To extract the features of ADHD and normal subjects, perform comparative analysis and predict the probable region of abnormality.
- To implement neural network algorithm and distinguish between ADHD and normal subjects.
- Perform 3-D plotting of EEG data for ease of visualization and diagnosis.

METHODOLOGY:

Here seven normal and seven ADHD affected subjects were identified and considered for the research. The international 10-20 system with bipolar longitudinal montage is used for the acquisition of data.
EEG data of seven normal and seven ADHD subjects (children) of age group 4-17 years has been collected using Braintech traveller portable EEG device, following a protocol which contains four events – Eyes close, Eyes open, Visual Cue and Motor activity. The data is segmented manually according to the events and markers that were placed during data acquisition. The segmented data is subjected to extract features like, energy that corresponds to Alpha, Beta, Delta and Theta frequency ranges; absolute power and amplitude levels at different electrode positions. Statistical parameters like, mean, variance and standard
deviation were calculated. Single map analysis and Frequency map analysis is also performed and comparative analysis is done between the normal and ADHD subjects. 3-D plotting of the EEG signals is done to predict the probable region of abnormality and neural network algorithm is used to classify between ADHD and healthy subjects.

CONCLUSION:

ADHD affected subjects show increased neuronal activities during eyes closed position. Normally, healthy subjects tend to suppress their neuronal activity during eyes close. Higher power and higher standard deviation is found in the ADHD subjects when eyes closed, eyes open and in motor activity; which indicates they are hyper active. However, in the normal subjects, all the parameters show significantly lower values. Usage of feed-forward back propagation technique in Neural network algorithm provides the accuracy of 99.9% when observed in the confusion matrix, which implies that, the applied method can clearly classify between ADHD affected subjects and normal (healthy) subjects. Figures 1 and 2 show the 3-D plots for ADHD and normal subject. Figure 3 shows the confusion matrix, which indicates 100% accuracy.

Figure1: Frequency map of ADHD and normal subjects

Figure2: Confusion matrix
This work draws the conclusion that, posterior region of the brain, covering electrode positions O1, O2, P3 and P4 could be considered to predict the abnormality during eyes open and eyes close; Anterior portion of the brain, covering pre-frontal regions and frontal region of the brain, with electrode positions FP1 and FP2 could be used to predict the abnormality. It also proves that, neural networks, if well-trained can be used to distinguish between ADHD and normal subjects, given the pattern of EEG as input.

**FUTURE WORK:**

- In this work, 3-D plots of the data to differentiate between normal and ADHD subjects were performed; which could probably be used by the doctors for further assessment and treatment of the ADHD subjects.
- With further research done, this method could be used as a substitute to FMRI, since this technique is cost-effective.
- Further researches on neural network algorithm would be helpful in differentiating ADHD from normal subjects with significant characteristics.