



Research Article

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## Biomedical image processing for epilepsy

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### ABSTRACT

Epilepsy is a neurological predicament in which brief, repetitive changes in the electrical action of the cerebrum lead to seizures or 'fits', enduring from a few moments to a few minutes. It is the world's second most normal Neurological condition. Around two million individuals around the globe have epilepsy. Of the 125,000 new cases that build up every year, up to half are in kids and youths. While medications exist, that can incidentally capture seizures; this is not generally a down to earth answer, as these meds treat the manifestations, not epilepsy itself. Neurosurgery can stop seizures; notwithstanding, this method is excessive and is of significant danger. We propose a constant shut circle observing and controlling gadget for epileptic seizure discovery and concealment. It is a remote installed gadget gets a molded EEG flags and figures out whether a seizure has happened, and a handset transmits to the backend PC for future disconnected from the net study. On the off chance that a seizure is identified, an empowering sign is sent to the stimulator to produce animating heartbeats to stifle seizure. An Electroencephalogram (EEG) is a record of the electrical possibilities created by the cerebral cortex nerve cell. It is characterized as electrical movement of an exchanging sort recorded from the scalp surface in the wake of being gotten by metal cathodes and conductive media. They are in the recurrence scope of 0.3 to 3000 Hz. On the cerebrum's surface, these voltages speak the truth 10mV.

**Keywords:** Epilepsy, seizure, Zig-bee Wireless, Electroencephalogram.

### INTRODUCTION

MATLAB (matrix laboratory) is a numerical processing environment and fourth-era programming dialect created by Math works. MATLAB permits lattice controls, plotting of capacities and information, execution of calculations, making of client interfaces, and interfacing with research written in different dialects, including C, C++, Java, and FORTRAN. In spite of the fact that MATLAB is proposed principally for numerical registering, a discretionary tool stash utilizes the MUPAD typical motor, permitting access to typical processing capacities. Utilizing MATLAB tool compartments like IMAGE PROCESSING AND SIGNAL PROCESSING. We have effectively recognized the begin and end of seizure from the cerebrum waves utilizing sign handling tool stash from MATLAB, and typical and strange patients are arranged by measuring crest to crest voltage levels of every mind waves by picture preparing tool stash from MATLAB. Electroencephalography is a therapeutic imaging strategy that peruses scalp electrical movement created by mind structures. The electroencephalogram (EEG) is characterized as electrical action of an exchanging sort recorded from the scalp surface in the wake of being gotten by metal anodes and conductive media.

The Objectives of EEG sign examination are,

- Information gathering – estimation of wonder to translate framework.
- Diagnosis – identification of glitch, pathology or Abnormality.
- Monitoring – obtaining proceeds intermittent data about the framework.
- Evaluation – Objective examination to focus the capacity to meet useful necessities, get evidence of execution or evaluate the impact of treatment.

Electroencephalographic estimations are normally utilized as a part of therapeutic and exploration ranges. The EEG measured specifically from the cortical surface is called Electrocardiogram while when utilizing profundity tests it is called Electrogram. Electroencephalographic perusing is a totally non-intrusive methodology that can be connected more than once to patients, typical grown-ups, and kids with for all intents and purposes no danger or confinement. EEG has been observed to be a capable instrument in the field of neurology and clinical neurophysiology. EEG signs are stochastic in nature. Being bio electric possibilities acquired from neural depolarizations in the mind, they have.

## EXPERIMENTAL SECTION

### Materials:

Electroencephalography (EEG) is a medicinal imaging method that peruses scalp electrical action created by mind structures. It straightforwardly measures from the cortical surface, when cerebrum cells (neurons) are enacted, nearby current streams are delivered. The terminal and neuronal layers current enters through skin, skull and a few different layers. Frail electrical signs recognized by the scalp anodes are hugely opened up, and after that showed on paper or put away to PC memory. Because of capacity to reflect both the ordinary and anomalous electrical movement of the mind. By utilizing of MATLAB we can distinguish that the patient is unusual or ordinary.

### Methods:

Encephalographic (EEG) estimations utilize recording framework comprising of

- Electrodes with conductive media
- Amplifiers with channels
- A/D converter
- Recording gadget.

Anodes read the sign from the head surface, intensifiers bring the microvolt signals into the reach where they can be digitalized precisely, converter changes signals from simple to computerized structure, and PC stores and presentations got information. Scalp recordings of neuronal action in the cerebrum, permit estimation of potential changes after some time in essential electric circuit leading between sign (dynamic) terminal and reference cathode. Additional third terminal, called ground cathode is required for subtracting so as to get differential voltage the same voltages demonstrating at dynamic and reference focuses.

For utilizing EEG methods, the accompanying recording framework segments are important:

- Terminal top with conductive jam or Ag-AgCl circle anodes with Conductive glue.
- Enhancers with general intensification increase between 100 - 100,000 With data impedances no less than 100 M Ohms, and regular mode Dismissal proportion in any event 100dB.
- Simple channels incorporated in the unit with high pass channel of cut- Off recurrence in the scope of 0.1-0.7 Hz and with low pass channel with Cut-off recurrence less than a large portion of one of the examining rate. Indeed, frequencies over 50Hz are once in a while included as they Contribute irrelevantly to power range of EEG.
- No less than 12 bit A/D converter with exactness lower than general Commotion (0.3-2 $\mu$ V pp.), and inspecting recurrence typically between 128 – 1024 Hz.
- Adequately snappy PC for assuming control information for recording and in the end for online investigation, with sufficient volume of hard plate.
- Computerized high pass FIR channel with comparable cut-off recurrence as simple high pass.

The record signs of the EEG can be checked by two systems,

1. Conventional Technique
2. Computerised EEG Monitoring Technique.

### Matlab:

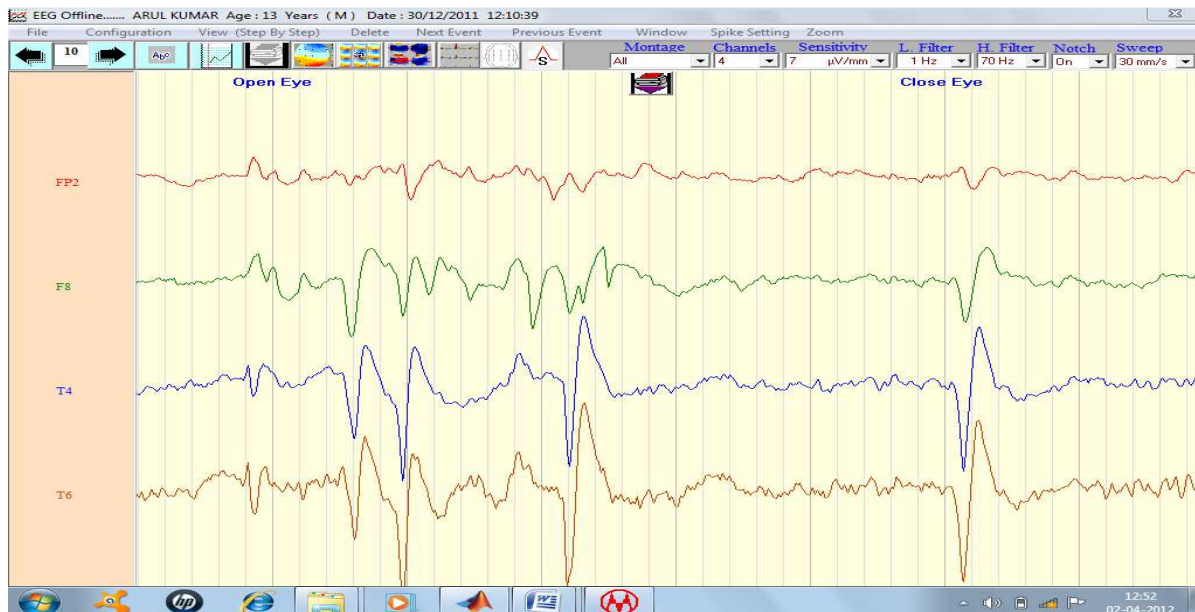
MATLAB is most commonly used fourth generation software which is user-interface and can be written easily than any other programmable languages. MATLAB supports BMP, HDF, JPEG, PCX,

TIFF, XWB image formats, now at present we are going to use for detection of normal or abnormal condition of a patient.

### Offline Data Processing:

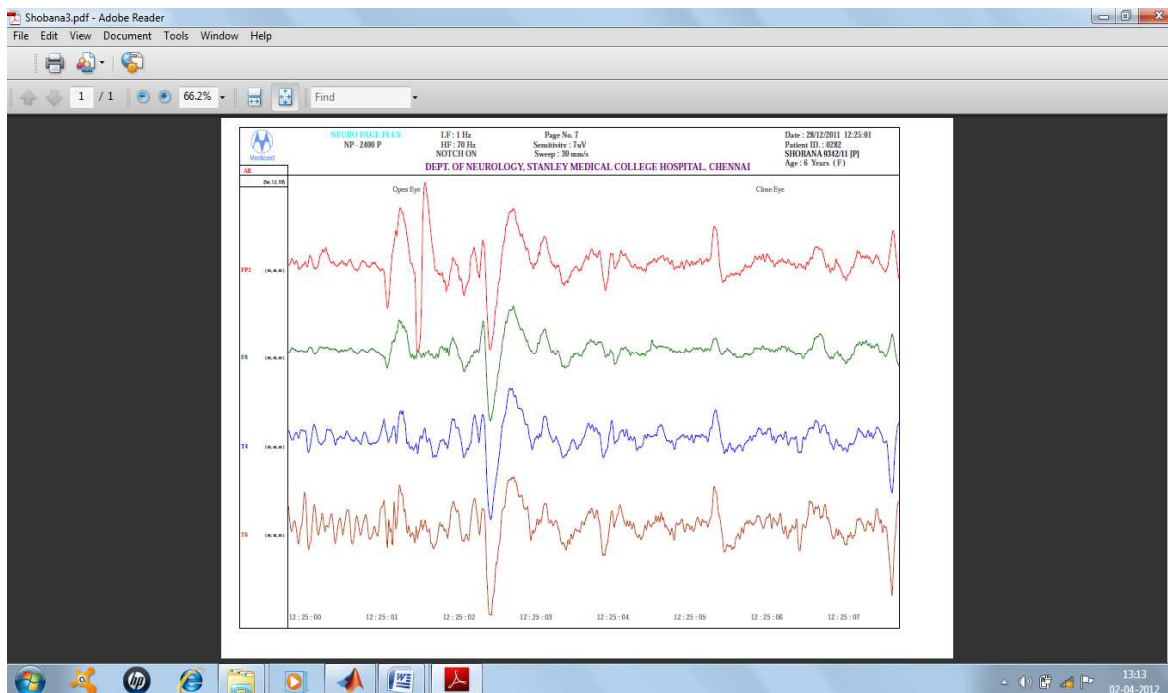
- With the collected EEG images we tried to detect the normal and abnormal EEG waves by measuring the peak to peak voltage values from the EEG waves of the patient using the MATLAB functions.

- Image processing toolbox has been used for the EEG data's which is collected from the hospital.
1. The below image represents the extracted EEG data from NEUROPAGE PLUS software, which is used to acquire the EEG data from the patients.



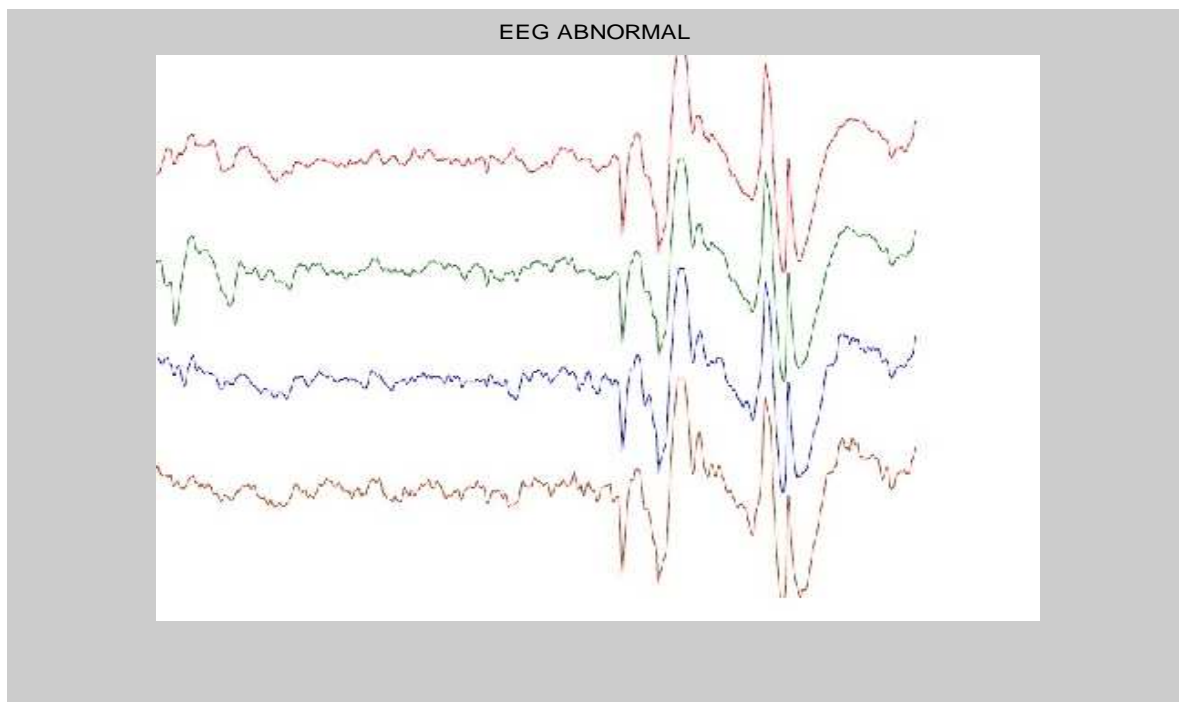
**Fig: 1 EXTRACTED EEG DATA**

2. Using “Pdf creator” we converted the extracted image into JPEG format.



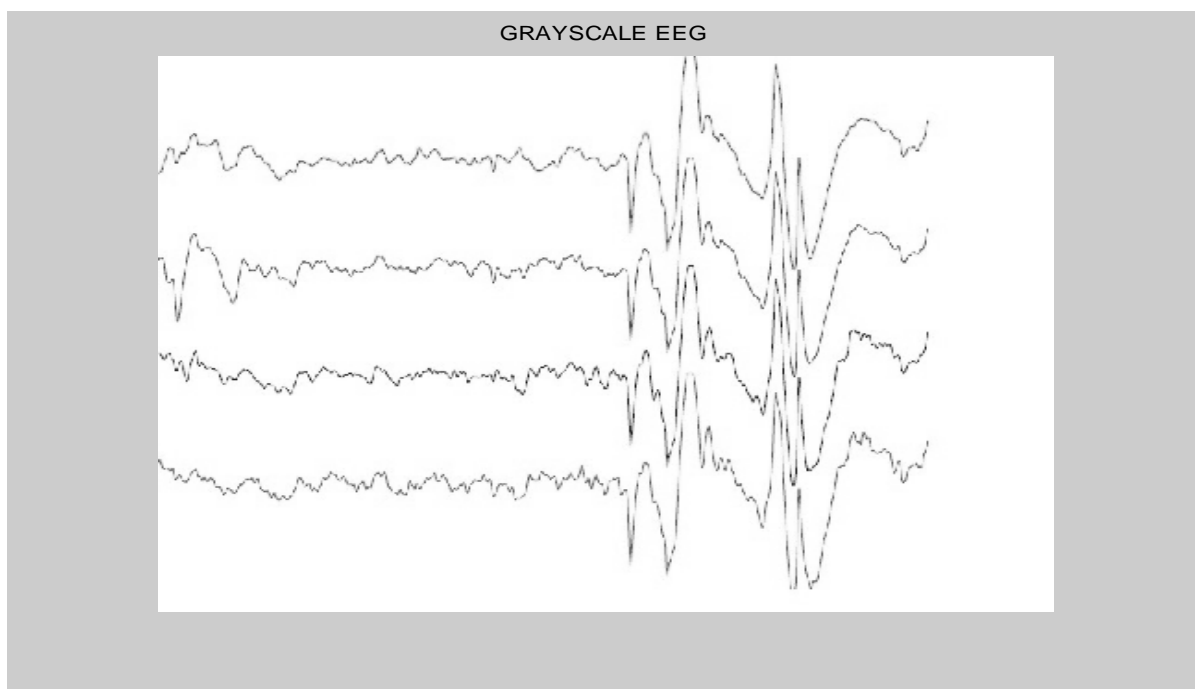
**Fig: 2 JPEG EEG IMAGE**

3. Displays the abnormal image of the EEG wave



**Fig: 3 ABNORMAL EEG WAVES**

4. Converted grayscale image from the above represented abnormal image.



**Fig: 4 GRAY SCALE IMAGE**

• **Gray Scale Image:** This is the picture we will for the most part work with in this course. It speaks to a picture as a network where each component has a worth comparing to how splendid/dim the pixel at the relating position ought to be shaded. There are two approaches to speak to the number that speaks to the pixel's shine: The twofold class (or information sort). This appoints a drifting number ("a number with decimals") somewhere around 0 and 1 to every pixel. The quality 0 relates to dark and the worth 1 compares to white. Alternate class is called uint8 which doles out a whole number somewhere around 0 and 255 to speak to the brilliance of a pixel. The quality 0 compares to dark

and 255 to white. The class uint8 just requires approximately 1/8 of the stockpiling contrasted with the class twofold.

5. Gray scale image is been converted into binary image

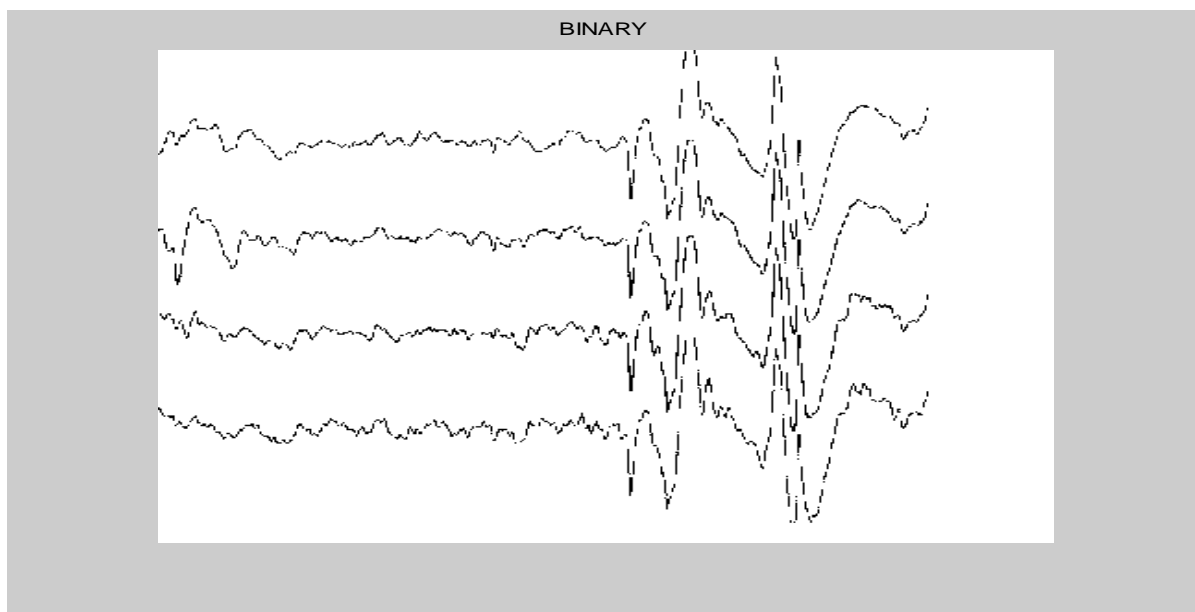


Fig: 5 BINARY IMAGE OF ABNORMAL WAVE

- **Binary image:** This picture organize likewise stores a picture as a lattice yet can just shading a pixel dark or white (and nothing in the middle). It doles out a 0 for dark and a 1 for white.

6. Converted complement image from the binary image

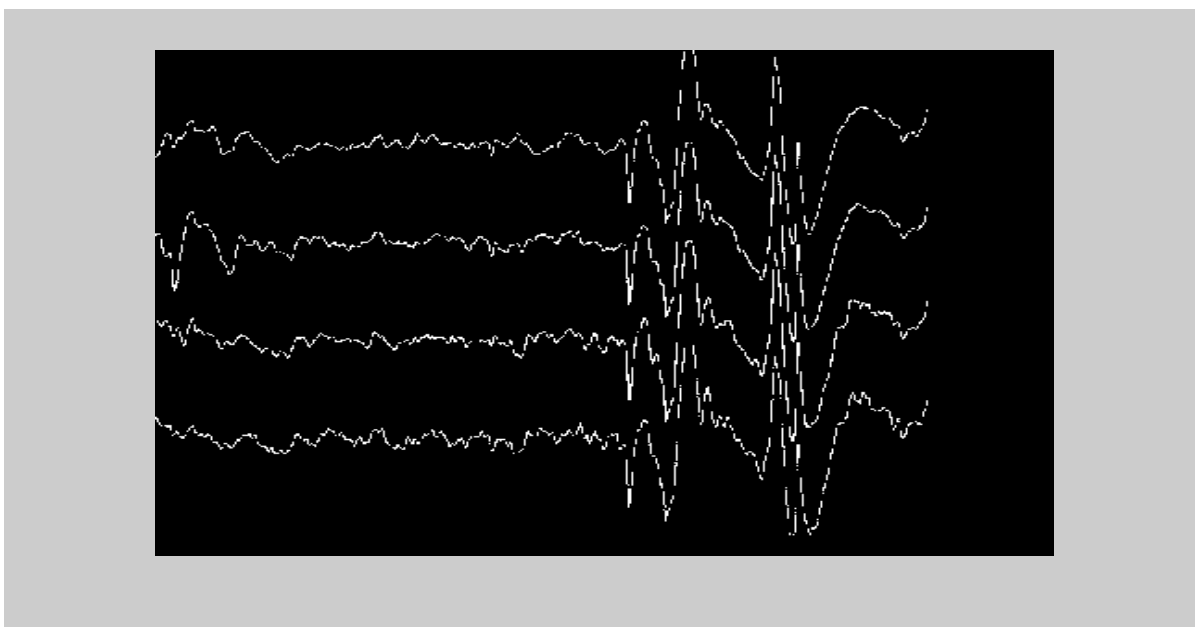


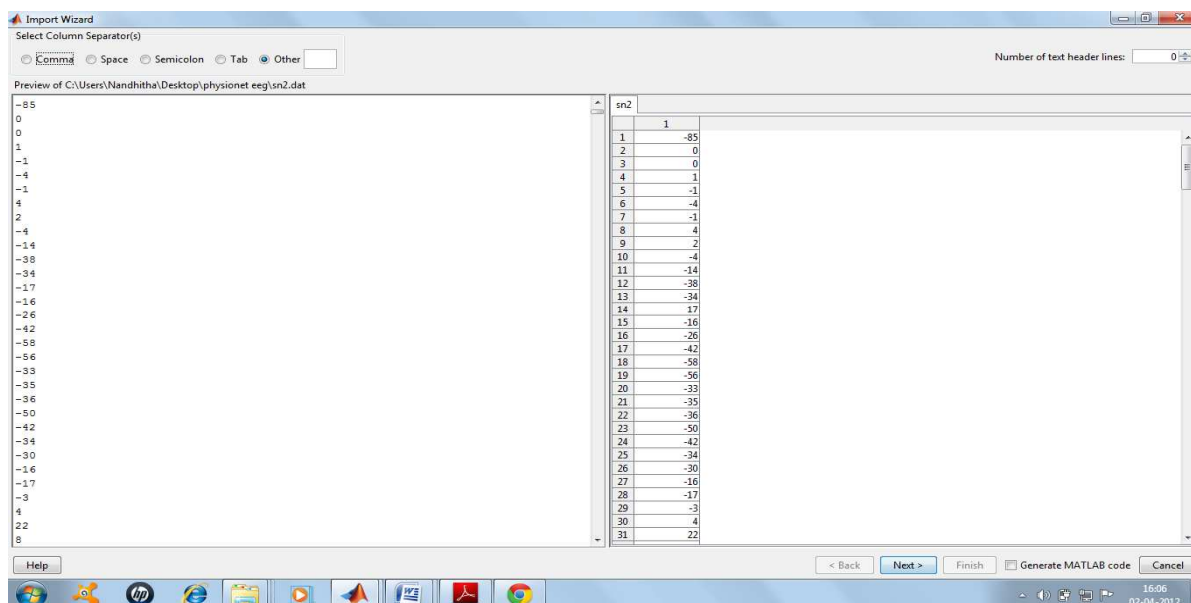
Fig: 6 COMPLEMENTED IMAGE

- **Complement image:** The Image Complement piece figures the supplement of a twofold, force, or RGB picture. For twofold pictures, the piece replaces pixel qualities equivalent to 0 with 1 and pixel qualities equivalent to 1 with 0. For a power or RGB picture, the piece subtracts every pixel esteem from the most extreme esteem that can be spoken to by the info information sort and yields the distinction.

**Online Data Processing:**

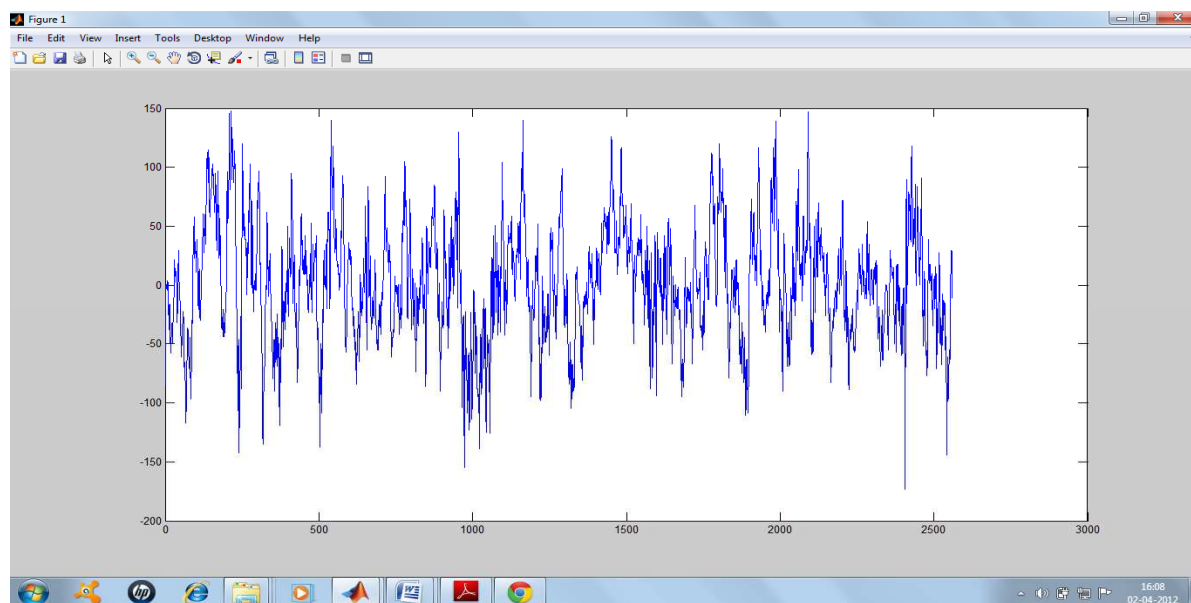
The offline data we got it from the hospital, we had done it with image processing was not upto our requirement, so we downloaded the EEG data from the PHYSIONET which is a online resource having online EEG data (.Mat files) contains both normal and abnormal. We continued our research with this online data by doing signal processing, and we detected the start and end of seizure from each of the brain waves by concatenating the 20-channel EEG data from a patient.

1. The below screen represents the voltage values of single channel EEG obtained from a patient (.mat file).



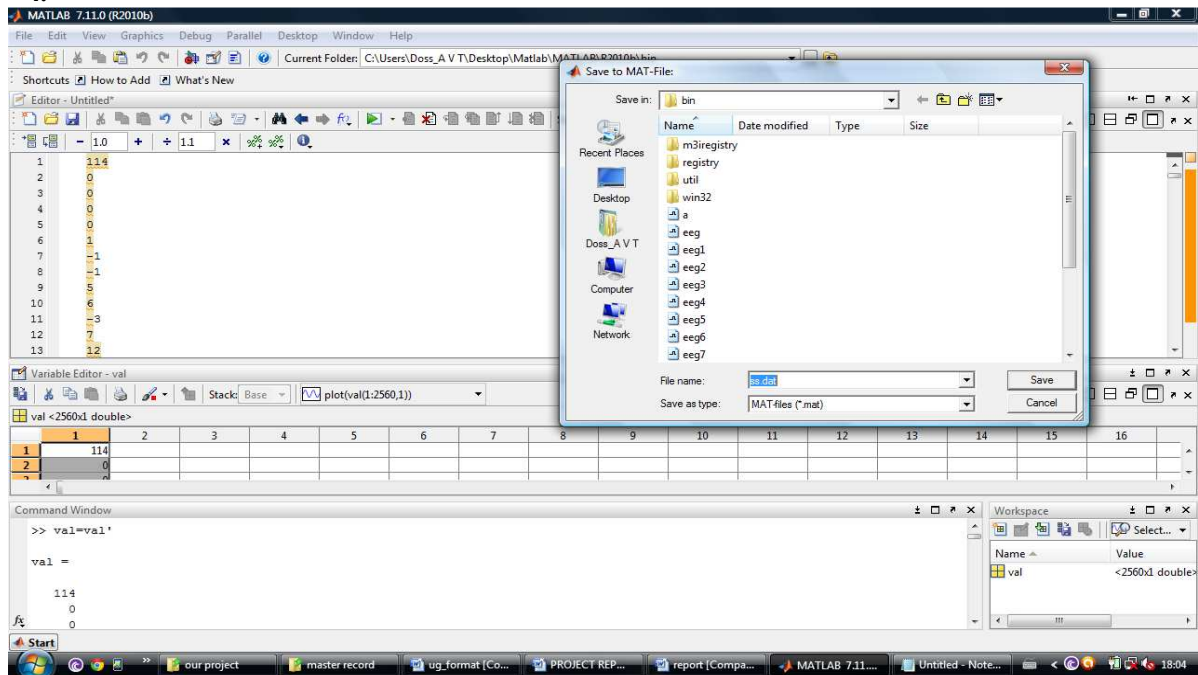
**Fig: 1 VOLTAGE VALUES OF SINGLE CHANNEL EEG**

2. The below screen represents the plot of the single channel EEG from a patient.



**Fig: 2 WAVEFORM OF SINGLE CHANNEL EEG**

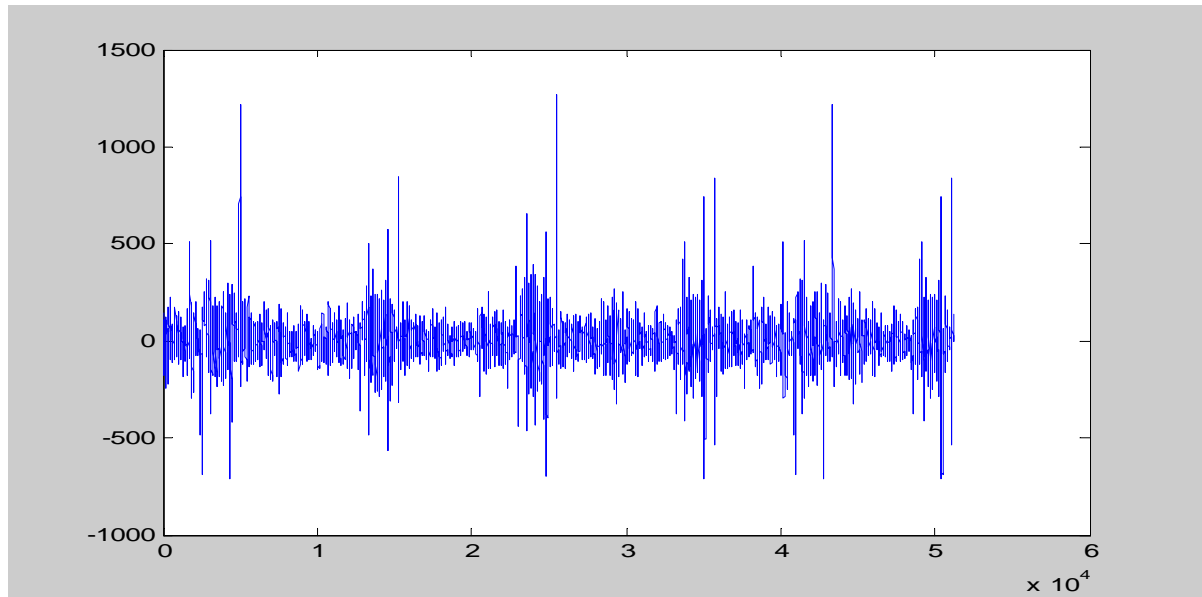
3. Conversion of .mat file into .dat file
- 4.



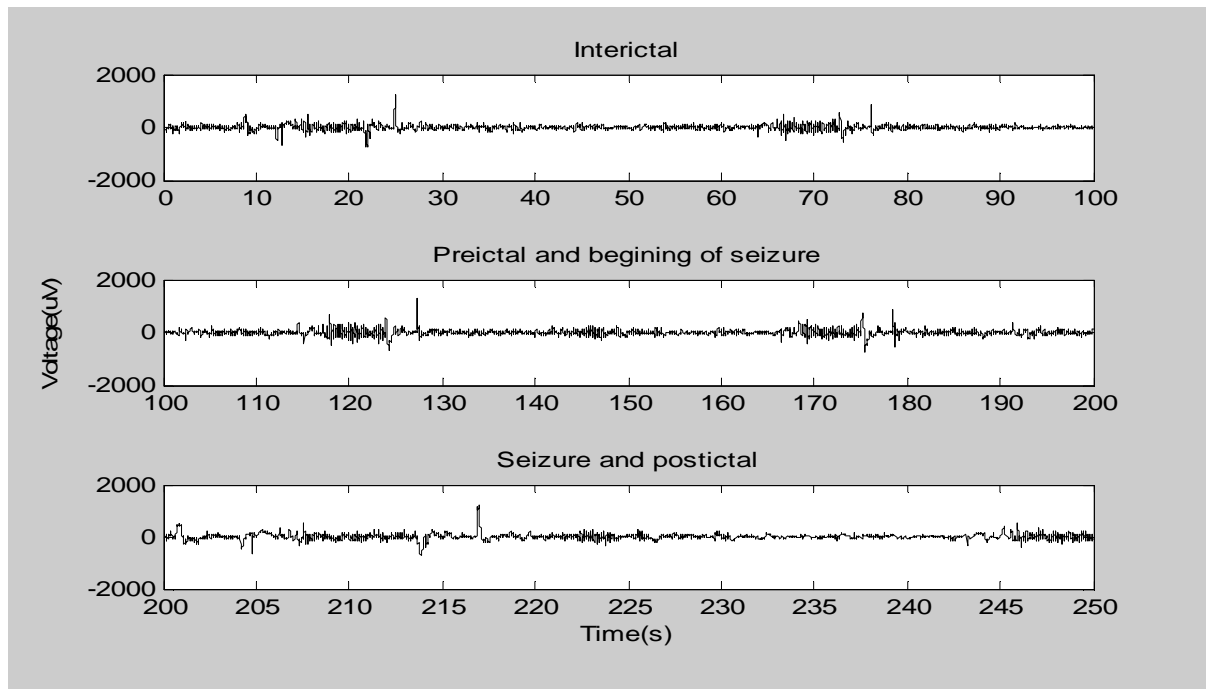
**Fig: 3 METHOD TO CONVERT .MAT TO .DAT FILE**

**RESULTS**

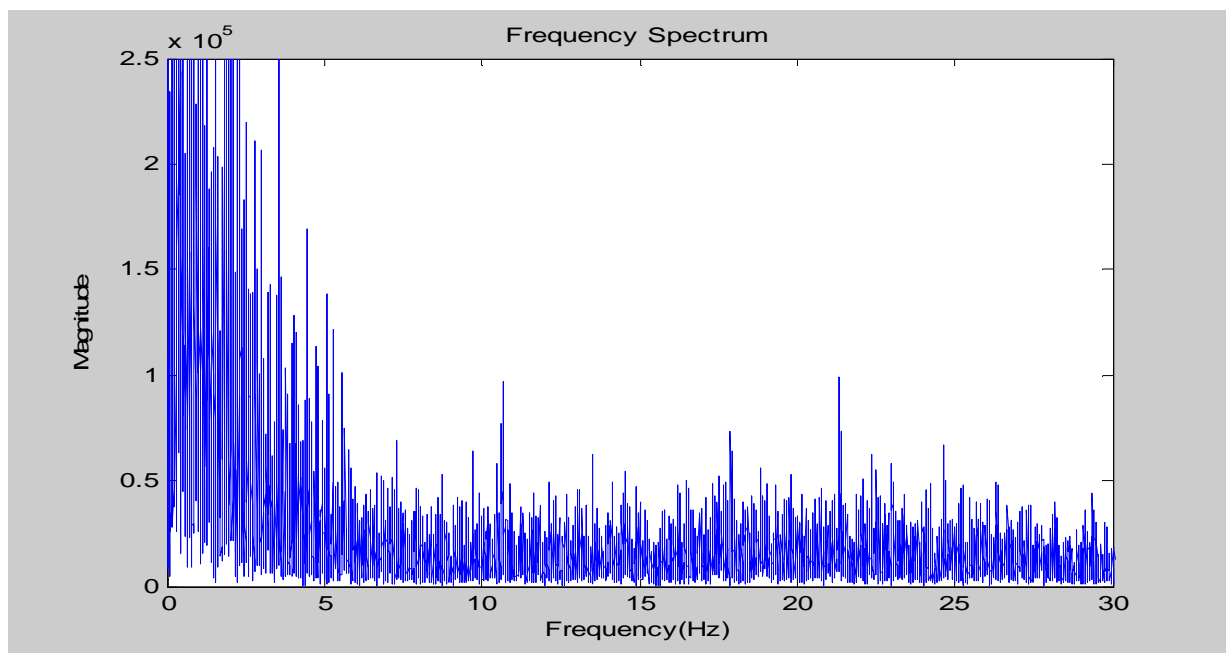
**Processed EEG Data:**



**Fig: 1 CONCATENATED 20-CHANNEL EEG**



**Fig: 2 AVERAGED 20 EEG SIGNALS OF DELTA ACTIVITY IN INTERICTAL, PREICTAL AND POSTICTAL PORTIONS**



**Fig: 3 FREQUENCY SPECTRUM OF EPILEPSY DATA**



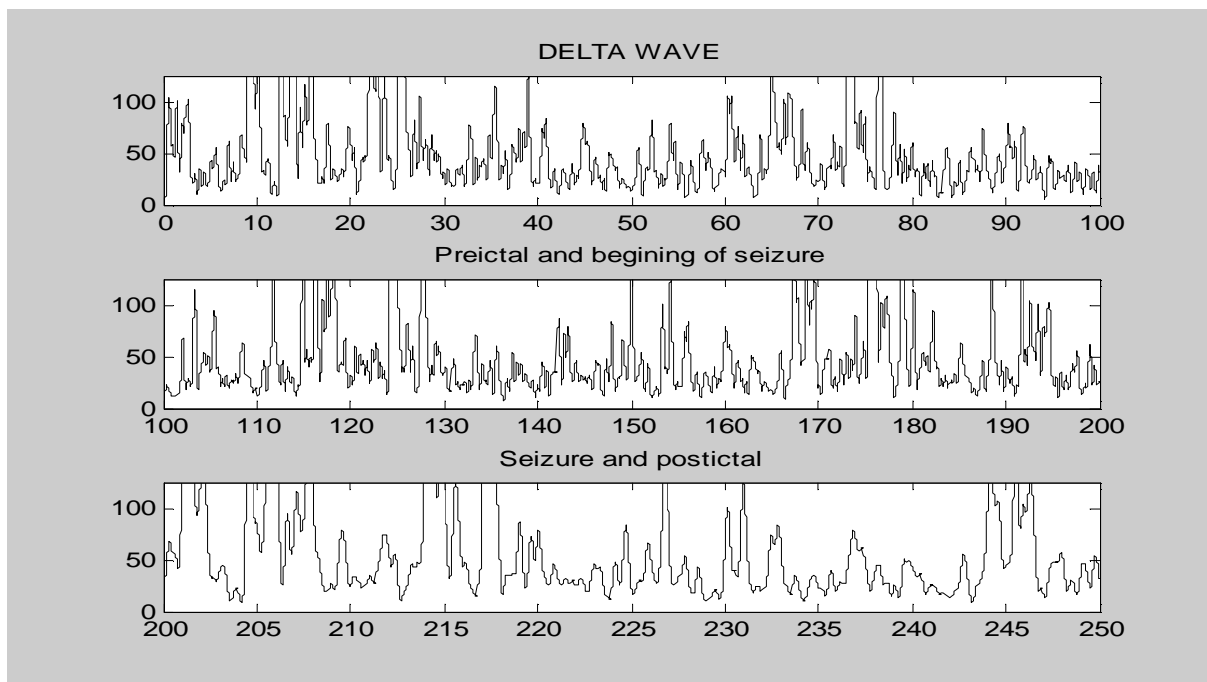


Fig: 4 NORMALISED DELTA RANGE OF EEG DATA

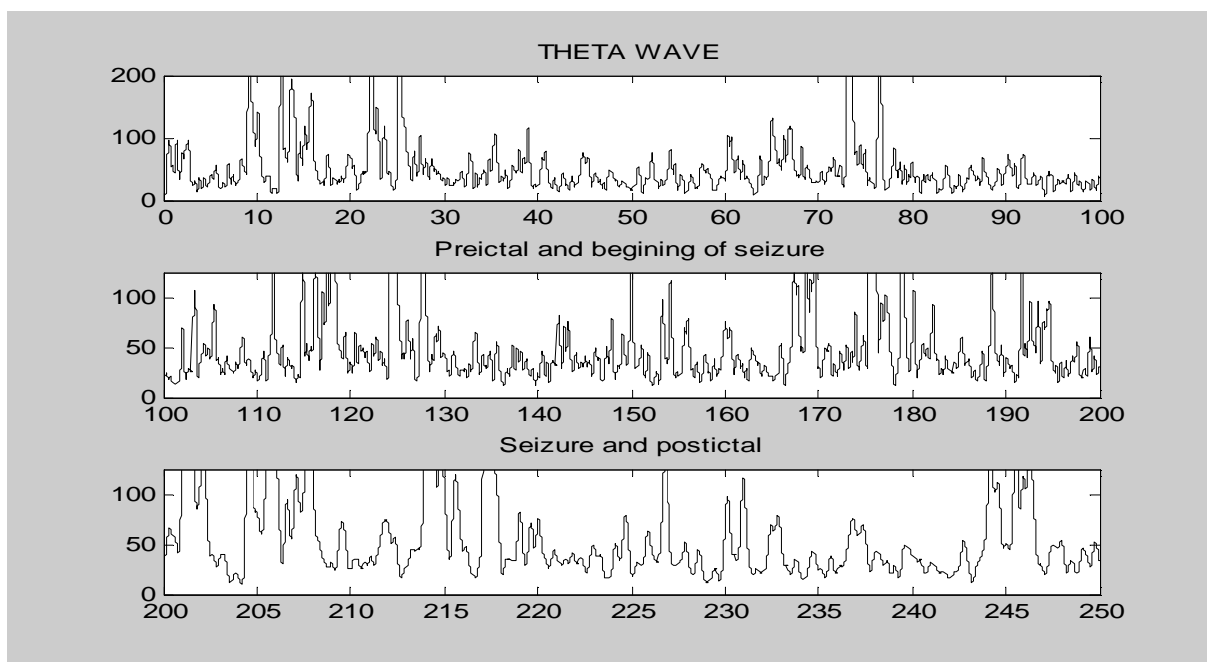
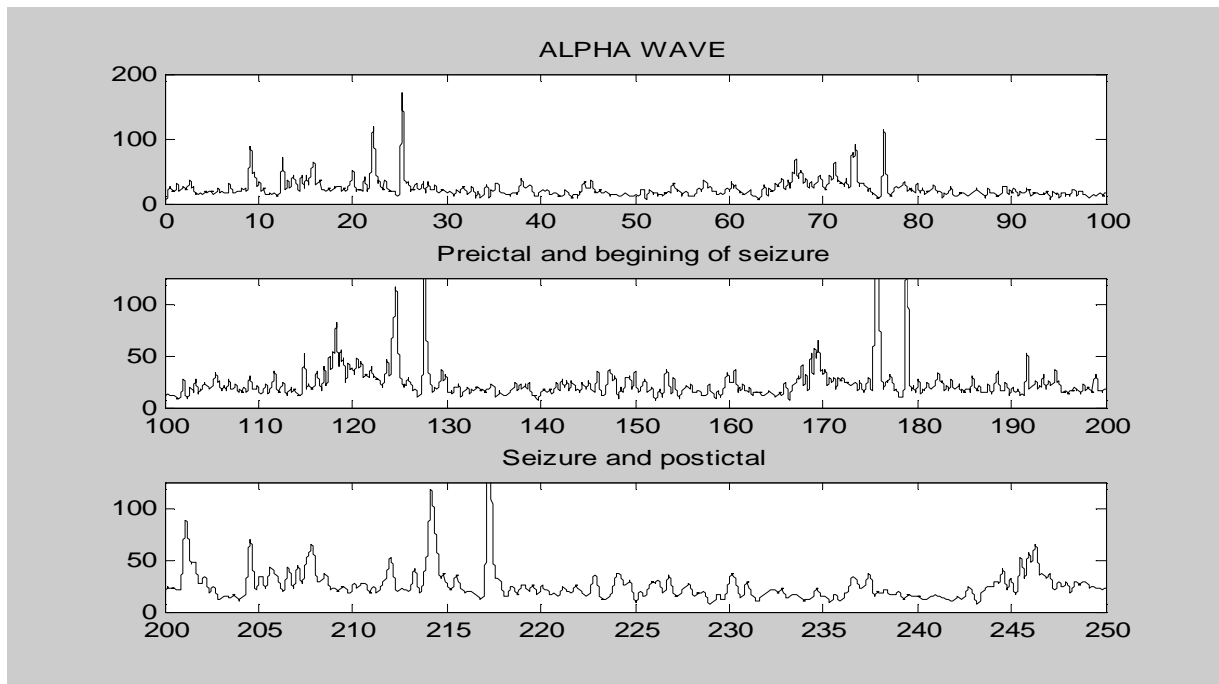
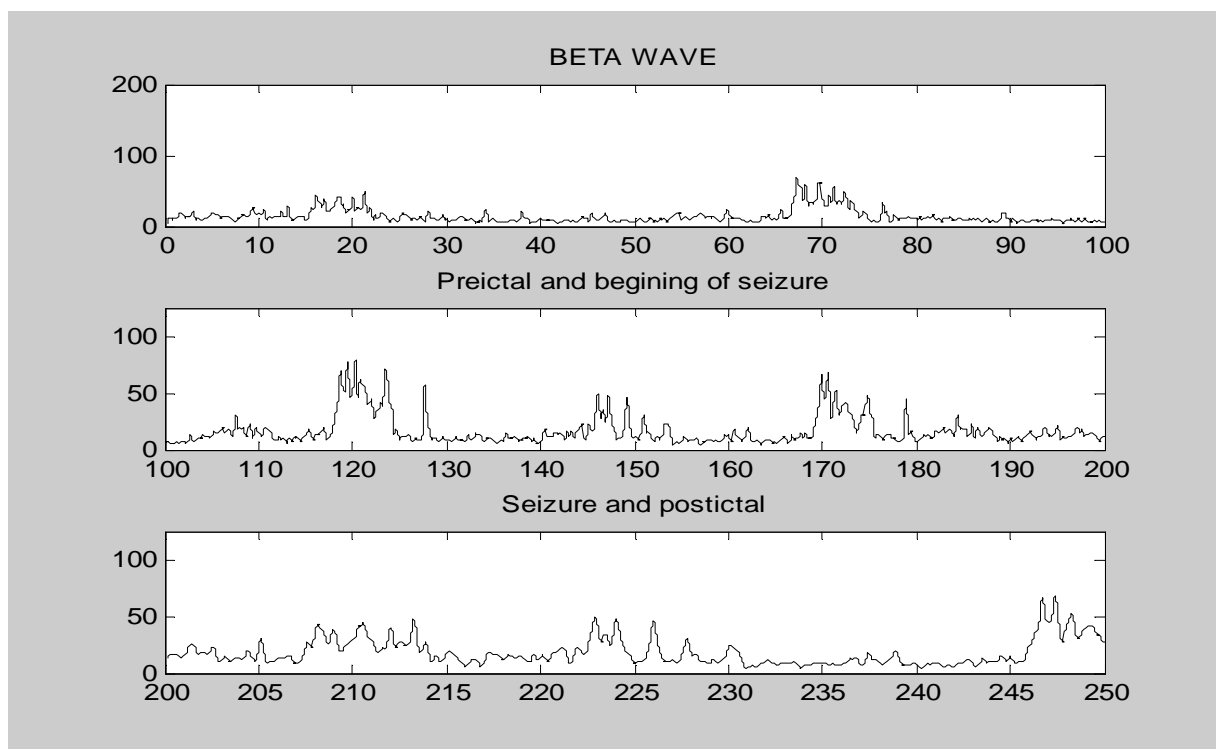


Fig: 5 NORMALISED THETA RANGE OF EEG SIGNAL

**Fig: 6 NORMALISED ALPHA RANGE OF EEG SIGNAL****Fig: 7 NORMALISED BETA RANGE OF EEG SIGNAL**

**FINAL OUTPUT:**

```

MATLAB 7.11.0 (R2010b)
File Edit Debug Parallel Desktop Window Help
Current Folder: C:\Users\Nandhitha\Desktop\Matlab2010\R2010b\bin
Shortcuts How to Add What's New

Command Window
> In imshow at 262
In sss at 8
Warning: Image is too big to fit on screen; displaying at 67%
> In imuitools\private\initSize at 73
In imshow at 262
In sss at 11
Warning: Image is too big to fit on screen; displaying at 67%
> In imuitools\private\initSize at 73
In imshow at 262
In sss at 14

ans =

    BoundingBox: [0.5000 109.5000 4 8]

ans =

    BoundingBox: [0.5000 176.5000 388 107]

ans =

    BoundingBox: [0.5000 207.5000 625 220]

ans =

    BoundingBox: [0.5000 399.5000 271 42]

abnormal
fx >>

```

**Fig: 1 OUTPUT OF OFFLINE EEG DATA**

```

MATLAB 7.11.0 (R2010b)
File Edit Debug Parallel Desktop Window Help
Current Folder: C:\Users\Nandhitha\Desktop\physionet.eeg
Shortcuts How to Add What's New

Command Window
fx >> seizure
8.9300

end of seizure
12.2800

```

**Fig: 2 OUTPUT FOR EFFECTIVE EPILEPSY PREDICTION****CONCLUSION**

The EEG monitor has been used to monitor the EEG waves from the subject, mainly in the frontal portion of the brain. Beta waves arise from the frontal lobe, and peaks on the Beta range are very indicative of an epileptic attack. So the hardware mainly focuses on the frontal lobes of the subject, using **Visual Basic 6.0**.

The brain waves of the subject will be continuously monitored on the computer,

Whenever the voltage values of the subject rise above 100 it means that the subject is suffering from the epilepsy attacks, when it is below 100 (i.e. 60V-85V) the subject is normal. Using **MATLAB** toolboxes like **IMAGE**

**PROCESSING AND SIGNAL PROCESSING** .We have successfully detected the start and end of seizure from the brain waves using signal processing toolbox from MATLAB.

**FUTURE ENHANCEMENT:**

For further development the device can be implemented for all types of epilepsy with highly predictive filter algorithm. In further experiments, the system is supposed to be tested in **32 EEG recordings** (now tested with 20 channels of EEG), also to be able to draw out of the EEG signal more detailed information in order to propose the system as an alternative for supplying visual scoring.

**REFERENCES**

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