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ANALYSIS AND SIMULATION OF EEG SIGNAL FOR DEPRESSION LEVEL PREDICTION USING MATLAB

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Abstract - *The human brain is the most complex part of the human anatomy, in which Depression is the most prevalent mental health disorder, atits worst can lead to suicide. This paper proposes a systematic approach to predict the depression level of a patient and diagnosing depression in the early curable stage which is very important. It may also lead to various disorders like sleep disorders and alcoholism. EEG is a brain signal processing technique that allows understanding the complex inner mechanisms of the brain and abnormal brain waves which is associated with particular brain disorders. Primarily the EEG signals were read using EDF browser software and the signals are loaded into MATLAB to get log Power Spectral Density from EEG bands. The results obtained from MATLAB are fed into neural network pattern recognition tool and ANFIS tool box which is integrated in MATLAB. These are powerful tool for data classification. The evaluated outputs are helpful to distinguish alcoholics and various sleep disorders like insomnia, narcolepsy, bruxism and nocturnal frontal lobe epilepsy.*

Key Words: ***EEG signals, Depression, Brain disorders, Neural Network pattern recognition, Microcontroller***

1 .INTRODUCTION

Depression is one of the most common types of illness worldwide. There are almost 350 million people suffering from depression. However, there are several types of depressive disorders .The relationship between sleep and depressive illness is complex, depression may cause sleep problems and sleep problems may cause or contribute to depressive disorders.

Sleep problems and depression may also share risk factors and biological features and the two conditions may respond to some of the same treatment strategies. EEG is a brain signal processing technique that allows understanding the complex inner mechanisms of the brain and abnormal brain waves which is associated with particular brain disorders. EEG signals are read using EDF browser software and the signals are loaded into MATLAB to get log Power Spectral Density from EEG bands. The results obtained from MATLAB are fed into neural network pattern recognition tool and ANFIS tool box which is integrated in MATLAB.

2. EXISTING SYSTEM

Depression may be caused by episodic misfiring of areas of the left frontal lobe and the left temporal lobe as a result of genetic, environmental, social, or physiological factors. That conclusion coincides with clinical observations that stroke patients are at greater risk for depression if the stroke is on the left side of the brain, especially in the left frontal lobe.

In the existing system the patient should lie on his back on a bed or in a reclining chair. Flat metal disks called electrodes are placed all over the scalp. The disks are held in place with a sticky paste. The electrodes are connected by wires to a recording machine. The machine changes the electrical signals into patterns that can be seen on a monitor or drawn on paper. These patterns look like wavy lines. The patient need to lie still during the test with his eyes closed since the movement can change the results. If patient's doctor needs to monitor his brain activity for a longer period, an ambulatory EEG will be recorded..

3. PROPOSED SYSTEM

In the proposed system EEG signals is measured through which electrical voltage is produced based on the activities of the brain. An experiment is conducted and the observation is made on the brain activities of the patient while

performing different task such as sleeping, moving and solving the mathematical problems which produces several different frequencies including Alpha, Beta, gamma, delta and theta waves.

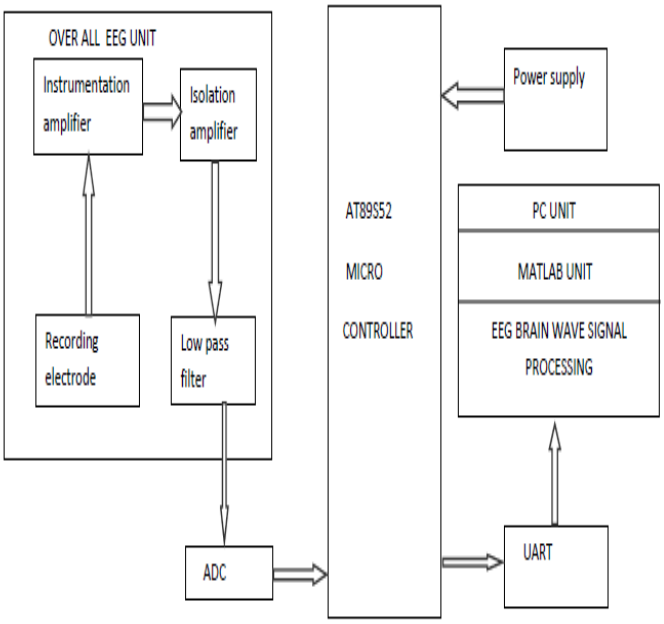


Fig 1: Block Diagram of the Proposed System

3.1 Instrumentation amplifier

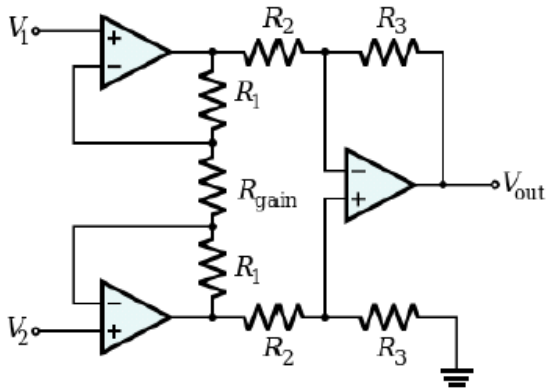


Fig 2: Circuit diagram of instrumentation amplifier

The gain of the circuit is

$$\frac{V_{out}}{V_2 - V_1} = \left(1 + \frac{2R_1}{R_{gain}}\right)\frac{R_3}{R_2}$$

An instrumentation amplifier is outfitted with input buffer amplifiers which eliminate the need for input impedance matching and thus make the amplifier suitable for use in measurement and test equipment. It is very low DC offset ,low drift, low noise, high CMRR, and high input impedance.

3.2 Isolation amplifier

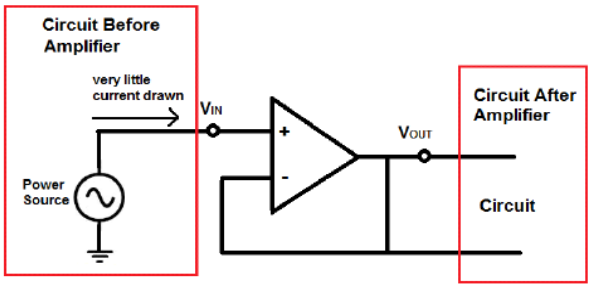


Fig 3 : Circuit diagram of Isolation amplifier

An isolation amplifier provides isolation of one part of a circuit from another ao that the power is not used, drawn or wasted in a part of the circuit. When a circuit has very high input impedance, very little current is drawn from the circuit. Thus Op- amp, being of very high input impedance does not cause any significant amount of current to be drawn from the power. Practically no current is drawn and transferred from the first part to the second part of the circuit. Thus Op – amp serves as isolation device.

3.3 AT89s52 Microcontroller

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density on volatile memory technology and is compatible with the Industry-standard 80C51 instruction set and pin out.

3.4 UART

An UART, universal asynchronous receiver / transmitter is responsible for performing the main task in serial communications with computers. The device changes incoming parallel information to serial data which is sent on a communication line.

A second UART is used to receive the information. The UART performs all the tasks, timing, parity checking, etc. needed for the communication. The only extra devices attached are line driver chips capable of transforming the TTL level signals to line voltages and vice versa.

3.5 The ADC0808, ADC0809

The ADC0808, ADC0809 data acquisition component is a monolithic CMOS device with an 8-bit analog-to-digital converter, 8-channel multiplexer and microprocessor compatible control logic.

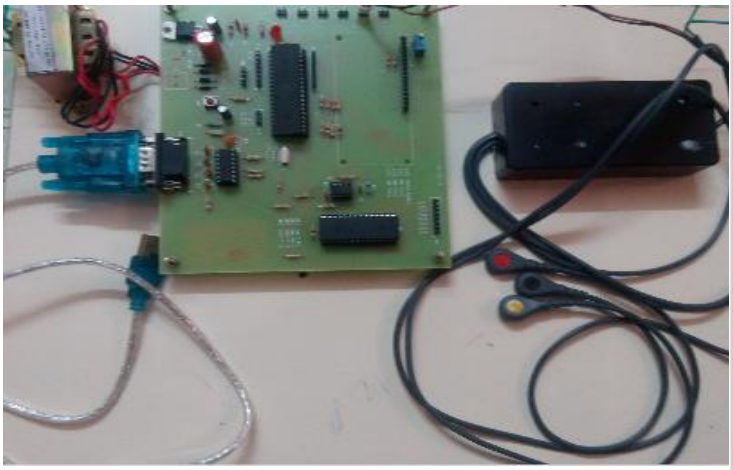
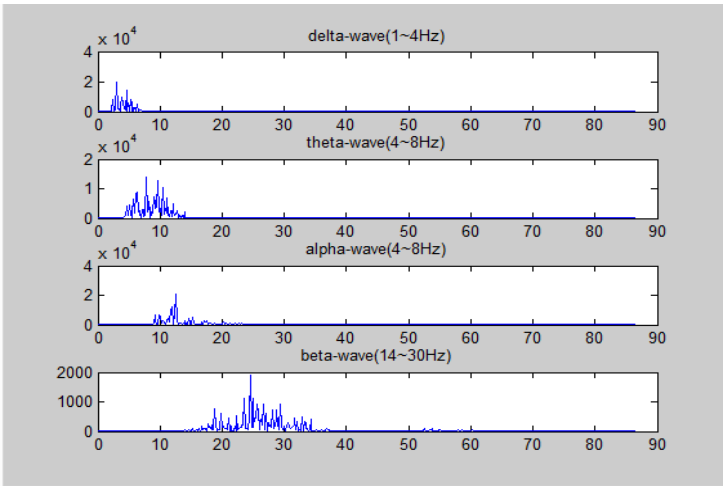


Fig 4. Experimental Setup



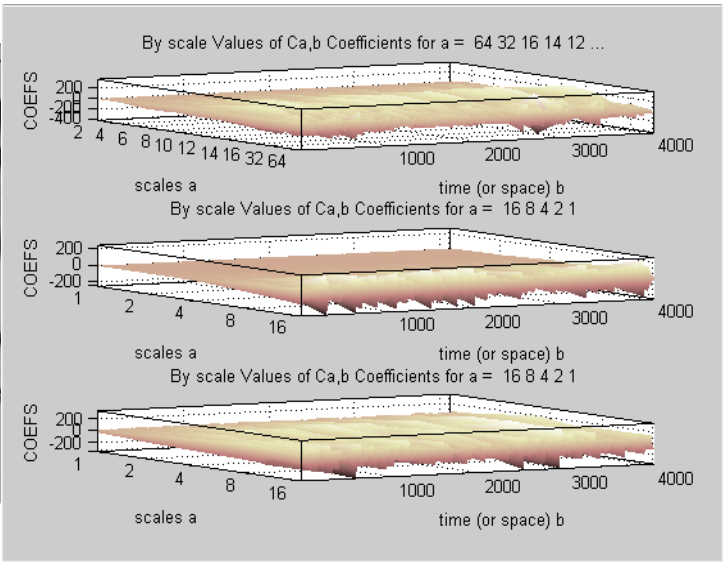


Fig 5. Results of MATLAB

4. EXPERIMENTAL RESULTS

The program of the microcontroller have been written in embedded C and is compiled using KEIL. The communication between PC and the microcontroller is established with MAX232 standard and the program is also written in C language.

DELTA: It is a high amplitude brain wave of range (0-4)HZ. It is associated with deep stage 3 of NREM sleep also known as slow wave sleep.

THETA: It is around the range of (4-8)HZ. It is engaged in monitoring behaviors such as walking and exploratory sniffing.

ALPHA: It is n the frequency range of (4-8)HZ. These are the types of brain waves occurred during wakeful relaxation with closed eyes.

BETA: It is in the range of (14-30)HZ. It is associated with active, busy, or anxious thinking and active concentration.

5.CONCLUSION

In the proposed system, the depression level of patient have been monitored using delta, theta , alpha ,beta waveform. These technique help to save the time of the doctor as well as save the patient, in case of emergency as the necessary precaution can be taken. The waveforms are used to detect the head injuries , periods of memory loss, infections, tumors, seizures and epilepsy.

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