Ambulatory Epilepsy Monitoring System

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Abstract-   Electroencephalogram   (EEG)   Ambulatory monitoring has been regarded as a promising tool to improve diagnosis, classification and medication prescription in patients with epilepsy and other paroxysmal diseases. This project presents the development of a wireless and wearable EEG acquisition system for ambulatory monitoring and critical situation intimation system to central control unit. For people who have been are suffering from epileptic seizures, a real time system is developed which is helpful in detecting such cases, is Smart epilepsy detection and alert system is an advanced technology by which we have developed a electronic gadget. Using that kit we can save the life of the person who is really effecting with the condition. It will do the help in both the ways means not only checks the condition but also sends an SMS to the concerned doctor for the patient's live saving sake.

Keywords- EEG, Epilepsy, Seizure.

I. INTRODUCTION

The traditional medical examination involves a number of chemical, physical and electro-physiological measurements. These measurements are of very short duration and comprise no more than a physiological snapshot of the patient's condition. However, when one wants to perform functional tests on patient, which are expected to have some relationship to his behavior in normal life, the measurements have to be made over a long period. Ambulatory monitoring concerns itself with the extension of such measurements into the time domain on unrestricted ambulatory (mobile) patients during everyday stress and activity as well as during periods of sleep. Therefore, the precise objective of ambulatory monitoring is to record one or more physiological variables continuously or repeatedly, without interference with the spontaneous activities of the subject by the restraints of conventional laboratory instrumentation and without influencing the variable being measured. Ambulatory monitoring is not only an invaluable aid to the physician in the differential diagnosis of many unexplained symptoms like dizziness, syncope and palpitation but it also provides accurate data for the evaluation of drug therapy, stress testing, artificial pacemakers, status of myocardial infarction and several other problems in research programmed. The technique is so well established now that it is predicted that within the next decade, ambulatory monitoring departments will become a common feature in the hospital service, accepted as a matter of course just like the X-ray or pathology department.

To improve ambulatory EEG systems in order to make them comfortable, easy to use, and last for a longer time. Power consumption of such systems is an important issue since it needs to be reduced to make them wearable. A reduction in the amount of data to be processed can save significant amount of power. Different methods of reducing data for long-term epilepsy monitoring include using lower sampling frequency, compression of data, and discontinuous recording.

II. ELECTROENCEPHALOGRAPHY

Electroencephalography (EEG) is the recording of electrical activity along the scalp. EEG measures voltage fluctuations resulting from ionic current flows within the neurons of the brain. In clinical contexts, EEG refers to the recording of the brain's spontaneous electrical activity over a short period of time, usually 20–40 minutes, as recorded from multiple electrodes placed on the scalp. Waves that appear in the brain are as follows:

DELTA WAVES: 0 to 4 Hz
THETA WAVES: 4 to 7 Hz
ALPHA WAVES: 8 to 12 Hz
BETA WAVES: 12 to 30 Hz
GAMMA WAVES: 30 to 100 Hz

EPILEPSY

Epilepsy   is   a   group   of neurological diseases characterized by epileptic seizures. Epileptic seizures are episodes that can vary from brief and nearly undetectable to long periods of vigorous shaking. In epilepsy, seizures tend to recur, and have no immediate underlying cause while seizures that occur due to a specific cause are not deemed to represent epilepsy.

Epilepsy is characterized by a long-term risk of recurrent seizures. These seizures may present in several ways depending on the part of the brain involved and the person's age.

III. AMBULATORY MONITORING SYSTEM

The design of Portable wireless Ambulatory monitoring system also called as Ambulatory monitor using microcontroller and wireless GSM transmission protocol. The Ambulatory monitor consist of a Physiological parameter sensors combined with the MCU measuring the EEG, Temperature and pulse rate with high speed processing computer and it take decision about the patient critical situation and is continuously wirelessly transmitted to nursing station and is displayed and save on computer, without interference with the spontaneous activities of patient.

BLOCK DIAGRAM:

A System for monitoring EEG is shown in the below Figure. It consist of Microcontroller unit, EEG Acquisition system, Laptop for further processing of the acquired signal.
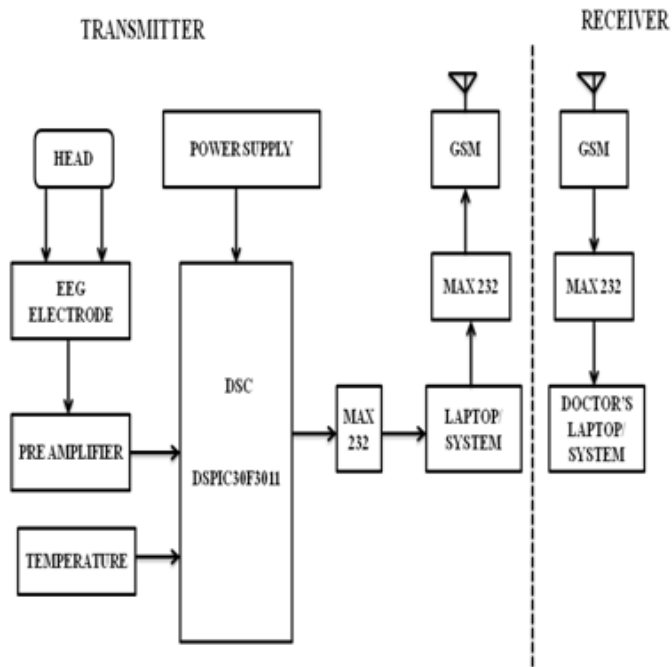

Figure: Ambulatory monitoring system.

The ambulatory EEG monitoring uses a small portable EEG recorder which is worn on a waist belt. Recording can thereby be made during regular daytime activities and sleep, in the natural environment. The EEG recorder records events that can be reviewed later on a special machine in an EEG laboratory. The patient should be asked to keep an account of daily activities, so that they can be related to the EEG recordings made at the time. In comparison to an inpatient monitoring, ambulatory outpatient monitoring may be less informative because: (a) reduction of medication to provoke seizures may not be safe in an outpatient, (b) faulty electrode contacts cannot quickly be noticed and repaired, (c) the patient may move out of video surveillance, and (d)

duration of ambulatory monitoring can be limited by technical constraints.

EEG ACQUISITION:

By placing the electrodes on the patients head the Brain waves are acquired and are sent to pre-amplifier for amplification. Along with the EEG signal the temperature of the patient are also sensed and is given to the microcontroller unit for further processing of the acquired data.

DSC:

Digital Signal Control unit is mainly used as Analog to digital Control unit. The acquired signal from the patient is analog signal which is to be converted to Digital data for processing in the laptop/system.DSC is a 40 pin IC.

In the laptop a software package is loaded for separating the normal and abnormal signal. The abnormal signal is separated and the kind of abnormality is loaded in the software package. The collected data is entered in the data sheet and the report is only sent to the doctor for the treatment to be given to patient quickly.

IV. RESULT

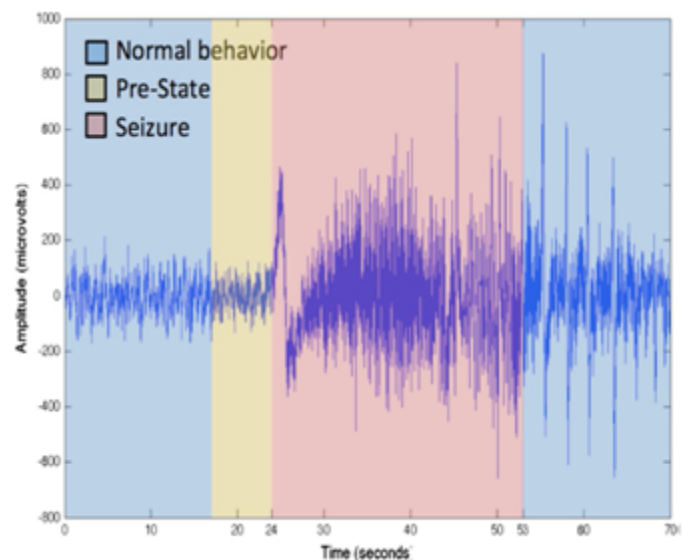The sample of normal and abnormal signal is shown in the below figure.

Figure : Separation of EEG signal

From the above Figure we can easily determine the normal behavior, pre-state(i.e before the occurrence of the seizure) and the seizure identified signal is separated and is sent to the doctor for further processing.

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