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EPILEPSY SEIZURE DETECTION USING EMG SIGNALS

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Abstract: Epilepsy is a chronic neurological issue with a few distinct sorts of seizures, some of them portrayed by compulsory repetitive spasms, which incredibly affect the regular day to day existence of the patients. A few arrangements have been proposed in the writing to distinguish this sort of seizures and to screen the patient; be that as it may, these methodologies need ergonomic issues and in the appropriate combination with the wellbeing framework. This examination makes an inside and out investigation of the principle factors that an epileptic recognition and observing apparatus ought to achieve. Besides, we present the design for explicit epilepsy location and observing stage, satisfying these variables. Extraordinary consideration has been given to the piece of the framework the patient should wear, giving subtleties of this piece of the stage. At last, a fractional execution has been conveyed and a few tests have been proposed and done to settle on some plan choices.

Keywords: Epilepsy, framework, Recognition, Seizures

I. INTRODUCTION

Epilepsy is a chronic neurological disorder characterized by involuntary recurrent convulsions. There are around 65 million individuals influenced from one side of the planet to the other, with a high and sensational effect on the patient's personal satisfaction, yet in addition on the expert turn of events and social conduct, the wellbeing framework spending plan is profoundly influenced also. Primary part of the anamnesis interaction is the place where the information is assembled. The fundamental piece of the writing manages compelled spaces, that is, research labs or clinic rooms, or even the patient's home, however without thinking about the ordinary regular daily existence. We claim that the information ought to be assembled in regular daily existence, permitting the patient to unreservedly choose what to do and how to do it This is important because firstly, the data is gathered from normal activities performed before and after a seizure, and secondly, the analysis and procedures should adapt to this unconstrained world, making the whole detection process much more difficult. A careful in- depth analysis of the seminal papers concerning epilepsy monitoring platforms and Mobile Cloud Computing (MCC) let us conclude that the current available platform, either in the scientific literature or in the market, lacks several main features that are not comprehensibly integrated. This investigation means to address a portion of these restrictions; to do as such, an answer is proposed and an experimentation stage has been acted to remove the reasonable ends for the epilepsy checking stages. In the following area, the most applicable commitments in the writing are broke down and censured, giving extraordinary consideration to the distributed stages; the principle worries that stay inexplicable are incorporated too.

Epilepsy is a gathering of neurological illnesses portrayed by epileptic seizures that influences over 10% of the human populace worldwide and brought about 116,000 Sudden Unexpected Death in Epilepsy (SUDEP) over the most recent two years, particularly engine vehicle mishaps. In created nations, babies represent the greater part of the seizures. Around 5-10% of individuals more than 80 years of age have had a seizure. The current seizure discovery arrangements depend on manual examination, and the interest for robotized recognition is high, also the requirement for expectation. Utilizing on the web unaided Brain Computer Interface (BCI), location and observing the arrangement can at any rate help in distinguishing the seizure indications ahead of schedule to keep away from deadly results. In any case, the constraints in the recognition time are a test.

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The present status of-the-craftsmanship structures either require an ideal climate to work, inclined to commotion, have limits with expectations, or require an amazing computational force just as a ton of wiring on the patients, and in a large portion of the cases, they don't give a shut circle forecast and identification frameworks nor simple specialist admittance to choices instruments, which can cost the patient's life. In this investigation, we propose an early indicator of epileptic seizures that is based on artificial immune systems (AIS).

The framework utilized a dispensable wearable non-obtrusive sensors set on a headband that speaks with an

advanced mobile phone or any ICU observing gadget through a Bluetooth (BT) association innovation.

The proposed framework of our system utilizes negligibly a non intrusive wearable EEG, with a sign handling chip joined to it, which is set behind the patient's ear and associates through a BT to an outside checking gadget, or to an ICU staff or specialist's shrewd handheld gadget.

II. LITERATURE SURVEY

Title: "Detection of generalized tonic-clonic seizures by a wireless wrist accelerometer: a prospective, multicenter study"
Author: S. Beniczky, T. Polster, T. W. Kjaer, and H. Hjalgrim,
Description:
This is mostly a research study focused only on the detection of tonic-clonic epileptic seizures. A WD without wireless communication stored data and some machine learning methods were performed for obtaining offline models.

Title: "Miniaturized wireless ECG monitor for real-time detection of epileptic seizures"
Author: F. Masse, M. V. Bussel, A. Serteyn, J. Arends, and J. Penders
Description:
This research details the design of an ad hoc epilepsy detection ECG wireless intelligent sensor, including several detection algorithms, linked to a local computer connected to a network. Several relevant factors were analyzed, the ergonomic issues and the battery life among them. The WD communicates with the local computer in order to deliver alarms, to receive configuration commands, or to start/stop HR recording to be downloaded to the computer. A very detailed explanation of the requirements and of the hardware decisions is included.

Title: "Identification of brain regions of interest for epilepsy surgery planning using support vector machines"
Author: Joshua A. Dian; Sinisa Colic; Yotin Chinvarun; Peter L. Carlen; Berj L. Bardakjian
Description:
In patients with intractable epilepsy, surgical resection is a promising treatment; however, post surgical seizure freedom is contingent upon accurate identification of the seizure onset zone (SOZ). Identification of the SOZ in extra temporal epilepsy requires invasive intracranial EEG (iEEG) recordings as well as resource intensive and subjective analysis by epileptologists. Expert inspection yields inconsistent localization of the SOZ which leads to comparatively poor post surgical outcomes for patients. This study employs recordings from 6 patients undergoing resection surgery in order to develop an automated and scalable system for identifying regions of interest (ROIs). Leveraging machine learning techniques and features used for seizure detection, a classification system was trained and tested on patients with Engel class I to class IV outcomes, demonstrating superior performance in the class I patients. Further, classification using features based upon both high frequency and low frequency oscillations was best able to identify channels suited for resection. This study demonstrates a novel approach to ROI identification and provides a path for developing tools to improve outcomes in epilepsy surgery.

Title: "Brain state evolution during seizure and under anesthesia: A network-based analysis of stereotaxic eeg activity in drug-resistant epilepsy patients"
Author :Robert Yaffe; Sam Burns; John Gale; Hyun-Joo Park; Juan Bulacio; Jorge Gonzalez-Martinez; Sridevi V. Sarma
Description:
Epilepsy is a neurological condition with a prevalence of 1%, and 14-34% have medically refractory epilepsy (MRE). Seizures in focal MRE are generated by a single epileptogenic zone (or focus), thus there is potentially a curative procedure - surgical resection. This procedure depends significantly on correct identification of the focus, which is often uncertain in clinical practice. In this study, we analyzed intracranial stereotaxic EEG (sEEG) data recorded in two human patients with drug-resistant epilepsy prior to undergoing resection surgery. We view the sEEG data as samples from the brain network and hypothesize that seizure foci can be identified based on their network connectivity during seizure. Specifically, we computed a time sequence of connectivity matrices from EEG recordings that represent network structure over time. For each patient, connectivity between electrodes was measured using the coherence in a given frequency band. Matrix structure was analyzed using singular value decomposition and the leading singular vector was used to estimate each electrode's time dependent centrality (importance to the network's connectivity). Our preliminary study suggests that seizure foci may be the most weakly connected regions in the brain during the beginning of a seizure and the most strongly connected regions towards the end of a seizure. Additionally, in one of the patients analyzed, the network connectivity under anesthesia highlights seizure foci. Ultimately, network centrality computed from sEEG activity may be used to develop an automated, reliable, and computationally efficient algorithm for identifying seizure foci.

Title: "A sparse Laguerre-Volterra autoregressive model for seizure prediction in temporal lobe epilepsy"
Author: Pen-Ning Yu; Shokofeh A. Naiini; Christi N. Heck; Charles Y. Liu; Dong Song; Theodore W. Berger
Description:
This A sparse Laguerre-Volterra autoregressive model has been developed as feature extraction from subdural human EEG data for seizure prediction in temporal lobe epilepsy. The use of Laguerre-Volterra kernel can compactly yield an autoregressive model of longer system memory without increasing the number of the coefficients. In 6 sets of seizure, we used a sparse Laguerre-Volterra autoregressive model with 6 coefficients and the decay parameter of 0.2 and obtained the 10-fold cross-validation prediction results of high Matthews correlation coefficients (0.7-1) and low prediction errors (<;15%). These results demonstrate that the sparse Laguerre-Volterra autoregressive model is effective in the feature extraction for seizure prediction. Finally, this sparse Laguerre-Volterra method can be easily adapted to a potentially more powerful nonlinear autoregressive model as the feature extraction rather than linear autoregressive model that we are currently using.

Title: "Pre-Ictal Entropy Analysis of Micro wire Data from an Animal Model of Limbic Epilepsy"
Author: Mitushi Mishra; Britta Jones; Jennifer D. Simonotto; Michael D. Furman; Wendy M. Norman; Zhao Liu; Thomas B. DeMarse
Description:
Epilepsy is a common neurological disorder that can have damaging effects in the brain including over 50% loss of neuronal activity in the hippocampus regions of the CA1 and CA3. The pre-ictal period was studied in an animal model of limbic epilepsy using Shannon entropy and correlation analysis. The primary aim was to uncover underlying relative changes in signals between the Dentate Gyrus and CA1 areas of the bilateral hippocampus. Preliminary entropy analysis results included dynamical changes between channels in the Dentate Gyrus and channels in the CA1 region at and around the time of the seizure.

Title: "Myepipal, Mobile application for managing, monitoring and predicting epilepsy patient,"
Author: N. A. Marzuki, W. Husain, and A. M. Shahiri
Description:
MyEpiPal is an app that monitors the patient, simplifies the intercommunication between the caregiver and the patient, and allows the self-management. This means that although it makes use of the sensory within the Smartphone, the main goal is to give support to the patient in everyday life. It is not an epilepsy detection platform itself, although the measurements can help in the prediction of the occurrence of a seizure, which is the reason that it is included in this comparison

III. IMPLEMENTATION

Epilepsy is a gathering of neurological sicknesses portrayed by epileptic seizures that influences more that 10% of the human populace worldwide and brought about 116,000 Sudden Unexpected Death in Epilepsy (SUDEP) over the most recent two years, particularly engine vehicle mishaps. In created nations, babies represent the vast majority of the seizures. Around 5-10% of individuals more than 80 years of age have had a seizure. Victims have an expanded possibility of encountering a subsequent seizure, and ordinarily epilepsy can't be relieved. Seizures can likewise happen to infants, sluggish, or critical engine impeded patients, particularly in Intensive Care Units (ICU).The circumstance can be much more extreme when clinical work force are not qualified for EEG signal investigation, which is an exceptionally regular case. The current seizure location arrangements depend on manual examination, and the interest for mechanized identification is high, also the requirement for expectation. Utilizing on the web unaided Brain Computer Interface (BCI), recognition and checking the arrangement can in any event help in identifying the seizure side effects right on time to stay away from deadly results. Notwithstanding, the limits in the recognition time are a test.
A number of tests are used to determine whether a person has a form of epilepsy and if so, what kind of seizures the person has. So, methods may be based on embedded systems along with Sensors, image processing and blood test in our project we are using Image processing Embedded system.

ALGORITHM

Step 1: Press the switch

If switch is pressed go to Step 4

Step 2: Indoor mode

Image processing mode

Step 3: Find the human expression

If Expression changed go to Step 8

Step 4: Outdoor navigation

Step 5: Read the status of the temperature sensor

If > Threshold , Go to step 8

Step 6: Read H.B sensor

If > Threshold , Go to step 8

Step 7: Read Muscular sensor and if there is variation , Go to step 8

Step 8: Alert through Buzzer and display on LCD and update through Wi-Fi

Image Processing:
Image Acquisition: Images utilized for look acknowledgment are static pictures. To take the pictures of articulations of individuals we utilize a Panasonic camera (Model DMC-LS5) with focal length of 5mm is utilized. The configuration of pictures is 24 digit shading JPEG with goal of 4320x 3240 pixels. The distance between the camera and individual was

four feet and pictures of six essential articulations of every individual were taken.

Image Preprocessing: The picture preprocessing methodology comes as a vital advance in the look acknowledgment task. The goal of the preprocessing stage is to take pictures which have standardized force, uniform size and shape, and address just a face communicating certain feeling. The preprocessing strategy ought to likewise lessen the impacts of brightening and lighting. Articulation portrayal can be sensitive to interpretation, scaling, and turn of the head in an image. To fight the impact of these inconsequential changes, the facial picture might be mathematically standardized before arrangement.

Feature Extraction: In creating exact look acknowledgment framework include extraction is the main stage. Natural facial pictures hold immense measures of information and highlight extraction is needed to diminish it to more modest arrangements of information called highlights. Highlight extraction change pixel data into a raised sum portrayal of shading shape, movement, surface, and spatial setup of the face or its highlights. The isolated portrayal is used for additional articulation arrangement. Highlight extraction usually diminishes the data's dimensionality space. The decrease system should keep up fundamental information having high isolation power and high security.

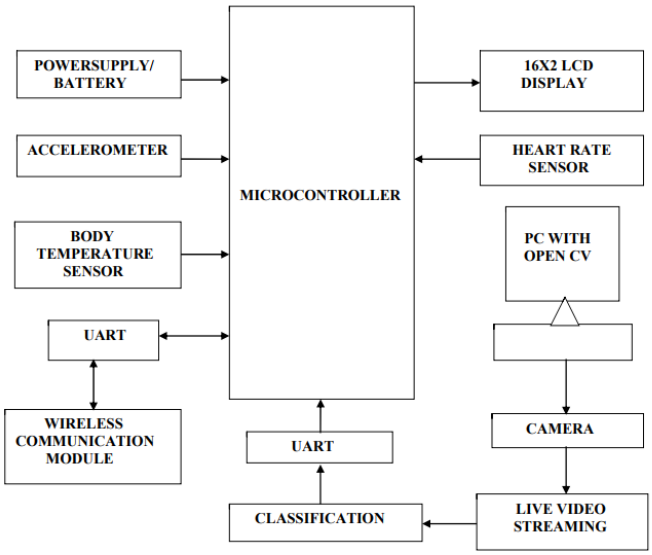
Feature Selection: Feature selection is worried about picking of a subset of highlights totally important to play out the characterization task from a bigger arrangement of up-and-comer highlights. The element determination step affects both the computational intricacy and the nature of the order results. It is fundamental that the data contained in the chose highlights is satisfactory to accurately check the information class. Such a large number of highlights may pointlessly raise the intricacy of the preparation and grouping errands, while a poor, deficient choice of highlights may detrimentally affect the characterization results. The way toward choosing a sub arrangement of highlights improves the proficiency of classifier and diminishes execution time.

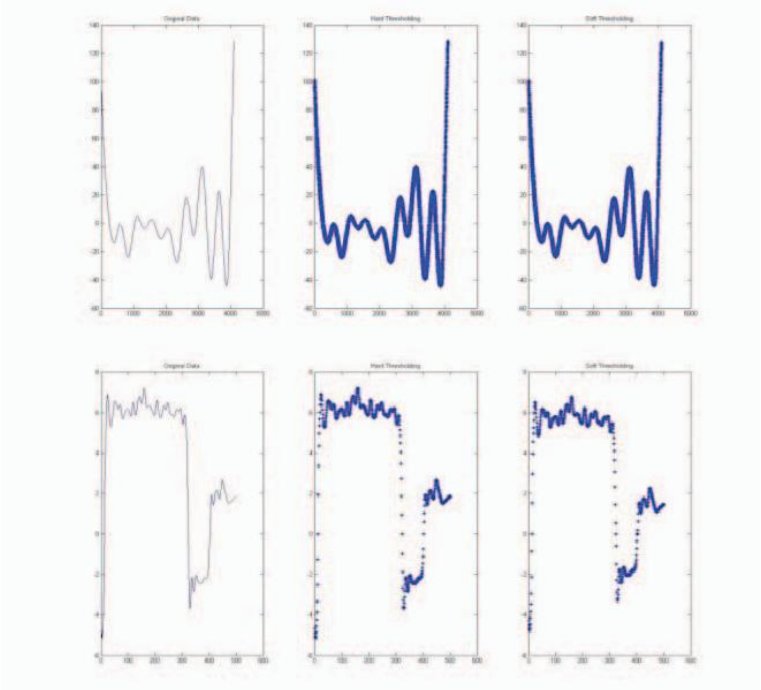
Classification: The last advance of Facial Expressions Recognition frameworks is to perceive look dependent on the removed highlights. Characterization alludes to an algorithmic methodology for perceiving a given articulation as one of the given number of articulations. We use Support Vector Machine classifier for characterization. When the order is done characterized data will be given to regulator by means of UART to advise the worry people versatile App through Wi-Fi.

Embedded system:

Second method of detecting the epilepsy is utilizing sensors with controllers, generally EEG is utilized recognize the brain waves through this neurological signs can be recognized however this isn't sufficient to distinguish the epilepsy, in our tasks we will focusing on look and body boundaries like temperature his head or body movements utilizing MEMS innovation and pulse of the individual, through this order should be possible and educated to concern individual utilizing Wi-Fi.

System architecture:





IV. OUTCOME

First, the entirety of the past work and the proposed work surpass the exhibition of the irregular supposition which makes them a specific possibility for future execution. We have seen the lower execution that we get with PT3, as there were more bogus positive forecasts and bogus location than the mean qualities. Accordingly, we read the EEG for that particular case in more subtleties, and it turns out an uncommon patient's condition and age. Be that as it may, there are a few downsides in the proposed framework at this stage. The first issue is the unusual antiquities that typically exit with a few babies who experience the ill effects of seizure. Baby Spasm Syndrome and Febrile Seizure, which normally happen in kids matured 3

months to 5 years. Be that as it may, such cases are viewed as uncommon (for example 2% to 5% of the multitude of youngsters). The second issue is that there is as yet a generally short forecast time. In any case, we accept that the advances in neurosciences can bring us more pieces of information and EEG signal markers that we can concentrate to anticipate a superior example for a more exact forecast. Despite the way that EMG is a significant clinical device for diagnosing, checking and overseeing neurological issues, unmistakable challenges related with EMG investigation and understanding which impede alters wide spread acknowledgment in our undertaking is zeroing in on both picture handling and inserted framework to track down the look of the individual and body boundaries. SVM is utilized for grouping which is precise than past strategies.

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