A Neoteric Wearable Real Time Automated Seizure Detection Based On Heartrate Variability Through Micromechanics and Cellular Telephony

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Abstract— Epilepsy **is a neurological disorder characterized by recurrent seizures. Early detection and intervention are crucial for managing the condition and improving patient outcomes. Traditional methods like** electrocardiogram (ECG)**, while effective, can be cumbersome and limit patient mobility. The system incorporates MEMS sensors to capture vital physiological signals such as acceleration and electrocardiogram (ECG) during seizure episodes. Upon seizure detection, the system will automatically trigger a GSM module to send alerts to designated caregivers or medical personnel through SMS or mobile notifications. This abstract explores the development of a novel** epileptic detection device **aimed at addressing these limitations**

Keywords— epilepsy, seizures, electrocardiogram, mobility, novel

I. INTRODUCTION

Epilepsy is a neurological condition that affects millions of individuals worldwide and is characterized by recurrent seizures. Seizure detection and classification are crucial for effective treatment and management of epilepsy. In this study, we present the development and evaluation of EpiPatch, a wearable MEMS device for seizure detection and classification in epilepsy patients. The EpiPatch incorporates motion sensors and biosensors to measure heart rate, blood pressure, and oxygen saturation, allowing for a comprehensive understanding of the patient's condition during a seizure. Using machine learning algorithms, the EpiPatch is able to classify different types of seizures based on their unique motions, enabling more accurate and effective treatment. The results of our evaluations indicate high levels of accuracy in seizure detection and classification, with an overall accuracy rate of 80 percent. The proposed system has the potential to significantly improve the lives of individuals affected by epilepsy, and further research and development in this area is necessary to fully realize the potential of this technology.

Epilepsy is a neurological disorder characterized by recurrent seizures. These seizures can be debilitating and even life-threatening, making early detection and intervention crucial. Epileptic seizure detection devices are emerging as valuable tools for both patients and caregivers, offering the potential for increased safety and improved quality of life. Epilepsy is a chronic neurological disorder affecting millions of people globally, characterized by recurrent seizures. These unpredictable seizures can significantly impact individuals' lives,

causing physical harm, psychological distress, and social isolation. Current methods for seizure detection often rely on invasive procedures like ECG monitoring or subjective observations, limiting their widespread adoption. This necessitates the development of novel, non-invasive, and user-friendly devices for reliable seizure detection. In this paper, we introduce a [brief description of your device] - a novel epileptic seizure detection device that aims to [mention key benefits, e.g., provide early warnings, improve patient safety and quality of life].

Conventional methods for seizure detection, such as electrocardiogram (ECG), often involve invasive procedures or require specialized equipment, limiting their widespread use. This has driven the exploration of alternative approaches, and Micro electro mechanical Systems (MEMS) technology has emerged as a promising candidate for non-invasive and user-friendly seizure detection devices.

II. LITERATURE SURVEY

A. Automatic Epileptic Tissue Localization through Spatial Pattern Clustering of High Frequency Activity

High-frequency activity (HFA) in intracranial electrocardiography (ECG) recordings has emerged as a promising diagnostic tool for intractable (stubborn) epilepsy. Its potential applications in clinical settings have been thoroughly investigated. HFA often exhibits distinct spatial configurations corresponding to specific states of neuronal activity, potentially enhancing the pinpointing of epileptic tissue. However, research on quantifying and differentiating these patterns remains limited. This paper introduces spatial pattern clustering of HFA (SPC-HFA), a novel approach addressing this gap.

B. Seizure Detection Using Novel Wrist-Worn Biosensor

Seizures are the main symptom of epilepsy. They occur due to abnormal electrical discharges in the brain. Epilepsy is a neurological disorder characterized by various seizure types. This paper proposes a novel wrist-worn biosensor to identify and monitor specifically generalized tonic-clonic seizures. Additionally, if the sensor detects unusual movements or other seizure effects, it will transmit the patient's vital signs along with an alert to their designated contacts.

C. Epileptic Seizure Detection using Micro Sensor

The proposed system addresses this need by offering a wearable monitoring device. It incorporates a MEMS accelerometer and associated electronic components. The core of the system is a microcontroller that continuously monitors the subject's activity. The accelerometer detects seizure-related movements, and the microcontroller verifies the presence of a convulsion before triggering an audiovisual alarm. This developed system, tested on various subjects, demonstrates its potential value in the field of neurology, benefiting both patients and caregivers.

D. IOT Based Epilepsy Monitoring using Accelerometer sensor

Seizures occur due to abnormal electrical activity in the brain, causing sudden behavioral changes. Seizure characteristics can vary depending on the affected brain region. This paper proposes a sensor-based approach for monitoring epileptic individuals. The sensors will assess various patient parameters, including temperature, falls, hand tremors, and sounds. Through an IoT platform, the patient's status will be accessible on a PC, allowing specialists and caregivers to remotely monitor their epilepsy on an ongoing basis.

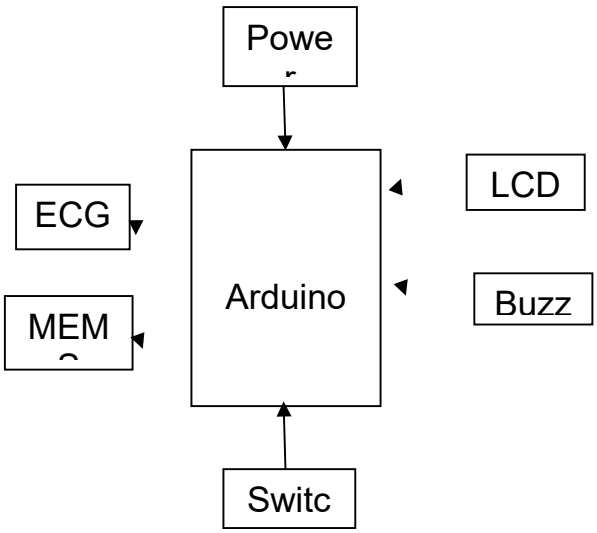
E. Fully-Automated Spike Detection and Dipole Analysis of Epileptic MEG Using Deep Learning

Magneto Encephalography (MEG) is a valuable tool for pinpointing the location of spikes occurring between seizures (interictal spikes) in clinical settings. Neurophysiologists visually identify these spikes from the MEG recordings and estimate the source of the electrical activity (equivalent current dipoles, ECDs). However, these analyses are currently performed manually by neurophysiologists, which is time-consuming and highly reliant on their individual expertise, leading to limited cost-effectiveness in clinical MEG examinations.

III. PROPOSED METHOD

1. In this system, we are using the, Temperature Sensor, Pulse Sensor, Thing Speak IoT platform, wifi Module, Power supply.An Smart patient health Monitoring System will not only help in maintaining health but also reducing the work of doctors and saving the time of patients.The proposed method of Epilepsy Detection using MEMS. After connecting internet to the Arduino Uno, it is connected to cloud database system which acts as a server. Then the server automatically sends data to the receiver system. Hence, it enables continuous monitoring of the patient’s health parameters by the doctor. Any abrupt increase or decrease in these parameter values can be detected at the earliest and hence necessary medications can be

implemented by the doctor immediately.To detect the epileptic in quick and high accuracy of the output and monitoring in continouosly.



A. *Micro electro mechanical system(MEMS)*

2. A MEMS (Micro-Electro Mechanical System) is a miniature machine that has both mechanical and electronic components. The physical dimension of a MEMS can range from several millimeters to less than one micrometer, a dimension many times smaller than the width of a human hair. The label MEMS is used to describe both a category of micro mechatronics devices and the processes used when manufacturing them. Some MEMS do not even have mechanical parts, yet they are classified as MEMS because they miniaturize structures used in conventional machinery, such as springs, channels, cavities, holes and membranes. Because some MEMS devices convert a measured mechanical signal into an electrical or optical signal, they may also be referred to as transducers. MEMS are composed of parts such as microsensors, microprocessors, microactuators, units for data processing and parts that can interact with exterior pieces.

B. *Global system for mobile communications(GSM)*

GSM stands for Global System for Mobile Communications. It is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for second-generation (2G) digital cellular networks used by mobile devices such as mobile phones and tablets. GSM is also a trade mark owned by the GSM Association. GSM was the first widely adopted global standard for mobile communications, and it is still used in many parts of the world today. It is a mature technology that is reliable and relatively inexpensive to deploy. However, it is also a slower technology than newer generation networks.

C. *ECG signals*

An electrocardiogram (ECG) is a test that records the electrical activity of your heart. It's a simple and painless procedure that can be used to diagnose a variety of heart conditions. ECG signals, short for electrocardiogram signals, are tiny electrical currents generated by the rhythmic contraction of the heart muscle. These electrical signals travel through the body and can be detected by electrodes placed on the skin. An electrocardiogram (ECG) is a recording of these electrical signals and is a valuable tool for diagnosing heart conditions.

IV. CONCLUSION

ECG-based seizure detection holds immense potential for improving epilepsy management. However, it's crucial to remember that it's still under development and not a foolproof solution. Further research and development are needed to address limitations like individual variability and false positives/negatives before widespread clinical adoption. Wearable devices with integrated ECG sensors are being explored for more convenient and real-time monitoring.

V. FUTURE EXTRACTION

Combining ECG with other physiological signals like heart rate variability (HRV), electromyography (EMG), or electro dermal activity (EDA) could provide a more comprehensive picture of brain-body responses leading to seizures. Integrating EEG data with Functional Magnetic Resonance Imaging (fMRI) or magneto encephalography (meg) could offer insights into the specific brain regions involved in seizure onset.

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