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AUTOMATIC SEIZURE DETECTION AND ALERT SYSTEM FOR EPILEPSY PATIENTS USING A SMART WEARABLE DEVICE

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ABSTRACT

The most typical epilepsy sign is seizures. Epilepsy is one of the most prevalent neurological disorders, affecting about 50 million people globally. Patients with epilepsy are continuously worried about accidents that could happen as a result of these seizures if someone else is not around to help. We suggest a prototype smart wearable device to address this issue and swiftly notify the patient's caretaker. The device is intended to track the patient's movements and pulse rate. For the purpose of determining whether the patient is having a seizure, the gadget includes an Atmega328 microcontroller, an accelerometer, a heart-rate sensor, a GPS module, and a GSM module. The device will notify a chosen helper of a seizure by calling them and sending a text message with the patient's location information. People who have epilepsy may feel safer and prevent harm with the aid of this device.

Keywords— Seizures, epilepsy, smart wearable device.

I. INTRODUCTION

Around 50 million individuals worldwide suffer from epilepsy, a chronic noncommunicable brain disease. It is characterised by recurrent seizures, which are brief bursts of uncontrollable movement that can affect just a small portion of the body (partial) or the entire body (generalized), and are occasionally followed by loss of consciousness and control. Generalized epilepsy, focal epilepsy, adolescent myoclonic epilepsy, absence epilepsy, and reflex epilepsy are just a few of the various forms of the condition. Depending on the type of seizure and where in the brain it happens, epilepsy symptoms can differ greatly. Temporary confusion, blank stares, stiff muscles, uncontrollable jerking movements of the arms and legs, and loss of consciousness or awareness are a few frequent symptoms

When someone experiences a seizure because of an accident and sustains a life-threatening injury, for example, epilepsy can end in death on its own. In the event that a severe, protracted seizure (status epilepticus) stops the brain from receiving enough oxygen, which results in heart and lung failure. Sudden unexpected death in epilepsy is the term used to describe a person with epilepsy (PWE) dying without being hurt, drowning, or another reason that is well-known. (SUDEP). PWEs worry about it constantly. Each 1000 epileptic patients has about 1.16 instances of SUDEP. The remaining 30% of epileptic patients have drug-resistant epilepsy, which can be treated with the right diagnosis and medicine to control their seizures in nearly 70% of cases. In these circumstances, they need surgery

Tonic-clonic seizures are the kind of seizures on which we are concentrating and attempting to assist the patients. Grand mal seizures are another name for tonic-clonic seizures. They exhibit both rigidity and jerking movements. When you have a generalised tonic-clonic seizure, both parts of your brain stop working properly. It is the seizure variety that is most frequently linked to both metabolic imbalances and epilepsy as well as seizures generally. Auras, which can be basic or complex partial seizures, can precede a seizure. When the tonic-clonic seizure starts, the person may feel tonic

activity, lose consciousness, and possibly fall. During this stage, there are severe tonic contractions followed by clonic activity. The patient as a consequence passes out and moves their body unintentionally. If no one was nearby, the patient could sustain severe injuries.
We are proposing a system that uses a wearable prototype device to monitor the patient's heart rate and movement pattern to determine and send alerts to the helper to come to the patient's aid. This is accomplished by using a GSM module integrated in the device that sends alerts in the form of call and text message that contains the location details of the patient and the location details of the helper. The patient can be contacted for assistance using this information by the carer.

II. LITERATURE SURVEY

Mohammad Khubed Siddiqui et al. Machine learning classifiers technique is used. They found that Machine learning classifiers are able to classify the EEG data and detect seizures along with revealing relevant sensible patterns without compromising performance. [1]
Paul Brain et al. State-of-the-art technique is used. They found that is to help the researchers to get familiar with state-of-the-art techniques for seizure detection and give them the valid research directions in the field of seizure detection. Various methods from various domains used to process long-term and short-term EEG signals are discussed.[2]
Baumgartner et al. Biomedical sensor and server transmitter network is used. They found that proposed system is to develop the real-time monitoring and alert system to help epilepsy affected persons in their day-to-day activities in life.[3]
Sanjay Sareen et al. Wireless sensor network (WSN) technology is used. They found that it integrates wireless body sensor network, mobile phone, cloud computing, and Internet technology to predict the seizure in real time irrespective of the patient’s geographic location. The objective in sending an alert message to users’ mobile phones is to encourage them to take precautionary measures to protect themselves from injuries. [4]
Acharya et al. SVM classifier is used. They found that to use DTWT (Dual Tree Wavelet Transform) instead of DWT (Discrete Wavelet Transform) for Feature Extraction. will have achieved sensitivity, specificity and classification accuracy which will be in the range90%, respectively. [5]
Lokhande et al. Automated detection algorithm is used. They found that it is to monitor and analyze the Epilepsy attack and also track the progress of patient with in a given period of time.[6]
Ramgopal et al. Brain-Computer Interface (BCI) technology is used. They found that proposed system is that the brain function of person will same at ever. It could vary only at the time of any disease attack in the neural system. Hence the false identification can be easily reduced. [7]
Birjandtalab et al. Deep learning technique is used. They found that it supports this fact that the proposed deep neural network provides better classification accuracy (F-measure more than 95%) and is able to effectively classify seizure and non-seizure data as separable groups. [8]

III. THE PROPOSED METHODOLOGY

This project's main objective is to keep an eye on patients' vital signs and movement in order to quickly respond to crises. The initiative works in the following ways: By alerting the appropriate helpers when a seizure starts, the gadget is made to assist people who experience seizures. It has a number of parts that all function together to accomplish this. Sensing devices are the first part. The patient's movement is tracked by the accelerometer, and the patient's pulse rate is measured by the heart rate sensor. The gadget can identify whether a seizure is happening by examining this data.
The ATmega328 MCU, which is in charge of directing the device's different parts, processes this data. The apparatus triggers the GPS module to locate the patient if a seizure is discovered. The

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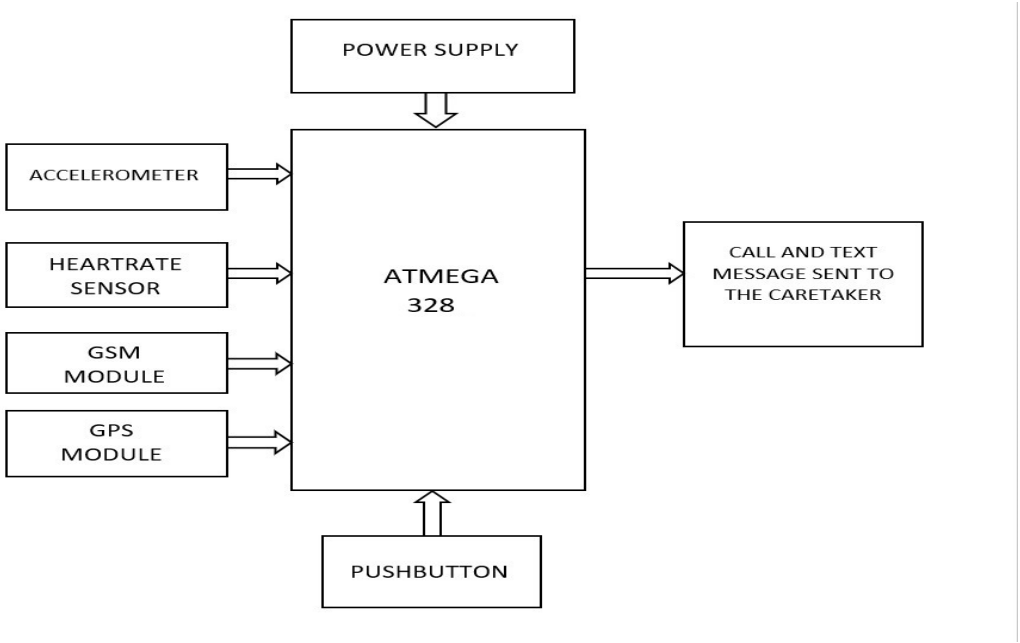
GSM module, the following element, uses this data to contact a chosen helper and transmit a text message in case of emergency. The location of the patient and the fact that a seizure is happening are both mentioned in the text message.
The device has a button that can be pushed by the patient's emergency button in addition to the seizure detection mechanism. The emergency call and text message are instantly sent to the designated helper when this button is pressed, skipping the seizure detection procedure.

BLOCK DIAGRAM



The project's primary goal is to assist the patient in the event of a seizure by notifying their carers of the situation if anyone is nearby or if the patient has left the house alone.
After being connected to a power source, the device begins to detect the patient's heart rate and shaking pattern. The device recognizes when a patient is having a seizure whenever the heart rate of the patient exceeds that of the patient's normal heart rate and if the patient exhibits the shaking pattern of a seizure. It then transmits alerts to the carer in the form of a message or call right away.

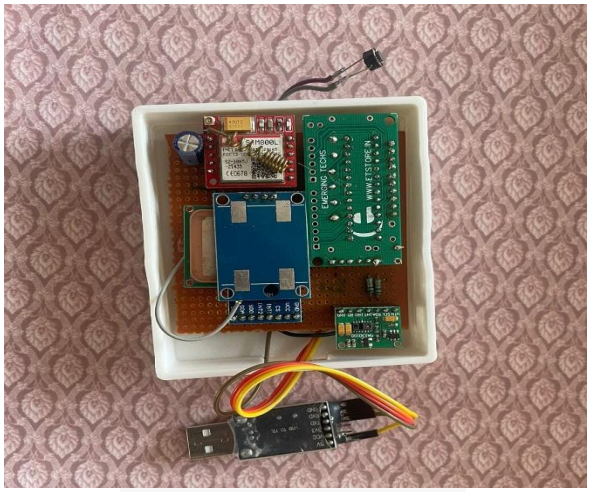


Fig 1. Model of the project

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The patient can also use a push button to send alerts to the carer without going through the detection procedure when he senses the need to do so just before a seizure starts. The images below represent warnings that the device sent to a contact number specified in the algorithm. When the network signal is strong, the warnings are delivered to the carer in few seconds.

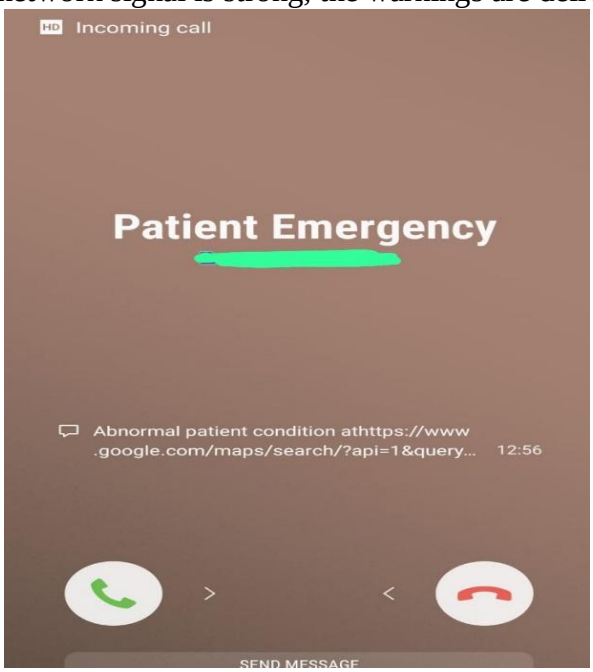
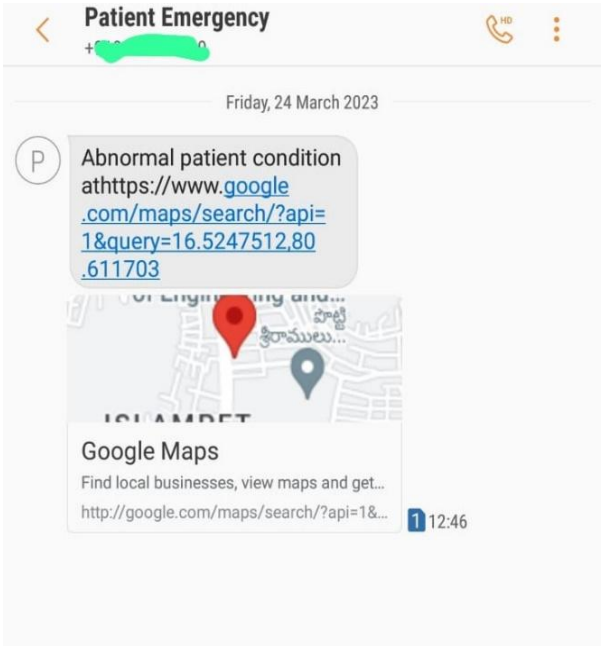


Fig 2. Phone call sent to the caretaker



g 3. Location of patient sent to a specified contact

IV. CONCLUSION

In conclusion, many elderly individuals as well as those who experience recurrent seizures can benefit from this device. The alerting system assists patients in notifying their caretakers and preventing accidents or injuries brought on by seizures. If the patient is left unattended, it may result in severe injuries or even death in some circumstances. By giving patients and their families timely information about the patient's state, this wearable prototype has the potential to significantly enhance the quality of life for people with epilepsy and their families.

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