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IoT BASED EPILEPSY MONITORING SYSTEM

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Abstract-Epilepsy is a neurological condition characterized by aberrant electrical activity in the brain that results in seizures. Seizures are unpredictable; the length of time between seizures, as well as the symptoms, differ from one patient to the next. Because seizures are unpredictable, and most epileptic patients experience physically dangerous symptoms during them, they are unable to do daily tasks. The goal of this project is to create and install a monitoring system for epileptic patients that will continuously check vital signs, evaluate measurements, and determine whether or not the patient is on the verge of having a seizure. The system sounds an alarm whenever a seizure is predicted. A notification should also be made to the health care provider in charge, as well as one recommended contact. People with epilepsy will have a better chance to work and live a normal life if the monitoring system is implemented. As a result, this article explains the whole system and demonstrates the outcomes of the three systems that have been implemented: EEG,Heart rate sensor, and a Fall Detection System. This system have been developed in the aim of assisting the doctors to identify the type of seizure with better accuracy.

Keywords: Epilepsy ,EEG , Blood pressure senor, Accelerometer , Fall Detection

I. INTRODUCTION

Healthcare is an unavoidable aspect of life. The term "health care" refers to the process of preserving and improving one's health by preventing and diagnosing diseases. CT, MRI, PET and other diagnostic instruments may be utilised to detect any ruptures or irregularities deep beneath the skin. Certain atypical illnesses, such as heart attacks and seizures, can be detected in advance. The unpredictable spread of chronic illness among the general public, along with rapid population expansion, has put a strain on current health-care systems, resulting in a high demand for everything from hospital beds to doctors. Monitoring and managing epileptic seizures is difficult. Despite the increase in anti-epileptic medications, most recent investigations of epileptic seizure detection reveal that drug-resistant epilepsy still lacks an ultimate cure. Epilepsy is a group of syndromes that share the symptom of recurrent seizures. It can be linked to a hereditary aetiology in some cases, or it can occur in conjunction with metabolic diseases, anatomical abnormalities, infection, or brain injury in others. Seizures are the worst because of their total intricacy, in addition to their unpredictability. The complexity of epilepsy is evident in the wide range of seizures and symptoms experienced by one patient to the next. It's tough to care and monitor an epilepsy patient if they can't be distinguished or classified. Seizures that are uncontrolled have a significant influence on the individual's family, friends, and society. People with epilepsy suffer from chronic anxiety, and many lives are altered to secure the safety of their loved ones. Novel epilepsy treatment techniques are still desperately needed. Seizures can be managed more effectively with new therapies that better manage and monitor seizures, as well as technology. Epilepsy is a fairly prevalent illness, and lack of awareness about it has a significant and harmful influence on persons with epilepsy, their families and communities, as well as healthcare institutions. To allow for new techniques to monitoring the condition, a greater understanding of the disease is required. In today's world of personalized medicine and rapid IoT breakthroughs, one question that has to be answered is whether epilepsy monitoring may benefit from a personalized strategy. The Internet of Things has the potential to greatly enhance the lives of 'patients' whose seizures are uncontrollable by medication or surgery. Much of this recent expansion can be attributed to the introduction of contemporary IoT technology, which has resulted in the rise of "smart environment" methods to healthcare monitoring. For monitoring, there are numerous IoT solutions. Many of these include a network of connected smart devices

with sensors embedded in clothing or smart phones to detect, forecast, or manage epilepsy. The findings reveal how the Internet of Things (IoT) is being used to assist the ever-growing trend of individualized healthcare. The trend toward "sensor utilization" and "remote monitoring" is seen in several contemporary "smart" initiatives in healthcare. In this paper we proposed an epileptic alarm system that uses the raw EEG output, blood pressure monitoring, and an accelerometer to detect human falls and not only notify people but also help in diagnosing the patient condition.

II. LITERATURE SURVEY

Electroencephalography (EEG) has traditionally been used to identify and diagnose epileptic episodes in patients. It is possible to detect epileptic seizures by evaluating the information on the recorded brain activity of the EEG signals.These operations, on the other hand, are lengthy and difficult, and are usually performed in a clinical setting. Today, some firms have developed commercial tools with the goal of monitoring epilepsy patients and notifying their families and caregivers before a convulsion occurs. The Smartwatch Embrace developed by scientists at the Massachusetts Institute of Technology (MIT), provides for the monitoring of factors such as psychological stress state and EDA measurement in the patient, as well as notification to the patient's family and caregivers' smartphones. Bioalert is a mobile application for the Android Wear wearable family that uses accelerometers to detect crises and provides a sound alert and notice if abnormal movements are observed. Emfit is a bedside monitoring system that detects patient movements while they are sleeping. Two sensors are installed beneath the mattress in the gadget. Other businesses, such as Bio serenity, have developed a vest and cap with EDA, EEG, and EMG sensors for patient diagnosis and monitoring, providing a more complex solution for the investigation of epileptic crises in patients in a controlled medical environment. Epileptic seizures are known to cause the patient to make a series of involuntary repetitive and com- pulsive movements. Many initiatives have been presented focused on the development of practical solutions for the analysis of motions based on Accelerometer to identify epileptic seizures, thanks to the advancement of wearable sensors and protocols such as Wireless Body Area Networks (WBAN). The biggest issue, however, is distinguishing convulsions from recurrent daily activities that the patient engages in in various circumstances.

III.PROPOSED METHODOLOGY

Epilepsy detection is a time-consuming process that necessitates continual clinical care. To avoid this, we created an epilepsy alarm system that uses the raw EEG signal, blood pressure monitoring, and an accelerometer app to detect human falls. The design is carried out with the help of the MATLAB GUI.

There are three parts to this epilepsy alarm system:

1.Seizures can be detected with a wearable EEG device (with battery and bluetooth) that detects sudden changes in the EEG.

2.To detect rapid changes in blood pressure and pulse, a wearable bp and pulse gadget (with battery and bluetooth) is used along with heartbeat sensor.

3.A typical smart phone with an accelerometer and GPS to detect a sudden drop of the phone and the person holding it.

4.Application that receives alerts from all three devices and sends out a text message. The care tracker must receive an SMS with the patient's location.

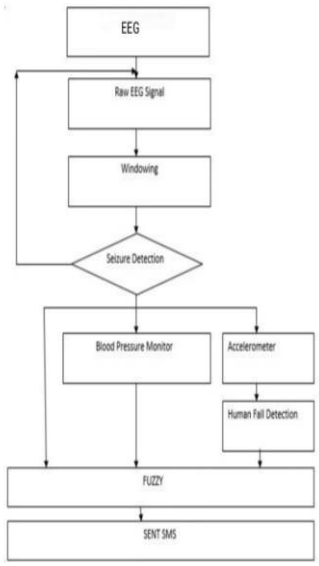

Figure 1: Framework

The volunteer, who had seizures on the dominant right side of the body, simulated a shaking from the right arm at the recorded time of 08.38 p.m. is shown below using Thing speak cloud.

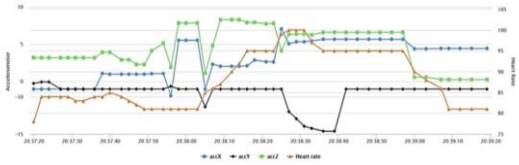

Figure 2: Observation

On the right wrist, the sensor-based gadget was worn. The heart rate jumped to its maximum peak at 100 in the three measurements on axes X, Y, and Z, indicating abrupt movement. The heart rate was higher before the seizure, ranging from 78 to 81, but it dropped to 80 following the episode. This meant the sensors had accurately recognised the fake seizure. In this research, complicated system behaviors are represented using logic rules and then implemented in a fuzzy inference system utilizing fuzzy designer. Epilepsy. Patients will be monitored around the clock with this equipment. Any irregularities will send the doctor alert messages. To improve accuracy, four primary parameters are used to confirm epilepsy: EEG (brain waves), heart rate, blood pressure, and fall detection.

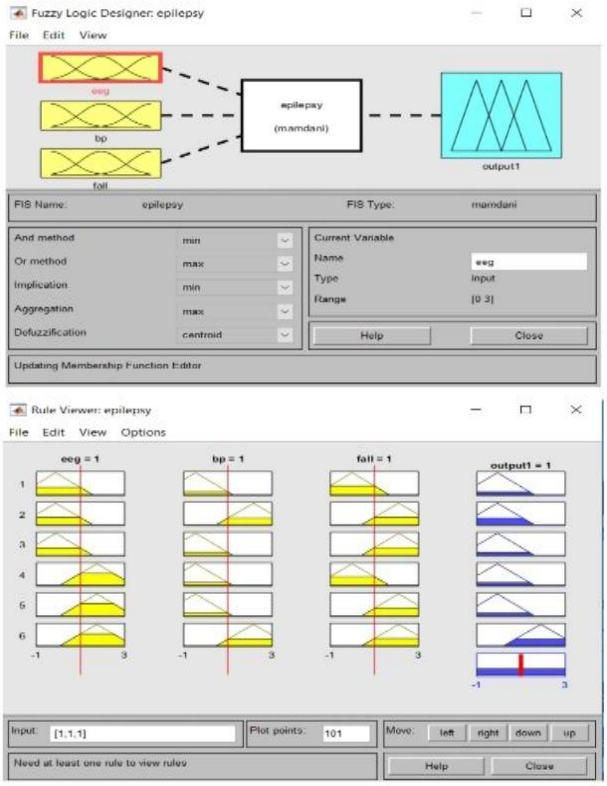

Figure 3: Result

A fuzzification unit allows for the use of a variety of fuzzification algorithms and turns crisp data into fuzzy data. When crisp information is converted to fuzzy input, a knowledge base - a collection of rule bases and databases - is created. The fuzzy input is finally turned into crisp output by the defuzzification unit. FIS takes crisp input data, fuzzifies it, utilizes fuzzy on-premise operators (antecedent), implements inferences from the premise for output (sequence), and combines the findings from fuzzy rules to create a fuzzy inference, which it then defuzzes to produce crisp conclusion. The membership functions are built after the inputs are defined, providing them ranges. To utilise in fuzzification and defuzzification, membership functions are created. They convert non-fuzzy inputs into fuzzy values, which are inferred using the rule basis as shown in figure 3.

IV.CONCLUSION

Long-term remote monitoring is possible thanks to the sensors and procedures utilized in the experiment. The use of a sensor-based gadget like the one used in the study could cut down on hospital visits and help with epilepsy care on a daily basis. As a result of these sensing techniques, results in the measuring of particular epileptic seizures based on observations have been produced. One of the cornerstones of epilepsy monitoring, as demonstrated by these research, is early identification combined with known patient features. Epilepsy patients will be monitored 24 hours a day, seven days a week with this equipment. Any deviations will trigger alert messages to the doctor. To have better accuracy, epilepsy is validated by four key parameters: EEG (Brain waves), Heart rate, Blood pressure, and Fall detection which assist the doctors to identify the type of seizure.

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