Mobile treatment for epileptic seizures using little scale electronic sensors

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Abstract

Epilepsy-Abnormal behaviors (neuro disorder) of a patient. The epileptic seizure patient need an ongoing frame work. It must support in acute cases. The brilliant epilepsy recognition and ready framework is a propelled innovation by which an electronic device is introduced. Utilizing that pack, the life of the individual who is truly affecting with the condition can be anticipated. As per World Health Organization (WHO), epilepsy is a standout amongst the most well-known essential sicknesses of the focal sensory system around the world [1], which is exasperated by the sudden variable that portrays the event of an epileptic occasion. In this manner, the capacity to recognize scene preceding its beginning is introduced as a relief variable to the upsetting effects that emerge from this situation [2]. The casing will be tolerable, confirms the condition and also alerts by a SMS to the the specialist in question for the life of the patient. To realize all the above plan, mainly utilized four modules: scaled down scale controller, KEIL module, ARDUINO module and GSM module.

Keywords: Epileptic Seizure; GSM; ARDUINO.

1. Introduction

This paper proposes to give a framework to the impression of epileptic seizures to shield patients from seizures. It additionally recommends to singular authorities about the patient's condition. The electronic structure described here is a portable gadget that predicts the epilepsy occasion right away. The gadget utilizes the indications or symptoms of the human body to perceive the occasion of epilepsy. At the point when the device recognizes the symptoms, it transmits a coded flag. The flag is then arranged utilizing the correspondence control instrument.

2. Literature survey

Current innovations for securing signals from the patient's body are especially created. Numerous sensors are accessible which can recognize the heart beat and strong developments non-intrusively and precisely [5]. Such non obtrusive strategy for measuring heart beat is heartbeat oximetry. Utilizing this strategy, heart beat can be precisely observed. Solid writhings are gathered utilizing small scale electromechanical sensors (MEMS) immovably connected to the body. The sensors utilized are little in size and can be solidly joined to the body. The increasing speeds coming about because of epileptic shakings are detected utilizing MEMS accelerometer which is exceptionally exact, exact and little in size.

Any sudden variety in heart beat which is brought about by the onset of epileptic seizures is distinguished and affirmed with the MEMS flag [3]. At the point when the seizure is affirmed, message is transmitted to the surroundings for starting essential defensive measures for the patient. The device is portrayed as a remote, compact, and individual PC. The device can distinguish the radiation of the parietal stage in no level time advance and takes the essential safety efforts normally. Along these lines the assistance of an expert isn't vital for the patient. Subsequently, this device is unimaginably helpful for the patient (especially adolescents) who wishes to be dynamic in their life. The client gets the preeminent chance of the links and can be utilized progressing. In every way that really matters the epilepsy expectation system runs, the going with viewpoints should be refreshed. Biometric Signal Detection: Two sorts of regular signs are required for readiness. They are the pulse and solid shaking. The pulse can be figured utilizing the pulse oximeter and solid advancements can be figured utilizing the MEMS sensor. Readiness and basic leadership: The handling of signs is finished by changing the programme in a lesser scale controller. The item is made in a way that distinguishes the right sign of epilepsy.

3. Proposed architecture

The configuration comprises of equipment and programming segments. The gadget equipment primarily comprise of three sections specifically, (A) Heart beat sensor (B) Seizure detector (C) Processor (D) GSM module.

3.1. Heart beat sensor

The pulse of the serene ought to be precisely observed. Therefore, an oxygen meter of the pulse is utilized. Pulse oximeter measures the pulse by recognizing the diversity in the absorbance of IR by blood amidstystolic & diastolic heart works out. The level of blood moving through the veins more often than not varies amidstystolic & diastolic heart works out.
The pulse oximeter composite here keeps on utilizing intellectual supervision. The IR hub transmits the IR radiation reflected by the circulation system. Beams are known utilize a photograph discoverer. A sensor is put in a thin piece of the patient's life frameworks, for the majority a finger or ligament of the ear, and light from the infrared λ moves toward becoming scene in the body. Infrared moving absorbance is measured, permitting the wellbeing of absorbance as of the blood of the veins alone, barring venous blood, skin, bone, muscle, fat and (when in doubt) nail cleaning. The pulse oxygen meter circuit includes a trans protection, voltage stick, differentiate amplifier, and channel enhancer. Each of these stages fall together from the whole heartbeat oximercircuit. The circuit works with a 5 V supply. With a particular last goal to get a faultless heightening without noise, the OP07 operational intensifier and the FET LF 356N operational information enhancer are picked.

A trans-resistor speaker is utilize as a major aspect of the fundamental stage to switch over the photo diode current to the voltage. The critical preparation of the sensor is its execution voltage & execution repeat. The execution repeat is band inhibited to 15 Hz utilize channels. The acknowledgment channel of the primary low-pass ask for is utilized. The lowpass channel is given at 15 Hz of upper repeat cut with a gathering of 1.5. A highpass 1st-pass ask for channel with a lower repeat cut-off of 0.5 Hz is diminished with the low will oust the DC voltage. An intensifier changes with meter execution with a particular last focus to raise the execution marker level to + 5V. Reinforcer with escalating component of 50 is depicted. The typical execution of the sensor is appeared in the table underneath. The common pulse is 72 beats per minute. That is the repeat of the flag is 1.2 Hz for a strong human. The execution amleness changes from 70mV to 120mV.

**3.2. Seizure finder**

Seizures are solid programmed advancements that happen amidst epilepsy. Strong improvements are distinguished utilizing the MEMS accelerometer (scaled down electromechanical sensor). The sensor is a scaled down scale-machined structure of polyeth-ylene silicon surface in view of the highest point of a silicon wafer. The silicon polyester springs swing the structure on the surface of the wafer. It gives a security over the forces of addition of the speed. Redirection of the formation is measured by capacitor that includes free settled plates related with the stirring mass. The established plates are ambitious by 180° out of arrange square waves. Extending speed divert the segment and unbalances the differential capacitor, accomplishing a yield square wave whose plentiness is concerning restoring. Organize fragile demodulation systems are used to reconsider the flag and pick the course of the accelerating.

**3.3. Processor**

The signals to sensors are generated by micro-controller (MC) PIC18F4620. The MC requires a 10-bit Analog to Digital Converter and a comparator circuit to deal with the signals from the sensor. PIC18F4620 joins work in Analog to Digital converter &comparator. The processor is customized at 4 MegaHz. The average heart mood repeat is about 1.4 Hz. On the other hand the day and age of the heart beat hail is 0.84 seconds. The count perceives the abrupt lessening in the size of the pulse which is one of the demeans of epilepsy. At the point when the assortments are perceived in the pulse, the count verifies the execution of the factory seizure waveform from the MEMS sensor. Right now these signs harmonize, the item takes the resolution as an epileptic fit and make control signals.

**3.4. GSM Module**

GSM /GPRS (TTL–Modem is SIM900 Quad-band GSM/GPRS contraption.)
The modem is portrayed with 3V3 and 5VDC-TTL interconnect gear, giving the client an immediate interface with the 5V microcontrollers (PIC, AVR, Arduino, 8051, and so on.) and the 3V3 microcontrollers (ARM, ARM Cortex XX, and so forth). The baud rate can be designed from 9600-115200 bps by means of AT (Attention). This TTL GSM/GPRS modem has inside the TCP/IP stack to draw in the client to interface with web by means of GPRS featured. It is sane for SMS and what’s more DATA move application in PDA to wireless interface. The modem interfaced with a MC utilizing USART.

4. Design implementation

The taking care of unit utilizes the method of reasoning carry out in the item for correct disclosure of seizures. Item check the data from the Pulse oxymeter from the patient’s body reliably and figures the pulse width of the banner. This width is changed over into heartbeat rate by the item. If there are any varieties from the standard in heart beat, it will be distinguished as an alteration in the beat width. As soon as the reason perceives a change it triggers the vibrator and the system sits tight for the response. The patient requires to press a catch on his wearable unit. If the patient can’t do that in capacity as a result of occasion of seizure, then response movement at MEMS sensor, it distinguishes the solid twist is gotten and separated.

On the off chance that there are indications of solid shocks the item presumes that the patient has seizures and strong cautioning is transmitted using the transmitter. The figuring of the area of the seizure from the MEMS signs is to perceive just the solid anomaly that happens in the body. The system keeps up a key separation from the conditions in which the heart rate increases because of the vast majority of the physical work or due to pressure and etc. The figuring utilizes the normal technique to choose the varieties of the standard with exactness. $R = \frac{(H + NH)}{2}$ where $H = $ past heart rate $\; NH= \; $ next heart rate. For a man who encounters epilepsy, in the introduction he organizes the pulse all of a sudden vacillates and in this manner the gauge of $R$ changes further. This modification in the estimation of $R$ is recognized and the agenda is made to fix tight for the banner from the 2nd sensor, it identifies the strong shakings. If solid shakings are perceived from the second sensor, it trigger the Tron which transmits a coded hail which is gotten by the beneficiary. The item fragment contains the going with major helpful modules:

1) Heart pulse rate estimations
2) Seizure detection from MEMS
3) Communication control
4) Overall supervision

This casing comprises of a heart rate sensor, amuscle convolution-sensor, a transmitter, a beneficiary, a convenient data gadget, an alert gadget and a modified vehicle control outline. All these parts are coordinated with a processor. The desire structure for epilepsy can be performed basically by combining the parts that go with.

![Fig. 6: Seizure Discovery and Rehabilitation Block Diagram.](image)

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**a)** Heart pulse sensor

A pulse oxymeter is utilized as a heart pulse sensor.

![Fig. 7: Pulse OXI Meter.](image)

**b)** Convolutions sensor

An accelerometer will be used as a twisting sensor. Strong seizures are distinguished utilizing a solitary MEMS ICMMMA1260EG center. The affectivity of the sensor is fixed as 1.55 g. This keeps running as appear in the circuit chart. The execution of the sensor is moved remotely during a low-pass RC channel. The gauge of $R$ is picked as 1KiloΩ and C as0.1μfarads.

**c)** Preparing unit

The unit fuses a comparator which is utilized to deal with the heart beat waveforms from the pulse oxymeter. The moving toward sign is readied using methods of reasoning executed in the item which runs the contraption. The get ready unit reliably checks for reactions in the moving toward sign. When it perceives a variety from the standard, will give a trigger a notice vibrator and the remote transmitter.

**d)** GSM module

It sends a SMS to the observer and the expert who can deal with the patient in the centers. The coding part for GSM module can be downloaded on the 8051 by KEIL programming.

**e)** Enclosure outline

The gadget is wearable (at the wrist). Thus the walled zone is made up to suit that requirement. The walled zone can be made up as a clock.

**f)** Sensor data Collection

The LEDs in MAX30100 are featured. The red LED is latent in the heart rate mode, and just the IR LED can be set. To suit that requirement. The walled zone can be made up as a clock.

![LEDs in MAX30100](image)

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**g)** Pulse oxymeter

A pulse oxymeter is utilized as a heart pulse sensor.

![Pulse Oxymeter](image)
5. Testing

The pulse oximeter was endeavored by harming the ancient rarity measure on a man’s pointer and the execution was seen in a DSO. Execution is appeared in the graph underneath.

The Pulse oxy meter viably recognized the heart-beat waveform from the patient’s pointer. The o/p repeat was 1.2Hz. Moreover, the voltage level is in the extent of 100-120mV.

The MEMS sensor is identified with the patient wearing straps. The conventional epileptic waveform shows up in the lower figure. The execution of the sensor depends on being the way it showed up as it takes a short time later. This stage has not yet been completely finished and the tests are continuous. Duties of the sensors were given to the PIC controller in which the thing was adjusted. Waveforms that portrayed unmistakable patient states were given as data and worked adequately.

A circulated single center point framework was encircled which advances the message to the recipient center. The structure formed here strategies the heart beat endlessly and varieties from the standard are perceived absolutely. The device Txs the banner exactly when seizures of epilepsy are distinguished. The execution of the gadget is not limited by headway of the patient. By utilizing this contraption the patient can move vivaciously without stresses.
6. Results

NI labview is used to interconnect the sensors and as the data yield lines during the Arduino board. By Lab view through the laptop, the results are shown about the condition of the patient at the period of getting influenced with the seizures and heartstrokes. Likewise, to run the framework when the individual finds the circumstance, at that point you can see the condition amid the MEMS and ECG screens gave on the screen of the tablet in the research center see module.

![Fig. 15: Lab VIEW Circuit Diagram.](image)

![Fig. 16: Epilepsy Kit with the Arduino and GSM Module.](image)

![Fig. 17: Labview Results.](image)

The sensor detects the patient finger & records the blood circulatory strain. Utilizing seizure pioneer computation, it verifies for variety from the standard in blood circulatory strain. On the off chance that found, at that point sees than the normal sensor data. It is there any peculiarity then it sees that the patient will get seizure, in like conduct uses the prepared edge work.

7. Conclusion

Pragmatic wearable and a light weight contraption is delivered, it will help a considerable number of losses of epilepsy worldwide. With the contraption carefully guarded an epilepsy setback can move around uninhibitedly like normal people sans stresses. The framework is effectively expandable to consolidate GPS framework and to catch and transmit different patient parameters like ECG, body temperature and so on. We can additionally broaden the venture when the patient in driving in the movement puts then we can incorporate the GPS framework to follow the correct area of the patient and make the essential move.

References


