# SEIZURE ALERT SYSTEM

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***Abstract*—**
**Epileptic seizure is caused by irregular patient cerebral cortex neuron synchronisation, usually detected by electroence phalograph (EEG) signals.**
**Electro-encephalography is the only effective tool for confirming epileptic seizures.**
**But for 24/7 surveillance, it is presently impractical.**
**Therefore, manufacturers of wearable systems rely mainly on indirect methods of seizure detection.**
**In this paper we will see how to design an alert system using Arduino for the detection of generalized seizures in patients and helps in monitoring them and to alert the physicians about it so that they could monitor the patients effectively. These days many people try to use the Arduino because it makes things easier due to the simplified version of C++ and the already made Arduino microcontroller.**

***Keywords—Alert system, Arduino, seizures.***

## I. INTRODUCTION

The epilepsy is a disorder of human brain by which around 1-2% of the world's population suffers [1]. The epileptic seizure is characterized by recurrent electrical discharge of the neurons of cerebral cortex. The portable EEG recording system is commonly used for monitoring of outpatients [2]. In most patients, seizures occur suddenly, without external, previously detected, pre- cipitants. A system able to predict seizures would allow some preventive measures to keep the risk of seizure to a minimum. These measures could improve the quality of life of patients with epilepsy. It has been shown that the ambulatory EEG recording system incorporates more useful diagnostic information and it is more convenient and less expensive for inpatient monitoring [3] . Most patients can become seizure free with appropriate medication. Nevertheless, in about 30% of patients with epilepsy none of the standard therapy options can control their seizures [4]. These patients are said to suffer from refractory epilepsy. Although the research works on predicting epileptic seizures have been carried out since 1970s [5], there are still no highly reliable and practical methods available to predict impending seizures in patients with epilepsy. That is why the development and improvement of seizure detection approaches is crucial [6]. Detection is especially important for those who are refractory to treatment and who experience particularly dangerous seizures.

## II. EPILEPTIC SEIZURE DETECTION APPROCHES

Epileptic seizures are defined as paroxysmal events which represent a clinical manifestation of abnormal discharges of a set of brain neurons. Thus, electro-encephalography (EEG) is the gold standard for epileptic seizures detection [7]. However, the method is uncomfortable for patients as electrodes are attached to the scalp. Furthermore, EEG analysis is labour-intensive and has yet to be automated and adapted for real-time monitoring. It is therefore usually performed in a hospital setting in epilepsy monitoring units (EMUs), for a few days at the most, and generally used to confirm the diagnosis of epilepsy, determine its type, distinguish between psychogenic non-epileptic seizures and epileptic seizures [6]. Epileptic episode may manifest itself as a sudden autonomic neural system dysfunction (alterations in cardiac, respiratory or electrodermal activity), vocalizations, and also changes in sensation, state of consciousness or motor behaviour. Presence of these signs and symptoms allow the use of indirect seizure detection methods: audio recording, electro-oculography, electromyography, electrodermal activity measuring etc. [6]. In about 60% of patient's epilepsy spells clinically manifest as involuntary muscles contractions [4], which are called motor seizures. They can be detected by human physical activity recognition methods.

## III. ARDUINO

Arduino is an open source microcontroller which can be easily programmed, erased and reprogrammed at any instant of time. Introduced in 2005 the Arduino platform was designed to provide an inexpensive and easy way for hobbyists, students and professionals to create devices that interact with their environment using sensors and actuators. Based on simple microcontroller boards, it is an open source computing platform that is used for constructing and programming electronic devices. It is also capable of acting as a mini computer just like other microcontrollers by taking inputs and controlling the outputs for a variety of electronics devices [8].

Main advantages of Arduino are fast processing and easy interface. Today, with increasing number of people using open source software and hardware devices day after day, technology is forming a new dimension by making

complicated things look easier and interesting. These open sources provide free or virtually low costs, highly reliable and affordable technology [8].

### A. *Need for Arduino*

- Active User Community: A group of people using a similar product can hold posted message conversations and share their experiences or solve the problems of the other users in the communities with their own experiences.
- Inexpensive Hardware: Since Arduino is an open source platform the software is not purchased and only the cost of buying the board or its parts is incurred, thus making it very cheap. The hardware designs are also available online for free from its official website.
- Multi-platform Environment: The Arduino IDE is capable of running on a number of platforms including Microsoft, Linux and Mac OS X making the user community even larger.

### B. *Programming basics*

There are two main parts every sketch will always have, they are: void setup () and void loop ()

- void setup (): This is the first routine that begins when the Arduino starts functioning. This function is executed only once throughout the entire program functioning. The setup function contains the initialization of every pin we intend use in our project for input or output [8].
- void loop (): This function is the next important function in the Sketch. It consists of that part of the code that needs to be continuously executed unlike the part of the code written in the setup function [8].

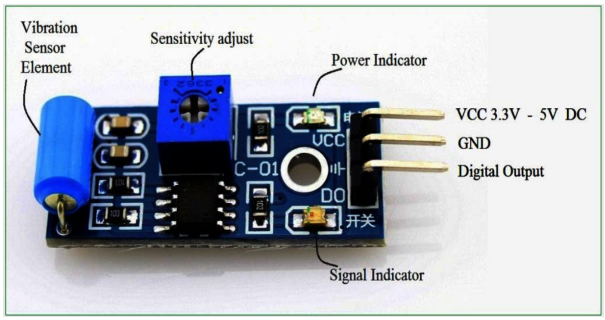
## IV. ARDUINO BOARD

The Arduino platform [9] has become well acquainted with people into electronics. Unlike most previous programmable circuit boards [10], the Arduino does not have a separate piece of hardware in order to load new code onto the board, you can simply use a USB cable to upload, and the software of the Arduino uses a simplified version of C++ [11], making it easier to learn to program, and it provides you with an easier environment that bypass the functions of the micro-controller [12] into a more accessible package. An Arduino Board [10] can be classified into two parts:

I) Hardware: The Arduino board [10] hardware consists of many components that combine to make it work, but we are going to discuss the main component on the board such as follows:
• USB Plug: This is the first part of the Arduino because it is used to upload a programme to the microcontroller [12] and has a regulated power of 5volts which also power the Arduino board.
• External Power Supply: This is only used to power the board and has a regulated voltage of 9 to 12 volts, mostly if the USB plug does not provide sufficient power for whatever you have programmed it to do.
• Reset button: This button resets the Arduino when it when its pressed in case you have uploaded another command and want the Arduino to do it.
• Microcontroller: This is the device that receive and send information or command to the respective circuit.
• Analog Pins(O-5): This are analog input pins from AO to A5.
• Digital I/O Pins: This are the digital input, output Pins 2 tol3.
• In-Circuit Programmer: This is another source to upload or programme your programme, it can also be done using “TX-l, I" output and "RX-l, O" input.
• Digital and analog Ground pins
• Power Pins: we have 3.3 and 5-volts power pins etc.

Software (The Arduino IDE [13]): The software is a set of instructions that informs the hardware of what to do and how to do it. The Arduino IDE (Integrated Development Environment) is divided into three main parts:
a) Cournand Area: This is the area where you have the menu items such as File, Edit, Sketch, Tools, Help and Icons like Verify Icon for verification, Upload Icon for uploading your programme, New, Open, Save and Serial Monitor used for sending and receiving of data between the Arduino and the IDE.
b) Text Area: This is where you write your code which uses a simplified version of C++ programming language that makes it easier to write your programme, which is also called a sketch. When writing your code there are mainly two important parts:
• The setup function: Before the setup you need to initialize the variables, you intend to use and assign them. Then the setup routine begins, this is where you set the initial condition of your variables and run preliminary code only once.
• Loop routine: This is the loop that runs or execute your main code over and over again.
c) Message Window Area: This shows message from the IDE in the black area, mostly on verification on your code.

## V. VIBRATION SENSOR




Vibration Sensor Module comes with SW-420 vibration sensor, integrated with adjustable sensitivity via on board potentiometer. There are also LED indicators for power and the digital output status on board. It has a simple and

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straight forward 3-pin interface, VCC, GND and the DO (digital output). It supports 3.3V or 5V power.

This vibration sensor module is compatible with any microcontroller that has a digital input, so of course any popular microcontroller such and PIC, Arduino and Raspberry Pi are compatible. A direct interface is essential to using this sensor.

The DO pin will be LOW when there is no vibration, and indicator LED will be lit up.

*Module features:*

- SW-420 using the company's production of normally closed type vibration sensor.
- The comparator output, the signal is clean, the waveform, the driving ability to exceed 15mA
- Operating voltage 3.3V-5V
- The output in the form: Digital switching outputs (0 and 1)
- A fixed bolt hole for easy installation
- Small board PCB size: 3.2cm x 1.4cm
- Wide voltage LM393 comparator

*Uses:*

This Vibration Sensor can be used to detect vibration from any angle. There is an on-board potentiometer to adjust the threshold of vibration. It outputs logic HIGH when this module not triggered while logic Low when triggered.

## VI. Temperature and pressure sensor

This precision sensor from Bosch is the best low-cost sensing solution for measuring barometric pressure and temperature. Because pressure changes with altitude you can also use it as an altimeter! The sensor is soldered onto a PCB with a 3.3V regulator, I2C level shifter and pull-up resistors on the I2C pins. The BMP180 is the next-generation of sensors from Bosch, and replaces the BMP085. The good news is that it is completely identical to the BMP085 in terms of firmware/software - you can use our BMP085 tutorial and any example code/libraries as a drop-in replacement. The XCLR pin is not physically present on the BMP180 so if you need to know that data is ready you will need to query the I2C bus.

This board is 5V compliant - a 3.3V regulator and a i2c level shifter circuit is included so you can use this sensor safely with 5V logic and power.

Using the sensor is easy. For example, if you're using an Arduino, simply connect the VIN pin to the 5V voltage pin, GND to ground, SCL to I2C Clock (Analog 5) and SDA to I2C Data (Analog 4). Then download our BMP085/BMP180 Arduino library and example code for temperature, pressure and altitude calculation.

*TECHNICAL DETAILS:*

- Vin: 3 to 5VDC
- Logic: 3 to 5V compliant
- Pressure sensing range: 300-1100 hPa (9000m to -500m above sea level)
- Up to 0.03hPa / 0.25m resolution
- -40 to +85°C operational range, +-2°C temperature accuracy
- This board/chip uses I2C 7-bit address 0x77.

## VII. Buzzer

Buzzers can be found in alarm devices, computers, timers and confirmation of user input such as a mouse click or keystroke.

*Module features:*

Operating voltage: 3.3V~5V
- VCC external 3.3V~5V voltage (can be directly connected to the 5V microcontroller and 3.3V microcontroller)
- GND external GND
- I / O external microcontroller IO port
- Great for sound
- Packing list:
- 1 x Buzzer alarm module
- 1 x 3-in-1 Dupont cable (20cm)


## Acknowledgment *(Heading 5)*

The preferred spelling of the word "acknowledgment" in America is without an "e" after the "g". Avoid the stilted expression "one of us (R. B. G.) thanks ...". Instead, try "R. B. G. thanks...". Put sponsor acknowledgments in the unnumbered footnote on the first page.


## References


[1] Mormann F, Andrzejak RG, Elger CE, Lehnertz K. Seizure prediction: the long and winding road. Brain. 2007; 130:314-33.

[2] Casson A, Yates D, Smith S, Duncan J, Rodriguez-Villegas E. Wearable electroencephalography. What is it, why is it needed, and what does it entail? IEEE Eng Med Biol. 2010; 29(3):44-56.

[3] WaterhouseE.Newhorizonsinambulatoryelectroencephalography. IEEE Eng Med Bio Mag. 2003;22(3):74-80.

[4] National Institute for Health and Care Excellence (NICE). The Epilepsies: the diagnosis and management of the epilepsies in adults and children in primary and secondary care. CG137.NICE: London, 2012.

[5] S.S. Viglione and G.O. Walsh, "Proceedings: Epileptic seizure prediction, "electroencephalogram. Clin. Neurophysiology., vol. 39(4), pp. 435 – 436, Oct 1975.

[6] A. Van de Vel, K. Cuppens, B. Bonroy, M. Milosevic, K. Jansen, S. Van Huffel, et al, "Non-EEG seizure-detection systems and potential SUDEP prevention: State of the art," Seizure, vol. 22(5), pp. 345 – 355, June 2013

[7] G. Rubboli, S. Beniczky, S. Claus, M.P. Canevini, P. Kahane, H. Stefan, et al, "A European survey on current practices in epilepsy monitoring units and implications for patients' safety," Epilepsy Behav., vol. 44, pp. 179 – 184, Mar 2015.

[8] Leo Louis, “Working principle of Arduino and using it as a tool for study and research”, July 2018.

[9] D. Mellis, M. Banzi, D. Cuartielles, and T. Igoe, "Arduino: An open electronic prototyping platform," in Proc. CHI, vol. 2007, 2007.

[10] A. U. ARDUINO UNO, "Front. Arduino uno board," 2012.

[11] B. Stroustrup et aI., The C++ programming language. Pearson Education India, 1995.

[12] A. M. Gibb, New media art, design, and the Arduino microcontroller: A malleable tool. PhD thesis, Pratt Institute, 2010.

[13] J. Boxall, Arduino Workshop: A Hands-on Introduction with 65 Projects. No Starch Press, 2013.