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Earlier Detection of Stroke and Stimulating a Nerve Using EEG in Human Brain

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***Abstract*: According to the World Health Organization, stroke is the second leading cause of disability. In 2022, 1 in 6 deaths from cardiovascular disease will be due to stroke. In India, 6.5 million stroke cases have been identified, with half of the strokes occurring between the ages of 46 and 65, and one-third occurring after the age of 65. The main aim of our project is to identify the brain stroke by using non-invasive methods and stimulating the nerves with current stimulation with a voltage range of 90 to 100 volts and a frequency of 3 Hz to 5 Hz. This paper mainly focused on the EEG level generated and when it reaches above threshold level stimulation is given when a brain wave signal is an abnormal condition to generate a small electrical signal for brain nerve stimulation. The main result of our paper is that normal or abnormal conditions of stroke exist. When it reaches an abnormal condition to generate the electric stimulation and prevent stroke.**

***Keywords*: EEG, Stroke, Stimulator, Brain nerve.**

1. Introduction

Brain stroke is one of the most common causes of mortality and chronic adult disabilities after ischemic heart diseases worldwide. It is the second-leading cause of death. As indicated by the World Health Organization, 15 million individuals endure stroke worldwide every year. Out of which 5 million die and another 5 million are permanently debilitated. But in developing countries like India. The frequency of stroke is still high because of the unavailability and unaffordability of quality stroke management facilities. Stroke can be comprehensively characterized into two noteworthy categories: ischemic stroke, with an 85–87% occurrence rate, and hemorrhagic stroke, with a 13–15% frequency rate [1]. Ischemic cerebrovascular accidents result. From a lack of sufficient blood flow to the brain due to the formation of a clot, whereby the brain is unable to meet its metabolic demands. A hemorrhagic cerebrovascular accident occurs due to ruptured cerebral blood vessels and the resultant bleeding into the head, where the brain is damaged by the impairment in blood flow due to the rupture of blood vessels [2]. As a result, developing countries are exposed to a double burden of both communicable and non-communicable diseases. The poor are increasingly of the disease. Late identification of stroke may lead to cognitive impairment, and the affected by stroke because of both changing population exposures to risk factors and, most tragically, not being able to afford the high cost of stroke care [3]. Recently, there has been an increase in the epidemiology data on stroke in India. Early detection of stroke onset is lifesaving. In many cases, stroke symptoms are not visible at an early-stage economic burden of stroke care with a mental impairment is three times greater than that of those without cognitive damage [4]. This damage to brain tissue affects the electrical activity of the corresponding local hemisphere and stabilizes the overall control of the nervous system [5]. This paper is mainly focused on an electrical stimulator that is used to provide electrical stimulation to the brain muscle [6]. When blood vessels in the brain rupture, a blockage in the blood supply to the brain will lead to a stroke. Through proper analysis and prescription by the doctor, future treatment processes will be carried out.

2. Working Process

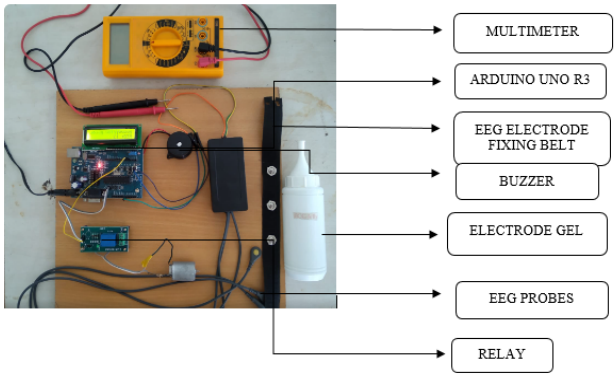

Fig. 1. Prototype of EEG stroke detection circuit

The paper proposes the electromyogram and EEG-triggered Electrical stimulator. This method requires the any abnormal activity of brine are possible to brain stoke. If the EEG activity exceeds the threshold, the brain muscle contractions are augmented by electrical stimulation that assists the patients to electrical movements. This patient can relearn their voluntary movements again and on its own. Signals are functionally divided into 3 blocks, an Input stage, a controller stage and a driving stage. In the input stage the rectified EEG that is pre-processed EMG is given to the microcontroller. Then according to the threshold parameters microcontroller generates the PWM output, and in driving stage the output is converted into current

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which is given to the patients through electrodes.

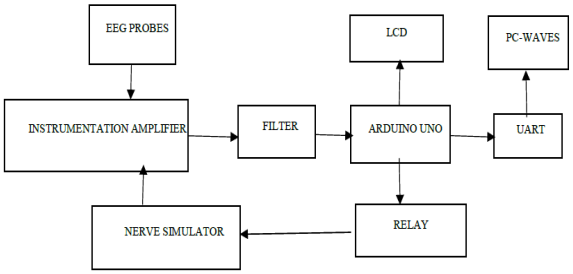

Fig. 2. Block diagram

The PWM wave is generated by Arduino UNO R3. At the output of controller, send to pc section. Relay is connected to nerve simulator. And feedback signal is sent to instrumentation amplifier. Custom characters (unlike in seven segments), animations and so on. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

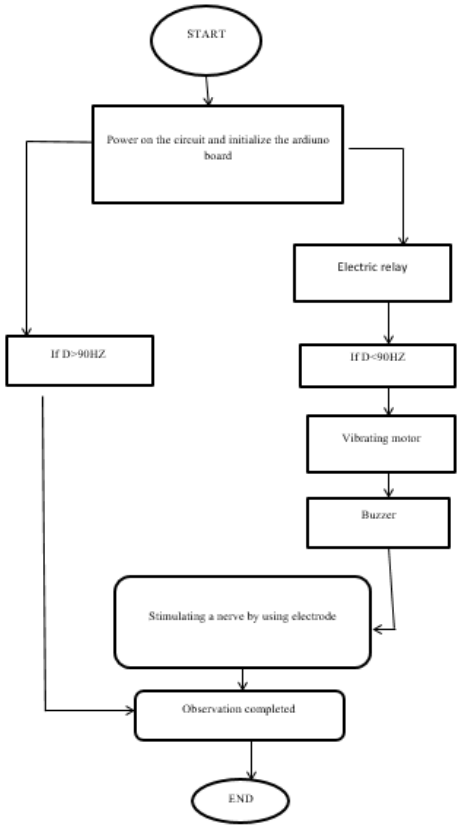

Fig. 3. Flow chart of the system

3. Materials

A. LCD

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LED. The reasons being: LCDs are Economical; easily programmable; have no limitation of displaying special & even Custom characters (unlike in seven segments), animations and so on.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

B. Instrumentation Amplifier

It is a device having a high input impedance. A low output impedance, a high common-mode rejection ratio. A low level of self-generated noise and a low offset drift.

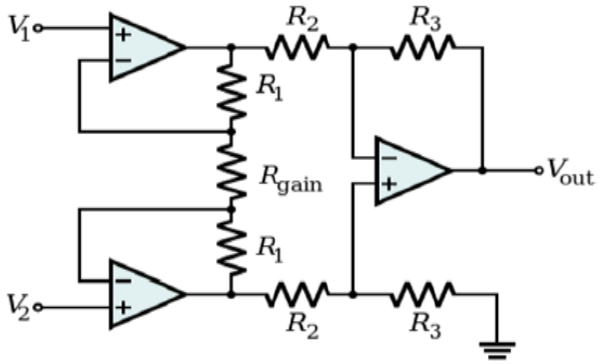

Fig. 4. Instrumentation amplifier

An instrumentation (or instrumentation) amplifier (sometimes shorthanded as In-Amp or In Amp) is a type of differential amplifier that has been outfitted with input buffer amplifiers, which eliminate the need for input impedance matching and thus make the amplifier particularly suitable for use in measurement and test equipment. Additional characteristics include very low DC offset, low drift, low noise, very high open-loop gain very high common mode rejection ratio and very high input impedances. Instrumentation amplifiers are used where great accuracy and stability of the circuit both short and long-term are required.

C. Nerve Stimulator

Deep brain stimulation (DBS) is a neurosurgical procedure involving the placement of a medical device called a neuro stimulator which sends electrical impulses, through implanted electrodes, to specific targets in the brain (the brain nucleus) for the treatment of movement disorders, including Parkinson's disease, essential tremor, dystonia and other conditions such as obsessive-compulsive disorder (OCD) and epilepsy. While its underlying principles and mechanisms are not fully understood, DBS directly changes brain activity in a controlled manner.

DBS has been approved by the Food and Drug Administration as a treatment for essential tremor and Parkinson's disease (PD) since 1997. DBS was approved for dystonia in 2003, obsessive–compulsive disorder (OCD) in 2009, and epilepsy in 2018. DBS has been studied in clinical trials as a potential treatment for chronic pain for various affective disorders, including major depression. It is one of few

neurosurgical procedures that allow blinded studies.

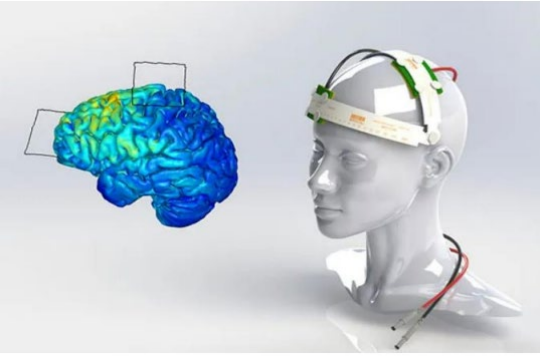

Fig. 5. Nerve stimulator

D. EEG Probes

An electroencephalogram (EEG) is a test that measures electrical activity in the brain using small, metal discs (electrodes) attached to the scalp.

Fig. 6. EEG probes

An electroencephalogram (EEG) is a recording of brain activity. During this painless test, small sensors are attached to the scalp to pick up the electrical signals produced by the brain. These signals are recorded by a machine and are looked at by a doctor.

E. Buzzer

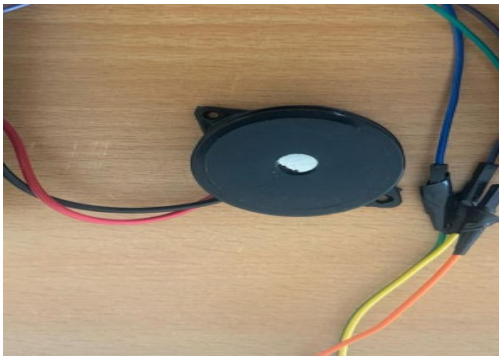

Fig. 7. Buzzer

A buzzer is a device which is used to generate alarm sound when the obstacle is detected by ultrasonic sensor.

F. Relay

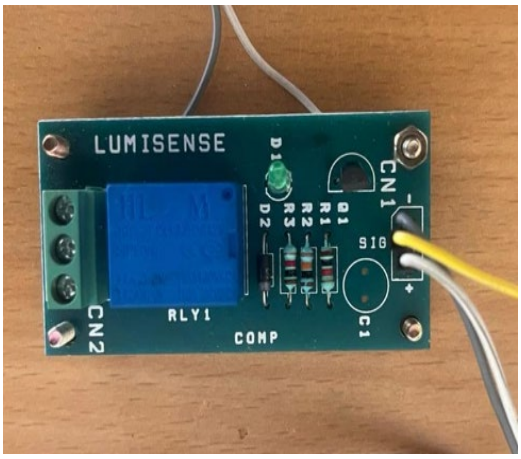

Fig. 8. Relay

Relays are electrically operated switches that open and close the circuits by receiving electrical signals from outside sources. Relays and contactors use a low-level control signal to switch a much higher voltage or current supply using several different contact arrangements. Thus far we have seen a selection of Input devices that can be used to detect or “sense” a variety of physical variables and signals and are therefore called Sensors. But there are also a variety of electrical and electronic devices which are classed as Output devices used to control or operate some external physical process. These output devices are commonly called Actuators.

G. Arduino Uno R3

Microcontroller is the brain of our system. It will handle all the processing and communication of data. We can use Arduino Uno Atmega328 microcontroller which is 8 bit and 28 pin. It has dimensions of width, height and weight that is 54 cm, 67 cm and 32g respectively.

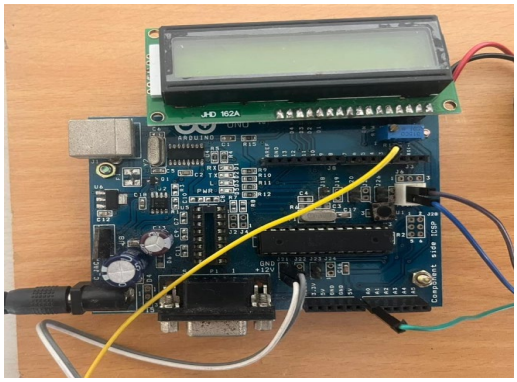

Fig. 9. Arduino Uno R3

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

Table 1
Arduino Uno board values

Microcontroller	ATmega328
Operating voltage	5V
Input voltage(recommended)	7-12V
Input voltage (limits)	6-20V
Digital I/O pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 Ma
DC Current for 3.3V Pin	50 Ma
Flash memory	32KB (AT mega 328) of which 0.5 KB used by bootloader
SRAM	2KB (AT mega328)
EEPROM	1KB (AT mega 328)
Clock speed	16MHz

4. Result and Discussion

The EEG stroke is designed to detect any kind of abnormal activity in the brain and provide an alarm sound and vibration to the user. The device uses an EEG electrode to detect brain waves. The device can be easily transported from one place to another.

Table 2
Tabulation of result value

Patient	Age	Gender	Normal range	EEG value	Voltage	Condition
1	50	Female	60-90	30	-	Normal
2	35	Male	60-90	22	-	Normal
3	40	Female	60-90	38	-	Normal
4	45	Male	60-90	48	-	Normal
5	60	Female	60-90	58	-	Normal
6	34	Female	60-90	29	-	Normal
7	66	Male	60-90	77	-	Normal
8	48	Female	60-90	86	-	Normal
9	76	Male	60-90	82	-	Normal
10	39	Female	60-90	75	-	Normal
11	55	Female	60-90	90	11.1	Abnormal
12	65	Male	60-90	99	11.2	Abnormal
13	68	Female	60-90	104	10.05	Abnormal
14	61	Female	60-90	108	10.06	Abnormal
15	54	Male	60-90	110	10.08	Abnormal
16	62	Female	60-90	116	11.07	Abnormal
17	58	Female	60-90	118	11.08	Abnormal
18	72	Male	60-90	122	11.09	Abnormal
19	53	Female	60-90	124	11.15	Abnormal
20	67	Male	60-90	126	11.16	Abnormal

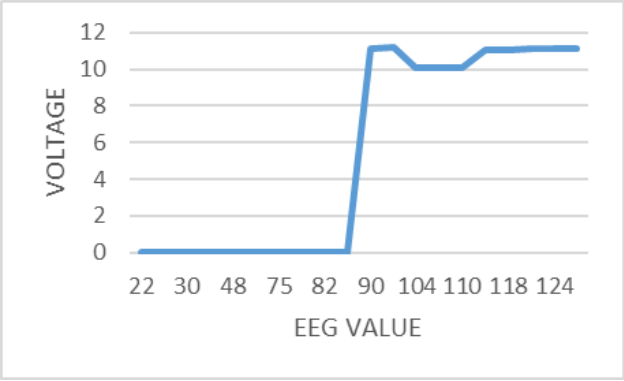

Fig. 10. Graphical representation of EEG stroke value with voltage

There were 20 patients are involved in the EEG reports, and 10 of them had an abnormality. Based on a total of 20 EEG reports, Table 2 reveals that there has been a total of two cases of both normal and abnormal situations in people throughout the ages of 20 and 50. Out of a total among the remaining 20 reports, ten additional occurrences of abnormalities were observed in patients over the age of 60. A total of 20 patients, 8 of whom were men and 12 of them had abnormal disorders.

5. Conclusion

We propose a new health monitoring system that detects and predicts the precursor. Symptoms of Stroke diseases with the attribute information of power, a relative value from raw Data in the brain waves collected during elderly walking predicts the precursor symptoms of stroke.

However, the majority of these current technologies are still in development and utilize a variety of accuracy metrics, making inter-technology comparisons difficult. Standardizing the evaluation of diagnostic accuracy may be helpful in further optimizing portable stroke detection technology for clinical use.

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References

[1] Dheeraj Khurana, "Detection of Brain Stroke Using Electroencephalography (EEG)," 2021.
[2] Dalchand Ahirwar, "Stimulating studies for non-invasive classification of ischemic and hemorrhagic stroke using near infrared spectroscopy," 2019.
[3] Paulin Sudhan, "Stroke Epidemiology and stroke care service in India," 2013.
[4] Iqram Hussain, "Real-Time Health Monitoring System for Stroke Prognostics," 2020.
[5] Lya E. Kutepov, "EEG Analysis in Patients with Schizophrenia Based on Lyapunov Exponents," 2020.
[6] Matan Gottlibe, "Stroke Identification Using a Portable EEG Device - A Pilot Study," 2019.
[7] Mira Katan, "Global Burden of Stroke," 2018.
[8] Seunggu Han, "Erica Hersh Ischemic Stroke," Sep. 29, 2018.
[9] Byeongnam Kim, "Cross-Association Analysis of EEG and EMG Signals According to Movement Intention State," 2017.
[10] Chiara Fanciullacci, "Delta Power is Higher and More Symmetrical in Ischemic Stroke Patients with Cortical Involvement," 2017.
[11] Noor Kamal Al-Qazzaz, "Discrimination of Stroke-Related Mild Cognitive Impairment and Vascular Dementia Using EEG Signal Analysis," 2017.
[12] Byeongnam Kim, "Cross-Association Analysis of EEG and EMG Signals According to Movement Intention State," 2017.
[13] Anna Aminov, "Acute Single Channel EEG Predictors of Cognitive Function after Stroke," 2017.
[14] Simon Finnigan, "EEG in Ischaemic Stroke: Quantitative EEG Can Uniquely Inform (Sub) Acute Prognoses and Clinical Management," 2012.
[15] Brandon Foreman," Quantitative EEG for the Detection of Brain Ischemia," 2012.