IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

Virtual Monitor For MND Patients Controlled By Eye Blink

VijayaSaraswathi RJ [1,a],Hansika M[2,b],Snegavarshini A[3,c],SeemaSherline A[4,d]Saphermathi MG[5,e], Swetha Nair S[6,f], Thilagavathi MC[7,g]

[1]*Assistant Professor, EIE, Panimalar Engineering College*

[2,3,4,5,6,7]*UG Student, EIE, Panimalar Engineering College*

[a]*viji20@yahoo.co.in*

[b]*hansikamanoharan@gmail.com*

[c]*snega15m@gmail.com*

[d]*a.seemasherline@gmail.com*

[e]*saphermathi@gmail.com*

[f]*swethasathyannair4@gmail.com*

[g]*thilaga2k2@gmail.com*

Abstract. Motor neuron disease (MND) is a medical illness in which the patient's motor neurons are paralyzed and incurable. It also leads to muscle weakness in the hand, feet, or voice. As a result, the patient is unable to execute voluntary acts, and it is extremely difficult for patients to convey their demands. Tetraplegia is another disorder in which persons are unable to move sections of their bodies below the neck. In this modern era, remedies for patients with the ailments listed above have been discovered, with one such invention being the system explained throughout. The proposed system helps the patients with motor neuron disease to control and communicate with others using eye-blinks for their needs. In the recent years due to the rapid advancement in the technology Brain Computer Interface has been in high demand (BCI). Blinking the eyes is a rapid motion of closing and opening the eyelids that is used to manage the virtual keyboard and express their needs and thoughts. This technology assists patients in typing letters using a virtual keyboard that is presented on a monitor was created with Python programming.

INDEX TERMS. Motor neuron disease (MND), brain computer interface (BCI), eye blinks, python

I.INTRODUCTION

Patients with MND suffer from inability to respond or express their needs due to paralyzed nerve cells. The system proposed here employs BCI and EEG signals from brain cells for the patients to deliver their necessities. The data is collected via virtual keyboard and displayed. BCIs are systems that allow the brain to communicate with various machines. Neuron feedback, recovering motor function in paralyzed individuals, and increasing sensory processing are all activities that BCI can help with. EEG measures voltage changes in the brain caused by ionic current. When electrodes are put along the scalp, it is non-invasive. The Electroencephalography (EEG) is an electrophysiological monitoring method to record electrical activity of the brain in which, the capturing of the brain's spontaneous electrical activity over time using several electrodes on the scalp. The Raspberry Pi Foundation produces a line of single-board computers known as the Raspberry Pi. It also provides a set of GPIO pins that can be used to control electronic components and explore the Internet of Things.

II.EXISTING SYSTEM

The system's operation is based on wires, transmitters, and other MATLAB applications. The working proceeds by the following steps Wire electrodes are put on the brain where neural connections are available to extract necessary features. The wire electrodes are connected to the BCI system, which handles data collection and signal processing. The feature extraction phase extracts the desired feature, such as an eye blink, from the previous step. The extracted eye blink is classified as intentional or unintentional. Then the control application is used for classification and sent to MATLAB computer to produce visual feedback to nurse or user. The paralyzed patient must be connected continuously with the BCI through a wired electrode. The accuracy depends on time to time changing of the electrode which requires a person to be with the patient always.

III.PROPOSED SYSTEM

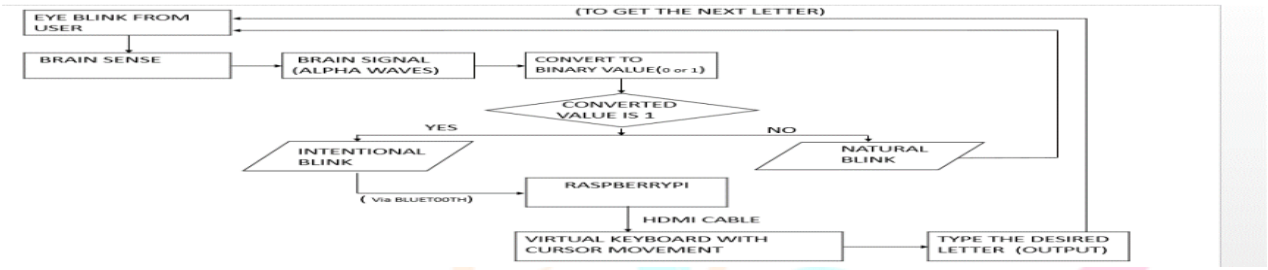

Fig: 1 .Proposed System's Flowchart

Initially, The MND patient is educated about the system. Their eye blinks are recorded by the electrodes. Alpha waves from brain signals are preferably used to control the eye blinks, whether intentional or natural. Binary values are assigned to them. The data is transmitted to the Raspberry Pi. A visual keyboard is used by the patients. It has a cursor that moves over each alphabet after a specific interval of time. When the person blinks his eyes intentionally over an alphabet, it gets selected. Keywords typed in this way are displayed on the monitor to the nurse or the user. Fig.1. illustrates the suggested system's flowchart.

Working

The working of the proposed system is from the eye blink of the paralytic patient. Fig.2 depicts the suggested system's operation. The patient is given a headband whose output is sent to the nurse or patient attendant. The headband has a BCI kit and Bluetooth installed in it. The Raspberry Pi is a tiny computer that connects to the virtual keyboard display on the monitor through Bluetooth and output. The proposed system is divided into three parts, BCI, Raspberry Pi, and the virtual keyboard's Output

Fig.2 Operation of the Proposed System

BCI:

The BCI (brain-computer interface) is a system that enables brain-to-machine communication. They operate in four stages: gathering brain impulses, analyzing them, extracting the required feature, and providing instructions to a machine that is linked. The suggested system employs a non-invasive methodology wherein sensors, such as EEG or MEG, are implanted on a scale to estimate the electric potential generated by the brain. The suggested device inserts one electrode between the brows on the forehead and completes the circuit by connecting the other electrode to the ear loop. The signal acquisition, which has waves known as ALPHA, BETA, and GAMA, begins as soon as the eye is blinked. The Alpha wave is used for signal acquisition because it has the desired output frequency. When the data collecting procedure is completed and the data is processed. Intentional or natural blinking takes place as soon as the processing of

the eye blink happens. The intentional blink is taken as the binary value 1 and the natural blink as 0. The binary value is communicated to the Raspberry pi system employing a Bluetooth device set up in the kit.

Raspberry Pi:

The Raspberry Pi 3 module in the proposed system was utilized to decide the output on the virtual keyboard displayed on the monitor. Python programming and built-in functions are employed by the Raspberry Pi. The graphical user interface (GUI) is to be designed for the presentation of the virtual keyboard on the monitor. The Python library can construct the virtual keyboard when the Tkinter file is imported. The cursor pointer must move automatically following the time established. To complete this operation, a file called pyautoguilibary is imported from the Python library, where the cursor point is automated and moved based on the period. The output that is offered in HDMI is the output from the Raspberry Pi, which has an integrated module to bring out the output that should be delivered in VGA form.As a result, the cable is connected to the display, resulting in the creation of a VGA model as output. The raspberry pi model's instruction set is used to generate this output and displayed on the notepad.

IV.HARDWARE DESCRIPTION

Raspberry Pi

The Raspberry Pi is a small computer designed by the Raspberry Pi Foundation to motivate schools to teach computer science. The operating system and program memory are saved in SD cards also with Micro SDHC form pattern. There will be between one to four USB ports on the boards. For connecting to the internet, the Raspberry Pi 3 and Pi Zero W contain intrinsic Wi-Fi, Bluetooth, and USB connectivity. Composite video and HDMI are provided for video output. And for audio output a 3.5 mm tip-ring-sleeve jack is included. Several GPIO pins are used that works on protocols like I^2C are used for deriving a low level output.

BCI

A BCI is an HCI that is focused on the GP: "think and make it happen without any physical effort." This is essential to always have a direct interface between the human brain and the computer.

Types of BCI

Invasive BCI

During neurosurgery, invasive BCIs are surgically inserted into the grey matter of the brain. The electrical activity of the brain is monitored by EEG (electroencephalography) from under the skull. A small plastic pad is implanted above the cortex, below the Dura master, having electrodes embedded in it.

Semi-Invasive BCI

This type of BCIs employs ECoG monitoring, which comprises placing electrodes on the exposed surface of the brain to assess electrical activity from the cerebral cortex .Semi-invasive use the same underlying neurophysiologic principles as EEG-based systems.

Non-Invasive BCI

The electrodes are placed on the scalp and are used to monitor minute voltage changes between neurons. It is then processed by computer software, which displays the impulses on a continuous sheet of paper in modern BCI systems.

EEG Based BCI.

The electrodes are attached to the scalp and measure minute differences in voltage between neurons. In today's BCI systems, a computer software interprets the impulses and exhibits them on a continuous sheet of paper .EEG signals are sent to the brain's control unit (BCI) which generates a "system answer".

Structure Of A BCI

Fig.3. Structure of a BCI

BCI Hardware

The system consists of four hardware parts 1) Power Supply, 2) BCI board with ear ending , 3) Bluetooth device attached to the BCI board ,4)An Electrode to get the blink data. These hardware parts are placed inside the head band for portability in this figure the head band parts are explained clearly and are placed in different positions for the purpose of getting information from the neuron connections, power supply to the system and communication via Bluetooth.

Fig.4. BCI Head Band

V. RESULT

The Virtual Keyboard is a BCI system, the Virtual Keyboard. Eye blinks are used as control signals in this BCI and kurtosis coefficient, maximum amplitude and minimum amplitude in a sample window are successfully used to detect eye blinks from non-eye blink signal. Sometimes normal blink also gets detected instead of voluntary blink.. Python when combined with Tkinter provides a fast and easy way to create GUI applications. The PyAutoGUI library provides cross-platform support for managing mouse and keyboard. These scripts can control other applications by sending them virtual keystrokes and mouse clicks. The pyautogui library works on Windows, macOS, and Linux, and runs on Python 2 and 3. When the output is detected as an intentional blink it is transmitted via Bluetooth to the Raspberry Pi kit. The Python algorithm and the Raspberry instructions gives the output to the monitor to operate the virtual keyboard along with the cursor movement. The output finally describes what the patient needs and what are their requirements using their eye blink. System cycle repeats till the patient blinks naturally to stop the action of their words being typed. The Figure (7) shows the output of virtual keyboard that has been opened for the patients use to perform the activity of natural blink. The Figure (5) represents the keyboard is been used by the patient where the automatic cursor moment occurs. The Figure (6) represents the output given by the patients eye blink.

Fig 5.Virtual Keyboard

Fig 6. Automated Cursor Movement

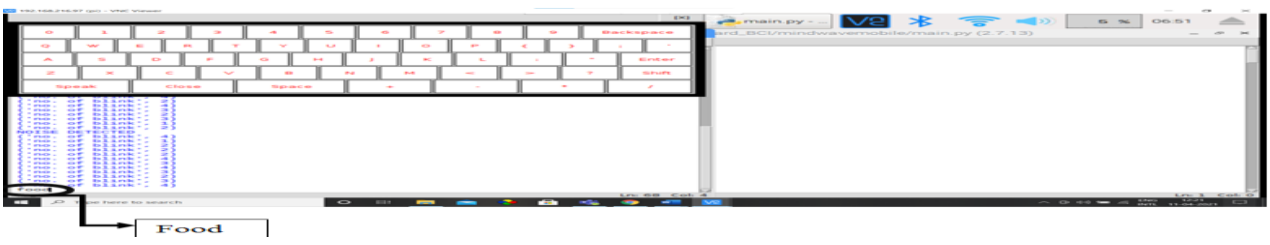

Fig.7 output

VI. CONCLUSION

The evolved BCI can be used for communication purposes by using eye blinks as activation signals, which is exceptionally useful for incarcerate individuals with ALS. This method described here makes use of a brain wave sensor that can collect EEG-based mind indicators of diverse recurrence and sufficiency. Further, it can be developed to provide speech output. Each person's eye blink intensity is different. The eye blink frame rate is used to distinguish between voluntary and natural blinks. This device gives paralyzed people with eye mobility a new chance at life. It allows paraplegic people to communicate their thoughts using the system's preprogrammed phrases. The goal of this technology is to use an eye movement algorithm to help disabled people communicate their thoughts more easily.

REFERENCES

[1] In: Brain-Computer Interfaces: Principles and Practice, Wolpaw, J.R. and Wolpaw (eds.), E.W. Oxford University Press.

[2] EEG-based brain-computer interfaces: an overview of basic concepts and clinical applications in neurorehabilitation. Machado S, Araújo F, Paes F, Velasques B, Cunha M, Budde H, Basile LF, Anghinah R, Arias-Carrión O, Cagy M, Piedade R, de Graaf TA, Sack AT, RibeiroP.RevNeurosci. 2010;21(6):451-68. doi: 10.1515/revneuro.2010.21.6.451.PMID: 21438193 Review.

[3] Yuan, H; Liu, Tao; Szarkowski, Rebecca; Rios, Cristina; Ashe, James; He, Bin (2010). "Negative covariation between task-related responses in alpha/beta-band activity and BOLD in human sensorimotor cortex: an EEG and fMRI study of motor imagery and movements". NeuroImage. 49 (3): 2596–2606. doi:10.1016/j.neuroimage.2009.10.028. PMC 2818527. PMID 19850134.

[4] Tamburrini, Guglielmo (2009). "Brain to Computer Communication: Ethical Perspectives on Interaction Models". Neuroethics. 2 (3): 137–149. doi:10.1007/s12152-009-9040-1. S2CID 143780006.

[5] Rajesh Singla, Balraj Gupta, "Brain Initiated Interaction", Journal of Biomedical Science and Engineering, p170 – p172, 2008.

[6] Sovierzoski M.A., Argoud F.I.M., de Azevedo F.M., "Identifying eye blinks in EEG signal analysis", Proceedings of the 5th International Conference on Information Technology and Application in Biomedicine, p406 - p409, May 2008, China.

[7] SaeidSanei and J. A. Chambers, "EEG Signal Processing", First Edition, ch. 1, p1 – p18, John Wiley and Sons Ltd., 2007.

[8] Lebedev, MA; Nicolelis, MA (2006). "Brain-machine interfaces: past, present and future" (PDF). Trends in Neurosciences. 29 (9): 536–46.

[9] AdrijanBozinovski "CNV flip-flop as a brain-computer interface paradigm" In J. Kern, S. Tonkovic, et al. (Eds) Proc 7th Conference of the Croatian Association of Medical Informatics, pp. 149-154, Rijeka, 2005

[10] D. G. Manolakis, V. K. Ingle, S. M. Kogon, "Statistical and Adaptive Signal Processing: Spectral Estimation, Signal Modeling, Adaptive Wolpaw, J.R. and Wolpaw, E.W. (2012). "Brain-Computer Interfaces: Something New Under the Sun".

Filtering and Array Processing", Artech House Publishers, 2005. ch. 3, pp. 75–82.