Multidisciplinary Journal for Applied Research in Engineering and Technology (MJARET)

Vol. III Issue 4, August – 2023, Pages: 01-04

DOI : https://doi.org/10.54228/mjaret0823001 **ISSN : 2583-1100**

EEG based authentication of body channel communication

S Rajaram
Bio Medical Engineering, Sri Venkateshwaraa College of Engineering, Puducherry, India.
rajaram1701091@gmail.com

V Murugesh
Bio Medical Engineering, Sri Venkateshwaraa College of Engineering, Puducherry, India.
murugesh5537@gmail.com

K Anbarasan
Bio Medical Engineering, Sri Venkateshwaraa College of Engineering, Puducherry, India.
anbuk1711@gmail.com

Mr. A.V Srinath
Assistant Professor, Bio Medical Engineering, Sri Venkateshwaraa College 0f Engineering, Puducherry, India

Abstract: EEG-based authentication is a method of verifying an individual's identity by analyzing and statistically analyzing their brainwave signals. This approach is particularly useful for security purposes, as it can provide an accurate means of confirming someone's unique identity. In many studies that use EEG-based authentication, researchers extract features from the frequency bands present in the EEG signal. This allows them to identify specific patterns in the signal that are unique to each individual, providing a reliable way of verifying their identity. One promising technology that could enhance EEG-based authentication is flexible electronics. These devices are designed to be compatible with soft and stretchable film substrates, allowing them to conform to the contours of the human body. By integrating various sensors and communication ICs, wearable flexible electronics can track an individual's vital signs without impeding their daily activities. Overall, the combination of EEG-based authentication and flexible electronics could provide a powerful tool for enhancing security measures and monitoring human health.

KEYWORDS: BCI, brain-computer interface, EEG signal (key words)

I. INTRODUCTION

In the past, healthcare sensors were mostly restricted to hospitals and labs. This is changing, as the advances in microelectronics have enabled proliferation of inexpensive, powerful, and energy-efficient embedded devices that can be interconnected in Body Area Networks (BAN). These new wearable sensors can achieve long-term health monitoring or based on EEG [2] wave to electronic device controller in natural environments without asking the residents to restrict their normal activities. In this way, the sensors enable applications such as ambient assisted living for people with chronic security condition. Healthcare now can become more personalized, more evidence & data-based, more cost-effective and more convenient to the users and the medical personnel. However, many healthcare applications benefit from having multiple sensors located on different parts of the body: In quality-of-motion applications, multiple on-bodies inertial Measurement (IMU) sensors are used to track the Movement of different limbs and body parts, with the goal e.g., of diagnosing and tracking the progress of Neurodegenerative conditions (such as Parkinson's) and the recovery of post-operatic patients; This work was supported in part by the Wearable's for Healthcare and Lifestyle Applications".

II. PROPOSED SYSTEM

A. Aim

Human Area Network (HAN) or Red Tacton is a technology developed by Nippon that provides a fast and secure way of transmitting signals between devices. It enables communication between mobile phones and other nearby objects. Unlike other communication technologies, Red Tacton does not require the electrodes to be in direct contact with the skin. Red Tacton enables high-speed communication between two points on the body or between the body and a machine. This technology works through the use of electric fields, which can propagate through the human body or other conductive materials [4]. This allows Red Tacton to transmit data at high speeds over short distances. One advantage of Red Tacton is that it does not require a clear signal line and ground line, which can simplify the design of electronic devices that use this technology. Red Tacton also provides a more secure means of communication compared to other wireless technologies, as the signal is confined to the body and cannot be intercepted by outside sources. Overall, Red Tacton is a promising technology that could have a wide range of applications, from mobile communication to healthcare and security.

B. Method

We propose to use EEG signals for biomedical data transmission applications. [12]EEG signals are complex, random, and non-stationary in nature, making it difficult to interpret them by visual inspection alone. Therefore, advanced signal processing techniques are required to extract hidden information from these brain signals. To ensure secure transmission of EEG signals, we suggest using a wave generation-based password authentication[15] system. This system generates an output code that is unique to each user and is activated when the same code is generated by the EEG signal. This user verification system allows for easy unlocking of doors or other secure locations by carrying a Red Tacton-capable device in one's pocket and touching the doorknob normally. In addition to this wave generation-based authentication system, we recommend combining it with other personal verification tools, such as fingerprint ID or other biometric authentication methods[1], that are available on mobile devices. This will help to enhance the security of the system and prevent unauthorized access. Overall, by implementing these techniques, we can ensure the secure transmission of sensitive biomedical data using EEG signals, while also providing an easy-to-use and convenient method of user authentication and access control.

C. Hardware Used

1.Microcontroller
2.EEG Probe
3. LCD display
4.ADC
5.UART

BRIEF ABOUT THE COMPONENTS USED:

1.Microcontroller - The AT89S52 is a high-performance CMOS 8-bit microcontroller that operates with low power consumption. It has 8K bytes of in-system programmable Flash memory and utilizes Atmel's high-density non-volatile memory technology. Additionally, the device is designed to be compatible with the 80C51 instruction set and pin out, which is a widely used industry-standard.

2.EEG Probe - An EEG [6] (Electroencephalogram) probe is a medical device used to record electrical activity in the brain. It typically consists of several small metal electrodes that are attached to the scalp using a special adhesive or paste.

3.LCD display - LCD stands for Liquid Crystal Display. A kind of flattened panel exhibit oftentimes employed in electronic gadgets like televisions, computer displays, and mobile phones. The application of liquid crystals in the creation of images on LCD screens is achieved by means of manipulation whereby light can either be allowed through or blocked.

4.ADC - It is data acquisition component is a monolithic CMOS device with an 8-bit analog-to-digital converter, 8-channel multiplexer and microprocessor compatible control logic.

5.UART - A universal asynchronous receiver/transmitter is a type of "asynchronous receiver/transmitter", a piece of computer hardware that translates data between parallel and serial forms.

D. Mechanism:

Unlike traditional wireless technologies like Bluetooth or Wi-Fi, which transmit signals through the air, Red Tacton uses weak electric fields on the surface of the human body to communicate. The technology uses a

Vol. III Issue 4, August – 2023, Pages: 01-04

DOI : https://doi.org/10.54228/mjaret0823001 ISSN : 2583-1100

transmitter to create an electrostatic field around the body, and a receiver to detect changes in the field caused by touching or coming close to the body. This makes Red Tacton a safe and secure way to transmit information, as the signal is confined to the body's surface and cannot be intercepted by other devices. Red Tacton also offers high-speed data transfer rates, with the ability to transmit data at up to 10 Mbps. Red Tacton technology has many potential applications, including wearable technology that can transmit data to other devices on the body, such as smart watches or health monitors. It can also be used in a range of industries, from healthcare to transportation, to enable safe and secure communication between device [11].

E. Working

We proposed using for bio-medical Data Transmission Application EEG signal is complex, random and not stationary in nature, it is unable to interpret signal by visual inspection. Thus, advanced signal processing is required to investigate the EEG signals by extracting hidden information from the brain [7] signal. Transmission setup used my EEG wave generation-based password authentication [5] when same output code generation same output load will activation User verification and unlocking with just a touch Carrying a mobile Red Tacton capable device in one's pocket, ID is verified and the door unlocked when the user holds the doorknob normally. Secure lock administration is possible by combining personal verification tools such as fingerprint ID or other biometric [3] in the mobile terminal

Working Principle of RedTacton

Similar to any other technology, RedTacton Technology,[13] will also have a transmitter and a receiver. As soon as the human body comes in contact with the RedTacton transceiver, the signals will start to be transmitted. When the contact is taken off, the transmission will also stop. The terminals are either embedded in the devices or are carried by the user itself. According to the natural and physical movements of the user, the communication will happen in various combinations. The communication through the user can occur only through his body surface [14] parts like hands, fingers, arms, feet, face, legs or torso. The technology also works in shoes and other clothing's as well.

Features of RedTacton

- Touch Feature

In this technology, every mode of communication can be done with a touch. All physical movements like touching, gripping, sitting, walking, stepping and so on are used as triggers for various processes of the equipment. The processes can be the START and STOP of the equipment, data retrieval or even locking and unlocking.

- Broadband Feature

For broadband communication, the ideal speed with this method is said to be 10 Mbps. This is constant for full duplex communication.

Even if multiple communications is used through this technology, the speed will not be affected as the signal is transmitted through the human body.

III.RESULT AND EXPERIMENT

As a result, we are safely transferring the data and information from one to another using an "RED TACTON" technology. We are using an EEG [8] signal for purpose of security and privacy process and digital display will display the EEG [9] signal (Brain waves) in display and the transferred data and information can be displayed in an pc or laptop.

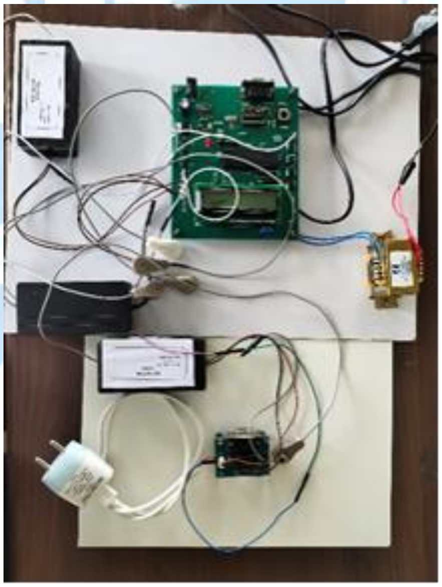

Fig. 1. Displaying the monitored body

CONCLUSION

Red Tacton offers many advantages over other communication technologies, making it a promising option for a variety of applications. One of the main benefits is its superior performance, which is due to the fact that it uses the human body's surface as a transmission medium. This means that data can be transmitted at high speeds and without the need for physical cables or wireless connections. One of the key advantages of Red Tacton is its ability to transmit data over short distances. This makes it an ideal choice for applications that require fast and secure communication between devices that are located close to each other. Additionally, because the technology uses the human body as a transmission medium, there is no risk of hacking or other security breaches. The high speed of Red Tacton is another major advantage. With a data transfer rate of up to 10 Mbps, it is significantly faster than other wireless communication technologies. This makes it well-suited for applications that require high-speed data transfer, such as medical applications or security applications.

V. ACKNOWLEDGMENT

We would like to acknowledge our HOD and guide Mr.A.V Srinath, BME department, Sri Venkateshwaraa College of Engineering and Technology for providing us with the opportunity and guidance at every single stage of work on this project.

REFERENCES

[1] Jain, Anik K., Arun Ross, and Salil Prabhakar. "An Introduction to Biometric Recognition‖ IEEE transactions on circuits & systems for Video Technologies (2004)." (2004).

[2] Barry, Robert J., Adam R. Clarke, Stuart J. Johnstone, Christopher A. Magee, and Jacqueline A. Rushby. "EEG differences between eyes-closed and eyes-open resting conditions." Clinical neurophysiology 118, no. 12 (2007): 2765-2773.

[3] Zúquete, André, Bruno Quintela, and João Paulo da Silva Cunha. "Biometric Authentication using Brain Responses to Visual Stimuli." In Biosignals, pp. 103-112. 2010.

[4] Duan, Lijuan, Hongyan Zhong, Jun Miao, Zhen Yang, Wei Ma, and Xuan Zhang. "A voting optimized strategy based on ELM for improving classification of motor imagery BCI data." Cognitive Computation 6 (2014): 477-483.

[5] Cao, Kai, and Anil K. Jain. "Hacking mobile phones using 2D printed fingerprints." Michigan State University, Tech. Rep. MSU-CSE-16-2 (2016).

[6] Kaur, Barjinder, Dinesh Singh, and Partha Pratim Roy. "A novel framework of EEG-based user identification by analyzing music-listening behavior." Multimedia tools and applications 76, no. 24 (2017): 25581-25602.

[7] P. Lakhan et al., “Consumer grade brain sensing for emotion recognition,” IEEE Sensors J., vol. 19, no. 21, pp. 9896–9907, Nov. 2019.

[8] P. Sawangjai, S. Hompoonsup, P. Leelaarporn, S. Kongwudhikunakorn, and T. Wilaiprasitporn, “Consumer grade EEG measuring sensors as research tools: A review,” IEEE Sensors J., vol. 20, no. 8, pp. 3996–4024, Apr. 2020.

[9] P. Autthasan et al., “A single-channel consumer-grade EEG device for brain–computer interface: Enhancing detection of SSVEP and its amplitude modulation,” IEEE Sensors J., vol. 20, no. 6, pp. 3366–3378, Mar. 2020.

[10] R. Chaisaen et al., “Decoding EEG rhythms during action observation, motor imagery, and execution for standing and sitting,” IEEE Sensors J., vol. 20, no. 22, pp. 13776–13786, Nov. 2020.

[11] T. Wilaiprasitporn, A. Ditthapron, K. Mattapan, and E. Chuangsuwanich, “Affective EEGbased person identification using the deep learning approach,” IEEE Trans. Cognit. Develop. Syst., vol. 12, no. 3, pp. 486–496, Sep. 2020

[12] F. Yousefi, H. Kolivand, “Brain Signals as a New Biometric Authentication Method Using Brain-Computer Interface”. In: Lee N. (eds) Encyclopedia of Computer Graphics and Games. Springer, Cham, 2019, DOI:

[13] Hussain, Syed Jawad, Muhammad Irfan, N. Z. Jhanjhi, Khalid Hussain, and Mamoona Humayun. "Performance enhancement in wireless body area networks with secure communication." Wireless Personal Communications 116 (2021): 1-22.

[14] Amintoosi, Haleh, Mahdi Nikooghadam, Mohammad Shojafar, Saru Kumari, and Mamoun Alazab. "Slight: A lightweight authentication scheme for smart healthcare services." Computers and Electrical Engineering 99 (2022): 107803.

[15] Fareed, Mohammad, and Ali A. Yassin. "A lightweight and secure multilayer authentication scheme for wireless body area networks in healthcare system." International Journal of Electrical and Computer Engineering 13, no. 2 (2023): 1782