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IOT Based on Computer Interface Providing Medical Applications

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ABSTRACT -Brain computer interface (BCI) was formed in order to bring ease to the disabled users who are finding it hard to communicate with other persons. This is done by interpreting the brain activity as into digital form which acts as a command to the computer. The challenge faced in current BCI research is how to decode and interpret these real data signals into simple human language such as English which can be understood by all human beings.Beyond communication, other applications of BCI involving multimedia can also be envisioned. There are different kinds of BCI; we propose EEG (electroencephalogram)based BCI system to collect brain signals. BCI is applied in various fields such as moniter alertness, coma, brain death, investigate epilepsy and locate seizure origin, test drugs for convulsive effects, investigate sleep disorder and physiology, test epilepsy drug effects.

KEYWORDS: BCI, EEG, MEDICAL APPLICATIONS, IOT

I. INTRODUCTION

The scientific study of nervous system is known as neuroscience. New discoveries are made in this area through new emerging technologies. The nervous system controls the storage reception and the release of information. It is quite complicated system consisting of various structures and specialized organs with different functions. It can be classified into sensory system, which collects information about the organism and the environment; motor system which organizes and executes actions; and the associative system. To control BCI users have to acquire conscious control over their brain activity. The BCI system usually capture and process neural activities of the brain, and they do not require other stimuli, such as muscle movements. Modern medicine consists of variety of imaging techniques of the human body. In this work we focus on electroencephalogram (EEG) based BCI. The EEG reads brain electrical activity measured on the surface of the scalp a

During more than100 years the encephalography has undergone massive growth. The existence of electrical currents in the brain was discovered in 1875 by an English physician Richard Caton. Caton observed the EEG from the exposed brains of rabbits and monkeys. In 1924 Hans Berger, a German neurologist, used an ordinary radio equipment to amplify the brain‘s electrical activity which is measured on the human scalp. He announced that weak electric currents generated in the brain can be recorded without opening the skull, and depicted graphically on a strip of paper. The activity that he observed changed according to the functional status of the brain, such as in sleep, anaesthesia, and lack of oxygen and in certain neural diseases, such as in epilepsy. Berger laid the foundation for many of the present applications of electroencephalography. He also used the word electroencephalogram as the first for describing brain electric potential in humans. He was right in his suggestion that brain activity changes in consistent and recognizable way when the general status of the subject changes, as from relaxation to alertness. Later in 1934 Adrian and Matthews published the paper verifying the concept of “human brain waves “and identified regular oscillations around 10 to12Hz which they termed “alpha rhythm”.

II. RELATED WORK

2. LITERATURE SURVEY

2.1 Natasha Padfield, Jaime Zabalza and Jinchang Ren **EEG Based Brain- Computer Interfacs using Motor Imagery: Techniques and Challenges**. It reviews state-of-the-art signal processing techniques for MI EEG-based BCI’s.

2.2 Adamatti, D. F., Silveira, J., and Carvalho F. H. **Analyzing brain signals using decision** A case study of treatment of brain signals using decision trees.

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2.3 Soegaard M. Dam R.F. **The Encyclopedia of Human-Computer Interaction.2nd ed.** The Encyclopedia of Human Interaction

2.4 Baig M.Z., Aslam N. Shum H.P.H. Zhang L. **Differential evolution algorithm as a tool for optimal feature subset selection in motor imagery EEG** A new hybrid method to select features that involves a differential evolution (DE)

2.5 Oikonomou V.P. Georgiadis K. LiarosG., Nikolopoulos S., KompatsiarisI. **A Comparison Study on EEG Signal Processing Techniques using Motor Imagery EEG Data** A review of various existing techniques for the identification of motor imagery (MI)tasks

2.6 Nicolas-Alonso L.F. Gomez-Gil j. Brain Computer Interfaces a Review. Analyzing brain signals using deci

The immediate goal of BCI research is to provide communications capabilities to severely disabled people who are totally paralyzed or 'locked in' by neurological neuromuscular disorders.

III. MODULES

3.1 Brain Waves Classification:

To obtain the brain pattern of individuals, subjects are instructed to close their eyes and relax. The brain patterns form sinusoidal wave shapes. Generally, they are measured from peak to peak and ranges for 0.5 to 100µV in amplitude, which is about 100 times lower than EEG signals.by applying Fourier transform power spectrum the raw EEG signal is obtained. The sine waves of different frequencies are visible due to the contribution of power spectrum even though is continuous, which ranges from 0Hz up to one half of sampling frequency, the brain state of the individual may make certain frequencies more dominant. The brain waves have been divided into four basic groups:

- Beta (>13Hz)
- Alpha(8-13 Hz)
- Theta(4-8 Hz)
- Delta(0.5-4 Hz)

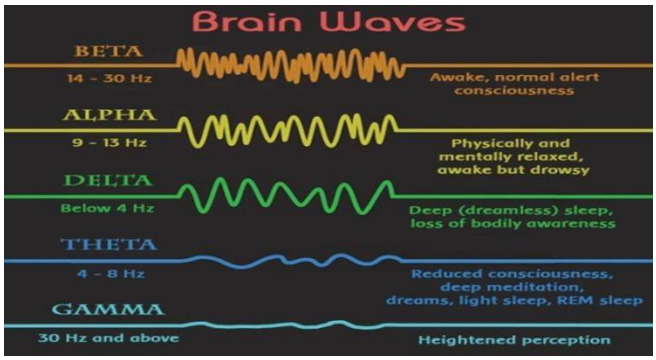

Figure 1: Brain wave samples with frequencies belonging to beta, alpha, delta, and theta and gamma band.

The most extensively studied rhythm of the human brain is the normal alpha rhythm. It is usually observed better in posterior and occipital regions with typical amplitude about 50µV. The Alpha activity is initiated by closing the eyes and relaxation, and terminated by eye opening or alerting by any mechanism. EEG is sensitive to a continuum of states ranging from stress state, alertness to resting state, hypnosis, and sleep. An EEG signal between electrodes placed on the scalp consists of many waves with different characteristics. A large amount of data received from even one single EEG recording presents a difficulty for interpretation. Individual's brain wave patterns are unique. In some cases, it is possible to distinguish persons only according to their typical brain activity.

3.2EEG Recording Techniques:

Encephalographic measurements employ recording system consisting of electrodes with conductive media, amplifiers with filters, A/D converter and Recording device. Electrodes read the signal from the head surface, amplifiers bring the

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microvolt signals into the range where they can be digitalized accurately, converter changes signals from analog to digital form, and personal computer (or other relevant device) stores and displays obtained data. A set of the equipment is shown in Figure 2.Scalp recordings of neuronal activity in the brain, identified as the EEG, allow measurement of potential changes over time in basic electric circuit conducting between signal (active) electrode and reference electrode. Extra third electrode, called ground electrode, is needed for getting differential voltage by subtracting the same voltages showing at active and reference points.

Minimal configuration for mono-channel EEG measurement consists of one active electrode, one (or two specially linked together) reference and one ground electrode. The multi-channel configurations can comprise up to 128 or 256 active electrodes.

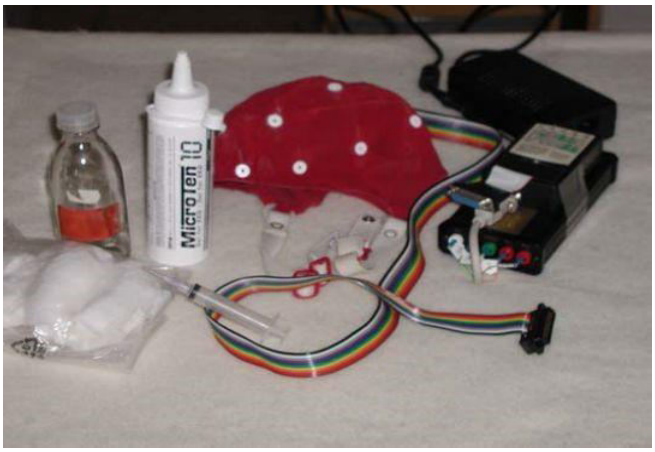

Figure 2: Equipment for EEG recording: amplifier unit, electrode cap, conductive jelly, injection, and aid for disinfection

3.2 Quantitative electroencephalography:

Technological advances increased ability of encephalography to read brain activity data from the entire head simultaneously. Quantitative EEG (QEEG) applies multi-channel measurements that can better determine spatial structures and localize areas with brain activity or abnormality. The results are often used for topographic brain mapping represented with colour maps in 2D and 3D to enhance visualization.

ADVANTAGES:

- Allow paralyzed people to control prosthetic limbs with their mind
- Transmit visual images to the mind of a blind person, allowing them to see
- Transmit auditory data to the mind of a deaf person, allowing them to hear
- Allow gamers to control video games with their minds
- Allow a mute person to have their thoughts displayed and spoken by a computer

DISADVANTAGES:

- Research is still in beginning stages
- The current technology is crude
- Ethical issues may prevent its development.
- Electrodes outside of the skull can detect very few electric signals from the brain
- Electrodes placed inside the skull create scar tissue in the brain

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APPLICATIONS:

The greatest advantage of EEG is speed. Complex patterns of neural activity can be recorded occurring within fractions of a second after a stimulus has been administered. EEG provides less spatial resolution compared to MRI and PET. Thus for better allocation within the brain, EEG images are often combined with MRI scans. EEG can determine the relative strengths and positions of electrical activity in different brain regions. According to R. Bickford research and clinical applications of the EEG in humans and animals
are used to:

- Monitor alertness, coma and brain death
- Locate areas of damage following head injury, stroke, tumor, etc.
- Test afferent pathways (by evoked potentials)
- Monitor cognitive engagement (alpha rhythm)
- Produce biofeedback situations, alpha, etc.
- Control anesthesia depth ("servo anesthesia")
- Investigate epilepsy and locate seizure origin
- Test epilepsy drug effects
- Assist in experimental cortical excision of epileptic focus
- Monitor human and animal brain development
- Test drugs for convulsive effects
- Investigate sleep disorder and physiology

IV. CONCLUSION

A potential therapeutic tool. BCI is an advancing technology promising paradigm shift in areas like Machine Control, Human Enhancement, Virtual reality and etc. So, it's potentially high impact technology. Several potential applications of BCI hold promise for rehabilitation and improving performance, such as treating emotional disorders (for example, depression or anxiety), easing chronic pain, and overcoming movement disabilities due to stroke. Will enable us to achieve singularity very soon. Intense R&D in future to attain intuitive efficiency.

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BIOGRAPHY

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