International Journal of Scientific Research and Engineering Development-– Volume 3 Issue 2, Mar-Apr 2020
Available at www.ijsred.com

RESEARCH ARTICLE OPEN ACCESS

EMOTION RECOGNITION USING EEG SIGNALS

Mr. L. Manoharan[*], S. Abinaya[**], K. Arulbarathi[***], V. Dhanya[****]
[*](Department of ECE, Jeppiaar SRR Engineering College, Chennai, Tamil Nadu, India.
Email: manoharsrr@gmail.com)
[**](Department of ECE, Jeppiaar SRR Engineering College, Chennai, Tamil Nadu, India.
Email: abinu4269@gmail.com)
[***] (Department of ECE, Jeppiaar SRR Engineering College, Chennai, Tamil Nadu, India.
Email: gkbharathi430@gmail.com)
[****] (Department of ECE, Jeppiaar SRR Engineering College, Chennai, Tamil Nadu, India.
Email: dhanyaavenkat@gmail.com)

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Abstract:

This project is based on a few brain controlled robot supported Brain computer interfaces (BCI). BCIs are systems which may be want to bypass conventional channels of communication which can also want to supply direct communication and control between the human brain and physical devices by translating different forms of brain activity into commands in real time. With these commands a mobile robot are often controlled. The intention of the project work is to develop a robot which will assist the disabled people in their lifestyle to try to some work independent of others. Here, we analyse the brain wave signals. Human brain consists of millions of interconnected neurons. The patterns of interaction between these neurons are represented as thoughts and emotional states. According to the human thoughts, this patterns are going to be changing which successively produce different electrical waves. A contraction also will generate a singular electrical signal. All these electrical waves are going to be sensed by the brain wave sensor and it will convert the info into packets and transmit through Bluetooth medium. Level analyser unit (LAU) will receive the brain wave data and it'll extract and process the signal using MATLAB platform. Then the control commands are going to be transmitted to the robot module to process. Electroencephalograms (EEG's) used to review brain activity within the context of strokes, epilepsy. It is desirable to eliminate EEG artifacts to enhance signal collection. The emotion recognition system for human brain signals is proposed using EEG signals. We measure EEG signals concerning emotion, divide them into five frequency ranges on the thought of power spectrum density, and eliminate low frequencies from 0 to 4 Hz to eliminate EEG artifacts. With increasing role of brain computer interface applications has grown by the importance and need of automatically recognize emotion from EEG signals. The detection of fine grained changes in functional state of human brain are often detected using EEG signals in comparison to other physiological signals. Under four emotions (disgust, happy, surprise and fear) from the participants the EEG signal is acquired using the audio-visual induction based acquisition protocol. The 63 biosensors are used for registering the EEG signal for various emotions. To classify the human emotions three statistical features are extracted when two different Lifting Based Wavelet Transform (LBWT) is employed after the pre-processing signals. Results confirm the likelihood of using two different lifting scheme based wavelet transform for assessing the human emotions from EEG signals.

*KEYWORDS:***Arduino UNO,EEG Sensor, Transmitter, Receiver, LCD.**

I. INTRODUCTION

To evoke target-specific emotion reliably and reproducibly, we construct a standardized database of 16 emotional film clips selected from over one thousand film excerpts, and build 8 emotional categories. The standardized database including participants' self-ratings will be made publicly available1 to provide a useful benchmark for elicited emotion evaluation. Our system out performs the state of mind in real-time emotion recognition systems in terms of accuracy and the ability to recognize similar discrete emotions that are close in the valence-arousal coordinate space. In particular, our system achieved an averaged accuracy of 92.26 per-cent (50 per-cent accuracy at random) in recognizing high-arousal and valanced emotions from neutrality. Based on basic discrete emotions that were elicited by standardized film clips, our system classified three positive emotions (joy, amusement, tenderness) and four negative emotions (anger, disgust, fear, sadness) with an overall accuracy of 86.43 per-cent (33.33 per-cent accuracy at random) and 65.09 per-cent (25 per-cent accuracy at random), respectively.

II. HARDWARE REQUIREMENTS

The hardware requires for this concept are Arduino UNO in which ATmega328 is mainly used, brain wave sensor and LCD to display the output.

A. ARDUINO UNO

Arduino is a source for creating computers which is used to sense and control the more operations than your personal computer. It is called as an open-source physical computing platform because it supports an easy microcontroller board and a development environment for writing code in software for the board. Arduino are often used to develop object interactions, inputs are obtained from a sensors and switches, which controls a lights, motors, and other physical outputs. Arduino projects are often stand-alone, or they will communicate with software running on your computer (e.g. Flash, Processing, MaxMSP) The boards are often assembled by hand or purchased preassembled; the open-source IDE are often downloaded for free of charge .The Arduino programing language is an implementation of Wiring, a similar physical computing platform, which is predicated on the Processing multimedia programming environment. The Arduino Uno features a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is out there on digital pins 0 (RX) and 1 (TX). An ATmega8U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the pc. The '8U2 firmware uses the quality USB COM drivers, and no external driver is required.

B. BRAIN WAVE SENSOR

At the basis of all our thoughts, emotions and behaviours is that the communication between neurons within our brains. Brainwaves are obtained when more number of neurons communicating with one another which forms synchronized electric pulses. Sensors will detect the brainwaves by placing it on the scalp. Functions are detected by dividing into bandwidth. Brainwaves as musical notes is a handy technology to think - the low frequency waves like a deeply penetrating drum beat, while the higher frequency brainwaves are like a subtle high pitched flute. Our brainwaves change consistent with what we're doing and feeling. When slower brainwaves are dominant we will feel tired, slow, sluggish, or dreamy. The higher frequencies are dominant once we feel wired, or hyper-alert. In practice things are much more complex, and brainwaves reflect different aspects once they occur in several locations within the brain. Brainwave speed is measured in Hertz (cycles per

second) and that they are dived into bands delineating slow, moderate, and fast waves.

III. EEG SIGNAL

To record electrical activity generated by the brain, EEG senor is the most essential component. When the sensors (electrodes) are placed at the scalp surface it records the electrical data. Depending on the scope of the experiment it comprises various sensors with number of electrodes ranging from 10 to 500 above, but it often requires only a double number of electrodes. Elastic caps, meshes, or rigid grids are mounted by EEG electrodes, ensuring that the data can be collected from identical scalp positions across sessions or respondents.

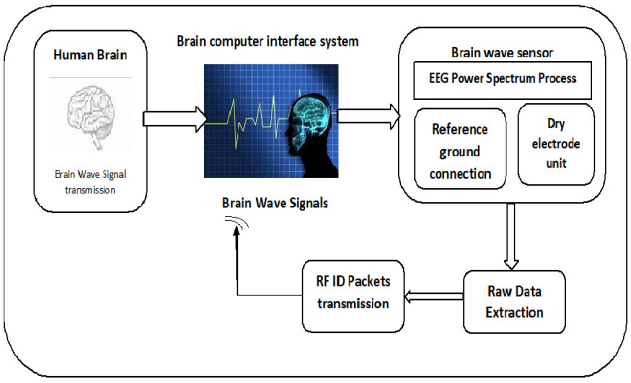
Since the electrical signals are very small, the recorded data is digitized and sent to an amplifier. Price differences in EEG systems are typically due to the number and quality of the electrodes, the quality of the digitization as well as the quality and sampling rate of the amplifier. Usually, EEG systems with higher sampling rates are more expensive than devices with lower sampling rate.

A. TRANSMITTER

A transmitter is a device utilized in telecommunications to supply radio waves so as to transmit or send data with the help of an antenna. The transmitter is in a position to get a frequency AC that's then applied to the antenna, which, in turn, radiates this as radio waves. There are many sorts of transmitters counting on the quality getting used and therefore the sort of device; for instance, many modern devices that have communication capabilities have transmitters like Wi-Fi, Bluetooth, NFC and cellular. A transmitter is additionally referred to as a transmitter.

Transmitters are devices that are wont to send data as radio waves during a specific band of the spectrum so as to full-fill a selected communication need, be it for voice or for general data. so as to try to this, a transmitter takes energy from an influence source and transforms this into a frequency AC that changes direction millions to billions of times per second counting on the band that the transmitter must send . When this rapidly changing energy is directed through a conductor, during this case an antenna, electromagnetic or radio waves are radiated outwards to be received by another antenna that's connected to a receiver that reverses the method to return up with the particular message or data.

Block Diagram of Transmitter:

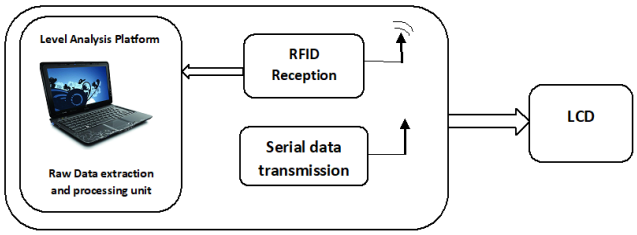


B. RECEIVER

The RX of this system is made up of data processing unit and LCD. A data processing unit is a programmable electronic component that processes the streams of data. It is mainly based on the

- Raw data extraction,
- RFID Reception,
- Serial data transmission.

Block Diagram of Receiver:



B. OUTPUT

IV. RESULT AND OUTPUT

The output is obtained in the LCD. It displays the message received from the receiver part of the EEG Sensor. In this paper we used only one electrode which is used to show two forms of brain needs. These two needs of brain is displayed in the LCD as an output.

A. LCD

The signals which are received from the sensor detect the needs of the brain and the output is obtained in the form of LCD. A liquid display or LCD draws its definition from its name itself. It's combination of two states of matter, the solid and therefore the liquid. LCD uses a liquid to supply a clear image. Liquid displays are super-thin technology monitor that are generally utilized in laptop pc screen, TVs, cell phones and portable video games. LCD's technologies allow displays to be much thinner in comparison to beam tube (CRT) technology. An LCD is either made from a lively matrix display grid or a passive display grid. Most of the Smartphone's with LCD display technology uses active matrix display, but a number of the older displays still make use of the passive display grid designs. Most of the electronic devices mainly depend upon liquid display technology for his or her display. The liquid features a unique advantage of getting low power consumption than the LED or beam tube.

V. CONCLUSION

In this paper, we established a standardized database of 16 Chinese film clips, and proposed a real-time EEG-based emotion recognition system for identifying an individual's emotional states through the analysis of brain waves. The system consisted of six modules: emotion elicitation, EEG data acquisition, data pre-processing, feature extraction, emotion classification, and human machine interface. We conducted an experiment to validate the efficiency and effectiveness of the system. Thirty participants took part in this experiment and watched a few emotional film clips that targeted seven basic discrete emotions (joy, amusement, tenderness, anger, disgust, fear, sadness) and neutrality. Our system achieved an average accuracy of 92.26% in recognizing balanced emotions from neutrality. In addition, the system successfully classified three positive emotions (joy, amusement, tenderness) and 4 negative emotions (anger, disgust, fear, sadness) with an overall accuracy of 86.43 and 65.09% respectively. These results demonstrated an

advantage over the existing state-of-the-art real-time emotion recognition systems from EEG signals in terms of the accuracy and the ability to recognize several similar discrete emotions that are close in the valence-arousal coordinate space.

VI. REFERENCES

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