

HUMAN-ROBOT INTERACTION USING EEG, WORLD WIDE RANGE OVER IOT

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ABSTRACT

In This project Electro Encephalogram is a tool for communication between human and robot. EEG is the first method to find epilepsy , sleep disorder, comma encephalopathy's and brain death[1]. EEG is an electrophysiological monitoring method to record electrical activity of brain. Here a robotic arm is controlled by a voltage signal from the human scalp. Gamma band signal is used for communication between human and robot. Here channel between human and robot is IOT, Commonly used channels are air, cables etc. IOT ensures worldwide communication over internet. EOG is the sub division of EEG which can get a voltage level from near human eyes ,using this potentials we can control the robot or robotic arm. It can be used in artificial intelligence with IOT. Raspberry pi is used as controller which has ARM 7 controller

Keyword : EEG-Electro Encephalogram, IOT-Internet of thinks

1. INTRODUCTION

EEG is an electro physiological monitoring method to record electrical activity of brain. The electrode used is noninvasive and invasive electrodes are used some times in specific application. EEG measures ionic fluctuation resulting from ionic current.[2]

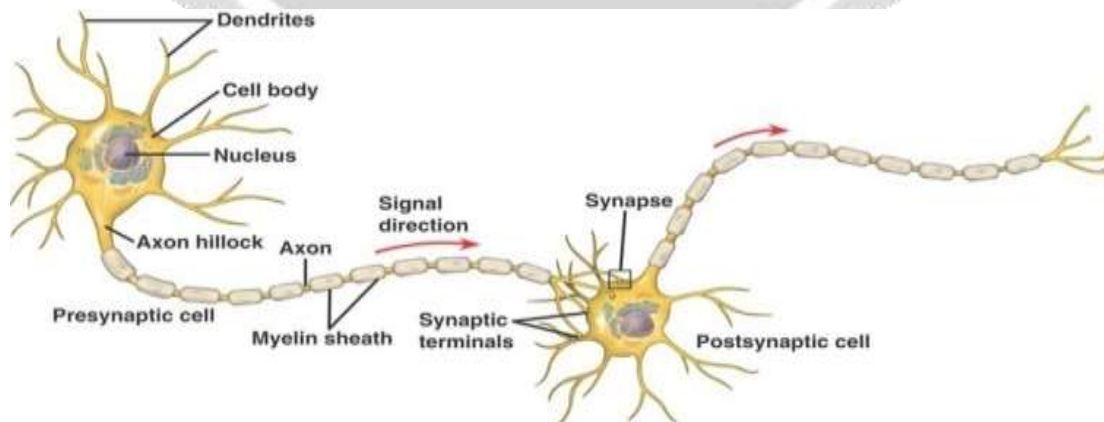


fig 1. Neuron

A neuron is an electrically excitable cell that process and transmit information through electrical and chemical signals. It maintaining voltage gradients across membrane by means of metabolic driven ion pumps. Concentration difference in Na, K, Cl, Ca in the membrane and channel generate intra cellular and extra cellular concentration. Charges across membrane voltage can alter the function of voltage dependent ion channels. If a voltage change by a large enough a pulse is generated called action potential. Which travels rapidly along the cells axon and active synaptic connection with other cells. Synaptic also known as voltage gated calcium cell. Neuron ending at the scalp we get a potential that potential is used here.

EEG is the first method to diagnosis of tumor stroke, and other focal brain disorders. EEG is typically described in terms of rhythmic activity and transients, Which is divided into bands of frequency.

1. Delta <4Hz
2. Theta 4-7Hz
3. Alpha 8-14Hz
4. Beta >14Hz
5. Gamma >32Hz
6. Mu 8-12Hz[6]

2. BLOCK DIAGRAM

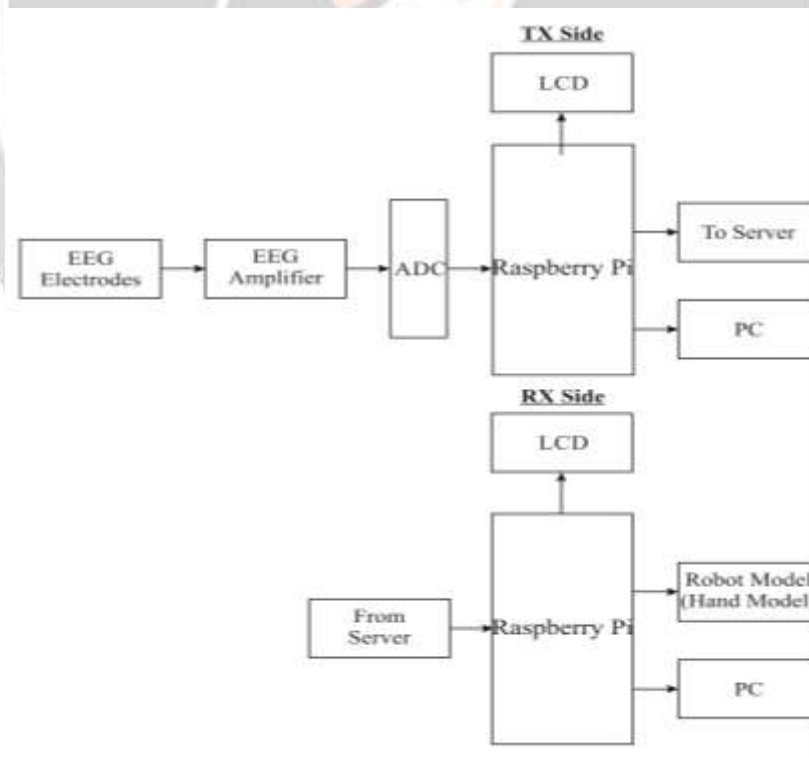


fig 2. Full block diagram

The block diagram consist of transmitter and receiver side. In the transmitter side electrode gets the signal from human face and given to signal processing units such as EEG amplifier & filter and ADC section. Here instrumentation amplifier is used for amplifying and for filtering and amplifying section opamp also given to it.

Low pass, high pass, band pass filters are used filtering the proper gamma band (>14Hz) signal, Alpha band is dominant in adults. Here gamma band given to a 12 bit ADC because of working memory. The raspberry pi convert serial signal message to parallel signal. Then it is convert into decimal value, and loaded into a server web hosting site. When there is an availability of internet connection in both receiver and transmitter, the receiver read the decimal value from the server and corresponding movements like up, down, left, right movements in the robotic arm can be done. fig 2. consist full block diagram. Total two raspberry pi are used one in transmitter side and other in receiver side.

Optocoupler like protection circuit can be given and a pulse width modulator and a demodulator circuit also provided for the modulation and demodulation of the signal and noise in the signal can be reduced.

In the robotic arm structure fig 3. consist of three servo motors. one for up and down movement. other two for clock wise 180 degree movement and anti clock wise 180 degree movement.

2.1 Robotic Arm

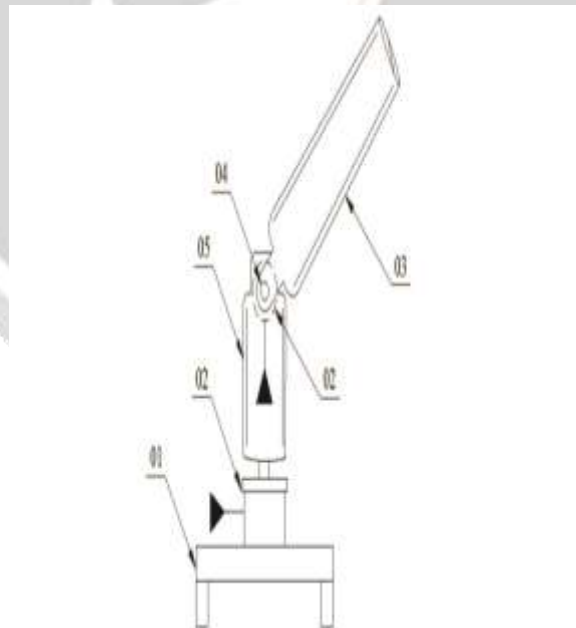


fig 3. Robotic Arm.

Table 1: Robotic Arm servo motor arrangement.

S.NO	PART NAME
01	Base frame
02	Servo motor
03	Hand structure
04	Elbow joint
05	Rotating arm
06	To control unit

The hand like structure move in four directions up, down, left, right. Right and left rotate 180 degree rotations.

3. IOT

The Internet of things (IoTs) connects the various types of objects like smart phones, personal computer and Tablets to internet, lights, fans etc. With the introduction of IoTs, the research and development of home automation are becoming popular in the recent days. Many of the devices are controlled and monitored for helps the human being. Additionally various wireless technologies help in connecting from remote places to improve the intelligence of home environment. An advanced network of IoT is being formed when a human being is in need of connecting with other things. IoTs technology is used to come in with innovative idea and great growth for smart homes to improve the living standards of life[4].IOT connects transmitter and receiver sides and produce useful movements of robotics arm from the instruction given by the EEG connected person.

4. EEG PLACEMENTS

Large amount of electro-oculographic (EOG) data recorded during EEG measurements. The auto calibration is based on automatic threshold value estimation.

The blinks recorded in two condition, were controlled task with free viewing (multi task).The result were compared with result from a video oculography device and manually scored blinks. The input signals, horizontal EOG (EOGrigh,EOGleft and vertical EOG (EOGup, EOGdown) were measured with four Ag-Ag-Cl electrodes and a ground potential at the hand.

There is two channel is used EOGup , EOGdown and EOGgnd other channel is EOGleft ,EOGrigh , and EOG gnd.

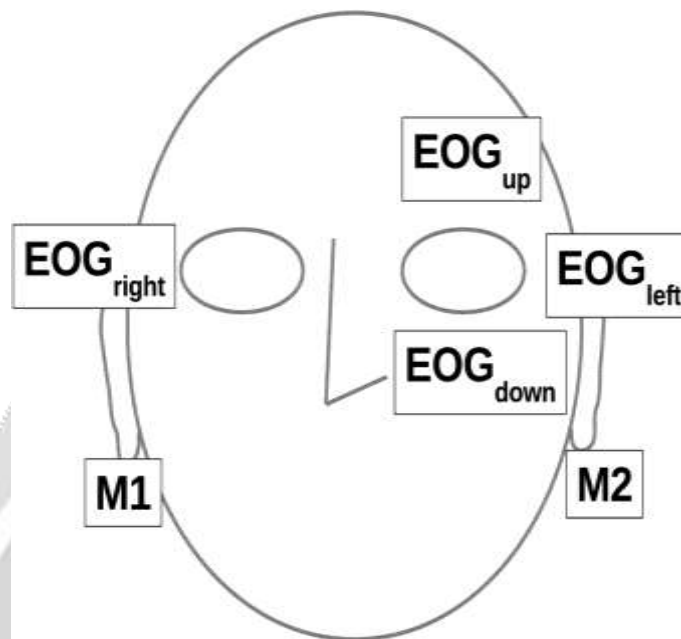


fig 4. EEG Placement

Gamma band is critical for learning memory, information processing, perception and behavioral of organism[3]. Gamma has been observed in the number of cortical areas as well as sub cortical structures numerous species. In sensory cortex, gamma power increases with sensory drive and with a board range of cognitive phenomena including perceptual grouping and attention.

At a given recording site, gamma is stronger for some stimuli than others, generally displaying selectivity and a preference similar to that of nearby neuronal spiking activity. In higher cortex gamma power is elevated during working memory, irregular gamma activity has been observed in neurological disorders such as Alzheimer's disease, Parkinson's disease schizophrenia and epilepsy.[5]

5. CONCLUSIONS

We can control our robotic arm by using EEG. Key hole surgery can be done using EEG than that of a joystick. EEG is more faster than other switching techniques used in human robot communication. It can use it for security purposes. This project offers worldwide controlling range. Internet connection is necessary for our project. The development of high speed internet like 4G client to server communication is faster.

6. REFERENCES

- [1]Tatum, William O. (2014). Handbook of EEG interpretation. Demos Medical Publishing. pp. 155–190. ISBN 9781617051807. OCLC 874563370..
- [2]Niedermeyer E.; da Silva F.L. (2004). Electroencephalography: Basic Principles, Clinical Applications, and Related Fields. Lippincott Williams & Wilkins. ISBN 0-7817-5126-8

- [3]Coherence of gamma-band EEG activity as a basis for associative learning
Wolfgang H. R. Miltner¹, Christoph Braun², Matthias Arnold³, Herbert Witte³ & Edward Taub⁴*Note that the place of publication,publisher, and year of publication are enclosed in brackets. Editor of book is listed before book title.*
- [4]IoT based Monitoring and Control System forHome Automation Pavithra.D
Proceedings of 2015 Global Conference on Communication Technologies(GCCT 2015)
- [5] Gamma Rhythms in the Brain, Xiaoxuan Jia, Adam Kohn
PLoS Biol. 2011 Apr; 9(4): e1001045. Published online 2011 Apr 12. doi: 10.1371/journal.pbio.1001045
- [6] Mental States, EEG Manifestations, and Mentally Emulated Digital Circuits for Brain-Robot Interaction
Stevo Bozinovski, Senior Member, IEEE, and Adrijan Bozinovski, Member, IEEE
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