Wireless Sensor Network For Post Stroke Health-Care Using Fugal Meyer Assessment

Suganya.P [1], Dr A.Kalaiarasi [2]
[1]Dept of EEE
[2]Asst. prof, Dept of EEE
[1, 2,]Sri Shakthi Institute Of Engineering And Technology, Coimbatore, India

Abstract- *EEG-based brain-controlled mobile robots can serve as powerful aids for severely disabled people in their daily life, especially to help them move voluntarily. In this paper, we provide a comprehensive review of the complete systems, key techniques, and evaluation issues of brain-controlled mobile robots along with some insights into related future research and development issues for the stroke survival. This mind controlled robot is in view of Mind – PC interfaces (BCI).BCIs are frameworks that can sidestep traditional channels of correspondence (i.e., muscles and considerations) to give direct correspondence and control between the human mind and physical devices by deciphering distinctive examples of cerebrum action into command continuously. With these orders a portable robot can be controlled. The venture's goal work is to create a robot that can help the crippled individuals in their everyday life to do some work free on other. The performance impromence are measured using fugalMeyer assessment.*

Keywords: wireless sensor network, mobile robots, PC-interface post stroke.

I. INTRODUCTION

ROBOTS have been generally utilized as a part of industry, as well as likewise step by step going into human life. Assistive robots can give backing to debilitated individuals in every day and expert life, along these lines making a developing interest for them. All in all, solid clients can work the robots with a traditional info device, for example, a console, a mouse, or a joystick. These devices are, in any case, hard to use for elderly or debilitated people. Hence alternative method of BRAIN- COMPUTER INTERFACE technique is employed to overcome this drawback. (Jr, 2013) The mind controlled robot fundamentally deals with catching the cerebrum wave signs, using it for the development of robot. Here the mind wave investigation is being performed, the cerebrum believed is not being caught rather the cerebrum fixation level is being measured. BRAIN-PC interfaces (BCIs) utilization signs recorded from the mind to work mechanical or prosthetic devices. (Honeywell S & C, 2009)

In Introduction you can mention the introduction about your research

Signal recordings of brain activity employed by BCIs are often either invasive or noninvasive. Invasive BCIs need surgery to implant electrodes directly on or within the cortex, whereas noninvasive BCIs do not do therefore. Noninvasive BCIs will use numerous brain signals as inputs, like electroencephalograms (EEG), magneto encephalograms (MEG), blood-oxygen-level-dependent (BOLD) signals, and (de) Hb concentrations. Due to the low value and convenient use in apply; encephalogram has been the foremost popular signal that helps develop BCI systems. So we are focused On EEG to do better. (InvenSenseInc, 2010)

II. LITERATURE REVIEW

An electroencephalograph (EEG) is the recorded electrical action produced by the cerebrum. In general, EEG is gotten utilizing cathodes put on the scalp with a conductive gel. In the mind, here are a huge number of neurons, each of which produces little electric voltage fields. The total of these electric voltage fields make an electrical perusing which cathodes on the scalp are capable identify and record. Therefore, EEG is the superposition of numerous less complex signs. The plentifulness of an EEG flag ordinarily extends from around 1 μV to 100 μV in an ordinary adult, and it is more or less 10 to 20 mV when measured with repress anodes, for example, needle cathode. (Wardhana, 2004)

The FFT (Fast Fourier Transform) is a scientific procedure which is utilized as a part of EEG investigation to research the organization of an EEG signal. Since the FFT changes a sign from the time domain into the recurrence space, recurrence appropriations of the EEG can be watched. EEG recurrence appropriation is exceptionally touchy to mental and passionate states and in addition to the area of theelectrode(s).Two sorts of EEG montages are utilized: monopolar and bipolar. The monopolar montage gathers signals at the dynamic site and analyzes them with a typical reference cathode. The normal cathode ought to be in an area

so that it would not be influenced by cerebral action. The primary point of preference of the monopolar montage is that the regular reference permits legitimate correlations of the signs in a wide range of terminal pairings. Disservices of the monopolar montage incorporate that there is no perfect reference site, in spite of the fact that the ear cartilage are ordinarily utilized. What's more, EMG and ECG relics may happen in the monopolar montage. Bipolar montage looks at signs between two dynamic scalp sites. Any action in the same way as these locales is subtracted so that just contrast in movement is recorded. Therefore some data is lost with this montage. (HoneywellS&C, 2009)

EEG is for the most part depicted regarding its recurrence band. The adequacy of the EEG demonstrates a lot of variability relying upon outer incitement and in addition inward mental states. Delta, theta, alpha, beta and gamma are the names of the diverse EEG recurrence groups. NernSky has added to a dry sensor framework for buyer utilizations of EEG innovation. Nero Sky framework comprises of dries cathodes and an exceptionally outlined electronic circuit for the dry terminals. (M. Bocca, 2000)NeuronSky has been comparing so as to direct benchmark tests of the dry EEG signs measured by the dry sensor framework with signs from the Biopic framework, an understood wet terminal EEG framework broadly utilized as a part of medicinal and exploration applications. EEG was at the same time recorded by the NeroSky framework and the Biopic framework. Anodes for the two frameworks were set at the same area, as near one another as could be expected under the circumstances without meddling with each other. Gold-plated dry cathodes were utilized for NeroSky system, while silver-silver-chloride expendable terminals with gel were utilized for Biopic framework. (http://www.analog.com/en/mems-sensors., 2006)
The portable robot was a little Khoper that nearly emulates a mechanized wheelchair. The robot moved at a most extreme rate of 33% of its distance across every second, like the pace of a wheelchair in an office building. The Khoperrobot is a two-wheel drive vehicle. It has 8 infrared sensors around its measurement to identify obstructions. The sensors have a constrained discernment range, which makes the acknowledgment of the distinctive ecological circumstances troublesome if the crude readings were utilized straightforwardly. To conquer this impediment, we actualized a multi-layer recognition that maps the 8 crude infrared tangible readings into 6 classes of ecological states, or robot's perceptual states; i.e., divider to one side, divider to one side, snag to one side, obstruction to one side, divider or deterrent in front, and free space. The mapping was enhanced on a free arrangement of examinations where the robot was put at different areas in the earth.

Numerous scientists have created different brain controlled portable robots, to the best of our insight; none of the current cerebrum controlled versatile robots is brought out of a controlled lab environment. The fundamental explanation behind this is that the BCI is not steady because of the non-stationary way of the EEG signals. Therefore, to make these versatile robots usable in genuine circumstances, table BCI frameworks should be investigated. In the event that a BCI framework is not steady, different strategies ought to be further created to enhance the general driving execution. (InvenSenseInc, 2010)

One typical example is that the work of Tanaka et al, Who first developed a brain-controlled robotic Chair whose left or right turning movement'ssquare Measure directly controlled by corresponding motion commands translated from user brain signals while imagining left or right limb movements, and tested this system in real-world state of affairs. Choi and coworkers additionally used a BCI supported motor imaginationto make a brain-controlled mobile robot, as illustrated, which might perform three-motion commands as well as turning left and right and going forward, and valid this automatonin an exceedinglyplanet. In our proposed model, we intend to use robotic arm or prosthetic arm to interface with EEG module. In this model a handicapped or disabled person can move the external interfaced arm as his own arm with his mind just as he controlling his real arm or hand. (HoneywellS&C, 2009)

Here we will use passive GEL based ELECTRODES for brain wave detection. It is then interfaced to a filtration circuit that differentiates and filters each signal. It is then analyzed and separated based on time/frequency variation which is then send to a feature recognition and classification circuit which classifies each signal based on frequency/time variation. These signals via Microcontroller are used to control the desired application. The output device to be controlled here is a Prosthetic arm which helps the disabled to pick or place any object under his will, without any aid or help from others. (http://www.analog.com/en/mems-sensors., 2006)

III. METHODOLOGY

The main aim of this project is to support the handicapped, disabled or even paralyzed person. The research and development of brain-controlled mobile robots have received a great deal of attention because they can help bring mobility back to people with devastating neuromuscular disorders and thus improve their quality of life. In this paper, we presented a comprehensive up-to-date review of the complete systems, key techniques, and evaluation issues of brain-controlled mobile robots. Brain - computer interface is a

technique of communication supported neural activity generated by thebrain and is freelance of its traditional output pathways of peripheral nerves and muscles. The goal of BCI is not to verify a person's intent by eavesdropping on brain activity, but rather to supply a new channel ofoutput for the brain that needs voluntary accommodative management bythe user.

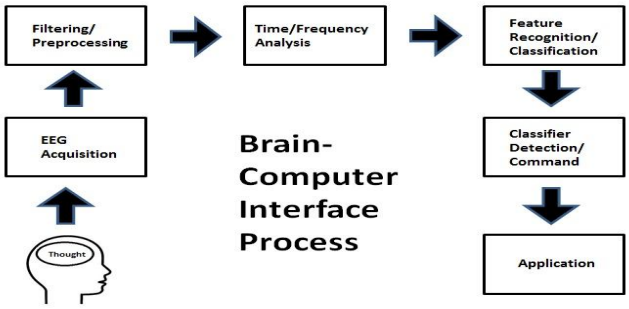
The Fourier Transformation and extraction of band powers is far and awaythe foremost applied method for signal process and analysis. The ruleis predicated on distinct Fourier rework (DFT) and by applying that to the encephalogram signal it makes it attainable to separate the encephalogram rhythms.WSN is becoming increasingly important for monitoring patients both in the clinical setting and at home. Remote monitoring allows monitoring of sports activities, emergencies, catastrophe responses, etc. Wireless communications also provide more comfort for the patients, with the absence of wires reducing costs and providing more flexibility. WSNs can integrate vital sign sensors and also environmental sensors such as air quality. The following section describes the WSN transmission technologies including a state of the art of the publications that implement a WSN system in health. Sensor deployment plays an important role in ensuring network connectivity and sensing coverage, and consequently, network resilience to faults. Network coverage refers to how well the sensor network covers the area of the phenomena being monitored. Connectivity refers to the ability of active nodes to stay connected. Designing and deploying a sensor network with considerations about connectivity in mind will provide fault tolerance without the need for fault detection or recovery functionality.

.The relationship between connectivity and coverage is quantified by previous work [13]. The authors define k-coverage as any location in the network being monitored by at least k nodes.

Current wireless technologies, such as wireless body area networks and wireless personal area networks, provide promising applications in medical monitoring systems to measure specified physiological data and also provide location-based information, if required. With the increasing sophistication of wearable and implantable medical devices and their integration with wireless sensors, an ever-expanding range of therapeutic and diagnostic applications is being pursued by research and commercial organizations.

This paper aims to provide a comprehensive review of recent developments in wireless sensor technology for monitoring behavior related to human physiological responses. It presents background information on the use of wireless technology and sensors to develop a wireless physiological measurement system. A generic miniature platform and other available technologies for wireless sensors have been studied in terms of hardware and software structural requirements for a low-cost, low-power, non-invasive and unobtrusive system.

BLOCK DIAGRAM:



IV. RESULTS AND DISCUSSION

The patients who were opted for experimental trial were assessed in prior to the therapy. The assessment criteria is categorized into three terms namely

- Pre assessment (week 0, prior to the therapy)
- Mid assessment (week 5, mid of the therapy)
- Post assessment (week 10, after completion of the therapy)

The paresis level of the patients wasanalyzed and the devices were chosen for the patient based on their severity and need of therapy. The duration of the therapy is for about 30 minutes/day and subjected to extension based on the patient's interest and mental state. The widely used method for Assessment for Upper Arm and Lower Arm Hemiplegia is Fugal Meyer Assessment (Fugal Meyer AR et al 1975) . The purpose of this assessment is to evaluate and measure the patient recovery of the survival group of stroke.

The major parameters of measurement using Fugal Meyer Assessment are Motor, Sensory, Balance, Range of Motion (ROM) and Joint pain.

All the electromechanical systems are applied to different patients and their assessment scores were generated with reference to the Fugal Meyer Assessment data sheet and the obtained values are converted into a Table 1.

Parameter	Pre-assessment	Mid-assessment	Post-assessment
A. Upper extremity	`13	17	20
B. Wrist	3	6	9
C. Hand	4	9	12
D. Coordination Speed	3	3	4
Total A-D	23	35	45
Sensation	1	4	8
Joint pain	10	13	16
Passive Joint Motion	11	14	17

Assuming that the variables of pre assessment to be ‘m’ and the variables of post assessment to be ‘n’, the hypothesis testing is proposed in order to identify the significance of the developed product. Paired-t test is

Conducted to identify the mean difference among the population ‘m’ and ‘n’. The paired sample t-test also referred as dependency t-test which is used to measure the significant improvement of the computed data. It is a factual system used to compute if the mean contrast between the two arrangements of the perception is zero. The paired t-test is conducted based on the following assumptions:

Null hypothesis (: This hypothesis states that there exists no significant mean difference between the populations considered for paired t- test Alternate hypothesis: This hypothesis states that there exists some notable mean difference between the populations considered for paired t-test. Here there exists upper tailed and lower tailed alternate hypotheses where the former denotes a positive mean difference while the later denotes a negative mean difference.

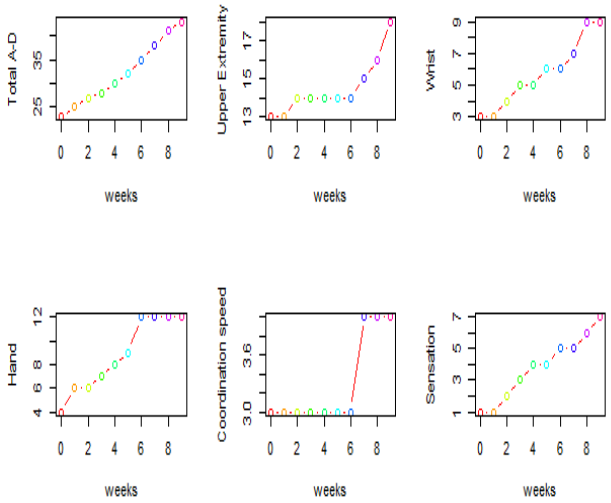


Figure 2: Scatter plot of the FMA

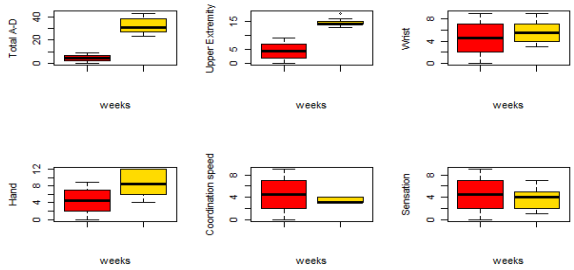


Figure 3: Box plot of FMA

From figure 2 and 3 proves the evidence for a normalized clean date outlier extremes hence the predictor and response variables prove to be in a linear modeling.

V. CONCLUSION

Although the standardand determination of the brain signals measured with our electroencephalogram system don't seem to be comparable to those recorded by deep-seated electrodes, they're enough to mentally operate robots in indoor environments. This is often potential due to the mixture of advanced artificial intelligence, an asynchronous protocol for the analysis of on-line electroencephalogram signal, and machine learning techniques. In particular, this paper introduces the novel plan of dominant robots by mapping asynchronously high-level mental commands into a finite state automation. Our results open the chance for physically disabled individuals to use a transportable EEG-based brain-machine interface for dominant wheelchairs and prosthetic limbs. During alot of general sense, our results indicate that on-line electroencephalogram analysis might, doubtless, be a lot of powerful than antecedently thought.

REFERENCES

[1] Inven SenseInc., http://invensense.com/memes/gyro/idg300.html
[2] InvenSenseInc.,http://invensense.com/mems/gyro/idg500.html
[3] HoneywellS&C,http://sensing.honeywell.com/product20pageprid52508
[4] AnalogDevices,http://www.analog.com/en/mems-sensors/mems-inertial-sensors/adis16355/products/product.html
[5] AnalogDevices,http://www.analog.com/en/mems-sensors/mems-inertial-sensors/adxl202/products/product.html
[6] AnalogDevices,http://www.analog.com/en/mems-sensors/mems-inertial-sensors/adxl330/products/product.html
[7] K. Wardhana and F. C. Hadipriono, "Analysis of recent bridge failures in the United States," Journal of Performance of Constructed Facilities, vol. 17, no. 3.
[8] Biopic Systems, Inc. http://www.biopac.com/pulse-plethysmogram-amplifier
[9] B. F. Spencer Jr. and S. Cho, "Wireless smart sensor technology for monitoring civilinfrastructure: technological developments and full-scale applications," in Proceedings of the World Congress on Advances in Structural Engineering and Mechanics (ASEM '11), Seoul, Republic of Korea, 2011.
[10] M. Bocca, E. I. Cosar, J. Salminen, and L. M. Eriksson, "A reconfigurable wireless sensor network for structural health monitoring," in Proceedings of International Society for Structural Health Monitoring of Intelligent Infrastructures (ISHMII '09), Zurich, Switzerland, 2009.
[11] J. Zhao and R. Govindan. Understanding packet delivery performance in dense wireless sensor networks.