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RADIO FREQUENCY BASED HIGH RESPONSIVE PROSTHETIC ARM ACTUATING SYSTEM USING EEG

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ABSTRACT

In brief, the prosthetic arm is a tool for persons who have paralysed body parts. The as a chic design for a natural and simple prosthesis. EEG **(**electroencephalography) impulses from the brain are what we employ in our endeavour. The fundamental issue with the prosthesis is the absence of a mobile, strong embedded system. We offer a concept and development of upper arm prosthetics based on electroencephalography (EEG) that can overcome numerous drawbacks of movements. In order to operate the prosthetic device, brain signals are also employed to determine force and torque. The sensor system and control system operate as necessary to provide the desired result. Our prototype will act as a foundation for a number of additional functions as well as a chic design for a natural and simple prosthetis. EEG **(**electroencephalography), prosthetic arm, prototype are some related terms**.**

KEYWORDS: Prosthetic arm, Paralysed, EEG electrode.

1.INTRODUCTION

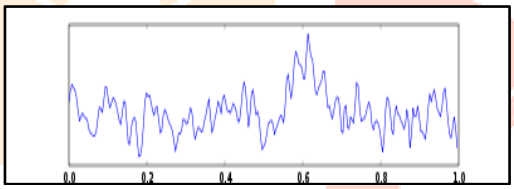
The proposed robot is entitled to record and process the brain activity as well as the position of the MEMS accelerometer and reflect it as per the requirement, the main aim of this project is to create a Low cost yet effective motion assist for the physically disabled individuals, the following design can be implemented on an assistive unit like a wheelchair.

This will be most helpful for the individuals suffering from illness like quadriplegia, or Amyotrophic lateral sclerosis (ALS). In few cases there is a need for continuous recording and access of brain activity of the patient, the sensing unit of the project can be effectively put to use under such circumstances. Insomnia or sleep deprivation is one of the most common problems among today's working class, this brain wave monitor can also be used to record the brain activity of such patients and help to suggest a suitable diagnosis. Another area in which the same concept can be implemented to a great extent is road safety, a large deal of highway accidents is due to dozing drivers, this mind sensing device can continuously monitor the brain activity and in case any abnormalities is detected a corrective or protective action shall have triggered. The Mind Control Robot involves obtaining brain electric activity. Research shows that different pattern of neural interactions in brain results in different brain states. These interaction results in different patterns of waves among them following waves are the most important for determining attention and meditation. 1. Theta Waves (frequency 4-7 Hz): These waves are associated with drowsiness. 2. Alpha Waves (frequency 8-13 Hz): These waves are associated with mediation and relaxation and are present during wakeful relaxation. Beta Waves (frequency 14-30 Hz): These waves are associated with active, busy or anxious thinking. There are different techniques that can be used to obtain these waves. However, the Electroencephalography (EEG) technology was used in this project. The EEG provides non-invasive technique of monitoring electric activity in space and time. The signal obtained from EEG sensor is one of the most reliable psychological indicators to measure the level of alertness. The EEG sensor comprises of electrodes which make contact to scalp and forehead.

The presence of hair hinders access to large portion of the scalp which results in weak EEG Signal. The quality of EEG signal can be affected by muscle movement and excessive environmental electrostatic noise. The signal obtained from EEG sensor is processed by a microcontroller. The microcontroller makes important decisions in determining the direction of motion of the robot. The motion of robot is supported by 3 wheels. Two of these wheels are driven by DC motors controlled by the microcontroller. The robot avoids obstacles by measuring distance of the nearest object close to robot in real time. It also detects and stops moving on the edge of surface it is moving on. The MEMS accelerometer is a device that can detect the positioning and movement along three dimensions (x, y, z), and these co-ordinates can be recorded and used to fine tune the motion control system along with the EEG unit.

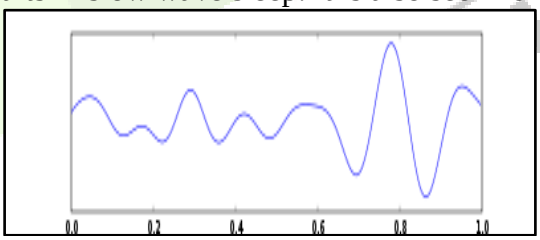
1.1 NORMAL ACTIVITY OF EEG WAVES

The EEG is typically described in terms of (1) rhythmic activity and (2) transients. The rhythmic activity is divided into bands by frequency. To some degree, these frequency bands are a matter of nomenclature (i.e., any rhythmic activity between 8–12 Hz can be described as "alpha"), but these designations arose because rhythmic activity within a certain frequency range was noted to have a certain distribution over the scalp or a certain biological significance. Frequency bands are usually extracted using spectral methods (for instance Welch) as implemented for instance in freely available EEG software such as EEGLAB.



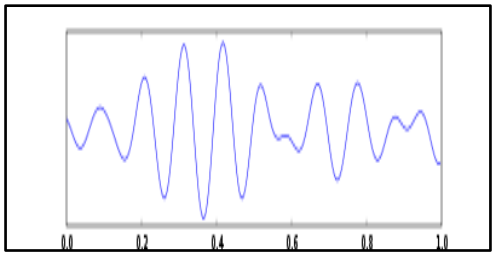
1.2 DELTA WAVES

Delta is the frequency range up to 4 Hz. It tends to be the highest in amplitude and the slowest waves. It is seen normally in adults in slow wave sleep. It is also seen normally in babies. system.



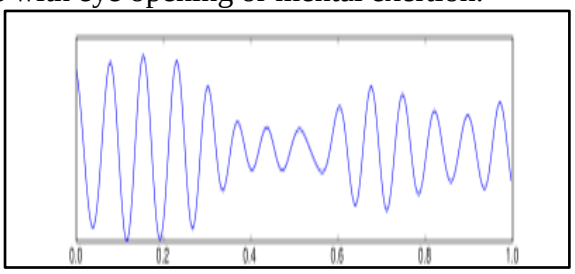
1.3 THETA WAVES

Theta is the frequency range from 4 Hz to 7 Hz. Theta is seen normally in young children. It may be seen in drowsiness or arousal in older children and adults; it can also be seen in meditation.



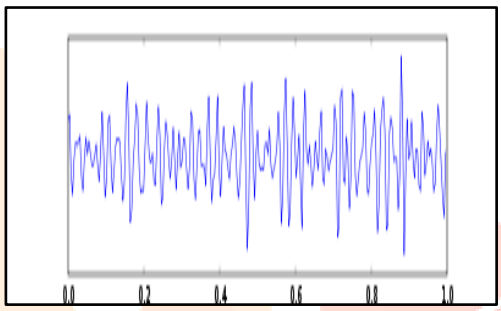
1.4 ALPHA WAVES

Alpha is the frequency range from 8 Hz to 12 Hz. Hans Berger named the first rhythmic EEG activity he saw, the "alpha wave. This was the "posterior basic rhythm" seen in the posterior regions of the head on both sides, higher in amplitude on the dominant side. It emerges with closing of the eyes and with relaxation, and attenuates with eye opening or mental exertion.



1.5 BETA WAVES

Beta is the frequency range from 12 Hz to about 30 Hz. It is seen usually on both sides in symmetrical distribution and is most evident frontally. Beta activity is closely linked to motor behaviour and is generally attenuated during active movements.



1.6 GAMMA WAVES

Gamma is the frequency range approximately 30–100 Hz. Gamma rhythms are thought to represent binding of different populations of neurons together into a network for the purpose of carrying out a certain cognitive or motor function.

2. METHODOLOGY

2.1 DESGIN AND CONSTRUCTION

The entire network consists of three main parts: (1) Portable EMG sensor, (2) Arduino controlled system which controls prosthetic hand, (3) Prosthetic arm. The Typical control procedure transmits three-channel EMG data to the controller system through an Arduino communication protocol. The Arduino will perform the algorithm and generate output every two seconds.

2.2 FUNCTION OF PROSTHETIC ARM

In this system, we use signals from the muscles for stoner- centered requirements. Myoelectric signals have been used in colorful natural operations. These signals are used to control the prosthetic arm. Myo- signals are a weak signal which is subordinated to modification by the amplifier circuits. The amplified signals are also filtered to exclude the stir vestiges. It increases the rigorousness of the signal and reduces the terrain and device noise. The degree of closeness was achieved by the elimination of vestiges. Displays the EMG control medium and its sequences.

2.3 WORKING PRINCIPLE OF EEG SENSOR

EEG reviews are performed by placing EEG detectors small essence discs also called EEG electrodes on your crown. These electrodes pick up and record the electrical exertion in your brain. The collected EEG signals are amplified, digitized, and also transferred to a computer or mobile device for storehouse and data processing.

2.4 ACCELEROMETER

An accelerometer is a device that measures proper acceleration, the acceleration endured relative to freefall. Single- andmulti-axis models are available to descry magnitude and direction of the acceleration as a vector volume, and can be used to smell exposure, acceleration, vibration shock, and falling. Micro machined accelerometers are decreasingly present in movable electronic bias and videotape game regulators, to descry the position of the device or give for game input.

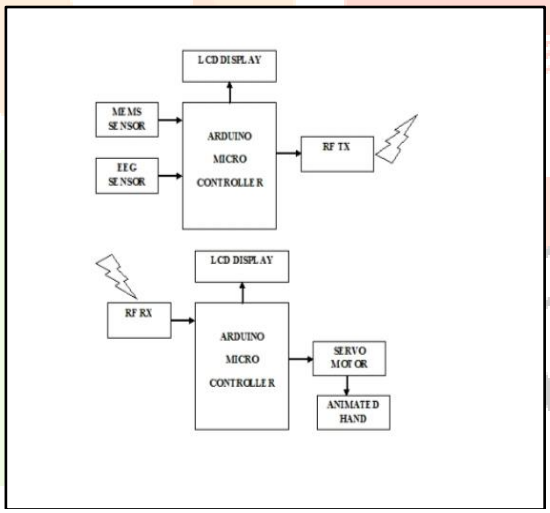
2.5 RADIO FREQUENCY

Radio frequency(RF) radiation is a subset of electromagnetic radiation with a wavelength of 100 km to 1 mm, which is a frequency of 3 KHz to 300 GHz, independently. This range of electromagnetic radiation constitutes the radio diapason and corresponds to the frequency of interspersing current electrical signals used to produce and descry radio swells. RF can relate to electromagnetic oscillations in either electrical circuits or radiation through air and space. Like other subsets of electromagnetic radiation, RF peregrination at the speed of light.

2.6 RADIO COMMUNICATION

In order to admit radio signals, for case from AM/ FM radio stations, a radio antenna must be used. still, since the antenna will pick up thousands of radio signals at a time, a radio tuner is necessary to tune in to a particular frequency (or frequence range). This is generally done via a resonator (in its simplest form, a circuit with a capacitor and an inductor). The resonator is configured to reverberate at a particular frequence (or frequence band), therefore amplifying sine swells at that radio frequence, while ignoring other sine swells. generally, either the inductor or the capacitor of the resonator is malleable, allowing the stoner to change the frequence at which it resonates.

3.BLOCK DIAGRAM



4. LITERATURE SURVEY

The estimation of grasp countries in myoelectric prosthetic hands is applicable for ergonomic interfacing, control and recuperation enterprise. In this paper we estimate the possibility to infer the grasp state of a prosthetic hand from RGB frames by using well- known deep literacy infrastructures in testing scripts involving variations of brilliance, discrepancy and flips [1]. In this paper, a wireless power transfer (WPT) system is proposed to supply power continuously to a prosthetic hand. The transmitter circuit (class- E power amplifier) and WPT coils are modeled and enforced along with commercially available receiver circuit and multiple motors. An algorithm is also proposed to cover and control the gyration of the prosthetic hand exercising wireless power [2].

Advancement in technology has bettered their capacities, independence and overall quality of their life. One similar advancement is Prosthesis. Prosthesis is an artificial approach, used to replace an impaired body part. It helps the impaired in acquiring the functional relief for their impaired body part by generally furnishing supplement to imperfect body corridor. The main purpose of the design is to design a low cost and stoner accessible prosthetic hand for the impaired. The simple construction and low cost of accoutrements, as well as the use of common bias similar as smart phones, enable the amputees to gain access to prosthesis with ease [3].

This exploration focus on developing of low cost anthropomorphic prosthetic hand using DC micro essence gear motor. The DC essence gear motor is named as selector because it's easy to find, low cost, and light weight. The prosthetic hand is grounded on 3D published material that enables it light weight, low cost, easy to manufacture and easy to maintain. The medium of the hand is grounded on the tendon spring medium. The prosthetic hand has five degree of freedom(DOF) and two joints in each cutlet. For performing the conditioning of diurnal living(ADLs), the hand is designed with seven grip patterns [4].

This paper presents a prosthetic hand control system for trans- radial amputees grounded on electromyogram EEG) signal processing. This study aims at rooting the muscle commands from face electromyogram(EEG) for controlling the prosthetic hand connected to the amputation part. The proposed prosthetic hand is developed so as to realize 10 joints including 4 active joints driven by electrical motors [5].

The development process is easily stated in order to successfully designing the hand prosthesis. The bracket of the position of amputation and current standard of hand prosthesis are also included in the design process. The design targets for lower- position upper- branch amputees and will be grounded on electroencephalography controlled (trans humeral amputation) [6]. controlling the wrist and servo 3 is for controlling the elbow once the signal is entered serially from AR through system the microcontroller gives the palpitation signal to the servos to act according to that. The Arduino is programmed in such a way that if the value' a ‘is feuded in virtual.

5.EXISTING SYSTEM

Passive prostheses for the relief of the hand include prosthetic hands and prosthetic tools. The stoked gesture shadowing is captured through camera from the system and transferred to the microcontroller.
The prosthetic arm corresponds of three servos to actuate also servo 1 is for controlling fritters and servo 2 is for terminal the servo1 gets actuated also the different characters is set for other 2 servos stoked reality gesture shadowing system is used as an input to record the gestures and erraticism of the right hand.

6.PROPOSED SYSTEM

This proposed system has two bias,

Transmitter
Receiver

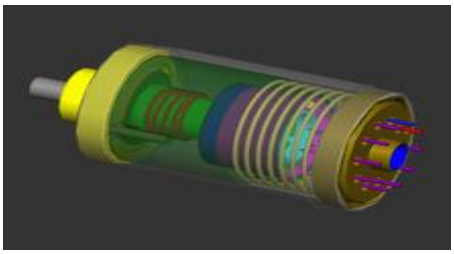
In transmitter, there's a glove setup and flex detector and gyroscope is fitted in it. The flex detector is used for cutlet movement and gyroscope is used for wrist movement. These values are observed by regulator and through Arduino UNO, RF transmitter the values are transferred. Motors are used to control the movement of fritters, wrist and hand. After seeing the signal, the device responds in time. So that using the subject can be advantaged better.

7. HARDWARE DESCRIPTION

7.1. ARDUINO UNO: Is a microcontroller board based an aT mega 328p.

7.2. LCD DISPLAY: Liquid crystal display have materials which combine the properties of both liquids and crystals. The use of LCD controller and driver IC’s result in low power consumption.

7.3. ACCELEROMETER: An accelerometer is a device that measures proper acceleration, the acceleration experienced relative to freefall.



7.4.EEG ELECTRODE: The electrode is used to recording the electrical activity along the scalp produced by the firing of neurons within the brain.

7.5. RF TRANSMITTER AND RECEIVER: Radiation is the subset of electromagnetic radiation of 100km to 1mm which is a frequency of 3khz to 300ghz respectively.

7.6. SERVO MOTOR: Servo motors are used in closed loop control systems in which work is the control variable. Servo is an automatic device that uses error sensing feedback to correct the performance of a motor.

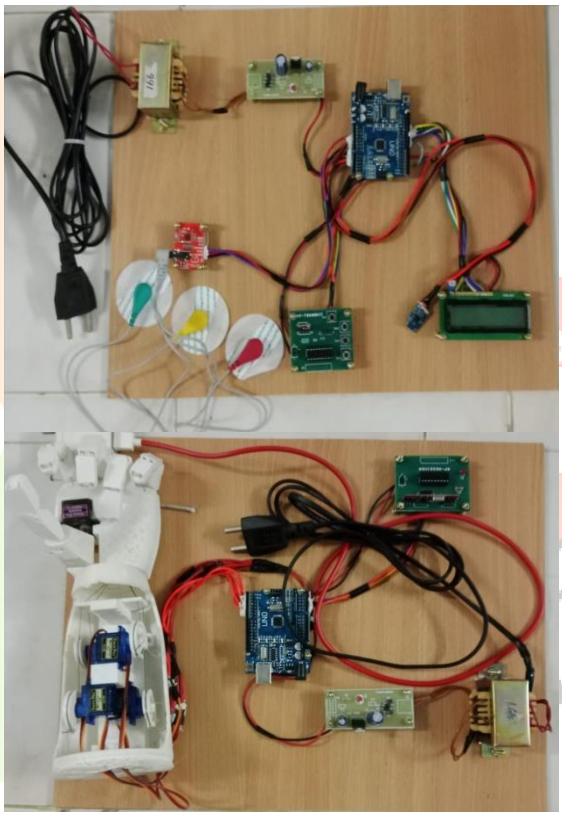
8.SOFTWARE REQUIREMENTS
PCB DESIGNING
ARDUINO IDE

9.APPLICATIONS

Prosthetic devices play a major role in rehabilitation. It increases mobility and the ability to manage household activities. The main purpose of prostheses is to restore the normal function of the missing body part. It is achieved by the software interfaced with the hardware designs. The various levels of amputation used in the upper extremity prostheses include shoulder disarticulation, transracial and transhumeral prosthesis. This main application of this project is better convenience for the amputee due to the lightweight prosthetic arm. The electrical tension produced by the voluntarily contracted muscles controls the movements of a prosthesis such as an elbow flexion/extension and wrist pronation. This application increases the chance for us to develop an EMG based prosthetic arm.

10.RESULT

Enabling the electroencephalogram(EEG) signals from them to be used in branch relief ways. EEG signals RF transmitted to the Arduino UNO after it senses the signals, it sends signals to RF receiver part of the prosthetic arm. The flex detector is used cutlet movement and gyroscope is used for wrist movement. This acts as a cutlet formerly it detects the action and act according to the time. Prosthetic arm which uses the EEG signals from the case and controls movement of the prosthetic arm.



11.CONCLUSIONS

This work presented the design and implementation of an EEG based BCI using motor imagery: two frameworks were presented, which performed a superior version that filter and classify the EEG signal before they output a message to Arduino to control the prosthetic. As a result, this study has successfully achieved all of the aims to create a fully functional system and proven the feasibility of the current design systems for highly accurate classification with two robust but affordable systems that could be applied patients requiring applications for external control. Finally, a BCI system takes the raw EEG signals and processes them into a viable source of controlling devices through the Open Vibe platform. In the future, other approached may be explored (Secco et al, 2002; Matrone et al, 2009; Secco et al, 2001; Magenes et al, 2008), as well as another technical methodology that provides a better transference of classifier labels or a box support for serial communication could be implemented rather than using the proposed bridge between the different software platforms.

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