EEG Based Brain Controlled Wheel Chair

Srikanth.S[1] Manojkumar.P[2] Prathepan.R[3] Prakash.T[4] Rupack.V[5]
[1,]Assistant Professor , [2345] UG Scholar, Department of ECE
SNS College of Technology
Coimbatore, India

Abstract : This project discussed about a brain controlled wheel chair based on Brain–computer interfaces (BCI).BCIs are systems that can bypass conventional channels of communication (i.e., muscles and thoughts) to provide direct communication and control between the human brain and physical devices by translating different patterns of brain activity into commands in real time. With these commands a mobile robot can be controlled. The intention of the project work is to develop a robot that can assist the disabled people in their daily life to do some work independent of others.

Here, the brain wave signals are analyzed. Human brain consists of millions of interconnected neurons. The pattern of interaction between these neurons are represented as thoughts and emotional states. According to the human thoughts, this pattern will be changing which in turn produce different electrical waves. A muscle contraction will also generate a unique electrical signal.

All these electrical waves will be sensed by the brain wave sensor and it will convert the data into packets and transmit through Bluetooth medium. Level analyzer unit (LAU) will receive the brain wave raw data and it will extract and process the signal using MATLAB platform. Then the control commands will be transmitted to the robot module to process. With this entire system, we can move a robot according to the human thoughts and it can be turned by blink muscle contraction.

Index Terms – LAU, BCI, Matlab,

I. INTRODUCTION

The main objective of this project is to design a Brain wave controlled Wheel chair for disable people. We used a brain wave sensor for analysation of thoughts by disable people such as the muscle contraction can be detected and the signals are captured by the electrode present in the brain wave sensor. The captured signals are the low wave signals. The low wave signals are sent to the matlab application software. The coding is the process of converting the low wave signals into the high frequency signals. The low frequency signals have a noise such as the filtering process is done so the noise in the frequency can be detected and the noise is removed. The signal transferring from the brain wave sensor to the personal computer is done by the using of Bluetooth module. The Raw data is transferred from the brain wave sensor to the personal computer. Such as the signals are processed by the matlab and it send to the Arm where the Arm controls the wheel chair for the movement of Forward, Left turn, and the Right turn. The control movement can intimate to eye blink of the disable people. Such as the thoughts of moving forward, left turn, and the right turn can be done using the blinking eyes. The attention and the meditation readings can be able to detect the current status of the disable people.

II. LITERATURE SURVEY

From the paper "A DEFAULT MODE OF BRAIN FUNCTION: A BRIEF HISTORY OF AN EVOLVING IDEA" by Marcus E. Raichlea,b,c, and Abraham Z. Snydera,b a Department of Radiology issued on 5 January 2007; revised 13 February 2007; accepted 15 February 2007. The concept of a default mode of brain function arose out of a focused need to explain the appearance of activity decreases in functional neuroimaging data when the control state was passive visual fixation or eyes closed resting. The problem was particularly compelling because these activity decreases were remarkably consistent across a wide variety of task conditions. Using PET, we determined that these activity decreases did not arise from activations in the resting state. Hence, their presence implied the existence of a default mode. While the unique constellation of brain areas provoking this analysis has come to be known as the default system, all areas of the brain have a high level of organized default functional activity. Most critically, this work has called attention to the importance of intrinsic functional activity in assessing brain behavior relationships.

From the paper "EEG DIFFERENCES BETWEEN RESTING STATES WITH EYES OPEN AND CLOSED IN DARKNESS" by Yu. A. Boytsova and S. G. Danko issued on April 27, 2009.Transition from a resting state with eyes closed (REC) to a resting state with eyes open (REO) is associated with visible changes in EEG, which are traditionally considered to be a sign of reorganization of the brain's activity in response to visual stimuli. The EEGs recorded in the REC and REO states in complete darkness, when the stimulatory effect of light to the eye's retina was absent, were compared. Thirty healthy subjects participated in the study. EEG in the range of 1.5–50 Hz was recorded from nineteen zones of the head monopolarly. It was found that, under conditions of complete darkness, the REC and REO states significantly differed in their EEG spectral power and coherence in the Δ, θ, $\alpha1$, $\alpha2$, $\beta1$, $\beta2$ and γ frequency bands. Under experimental conditions, these changes in the EEG could not be induced by external influence to the visual system. Therefore, we suppose that they are correlates of the switching of involuntary preliminary attention from internally directed attention specific for the REC state to externally directed attention specific for the REO state.

From the paper "DOES THE BRAIN HAVE A BASELINE? WHY WE SHOULD BE RESISTING A REST" by Alexa M. Morcom and Paul C. Fletcher issued on 15 September 2006 Available online 17 October 2006.In the last few years, the notion that the brain has a default or intrinsic mode of functioning has received increasing attention. The idea derives from observations that a consistent network of brain regions shows high levels of activity when no explicit task is performed and participants are asked simply to rest. The importance of this putative "default mode" is asserted on the basis of the substantial energy demand associated with such a resting state and of the suggestion that rest entails a finely tuned balance between metabolic demand and regionally regulated blood supply. These observations, together with the fact that the default network is more active at rest than it is in a range of explicit tasks, have led some to suggest that it reflects an absolute baseline, one that must be understood and used if we are to develop a comprehensive picture of brain functioning. Here, we examine the assumptions that are generally made in accepting the importance of the "default mode". We question the value, and indeed the interpretability, of the study of the resting state and suggest that observations made under resting conditions have no privileged status as a fundamental metric of brain functioning. In doing so, we challenge the utility of studies of the resting state in a number of important domains of research.

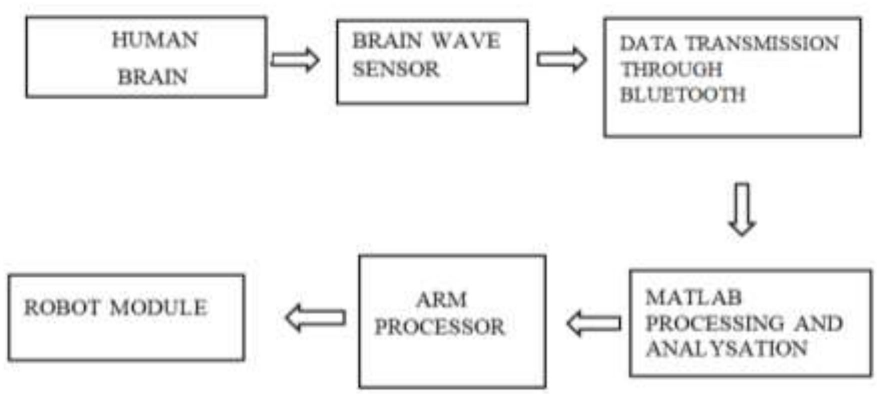

Fig.1Block diagram

III. HARDWARE

Brain wave sensor

Electroencephalography (EEG) signals are commonly used in almost all brain-controlled interface (BCI) system which are designed for people with server motor disabilities. Such disable people need special system to help them to be able to communicate with their surroundings. A BCI system could be a breakthrough technology to express disable people's intentions and expressions via a brainwave sensor. On top of the p300 wave, which is an event related potential (ERP) of EEC or say in a general way, a component of our brain signal, is used in many BCI system and has characteristics among the noisy background EEG signal. The P300 (P3) wave is an event related potential (ERP) component elicited in the process of decision making. . It is considered to be an endogenous potential, as its occurrence links not to the physical attributes of a stimulus, but to a person's reaction to it. More specifically, the P300 is thought to reflect processes involved in stimulus evaluation or categorization. It is usually elicited using the oddball paradigm, in which low-probability target items are mixed with high-probability non-target items. When by using the component EEG-electroencephalography (EEG) P300 component, it surfaces as a positive deflection in voltage with a latency (delay between stimulus and response) of roughly 250 to 500 ms.

The signal is typically measured most strongly by the electrodes covering the parietal lobe The performance of an asynchronous BCI can be measured by the true positive rate (TPR) during the control state and the false positive rate (FPR) during the idle state. Thus, researchers strive not only to improve the TPR in the control state, but also to keep the FPR as low as possible in the idle state.

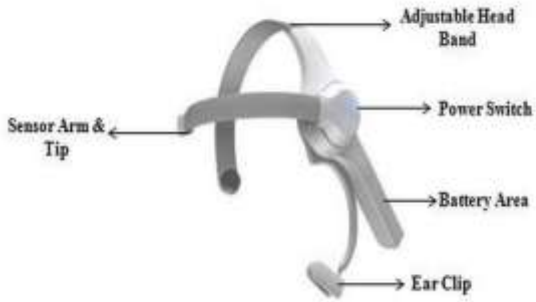

Fig.1 Brain wave Headset

IV. PROPOSED SYSTEM

Microcontroller

The LPC2148 micro-controllers are based on a 32/16 bit ARM7TDMI-S CPU core. They have real-time emulation and embedded trace support that combines the micro-controller with embedded high speed flash memory of 512 KB. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode (16bit instruction set) reduces code by more than 30% with minimal performance penalty.

Due to their tiny size and low power consumption, LPC2148 are ideal for applications where miniaturization is a key requirement, such as access control systems and point-of-sale systems. It has serial communications interfaces ranging from a USB 2.0 Full Speed device, multiple UARTS, SPI, SSP to I2Cs. It has on-chip SRAM of 8 KB up to 40 KB. This makes these devices very well suited for communication gateways and protocol converters, soft modems, voice recognition and low end imaging, providing both large buffer size and high processing power.

Risc features

Fixed instruction width of 32 bits to ease decoding and pipelining, at the cost of decreased code density. Later, "the Thumb instruction set" increased code density. No support for misaligned memory accesses (now supported in ARMv6 cores, with some exceptions related to load/store multiple word instructions).

Features of ARM LPC2148

16/32-bit ARM7TDMI-S microcontroller in a tiny LQFP64 package.8 to 40 KB of on-chip static RAM and 32 to 512 KB of on-chip flash program memory 128 bit wide interface/accelerator enables high speed 60 MHz operation.In-System/In-Application Programming (ISP/IAP) via on-chip boot-loader software. Embedded ICE RT and Embedded Trace interfaces offer real-time debugging with the on-chip Real Monitor software and high speed tracing of instruction execution. USB 2.0 Full Speed compliant Device Controller with 2 KB of endpoint RAM. In addition, the LPC2146/8 provides 8 KB of on-chip RAM accessible to USB by DMA.

V. SOFTWARE

Keil introduction

Keil Software publishes one of the most complete development tool suites for ARM7 microcontroller , which is used throughout industry. For development of C code, their Developer's Kit product includes their C51 compiler.The purpose of this manual is to further explain the limitations of the Keil compiler, the modifications it has made to the C language, and how to account for these in developing software for the ARM7 microcontroller.

Keil limitations

There are several very important limitations in the evaluation version of Keil's Developer's Kit that users need be aware of when writing software for the 8051.

c modifications

The Keil C compiler has made some modifications to another wise ANSI-compliant implementation of the C programming language. These modifications were made solely to facilitate the use of a higher-level language like C for writing programs on microcontrollers.

keil variable extension

In writing applications for a typical computer, the operating system handles manages memory on behalf of the programs, eliminating their need to know about the memory structure of the hardware. Even more important, most computers having a unified memory space, with the code and data sharing the same RAM. This is not true with the 8051, which has separate memory spaces for code, on-chip data, and external data.

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