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EEG BASED BRAIN WAVE SIGNAL PROCESSING

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***Abstract*— A brain-computer interface (BCI) is a new communication channel between the human brain and a digital computer. The ambitious goal of a BCI is finally the restoration of movements, communication and environmental control for handicapped people. An electroencephalogram (EEG) based brain-computer interface was connected with a Virtual Reality system in order to control a smart home application. It offers an alternative to natural communication and control. It is an artificial system that bypasses the body's normal efficient pathways, which are the neuromuscular output channels.**

Different brain states are the result of different patterns of neural interaction. These patterns lead to waves characterized by different amplitudes and frequencies. This neural interaction is done with multiple neurons. Every interaction between neurons creates a minuscule electrical discharge. This project deals with the signals from brain. Different brain states are the result of different patterns of neural interaction. These patterns lead to waves characterized by different amplitudes and frequencies. The signal generated by brain was received by the brain sensor and it will divide into packets and the packet data transmitted to wireless medium (blue tooth).the wave measuring unit will receive the brain wave raw data and it willI. convert into signal using MATLAB GUI platform. Then the instructions will be sending to the home section to operate the modules (bulb, fan). The project operated with human brain assumption and the on off condition of home appliance is based on changing the muscle movement with blinking.

Keywords—*electroencephalogram, neuromuscular*

I. .INTRODUCTION

Humans have traditionally interacted with computers and machines by using their hands to manipulate computer components. This kind of human-computer interaction (HCI), however considerably limits the human's freedom to communicate with machines. Over the years, many attempts have been made to develop technologies that include other modalities used for communication. Recent advances incognitive, neuroscience and neuroimaging technologies in particular have allowed for the establishment of direct communication between the human brain and machines. This ability is made possible through invasive and noninvasive sensors that can monitor physiological processes reflected in brain waves, which are translated online into control signals for external devices or machines.

Such brain-computer interfaces (BCIs) provide a new communication channel between the human brain and a digital computer. The ambitious goal of a BCI is finally the restoration of movements, communication and environmental control for handicapped people. An electroencephalogram (EEG) based brain-computer interface was connected with a Virtual Reality system in order to control a smart home application. It offers an alternative to natural communication and control.

II. PROJECT DESCRIPTION

The operation of power supply circuits built using filters, rectifiers, and then voltage regulators. Starting with an AC voltage, a steady DC voltage is obtained by rectifying the AC voltage. Then filtering to a DC level, and finally, regulating to obtain a desired fixed DC voltage. The regulation is usually obtained from an IC voltage regulator Unit, which takes a DC voltage and provides a somewhat lower DC voltage, which remains the same even if the input DC voltage varies, or the output load connected to the DC voltage changes.

The ARM7TDMI-S core is the synthesizable

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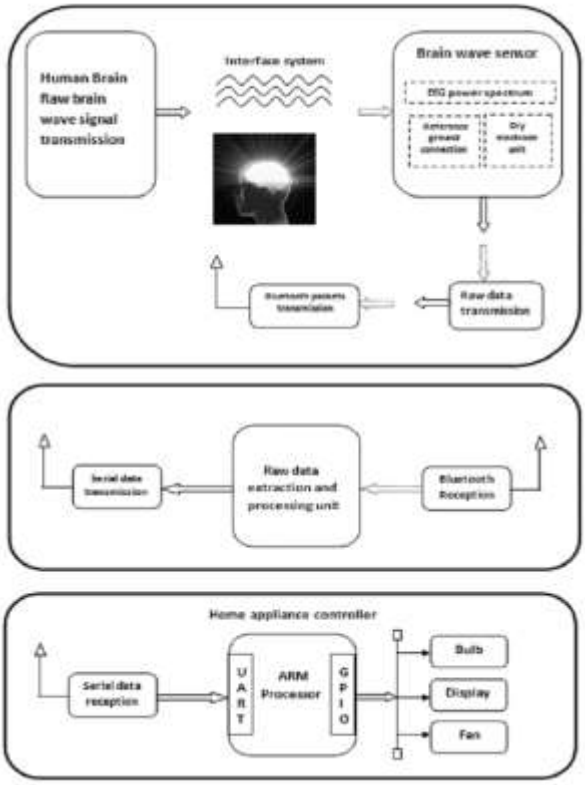
version of the ARM7TDMI core, available in both VERILOG and VHDL optimized for flexibility and featuring an identical feature set to the hard macro cell. It improves time-to-market by reducing development time while allowing for increased design flexibility, and enabling 98% fault coverage. The ARM720T hard macro cell contains the ARM7TDMI core, 8kb unified cache, and a Memory Management Unit (MMU) that allows the use of protected execution spaces and virtual memory. This macro cell is compatible with leading operating systems including Windows CE, Linux, Palm OS, and SYMBIAN OS.

The ARM7TDMI processor core implements the ARMv4T Instruction Set Architecture (ISA).This is a superset of the ARMv4 ISA which adds support for the 16-bit Thumb instruction set. Software using the Thumb instruction set is compatible with all members of the ARM Thumb family, including ARM9, ARM9E, and ARM10 family.



LPC2148 microcontroller board based on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combine microcontrollers with embedded high-speed flash memory ranging from 32 kB to 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 reduces code by more than 30% with minimal performance penalty. The meaning of LPC is Low Power Low Cost microcontroller. This is 32 bit microcontroller manufactured by Philips semiconductors (NXP).

The Vectored Interrupt Controller (VIC) accepts all of the interrupt request inputs and categorizes them as Fast Interrupt Request (FIQ), vectored Interrupt Request (IRQ), and non-vectored IRQ as defined by programmable settings. The programmable assignment scheme means that priorities of interrupts from the various peripherals can be dynamically assigned and adjusted. Fast interrupt request (FIQ) has the highest priority. If more than one request is assigned to FIQ, the VIC combines the requests to produce the FIQ signal to the ARM processor. The fastest possible FIQ latency is achieved when only one request is classified as FIQ, because then the FIQ service routine does not need to branch into the interrupt service routine but can run from the interrupt vector location. If more than one request is assigned to the FIQ class, the FIQ service routine will read a word from the VIC that identifies which FIQ source(s) is (are) requesting an interrupt.

Serial communication is basically the transmission or reception of data one bit at a time. Today's computers generally address data in bytes or some multiple thereof. A byte contains 8 bits. A bit is basically either a logical 1 or zero. Every character on this page is actually expressed internally as one byte. The serial port is used to convert each byte to a stream of ones and zeroes as well as to convert a stream of ones and zeroes to bytes. The serial port contains a electronic chip called a Universal Asynchronous Receiver/Transmitter (UART) that actually does the conversion.

(a).BRAINWAVES

The last century of neuroscience research has greatly increased our knowledge about the

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brain and particularly, the electrical signals emitted by neurons firing in the brain. The patterns and frequencies of these electrical signals can be measured by placing a sensor on the scalp. The MindTools line of headset products contain NeuroSky ThinkGear™ technology, which measures the analog electrical signals, commonly referred to as brainwaves, and processes them into digital signals. The ThinkGear technology then makes those measurements and signals available to games and applications.

(b).BRAIN WAVE SENSOR

In 1924, Hans Berger a German psychiatrist performed the first electroencephalographic (EEG) recording in humans (Berger, 1929), a discovery that was initially greeted with great skepticism by the scientific community. By recording from one electrode placed over the forehead and one over the occipital cortex, Berger discovered the existence of rhythmic activity oscillating at approximately 10 Hz, particularly during relaxed wakefulness and in the absence of sensory stimulation or mental activity. In this landmark discovery, Berger described for the first time what would become known as alpha waves. As a result, Berger was among the first to suggest that the periodic fluctuations of the human EEG may be associated with mental processes, including arousal, memory, and consciousness. Over the years, developments in data collection and analyses transformed EEG into one of the prime techniques for studying the human brain.

(c).eSENSE

eSense™ is a NeuroSky's proprietary algorithm for characterizing mental states. To calculate eSense, the NeuroSky ThinkGear technology amplifies the raw brainwave signal and removes the ambient noise and muscle movement. The eSense algorithm is then applied to the remaining signal, resulting in the interpreted eSense meter values. Please note that eSense meter values do not describe an exact number, but instead describe ranges of activity.

III. RESULTS

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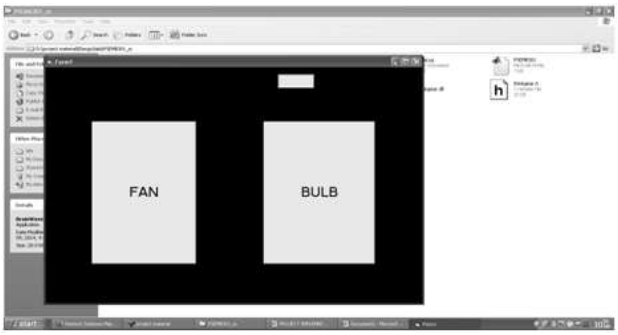
In order to attain our functionality it is necessary to calculate meditation levels and attention levels of our brain. This can be achieved by using MATLAB software as shown in above figure.



By calculating the attention and meditation levels we can control the home appliances as shown in above figure.

IV. .CONCLUSION

The signal generated by brain was received by the brain sensor and it will divide into packets and the packet data transmitted to wireless medium (blue tooth).the wave measuring unit will receive the brain wave raw data and it will convert into signal using MATLAB GUI platform. Then the instructions will be sending to the home section to operate the modules (bulb, fan). The project operated with human brain assumption and the on off condition of home appliance is based on changing the muscle movement with blinking.

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