Mind -Controlled Wheel Chair using an EEG Probes using Microcontroller

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Abstract

In this paper, an attempt to propose a thought controlled wheelchair, which uses the catch signals from the brain and eyes and processes it to control the wheelchair. Electroencephalography technique display an electrode cap that is placed on the user's scalp for the acquisition of the EEG signals which are captured and translated into movement commands by the micro controller which in turn move the wheelchair. The electrical activity of the brain can be monitored in real– time using electrodes, which are placed on the scalp in a process known as electroencephalography. In order to bypass the peripheral nervous system, we need to find some reliable correlates in the brain signals that can be mapped to perform specific actions. In the next two subsections, we wil discuss the philosophy of different BCI paradigms, before explaining our chosen asynchronous implementation for controlling the wheelchair. In this paper, we are going to implement mind controlled wheel chair using EEG and MEMS. The EEG will monitor the brain signals and wheel chair will move according to the movement of the head with help of MEMS.
Keywords: EEG, MEMS, Alpha Waves, Microcontroller

I. INTRODUCTION

In this world there are number of people who were physically challenged, there are different technology which gives physically impaired the ability to move around. But still there are number of people who were fully paralised but only there mind work properly. with the help of these mind power so many task can be performed by these people .one of them is they can move around the world using this mind power. To improve the lifestyle of the physically challenged people, this work aims at developing a wheelchair system that moves in accordance with the signals obtained from the neurons in the brain through the mounted probes on the scalp of the human and also using mems.

The electrical activity of the brain can be monitored by using an array of electrodes, which are placed on the scalp. An EEG records patterns of brain activity. Among the basic waveforms are the alpha, beta, theta, and delta rhythms. Alpha waves occur at a frequency of 8 to 12 cycles per second in a regular rhythm. They are present only when you are awake but have your eyes closed. Usually they disappear when you open your eyes or start mentally tare usually associated with anxiety, depression, or the use of sedatives. Theta waves occur at a frequency of 4 to 7 cycles per second. They are most common in children and young adults. Delta waves occur at a frequency of 0.5 to 3.5 cycles per second. They generally occur only in young children during sleep.

Micro-electromechanical systems (MEMS) incorporate miniature electro-mechanical components fabricated with processing techniques and equipment originally developed in the semiconductor industry. While existing MEMS sensors andactuators have enabled automotive crash sensors, ink jet printer nozzles and catheter tippressure sensors, new market opportunities for MEMS technology abound in the telecommunication, biomedical, semiconductor, and aerospace industries.In this paper Mems are used to move the wheel chair in four direction ,forward ,reverse ,right and left.

II. RELATED WORKS

The simple automatic wheelchair using MEMS technology with head and neck mobility was proposed by vinay and laxman in this paper they explain that the speed and direction of wheelchair is controlled using the position of head.The mems sense the change in direction of head ,the signal is given to microcontroller that control the wheel chair to move in direction like right,front,left and back.In Thought controlled wheelchair using EEG proposed by Rajeshkannan explained that the wheelchair is controlled by the signal obtained from the brain.The mind control wheelchair using EEG and ardunio microcontroller proposed by Imran Ali Mirza explained that the signal from the brain and eyes are captured by EEG using electrode placed on the scalp and translate the signal into movement command by the arduino microcontroller which makes the wheelchair to move. The

benefit of this proposed system is the wheelchair can move in slopes and it can detect the obstracles using two sensor i.e, Ultrasonic sensor and accelerated sensor.

III. DESIGN OF WHEELCHAIR SYSTEM

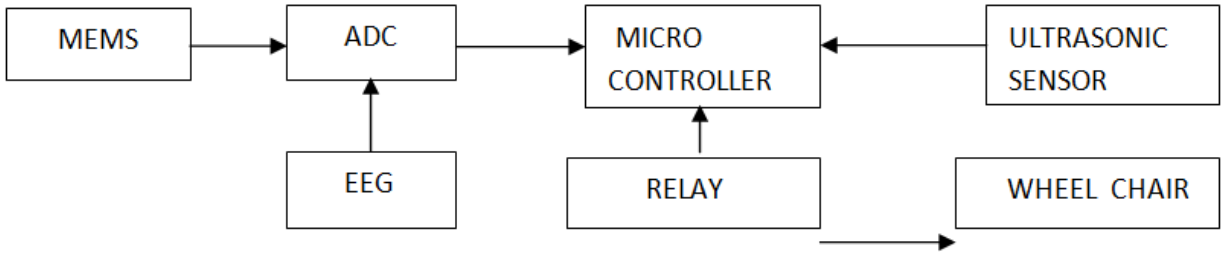

Fig. 1: Block diagram of wheelchair

This system broadly classified into four blocks a)signal capturing block, b)signal processing block,c)signal transmission block,d)motor movement block each of which aims at acquisition of the EEG signal from user scalp and processing it for controlling a wheelchair. EEG scalp potentials obtained are amplified, digitized and transmitted to a processor and after processing the output of the processed signals are used to control the wheelchair. The four main blocks involved in the wheelchair system are briefly discussed below.

A. Signal Capturing Block

Types of brain signals:

1) Alpha waves occur at a frequency of 8 to 12 cycles per second in a regular rhythm. They are present only when you are awake but have your eyes closed. Usually they disappear when you open your eyes or start mentally concentrating.
2) Beta waves occur at a frequency of 13 to 30 cycles per second. They are usually associated with anxiety, depression, or the use of sedatives.
3) Theta waves occur at a frequency of 4 to 7 cycles per second. They are most common in children and young adults.
4) Delta waves occur at a frequency of 0.5 to 3.5 cycles per second. They generally occur only in young children during sleep.

The initial process is capturing the signal from brain using EEG without any loss.The neuron will produce four type of signals simultaneously But we required an alpha signal to initiate the movement of wheel chair.Because an Alpha waves is produced during concentration.

Fig. 2: Signal capturing blocks

The signals captured through probes from the brain and The amplifier amplify the signals and fed into the BPF.it allow only fixed bandwidth signals(alpha signals 8-12HZ) .The mux covert a single ouput from the two probe signals and finally the values are displayed through LCD.

B. Signal Transmission Block

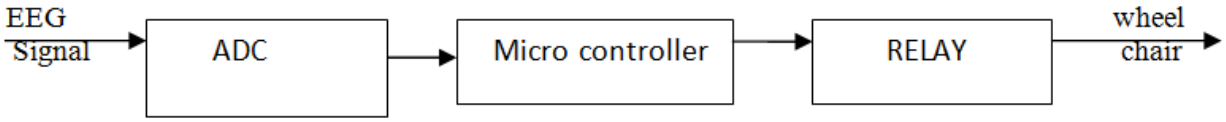

Fig. 3: Signal transmission blocks

The signal obtained from the capturing block is entered into the transmission block.The 8-bit A/D converter uses successive approximation as the conversion technique. The converter features a high impedance chopper stabilized comparator, a 256R voltage divider with analog switch tree and a successive approximation register. The 8-channel multiplexer can directly access any of 8-single-ended analog signals. The device eliminates the need for external zero and full-scale adjustments. Easy interfacing to microprocessors is provided by the latched and decoded multiplexer address inputs and latched TTL TRI-STATE outputs.The overall electronic starts operation in rhythm with pulse sequence. From now on the time is measured in micro and nanoseconds.Program Counter is set to zero. Instruction from that address is sent to instruction decoder which recognizes it, after which it is executed with immediate effect.The value of the Program Counter is incremented by 1 and the whole process is repeated...several million times per second.

C. Signal Processing Block

The processer block consists of processor which processes the signal that is transmitted from the signal capturing block to the signal transmission block.

D. Motor Movement Block

The wheelchair can be controlled by the wheel chair controller which has the functionality of controlling the direction and speed of the wheelchair.which is based on the output obtained from the signal processing block. The MEMS sensor sense the direction of neck or hand from which the signal is given to the microcontroller ,depending upon the signal fron MEMS the microcontroller controls the direction of the wheelchair i.e,front,back,right and left.This is used to control the motors in real time wheelchair. Relay circuit is designed by load circuit .The load here is used to drive the wheel of the wheelchair the motor is trun ON and OFF using Relay.

IV. RELAY

Relay is connected with motor and control the motor running.when ultrasonic sensor detect obstacles suddenly the relay stop the motor.Relay consist of two circuit.load circuit and control circuit

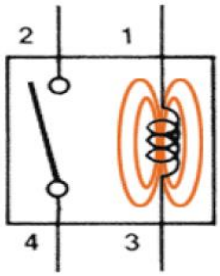

Fig. 4: Relay circuit

A relay is an electrically operated switch. Current flowing through the coil in the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be change the ON and OFF of motor which is help to move the wheel chair.

V. ULTRASONIC SENSOR

Ultrasonic sensors working principle similar to sonar which evaluate constitution of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors produce high frequency (sound) waves and evaluate the echo which is received back by the sensor. It calculates the time interval between sender and receiver signals to evaluvate the distance to an object.

VI. SOFTWARE TOOLS

A. KEIL Compiler:

It's used compile the overall program of microcontroller and converts the programming language into hex files.The microcontroller supports hex files data only.

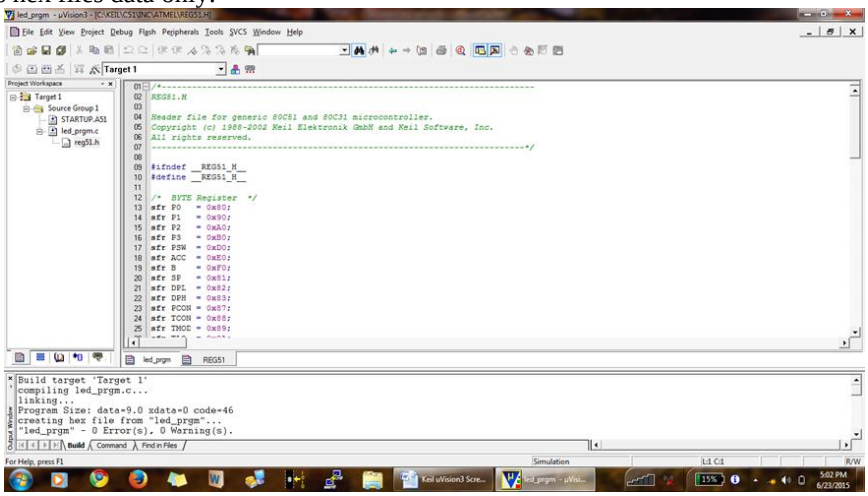

Fig. 6: compilation of microcontroller using KEIL COMPLIER

VII. CIRCUIT DIAGRAM

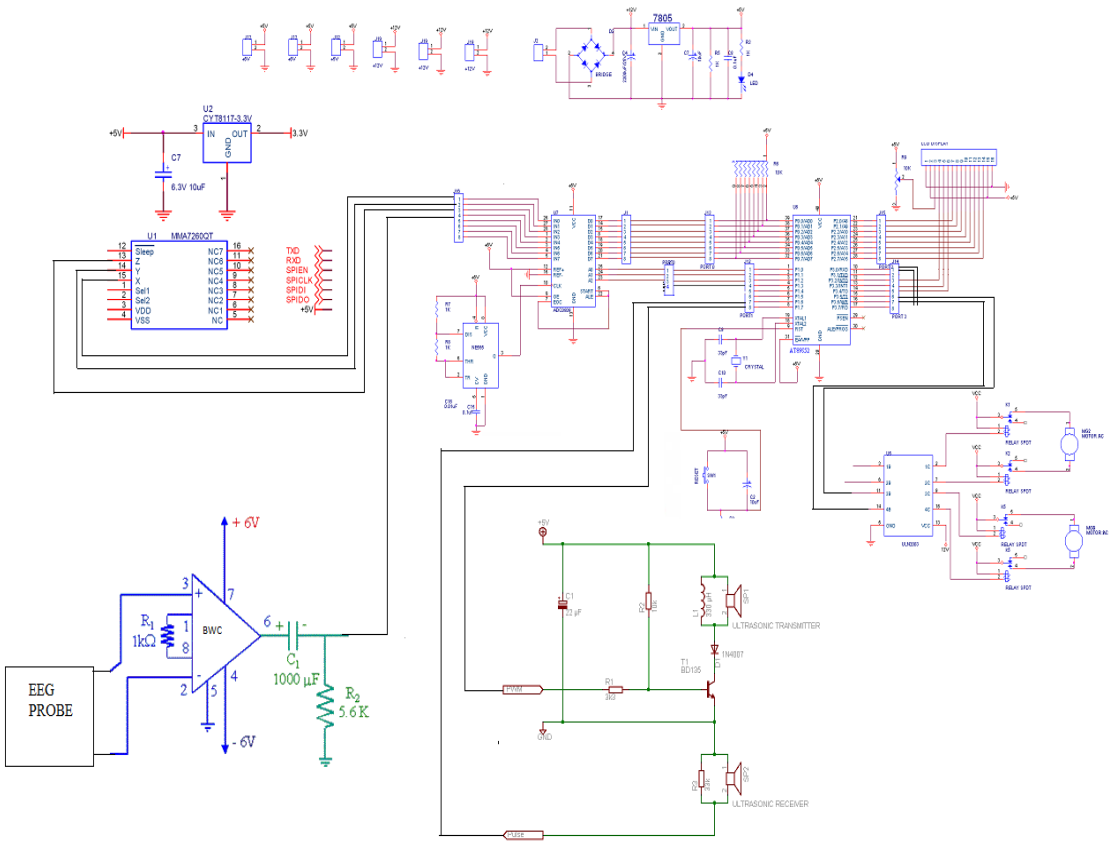

Fig. 5: Circuit diagram of mind control wheelchair

VIII. CONCLUSION

The benefits of our proposed system is the wheelchair designed using ultrasonic sensor and accelerator sensor (MEMS).ultrasonic sensor is used to detect the obstacles upto 2cm to 3m distance, accelaration sensors are added to calculate the amount of acceleration tilt to help navigate on ramps and slopes and control the movements of wheelchair through hands.The future work may be implement the videogames and military equipments, home applications based on the BCI.

REFERENCES

[1] Rajesh Kannan. Megalingam, Athul. Asokan Thulasi, Rithun. Raj Krishna, Manoj. Katta Venkata, Ajithesh. Gupta B V, Tatikonda. Uday Dutt, "Thought Controlled Wheelchair Using EEG Acquisition Device," 3rd International Conference on Advancements in Electronics and Power Engineering (ICAEPE'2013), January 2013.

[2] Yuanqing Li, Chuanchu Wang, Haihong Zhang and Cuntai Guan, "An EEG-based BCI System for 2D Cursor Control," IEEE International Joint Conference on Neural Networks, 2008.

[3] Jinyi Long, Yuanqing Li*, Tianyou Yu, and Zhenghui Gu, "Target Selection With Hybrid Feature for BCI-Based 2-D Cursor Control," IEEE Trans. Biomedical Engineering. January 2012.

[4] Prapon Jitkreeyarn, Niyom Nulek, Kanokvate Tungpimolrut and Nattapon Chayopitak, "Electric Motor Based Head Controller for Power Wheelchairs with Joy Stick Input", 3rd International Convention on Rehabilitation Engineering & Assistive Technology, April 2009

[5] Brice Rebsamen, Chee Leong Teo, Qiang Zeng, and Marcelo H.Ang Jr., Etienne Burdet, Cuntai Guan and Haihong Zhang, Christian Laugier, "Controlling a wheelchair indoors using thought," published by IEEE Computer Society 2007.

[6] Amit Ranjan Trivedi, Abhash Kumar Singh, Swagat Kumar, Deepak Fulwani, "Design and Implementation of a Smart Wheelchair", Proceedings of Conference on Advances In Robotics, July 2013