A Prototype Implementation of Brain Controlled Wheel Chair

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Abstract- *Mobility for elders and disabled persons is a big issue and for us helping them to lead a fruitful life is an important role to be performed by us being responsible members of the society. It's not easy for the disabled and elderly people to maneuver a mechanical wheelchair, which many of them normally use for locomotion. Hence there is a need for designing a wheelchair that is intelligent and provides easy maneuverability. In this context, an attempt has been made to propose a thought controlled wheelchair, which uses the captured signals from the brain and eyes and processes it to control the wheelchair. Electroencephalography (EEG) technique deploys 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 arduino microcontroller which in turn move the wheelchair.*

Keywords- Neuroscience, Brain Computer Interface (BCI), EEG, Micro-controller.

I. INTRODUCTION

Wheelchair users are among the most visible members of the disability community; they experience a very high level of activity and functional limitation and also have less of employment opportunities. Elderly people are the group with the highest rates of both manual and electric wheelchair use. Wheelchair users report difficulty in basic life activities, and perceived disability. It's not easy for the physically challenged and elderly people to manoeuvre a mechanical/ electric wheelchair. In recent times there have been a wide range of technologies that help aid the disabled physically challenged. These control systems are designed to help the physically challenged specifically. These competitive systems are replacing the conventional manual assistance systems. The wheelchair too has developed significantly with a variety of guidance systems alongside like using the joystick and a tactile screen, and systems based on voice recognition. These systems however are of use to those with a certain amount of upper body mobility. Those suffering from a greater degree of paralysis may not be able to use these systems since they require accurate control. To help improve the lifestyle of the physically challenged further, 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 headset. Since the brain comprises of a plethora of neurons which process the data, this work aims at exploring the signals collected from EEG to help manoeuvre the wheelchair. Brain Computer Interface (BCI) is a technique that provides direct interface between the human brain and the computer. BCI techniques are broadly classified into invasive and non-invasive techniques. Non-invasive techniques have become more popular and more research is being done on this topic. There are various non-invasive BCI techniques such as Electroencephalography (EEG), Electro-Oculography. EEG technique makes use of an electrode cap that is placed on the user's scalp for acquiring the EEG signal, which relates the scalp potential differences to various complex actions [5]. Classification of the EEG signal has been made into several bands like alpha, beta, delta, theta and mu suppression, each corresponding to various states of being like relaxing, ranging over 8-14 Hz; concentrating, ranging over 13-30 Hz; deep sleep, from 0-4 Hz; meditating from 4-8 Hz; moving your hands or legs or just by imagining these motor actions respectively [2]. As it is non-invasive in nature, it has an advantage over traditional BMI, not being hazardous to health. With the advent of technology, EEG acquisition devices are made more compact, handy and wireless. Using the above mentioned technique, a simple thought controlled wheelchair system has been proposed in this paper.

II. PROPOSED WORK

The aim of this work is to use parameters gathered by the headset to move the wheelchair in the directions the user wants, the main being attention and meditation. The proposed methodology involves using the wheelchair to move around using neuron signals. Signal acquisition Signal acquisition and processing techniques and devices acquire and process the ionic electrical signals generated by the neurons in the brain.

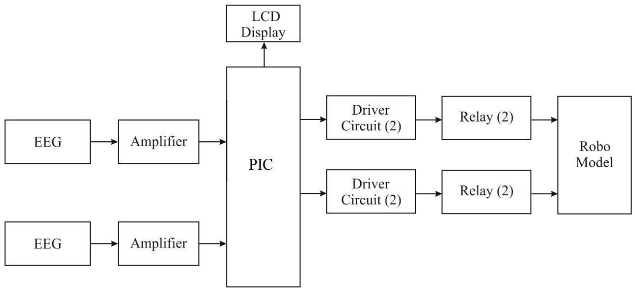

Fig 1 Block Diagram of Brain controlled Wheel Chair

The figure above shows the block diagram of the brain controlled wheel chair.The EEG electrodes are attached on the scalp of the person who wants to use the wheel chair. In our work we are using a small robo model to represent the wheel chair. The signals from the EEG headset are amplified and given to the microcontroller .The microcontroller then drives the relay connected to it through a driver circuit and depending upon the signal received from the microcontroller the robo model or the wheel chair. Arduino Microcontroller is 28 pin Atmega328 IC based Microcontroller.which is used to control wheelchair through commands given by EEG electrode fitted on scalp of user.Wheelchair is four brushless dc motor based vehicle for user is controlled by brain of user. there are two types of brain wave acquisition techniques: invasive acquisition• Non invasive acquisition• The non-invasive technique on the other hand uses the electrophysiological signals from the scalp and takes measurements using that technique. in this thesis research is done on the basis of non invasive acquisition technique. At the root of all our thoughts, emotions and behaviors is the communication between neurons within our brains. Brainwaves are produced by synchronized electrical pulses from masses of neurons communicating with each other. Brainwaves are detected using sensors(EEG electrode) placed on the scalp.

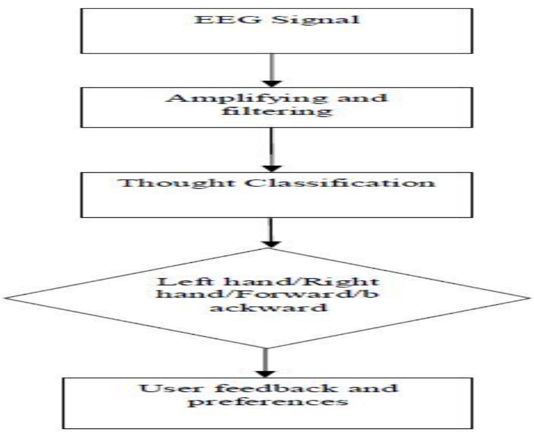

Fig 2 The flow chart of the implemented concept

III. IMPLEMENTATIONS

The central part of the circuit is the EEG control board. The EEG sensor are placed on the body and the signals relayed from the sensors are given to the EEG control board. The EEG Control board modifies the signal and forwards them to the microcontroller. On the basis of the signal received the microcontroller drives the motor driver which ultimately drives the motor as required. The achieved movement are forward backward, left and Right

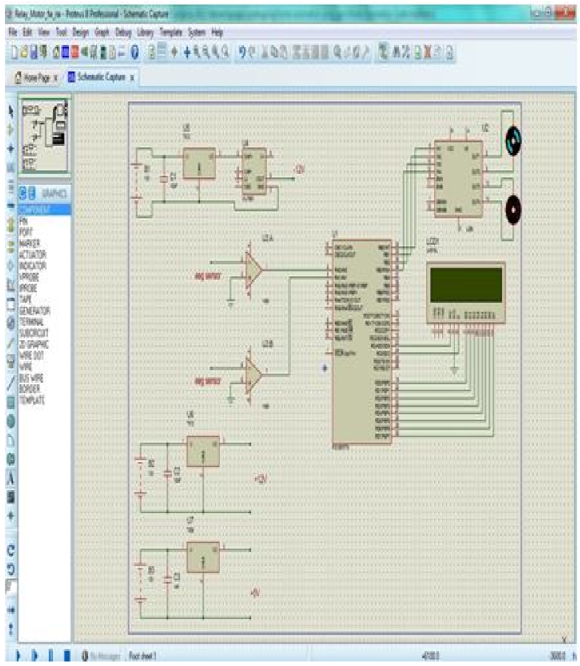

Fig 2 The proteus simulation implementation

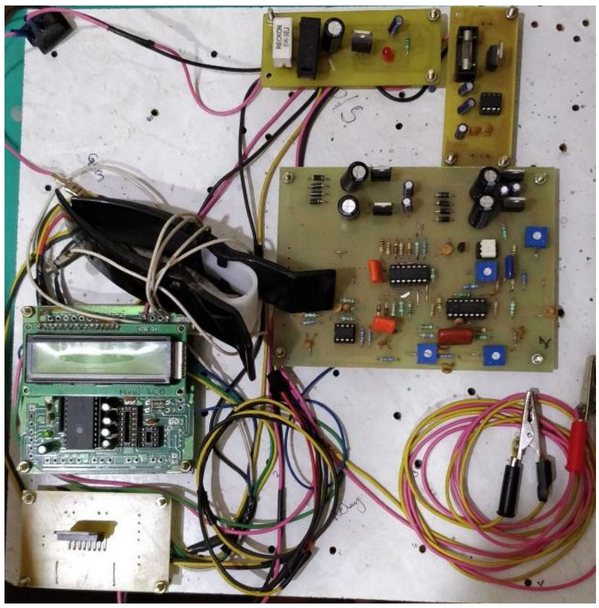

Fig 3 The implemented circuit

IV. SUMMARY

There are many research institutions around the world using EEG caps to drive wheelchairs, and there may well be commercial products reaching the market in a few years as a result of these efforts. The brain-controlled wheelchair has not yet been widely adopted, and any commercial device would need proper safety trials and approval before release [1]. But there are high hopes for the future of brain-controlled chairs and prosthetics. Ultimately, even profoundly disabled people will be able to gain some independence through the use of mind controlled chairs and prosthetics. Using the system proposed in this paper the signals were sent from the headset to the microcontroller in order to instigate movements in the wheelchair based on the inputs from the brain. Although this system is very raw it is a step towards brain-controlled movement. The movement of the wheelchair will be solely configured to the signals generated by the mind thus negating any physical force required. User based or specific modules can be created thus generating a unique footprint. External help maybe required by people who suffer from paralysis of the upper torso for placement/adjustment of the headset. Exact thoughts cannot be measured using the current headset.

V. FURTHER WORK

An obstacle in the way could be detected automatically by the wheelchair forcing it to stop. Acceleration sensors could be added onto the wheelchair to calculate the amount of acceleration tilt to help navigate on ramps and slopes. The wheelchair could be integrated with head movements to control factors such as speed and brakes.

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