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Brain Controlled Wheel Chair

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***Abstract*—The paper presents the design and development of a brain-controlled wheel chair. This is a real time model of a low-cost wheel chair based on the Brain Control Signal by Eye Blink, for the persons disabled with quadriplegia. This model expected to benefit the poor paralyzed people as it provides a simplified low-cost model of the wheel chair. The model is realized through data comparison in serial communication with the special purpose microcontroller IC. This is detected like an object cross in a transmitter and receiver, and it will intimate. In this paper voice is our object detected by using infrared signal serially interact with controller, which in turn, controls the wheel chair movements based on brain wave signal. The work presented in this paper is the mini-project work of the under-graduate students of the engineering college guided by their supervisors.**

***Index Terms*— Brain, Control, Chair, Arduino, Handicapped, Microcontroller.**

I. INTRODUCTION

Systems capable of understanding the different facets of human communication and interaction with computers are among trends in Human-Computer Interfaces (HCI). An HCI which is built on the guiding principle (GP): "think and make it happen without any physical effort" is called a brain-computer interface (BCI). Indeed, the "think" part of the GP involves the human brain, "make it happen" implies that an executor is needed (here the executor is a computer) and "without any physical effort" means that a direct interface between the human brain and the computer is required. To make the computer interpret what the brain intends to communicate necessitates monitoring of the brain activity. The Brain Controlled Wheelchair (BCW) is a simple robotic system designed for people, such as locked-in people, who are not able to use physical interfaces like joysticks or buttons. This is a real time model of a low-cost wheel chair based on the Brain Control Signal by Eye Blink. This model expected to benefit the poor paralyzed people as it provides a simplified low-cost model of the wheel chair. The model is realized through data comparison in serial communication with the special purpose microcontroller IC. Fig. 1 gives the model of a brain controlled wheel chair. The methodology that is being adopted in this paper is shown in the Fig. 2 which gives the block-diagram of the work [1][2].

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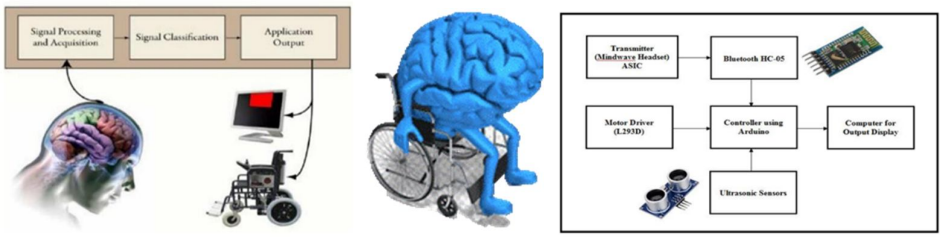

Fig. 1 : Model of a brain controlled wheel chair & the methodology used

II. Description of the Project

EG is an electro-physiological monitoring method to record electrical activity of the brain. It is typically non-invasive, with the electrodes placed along the scalp. EEG measures voltage fluctuations resulting from ionic current within the neurons of the brain. The brain signals are classified based on their frequency EEG signal acquisition is done with the help of a specially designed non-invasive bio sensor. The acquisition part consists of Nuerosky mindwave, Arduino and Bluetooth HC05 module. The mind wave device is used to capture the raw signal from the brain and transmit to HC-05 module over Bluetooth link. This Bluetooth device transfers these incoming raw EEG data into Arduino board at a baud rate of 57600. Inside the Arduino board the raw signal is classified into eye blink values and attention values. The eye blink value varies continuously as the eye blink strength varies [3][4].

The separate eye blink strength and attention value is serially transmitted to the Arduino microcontroller via HC-05 at a baud rate of 57600. The eye blink and attention values are split and stored in separate memory locations. After classification these signals are checked to meet the predefined conditions which is already defined in the instructions. Once conditions get matched, the Arduino module gives commands to the motor driver. The motor driver unit is connected to 12 Volts dc supply and 2 gear motors. Depending upon the commands given the motor driver, motor rotates in 3 different directions say left, right and forward. In order to ensure the safety during wheelchair movement, an Ultrasonic sensor is placed to detect the obstruction and change in floor level to avoid collision. Block diagram of the Arduino project with Bluetooth mechanism is shown in the Fig. 3. The developed schematic architecture of the Arduino project is shown in the Fig. 4 [5][6].

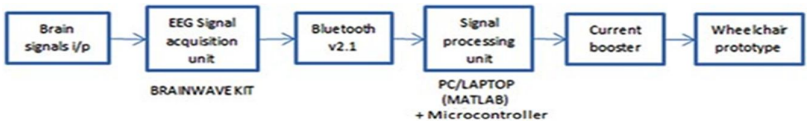

Fig. 2 : Schematic architecture

III. Working Principle of the Project

The Brain Signals used here are Spontaneous EEG signals. These signals are associated with various aspects of brain function related to mental tasks carried out by the subject at his/her own will. The mental tasks include attention, eye blinks and eye movement for forward, reverse and stop actions respectively. In this application a headgear is used for signal acquisition instead of the electrode cap. The headgear or the brainwave starter kit makes use of dry sensors which does not require application of a conductive gel between the sensors and the scalp. Also, this device is much lighter and convenient for usage when compared to the conventional EEG sensors as it requires only one electrode for sensing. The Signal Processing Unit used in this application is a laptop/PC [7][8].

IV. Flow Chart

The flow-chart is shown in the Fig. 5 which gives the idea about how the software module is developed to control the brain based wheel mechanism [11][12].

V. Mechanical Set-Up

This is the Main Model of Our project which is Designed As a Small wheelchair With Arduino Setup for the process Of this Chair by taking the input from the mind wave kit(Brain Signal) and the chair runs accordingly for

the movement of Wheel Chair we have implemented a DC Motor Which is connected with 2 Wheels. Fig. 6 gives the prototype of the system that is being developed [15][16].

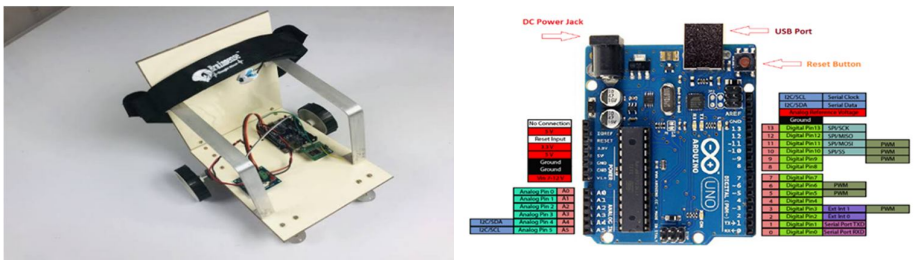

Fig 3. Prototype of the system developed & Arduino board with DC power jacks & USB Ports

VI. Arduino

The Arduino Uno is an Open Source Microcontroller Board based on the MicrochipATmega328P microcontroller and developed by Arduino.cc.

VII. HC-05 Bluetooth Module

HC-05 is a Bluetooth module which is designed for wireless communication. This module can be used in a master or slave configuration.

Fig. 4 : HC 05 Bluetooth module & the Neurosky's Mindwave Mobile Kit

VIII. Neurosky's Mindwave Mobile Kit

Neurosky's Mindwave Mobile is a dark plastic headband with solitary metal cushion that touches the client's forehead with single electrode, and ear clip used as ground, which are the main part [21][22].

IX. Matlab

This is the platform which we use to Run the code by Embedded c languages. It is a proprietary multi-paradigm programming language and numeric computing environment developed by MathWorks [23].

X. Simulation Results

An EEG signal with HCI is developed to control a wheelchair. The total design is based on electrical components and eliminates most of the mechanical parts. The conventional steering system that requires the user to control by hand is eliminated. [24][25].

XI. Conclusion

The innovative work of Mind-controlled framework has gotten a lot of consideration since they can take portability back to individuals with crushing neuromuscular issue and in this way enhance their personal satisfaction. In this paper, we displayed an extensive of the Mind-controlled System. This paper utilizes a cerebrum wave sensor which can gather EEG based mind signs of various recurrence and adequacy and it will change over these signs into bundles and transmit through Bluetooth medium into the level splitter segment to check the consideration level and give sound sign to driver. The significant distinction between brain-controlled

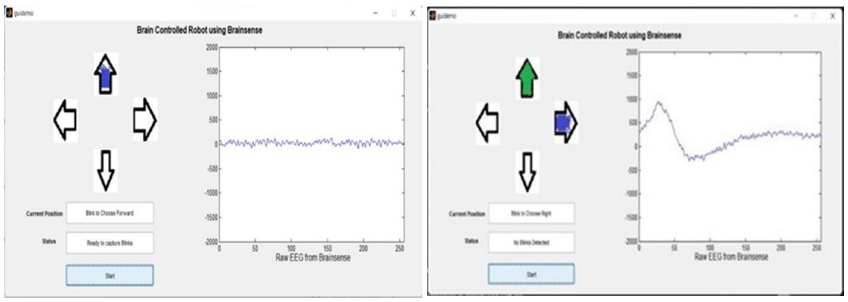

Fig. 5 : Simulation results - 1

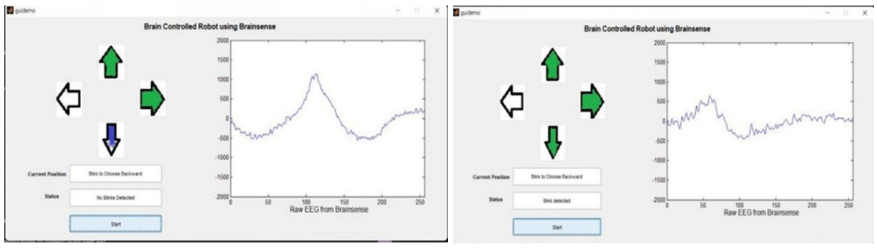

Fig. 6 : Simulation results – 2

framework and other personality controlled gadgets is that these frameworks require higher security since they are utilized to transport handicapped individuals. Numerous analysts have created different personality-controlled framework utilizing distinctive BCI methods and in addition different procedures, for example, insight strategies (in detecting circumstances, limitation, and way arranging) and shared control systems in order to make these frameworks more secure.

FUTURE WORK

The present work is a preliminary study and it still has few limitations. The Future scope of this work may include following points. In design instead of single channel, multiple channels can be used to more accurate decisions. Using analysis, disabled people could access any device placed in the environment decreasing their dependence on care-givers, nurses, and relatives etc. This can also be implemented for creating fully functional prosthetic arms, which would work like a human hand for handicaps because they might respond differently from the healthy users. We are currently using attention and blink value processing (Threshold), their limitations can be overcome by implementing new technologies like machine learning, artificial intelligence, fuzzy logic, etc.

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