Robotic Wheel Chair using Sensors and Voice Control

[1]Mr.Abdul Azeem, [2]Surakasula Revathi, [3]Kollati Bhavani Durga, [4]Shaik Fouziya
[1]Assistant Professor, [2,3,4]UG Students

Abstract **-** This project describes about a controlling wheelchair using EEG, Eye blink, MEMS and voice. Being responsible to our society we are trying to give a wheel chair for those who are suffering from paralysis disease known as tetraplegia, paraplegia. It is very difficult to move the wheelchair for elderly and disabled people from one place to another place. So, to avoid the support from care takers this is one of the best solutions to implement it for the society. Here we are presenting a wheelchair in which simple unipolar electrode is used to capture the EEG signals from the brain to find whether the patient is in active (conscious, attention) state or inactive (drowsy, meditation) state which produces the movement in wheelchair when patient is in active state otherwise there will be no motion. In the second technique, a patient sitting on the wheel chair looking in a straight way where infrared sensors receive the signals from the eyes which leads to movement of the wheel chair. In the third technique, by using MEMS sensor tilting positions the movement of the wheelchair is produced. Similarly, in the case of fourth technique wheelchair movements are controlled by the voice instructions made by the patient using android mobile. The signals are monitored by a serial monitor, which will guide the motors wired to the ATMEGA328 micro controller over the serial interface to move in a particular direction. The system is cost effective and thus can be used by patients spread over a large economy.

Keywords **-** Atmega-328, mind wave sensor, infrared sensors, ultrasonic sensors,Accelerometer HC-05 bluetooth.

I. INTRODUCTION

We are trying to improve the quality of life for elderly and disabled people. The wheelchair has developed significantly with a variety of guidance systems alongside like using the joystick where the patients effected to the nerves of the hands can't be used and systems based on the voice recognition alone are not be able to used by the patients for those effected by the paralysis to throat and also dumb people.And also some. But here we are presenting a device where it can be used in multiple ways simply a multiple purpose wheelchair. By this the patients who are effected with any types of paralysis to their different parts of body which the patients with any type of praralysis.

Here we are developed a wheelchair which can be used by patients suffering from paralysis .In the first case, we are using mindwave headset to sense the EEG signals from the brain that is transferred to the arduino microcontroller through HC-05 bluetooth. Based on the data Produced through the headset the wheelchair movement is Produced. In the second case, we are using two IR sensors to monitor the eye lid movements. So, that when two eyes are opened movement will be obtained based on the property of IR radiation. Those systems however are of use to those with a certain amount of upper body mobility. We have designed in such a way that wheelchair navigates with the possibility of avoiding collisions and holes. In this case, we propose a new methodology to control the wheelchair using infrared radiation It is a hand free technology which will drive based on movement of eye lids of the user.

In this type of controlling mode the user can look around the surroundings freely during the navigation to their goal point. In this case the patient is unable to navigate through arena those who are suffering with greater degree of Paralysis.

II. SYSTEM MODEL

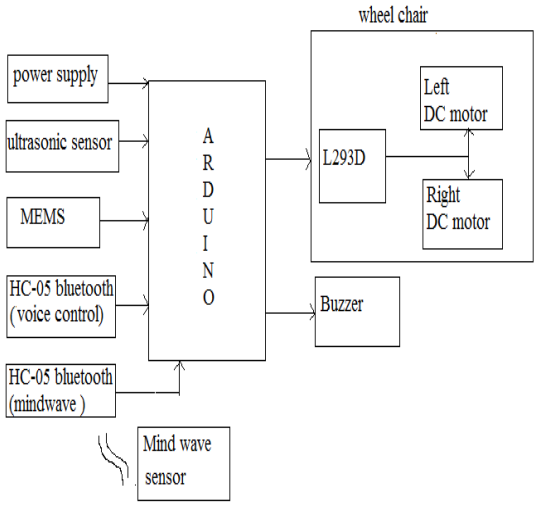

Figure1: Block diagram of system

Figure1 shows that there will be four ultrasonic sensors on the wheel chair for detecting obstacles. In this system we have design an optical using infrared sensor which Provides input to the microcontroller for driving a wheel chair IR sensors using reflected light intensity to estimate the distance from an object. Infrared rays Produced by transmitter Led and are received by the receiver led.

Signal acquit ion are mainly two types;

A. Invasive acquisition - This technique acquires the brain signals to electrodes that are implanted directly in the brain tissue. Surgery is required to implant the electrode on the cortex. This technique gives excellent quality of signals with very delay. However, as the electrodes are Pieces of wires Pins they are not completely reliable when placed inside the brain. Additionally, the invasive acquit ion technique may Prove to be an ethical controversy

B. Non-Invasive acquisition- The non-invasive technique on the other Hans uses the electrophysiological signals from

the scalp and takes measurements using that technique. The electroencephalogram is most commonly used due to its simplicity and ease in using other than meeting with the requirements for BCI systems. In the Paper electroencephalogram is used as the signal capturing technology.

Table 1: Wheel chair direction

Wheelchair direction	Left motor movement	Right motor movement
Forward	Forward	Forward
Backward	Backward	Backward
Left	Stop	Forward
Right	Forward	Stop
Stop	Stop	Stop

III. FEATURE EXTRACTION

Classification - There is a certain amount of discrepancy in classifying the waves, since the signals are continuously being captured but the many electrodes Present on the scalp. These waves are therefore classified into the following types:

A. Alpha waves - These waves generally range from 8HZ TO 13HZ with a very low voltage of about 5micro volts to 30 micro volts. These waves are generally by the brain it is in an empty or inactive state.

B. Beta wave - These waves generally range from 13HZ to30HZ with a voltage of about 30uv.They are released by the brain is active and thinking, solving a problem.

C. Theta waves - These waves generally range from 4HZ to 7HZ with a voltage of about 20uv.these waves are generally generated by the brain under stress, emotional tension, disappointment etc. these waves are also generated when the user is in deep meditation or unconscious.

D. Gamma wave - These e waves are released by the brain when the user is conscious and are generally of a frequency of 35HZ or greater.

E. Mu waves - These waves generally range from 8HZ to 12HZ. They are generally released when the brain responds to spontaneous activities such as motor activities etc.

Flow chart -

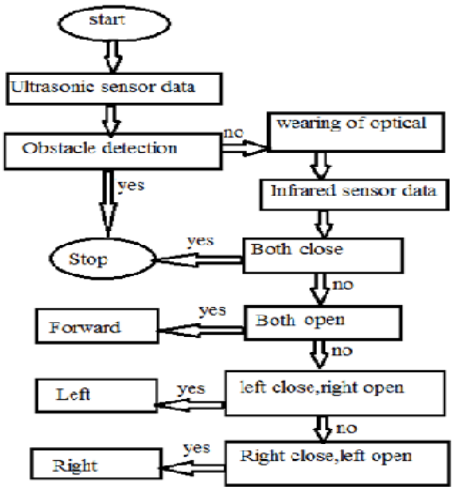

Figure 2: Flow chart of the EYE blink controlling system

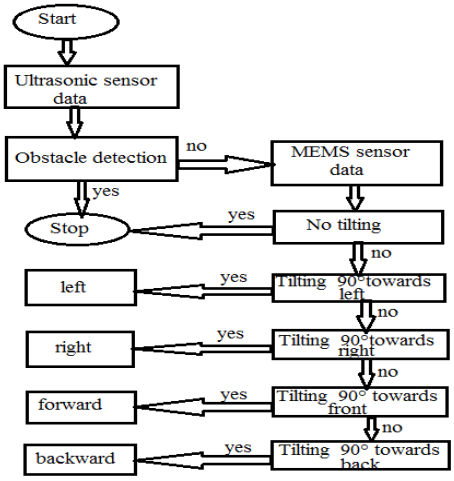

Figure 3: Flow chart of the MEMS controlling system

IV. METHODOLOGY

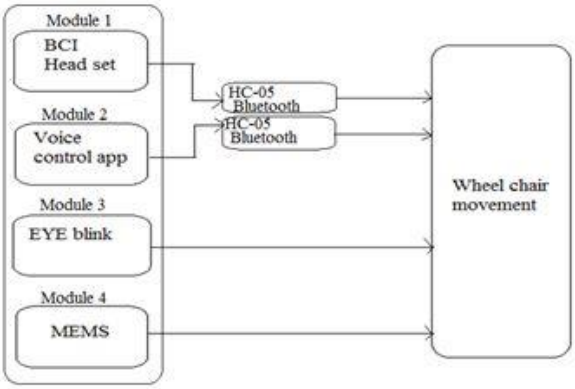

Figure 4: Proposed system

A. Neurosky mind wave mobile headset - The mind wave mobile safely measures and outputs the EEG Power spectrums in the form of alpha waves, neurosky sense meter and eye blinks. The device consists of a headset, an ear-clip, and a sensor arm. The headset reference and ground electrodes are on the ear clip and the EEG electrode is on the sensor arm, resting on the forehead above the eye. It uses a single AAA battery with 8hours of life.

B. HC-05 Bluetooth Module - HC-05 embedded serial communication module has two work modes: order response work model by and automatic connection work mode, and three work roles at the connection work mode. When the module is at the automatic connection work mode. When the module is at the automatic connection at the work mode, it will follow the default way set lastly to transmit the data automatically. When the module is at the order-response work mode, user can send the AT command to module can be switched by controlling the module.

C. Arduino UNO - The Arduino uno is a microcontroller board based on theATmega328.It has 14 digital input\output pin,6 analog Pins,16MHZ ceramic resonator, a USB

connection, a Power jack, an ICSP header, and a reset button. The main reason for selecting this specific model of arduino was that it satisfies our basic requirement of connection.

D. Accelerometer - An accelerometer is an electromechanical device that will measure acceleration force. It shows acceleration, only due to cause of gravity i.e. g force. It measures acceleration in g unit. Accelerometer can be used for tilt-sensing applications as well as dynamic acceleration resulting from motion, shock, or vibration.

V. CONCLUSION

This paper proposed the design of new concept of motion control of wheelchair using eye lids movement . The main purpose of this study is to develop a prototype that can detect obstacle and make disables self-dependent by increasing their range of mobility. There are four broad beam angle ultrasonic sensors integrated in order to detect obstacle and to obtain detailed regarding disable's environment. We have developed some logics to control the wheelchair through infrared sensors as if any user wants to drive the wheelchair forward, simply he should open both the eyes. If he wants to drive it backward, he should close both the eyes. Similarly if he wants it to turn left, he should close his left eye and open his right eye. And if he wants it to turn right, he should close his right eye and open his left eye. 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. It uses upcoming and ever evolving technology that will enable easy and manageable iterations. The components used are very low cost yet have an optimum performance level .External help may be 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.Similarly through the MEMS sensor and voice the wheelchair can be controlled.Finally, our wheelchair can be multiple ways by those patients who are effected with different types of paralysis like Paraplegia,Tetraplegia.

VI. FUTURE SCOPE

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 wheel chair could be integrated with head movements to control factors such as speed and brakes.

VII. REFERENCES

[1]. Ling Li, Lei Xiao, and Long Chen, “Differences of EEG between Eyes-Open and Eyes-Closed States Based on Autoregressive Method”, Journal of electronic science and technology of China, vol.7, no.2, June 2009

[2]. Hugues Sert , S.P. Levine, D.A. Bell, 1.A. Jaros, R. c. Simpson, Y. Koren, and J. Borenstein, "The NavChair assistive wheelchair navigation system," IEEE Transactions on Rehabilitation Engineering, Vol. 7, No. 4, pp. 443-451,Dec. 1999

[3]. Tsui, C.S.1., "EMG-based hands-free wheelchair control with EOG attention shift detection," IEEE International Conference on Robotics and Biomimetic, ROBIO. 2008.

[4]. Deng, L. Y., Hsu, C. 1., Lin, T. c., Tuan, J. S., Chang, S. M., "EOG based Human-Computer Interface system development," Journal of Expert Systems with Applications, Vol. 37, pp. 3337-3343, 2010.

[5]. R. Barea, L. B., M. Mazo and E. Lopez, "Wheelchair Guidance Strategies Using EOG," Journal of Intelligent and Robotic Systems 34, Number 3I July, 2002.

[6]. Yathunanthan, 1. U. R. Chandrasena, "Controlling a wheelchair by use of EOG signal," Proceedings of the 2008 4th International Conference on Information and Automation for Sustainability, ICIAFS 2008.

[7]. P. Jia, H. Hu, T. Lu, and K. Yuan, "Head gesture recognition for hands free control of an intelligent wheelchair," Journal of Industrial Robot,Vol. 34, No.1, pp. 60-68, 2007.

[8]. T. Felzer and B. Freisleben, "HaWCoS: The "hands free " wheelchair control system," in Proc. 5th Int. ACM Conf. on Assistive Technologies, Edinburgh, Scotland, pp. 127-134,2002.

[9]. T. Moon, M. Lee, J. Chu, and M. Mun, "Wearable EMG based HCI for electric-powered wheelchair users with motor disabilities," Proceedings of IEEE International Conference on Robotics and Automation, Barcelona, Spain, pp. 2649-2654, 2005.

[10]. Arduino, Ardunio Website, http://arduino.cc/ (accessed on 3rd May, 2014)

[11]. NeuroSky,NeuroSkyWebsite,http://developer.neurosky.com/ (accessedon 3rd May, 2014)

[12]. LinoTux,LinoTuxWebsite,http://www.linotux.ch/arduino/HC0305_serial_module_AT_commamd_set_201104_revised.pdf, (accessed on 20th September, 2014)

[13]. Brain Computer Interfaces, a Review, http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3304110/, (accessed on 17th October 2014)