ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 3, March 2016

A Survey on Different Methodologies to Assist Paralysed Patients

Rolga Roy[1], Archa S[2], Josny Jose[3], Rinku Varghese[4]

Assistant Professor, Dept. of EEE, Sree Buddha College of Engineering for Women, Kerala, India[1]

UG Student, Dept. of EEE, Sree Buddha College of Engineering for Women, Kerala, India[2]

UG Student, Dept. of EEE, Sree Buddha College of Engineering for Women, Kerala, India[3]

UG Student, Dept. of EEE, Sree Buddha College of Engineering for Women, Kerala, India[4]

ABSTRACT: Paralysis is caused by impairment of nervous system disabling the people from performing various common functions. There are different methodologies available to assist paralyzed patients .In our literature survey we found some papers that uses different technologies to assist paralyzed patients .They are head movement based wheel chair control, in which we can control the movement of wheel chair by moving head. Tongue motion based system to assist paralyzed patients where tongue based motions are used, Eye movement based intelligent wheel chair, here we use the optical-type eye tracking system to control powered wheel chair. Exo-skeleton to rehabilitate paralyzed arm, which is based on the patient's self-guided control.

KEYWORDS: Head Movement, Wheel chair control, Self-guided control.

I.INTRODUCTION

Approximately 6 million people in the world face the problem of disability due to paralysis of various degrees. Paralysis is caused by impairment of nervous system disabling the people from performing various common functions. Paralysis is loss of muscle function for one or more muscles. Paralysis can be accompanied by a loss of feeling (sensory loss) in the affected area if there is sensory damage as well as motor. About 1 in 50 people have been diagnosed with some form of paralysis, transient or permanent. Adaptive equipment can be used to help stroke patients have greater independence with everyday life skills or activities of daily living. There is a great assortment of assistive devices for all areas of self-care including dressing, bathing, grooming, cooking, feeding, toileting, and mobility aids. There are also assistive technology devices to help with communication, using a computer, operating household devices, and driving. Head movement based control of an electric powered wheelchair based on an EEG sensor called Emotive EPOC, which have the ability to detect head movements. It has two modes: one uses only one head movement to control the wheelchair and the other uses four head movements. It is possible by eye tracking system to control powered wheel chair. Eye movements of the user are translated to screen position using the optical type eye tracking system.In Exoskeleton to rehabilitate paralyzed arm based on patient healthy arm guidance we discuss the stroke rehabilitation by robotic device and a novel exoskeleton, which is based on the patient's self-guided control. It is realized by moving the patient's own healthy arm in order to provide movement for the exoskeleton. trajectories.

II.DIFFERENT METHODS FOR ASSISTING PARALYZED PATIENTS

- Head Movements Based Control Of An Intelligent Wheelchair In An Indoor Environment
- Tongue Motion Based Operation Of Support System For Paralyzed Patients
- Eye Movement Based Electronic Wheel Chair For Physically Challenged Persons
- Exoskeleton To Rehabilitate ParalyzedArm Based On Patient Healthy Arm Guidance

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 3, March 2016

III. HEAD MOVEMENTS BASED CONTROLOF AN INTELLIGENT WHEELCHAIR IN AN INDOOR ENVIRONMENT

The control of an electric powered wheel chair by using head movements is done with the help of an EEG sensor called emotive EPOC headset. Mainly there are two control modes they are
i) One head movement mode
ii) Four head movement mode**.**

1. METHODOLOGY

In order to detect the head movements a gyroscope is placed in the emotive EPOC head set. The EPOC headset consists of 14 saline electrodes. The arrangement of electrodes are done according to 10/20 system and their locations are AF3, F7, F3, FC5, T7, P7, O1, O2, P8, T8, FC6, F4, F8 andAF4.An emotive EPOC headset is shown in figure1

Fig 1 : Emotive EPOC headset

Both modes provide four control commands :going forward, turning right, turning left and stopping. The gyroscope of the Emotive EPOC headset have two axis X and Y through which the EPOC headset receives the information about the movements of head**.** The X axis detects horizontal movements of the head and Y axis determines the vertical motion of the head. the X axis reports horizontal movements of the head, a negative value indicates a left movement of the head and a positive value represents a right movement of the head. On the other hand, the Y axis identifies vertical movements of the head, a positive value corresponds to an up movement of the head and a negative value indicates a down movement of the head.

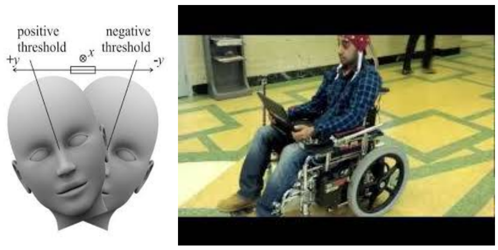

Fig 2: Head movement based wheelchair

In our proposed HMI, the four head movements based control mode employs the motion data obtained by a two- axis gyroscope inside the Emotive sensor to recognize head movements without the need of a camera. In this way, lighting illumination effect is eliminated. The previous control mode offers four control commands; each command is issued by a different head movement, and therefore four head movements are needed for controlling the wheelchair. Nevertheless, some patients may only be able to perform one head movement, for this reason this mode was designed for controlling the wheelchair by using just one head movement.

IV. TONGUE MOTION BASED OPERATION OF SUPPORT SYSTEM FOR PARALYZED PATIENTS

Tongue motion based wheelchair control is a good method because during spinal cord injuries tongue usually escapes from this as it is connected to brain by hypoglossal nerves. Tongue movement is fast when compared to other methods and it is accurate no need of much thinking. Even though in resting position tongue can be easily moved by the user. This method gives a new control device based on tongue motions to control and communicate with a support system for a paralyzed patient. Tongue is one of the capable parts for the motions and is not affected by spinal cord damage. The tongue motion is easily observed from his/hermouse inside, it is, however, hard to observe them from outside.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 3, March 2016

1. METHODOLOGY

Fig 3 shows the block diagram showing the methodology of tongue motions based wheelchair. Mainly there are two sections Transmitter section and receiver section

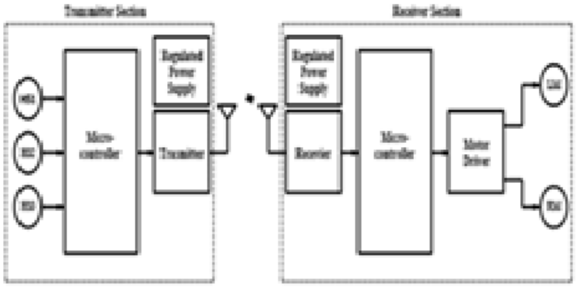

Fig 3 :Block diagram of Tongue motion based electronic wheelchair

This system employs an array of hall effect sensors and a permanent magnet. The users command is converted to control command by detecting the tongue motions. When the user moves the tongue the magnetic field created by the permanent magnet also varies and these variations are detected by hall effect sensors and depending on the strength of magnetic field the output will vary. The output of the sensor is analog so an analog to digital converter is used to convert it into digital signal. The microcontroller present in the transmitter section is provided with predefined values, and the microcontroller will compare the output of sensor with the predefined values and according to the programming it will identify which command the user have produced. The micro controller will send certain command to transmitter and the encoded data is transmitted wirelessly. Receiver will receive the data and decode it and given to the microcontroller of the receiving section. The microcontroller controls the movement of wheel chair With the help of DC motors wheels of the wheelchair model rotates. A dual full bridge inverter is already loaded in microcontroller using Embedded C programming. Depending on the input microcontroller will provide predefined logic to the dual full bridge driver.. Driver IC in turn will control the rotation of DC motor (clockwise and anticlockwise rotation) due to which wheelchair can move in left, right and forward direction. In this method we are using five commands. Out of this three of them are directional commands that is LEFT,RIGHT,FORWARD and two them are selection commands that is Stand-by and Active Mode. When driving PWCs, FORWARD is used to move the wheelchair forward, while LEFT and RIGHT are used to turn left and right respectively. To deactivate the system during eating and talking we can switch the TDS from active to stand-by mode, during which wheelchair will remain still.

V. ELECTRONIC WHEEL CHAIR FOR PHYSICALLY CHALLENGED PERSONS BASED ONEYE MOVEMENT

In this method we use the optical-type eye tracking system to control powered wheel chair. Using this optical eye tracking system eye movement is translated to screen position. Here we have a software based on the angle of rotation of pupil. When user looks at appropriate angle, then computer input system will send command to the software based on the angle of rotation of pupil i.e., when user moves his eyes balls up (move forward), left (move left), right (move right) in all other cases wheel chair will stop.

1. METHODOLOGY

After the image has been processed it will sent to the microprocessor. The microprocessor will take a USB output from the laptop and convert the signal into signals that will be sent to the wheelchair wheels for movement. In order to provide necessary feedback operation of the wheelchair system, pressure and object detection sensors will be connected to our microprocessor. The final part of the project is the wheelchair itself. The rear wheels will provide forward. The front two wheels will be used for steering left and right. All four wheels will be connected to our microprocessor that will send signals to control the wheels and thus the overall movement. Fig 4 shows the block diagram for the eye movement controlled wheelchair. Here, in this block diagram the whole system is controlled by Arm11 processor and this processor is implemented on Raspberry Pi Board so this board is connected with many components as shown in figure. The Implementation process for Pupil detection using Raspberry pi and on the terminal

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 3, March 2016

of Raspbian image installed on raspberry pi. The Raspberry Pi is an ultra-low-cost, deck- of-cards sized Linux computer.

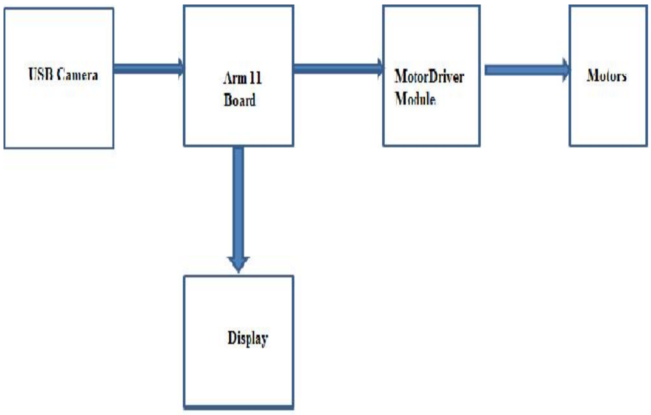

Fig. 4.Blockdiagramof eye movement based electronic wheelchair

It is controlled by a modified version of Debian Linux optimized for the ARM architecture. It has two models model A and model B. The Model B has 512 MB RAM, BCM2385 ARM11, 700 MHz System on chip processor. It has 2 USB ports and HDMI out.USB Camera interface with the Raspberry Pi USB Cameras are imaging cameras that use USB 2.0 to transfer image data. USB Cameras are designed to easily interface with dedicated computer systems by using the same USB technology that is found on most computers. It is on raspberry pi on also. The accessibility of USB technology in computer systems as well as the 480 Mb/s transfer rate of USB 2.0 makes USB Cameras ideal for many imaging applications. Resolution Of 640x480 Or Even 320x240 pixels. The distance between camera and eye is 12 to15 cm. In this project use INTEX IT-306WC PC webcam as a USB camera. There is a lot of recent motivation to do image processing and computer vision tasks on the Raspberry Pi. Then opencv is installed on raspberry Pi. Install properly USB camera with the raspberry pi then, also USB camera will use the driver to work properly on raspberry pi board.UV4L driver will be used for raspberry pi. If everything works, then I used scrot to take the screenshot for testing. sudo apt-get install scrot.

VI. EXOSKELETON TO REPLACE PARALYSED ARM BASED ON HEALTHY ARM GUIDANCE

In this method we discuss the stroke rehabilitation based on the patient's self-guided control, by robotic device and a novel exoskeleton. It is realized by moving the patient's own healthy arm in order to provide movement trajectories for the exoskeleton. Flexibility and adaptively is the main advantages of exoskeleton. In this method we are using new model predictive control (MPC) algorithm and a microprocessor-based drive system for the exoskeleton. High resolution potentiometers are used to measure the angular positions corresponding to the joint angles of arm. Stroke rehabilitation is the process by which patients with disabling strokes undergo treatment to help them return to normal life as much as possible. This process is usually supported by one rehabilitation team which is multidisciplinary as it involves staff with different skills working together to assist patients.

1. METHODOLOGY

The exoskeleton system is to be realized through the acquisition of joint angles, angular velocities and joint accelerations generated from patient's own healthy arm we can realize exoskeleton system. Exoskeleton mounted on the paralyzed arm is controlled to perform movements with the aid of model-predictive control (MPC) algorithm and microprocessor-based drive system. Fig.5 illustrates this scenario, where the left arm generates the movement trajectory and pattern as it is supposed to be the healthy arm, while the exoskeleton mounted on the paralyzed right arm drives it to perform movements. The actuators drive the exoskeleton, i.e. generate torques. In order to realize the feedback control sensors are used to measure the corresponding angles.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 3, March 2016

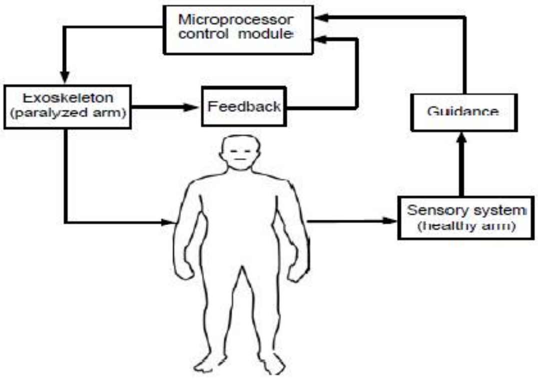

Fig.5.Schematic diagram of arm exoskeleton with healthy arm guidance

Actuators are based on servo motors with specified torques. The torques required is computed based on the weight of exoskeleton and arm weight. Based on the knowledge of human upper-limb articulation, the exoskeleton mainly consists of a shoulder motion support part and an elbow motion support module. For each part, it mainly consists of arm link, driver, pulleys, DC motors (or pneumatic and/or hydro-actuators), force sensors, arm holders and the mechanism for moving centers of rotation of joints.

VII. CONCLUSION

Different methods for assisting paralyzed patients are studied. Wheelchairs based on head movement, eye movement, tongue motion, exoskeleton system are very useful to those peoples those facing stroke. To achieve independence in mobility for people with physical disability, right mobility equipment have to be designed based on the severity and type of disability. This is not a trivial job just because the nature and type of disability varies from person to person. So different methods are essential to help those peoples and as future engineers it is our duty to develop newer technologies to assist paralyzed patients.

VIII. FUTURE SCOPE

In future we are introducing an automatic system which acts as assistance for paralyzed patients. In our proposed system we introduce an automatic control system for the assistance of paralyzed patient .System provides load control based on head movements and eye blinking. It provides facilities to inform the concern relatives in case of emergency situations through GSM. This system also helps to know internal conditions of patients.

REFERENCES

1. Ericka Janet Rechy-Ramirez, Huosheng Hu and Klaus McDonald-Maier, “Head movements based control of an intelligent wheelchair in an indoor environment”,2012
2. Junji TAKAHASHI, Satoru SUEZAWA, Yasuhisa HASEGAWA, Yoshiyuki SANKAI, “Tongue Motion-based Operation of Support System for Paralyzed Patients”, 2011
3. GundaGautam, GundaSumanth, Karthikeyan K C, ShyamSundar, D.Venkataraman, “Eye movement based Electronic Wheel Chair For Physically Challenged Persons”, 2014
4. Jiajia Hu, XinminXu, and Weidong Liu,” Exoskeleton to Rehabilitate Paralyzed Arm Based On Patient Healthy Arm Guidance s”,
5. YashShaileshkumar Desai, “Natural Eye Movement & its application for paralyzed patients”,2013
6. Mohammed Ismail.B, Syed FouzanIshaqui, Abdul Karim Khan, Mohammed Abdul Quadeer,” head Geastures Based Control Of Wheelchair For a Paralysed Person In an Indoor Enviroment”, 2014