Gesture Controlled Wheelchair

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Abstract—The most difficult tasks for physically challenged people are, like they are dependent on other people. If they want to go anywhere they have to wait for someone to take them out. Or make moving manual wheelchairs all the time is almost impossible. Which results in restricting the freedom.

By our this project we try to make them independent. The user just needs to wear a gesture device in which a sensor is included. The sensor will record the movement of hand in a specific direction which will result in the motion of the wheelchair in the respective directions. In this article, gesture based wheelchair uses an accelerometer sensor which controls the direction of wheelchair using hand movements and GPS and GSM modules are used for live location .This paper presents a model for hand Gesture controlled user interface. We presents very useful and integrated approach to real time detection, hand gesture based data glove technique is used which controls the wheelchair using hand movements by using the accelerometer sensor. This paper presents a low voltage supply, low-cost and small 3-axis wireless system to control the wheelchair using 2 AVR microcontroller. The wheelchair and the Gesture instrument are connected wirelessly through radio waves. User can interact with the wheelchair in a more friendly way due to the wireless communication.

keywords- microcontroller, accelerometer sensor, wheel chair control, hand gesture recognition, RF module, GPS, GSM.

I. INTRODUCTION

Wheelchair is intended to facilitate patients in shifting them , moving physically challenged folks from one place to a different with the assistance of attender or by means that of self propulsive. The machine driven chair operation rely upon the instruction given by the patient's hand movement or the other mechanism In our project, the machine-driven chair is developed by victimisation the hand gesture supported accelerometer (ADXL335). The automated chair is to be developed to regulate the motor rotation of chair supported hand movement of physically challenged person to facilitate the disable people for his or her freelance movement, associate accelerometer device (ADXL335) based mostly transmitter is fitted on person's hand through gloves. within the transmitter circuit, associate accelerometer supported hand movements generates command signals. At first, microcontroller converts the command signal i.e. associate analog signal to the digital sequence so compare within with pre-defined variables. Within the receiver, the RF receiving module receives signals from the transmitter. in step with the signals, the driving force circuit can drive the motor fitted to the chair.The automated chair is based on easy electronic system and also themechanical arrangement that's controlled by AVR controller..

A. Head Mounted assistive Technology

The head mounted assistive technology is developed for such an individual United Nations agency is suffering from paralysis however has maintained bound reasonably neck or shoulder movements. This technology is principally used to create devices that imitate mouse victimisation head movement. In one among the approach, associate infrared beam emitted or mirrored from a transmitter or reflector connected to user's cap, glasses or band is caterpillar-tracked, for dominant the movement of pointer. In one among the system tilt sensors area unit accustomed move the pointer in vertical and horizontal direction on visual display unit. To notice the lean from the gravity vector, the lean detector general ly makes use of inertia because the user move the pinnacle in some direction the angle between a sensing axis and a reference vector that is earth's magnetic field is detected by sensor and depending upon the angle cursor movement will take place. One more system known as ― Camera Mouse has been developed to control the movement of cursor. This system consist of a video camera in front of the user, which continuously track the head or nose movement and proportionally moves the mouse pointer on the computer. Developed a visual based HMI for controlling a wheelchair by head gestures which were recognized by detecting the position of the nose on user's face. The main drawback of these systems is that it constantly requires neck or shoulder movement which is tiring and uncomfortable for the user. The head of the user should always be in the range of sensor otherwise the user cannot be able to control the movement of cursor. Also the design limits the allowable commands to be generated.

B. Eye tracking assistance

In eye tracking assistive technology instead of usingcamera for tracking the eye movement several light sensors can be used [1]. The sensors can be fitted in eye glass type apparatus that can be easily wearable by the user. Also, the light sensors are cheap in cost hence, reducing the whole system cost. Furthermore since the used light sensors are

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small in numbers, the generated vectors dimension is small and easy to calculation and fast as well instead of size of typical video frame captured by the camera decreasing the computational complexity of the system. In eye tracking assistive technology an Eye touch system is used. Eye touch system consists of components such as infrared light sensitive apparatus such as infrared light sensitive apparatus, a data acquisition unit, computer software and the power supply. Gajwani and Chhabria used eye tracking and eye blinking system which is obtained by a camera mounted on a cap to control a wheelchair. However, the performances of these HMIs are likely affected by environmental noises such as illumination, brightness, and the camera position. Additionally, eye tracking may force and affect the vision of the user, causing tiredness and dizziness. Ericka Janet Rechy-Ramirez et al. developed an intelligent wheel chair which uses An EEG device, namely Emotiv EPOC to be installed on used head that make it bulky and complex .This paper is inspired from a research paper titled “Head Gesture Recognition for Hands-free Control of an Intelligent Wheelchair” by Jia et al. This paper approach was to control a wheel chair using visual recognition of head gesture.

II. NEURAL INTERFACE ASSISTIVE TECHNOLOGY

Recent advancement in neuro-technology has helped the users who cannot benefit from mechanical movement of any body organs by developing the series of devices known as Brain Computer Interfaces (BCI) or Neural Interface System (NSI). This system control the external devices by detecting user’s intention by utilizing electric signal originated from brain wave. Recently, a new EEG sensor, Emotive EPOC, has been available on the market to provide potential applications on hands-free HMIs [5]. It has three suites: “cognitive suite” to detect thoughts, “expressive suite” to detect facial expressions and “affective suite” to detect emotions, as well as a gyroscope to detect head movements. It was used to recognize four trained muscular events to steer a tractor: eyes looking to the right and jaw opened, eyes looking to the right and jaw closed, eyes looking to the left and jaw opened, and yes looking to the left and jaw closed. In such systems for making good electrode contact with the cortical region considerable amount of time is required because if good contact is not possible the electrode is removed and cleaned each and every time until we create good electrode contact. Hence it set up time is more. Also this system is prone to high error rate as the signal generated by the EEG has very small amplitude. The system can give unwanted command to the device due to interference of signals resulted from other activities such as talking and muscle contractions. To overcome such problem heavy signal processing and complex computational algorithm can be used, but it will increase the cost and delay.

III. VOICE CONTROLLED ASSISTIVE TECHNOLOGY

Voice controlled mechanism can also be used to operate power wheelchair by the individual who can produce consistent and distinguishable voice. This technology makes use of speech recognition system for taking voice of the user as the input signal. Before this speech recognition system is used for actual control of the wheelchair it has to be trained. The set of command spoken by the user will be saved by this system. During operation the user speaks a command into the microphone; the speech recognition system will compare the spoken command with the saved command and will transmit the computer code associated with it. In this way we can operate the wheelchair. The advantage of this technology is that, users don’t have to physically operate the wheelchair and it is also easy to learn. Out of all these assistive technologies which were developed, very few assistive technologies has been proved successful in outer environment rather than in research laboratories. There are various technical and psychophysical factors which affect the acceptance rate of an assistive technology which are as follows:

• it should be easy and convenient to operate
• device should require less time to learn
• it should be cosmetically suitable

IV. HARDWARE

Module A: Accelerometer based hand Gesture controlled wheelchair

In this module we will design accelerometer based hand gesture controlled wheelchair with AVR ATmega328 microcontroller. Here, we will use our hand gestures as input signals to drive the wheelchair in different direction and we will display the direction of movement of the robot in a 16X2 alphanumeric LCD.

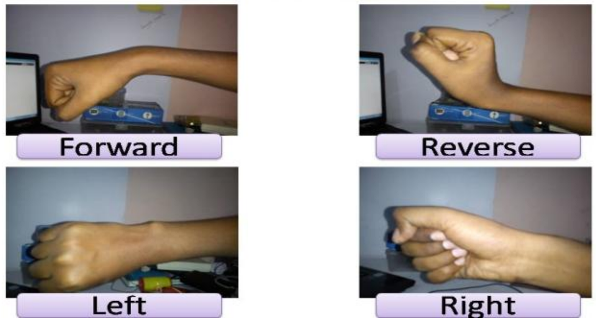

Fig. 1 Hand Movement Controlling

In this case, hand gestures mean movement of hand in different direction. To detect different hand gesture, we will use the ADX335 accelerometer sensor. The sensor will be attached to our hand with some material or through a hand glove. The three output signals of accelerometer sensor are analog in nature and it cannot be processed directly with the help of ATmega328 microcontroller. For this, we will use the ADC of the ATmega328 microcontroller to convert the analog signals to digital values. After converting the signals from analog to digital of accelerometer sensor , the ATmega328 microcontroller will process the digital values to find different gestures of the hand. Once the hand gesture is identified, the ATmega328 microcontroller will send the required signal to the DC motor driver (L293D) of the wheelchair to drive the wheelchair in the desired direction. Also, the microcontroller will display the direction of movement of the wheelchair in a 16X2 alphanumeric LCD. The control hand gestures for the wheelchair are forward tilt, backward tilt, left tilt, right tilt and no tilt to drive the robot in forward, backward, left, right direction and to stop it respectively.

Module B: GSM (SIM-900) and GPS modules
(Emergency)

These modules are used to in the system to help the user in case of emergency, Where in We communicate the emergency situation to the relatives of the user of the system or the Ambulance etc. This is achieved by sending the location parameters to as an SMS. Here When the user gives the command as Emergency, We immediately capture the GPS parameters such as Longitude and Latitude and send them as an SMS using SIM-900 to the above any pre mentioned contacts numbers, these numbers are preprogrammed into the software.

V. RESULTS AND CONCLUSION

COMPONENTS	VOLTAGE RATINGS
LM7805 input voltage	11.05
LM7805 output voltage	4.89
Sensor‟s input voltage	4.87
L293d output voltage	11.04

This paper is capable to control the wheelchair motion for disabled people using hand gesture. Improvements can be made by using different body gestures like eye gaze, leg movement or head movement respectively.

VI. REFERENCES

[1] CihanTopal, AtakanDoğan and ÖmerNezihGerek, "A Wearable Head-Mounted Sensor-Based Apparatus for Eye Tracking Applications" VECIMS 2008 – IEEE International Conference on Virtual Environments, Human- Computer Interfaces, and Measurement Systems Istambul, Turkey, 14-16 July 2008

[2] Y. Chen, ―Application of Tilt Sensors in Human–Computer Mouse Interface for People with Disabilities‖, in IEEE Transactions Neural Systems and Rehabilitation Engineering, Vol. 9, No. 3, September 2001, pp. 289–295.

[3] P. Jia, H. Hu, T. Lu and K. Yuan, "Head Gesture Recognition for Hands-free Control of an Intelligent Wheelchair".

[4] P.S. Gajwani and S.A. Chhabria. Eye motion tracking for wheelchair control. International Journal of Information Technology, 2(2):185–187, 2010.

[5] Ericka Janet Rechy-Ramirez, Huosheng Hu and Klaus McDonald- Maier, "Head movements based control of an intelligent wheelchair in an indoor environment", Proceeding of the 2012 IEEE, international conference on robotics and biomimetic, December 11- 14, 2012, Guangzhou, China.

[6] Rabiner L. R., "A Tutorial on Hidden Markov Models and Selected Applications in Speech Recognition", Proc.

[7] Moon, M. Lee, J. Chu, and M. Mun, "Wearable EMG-based HCI for Electric-Powered Wheelchair Users with Motor Disabilities," Proc. of the 2005 IEEE Int. Conf. on Robotics and Automation, pp. 2649-2654, 2005.

[8] Rajesh KannanMegalingam, Ramesh Nammily Nair, SaiManojPrakhya," Automated Voice based Home Navigation System for the Elderly and the Physically Challenged"proc.ICACT2011P.603-08,Feb.2011.

[9] J.Z. Yi , Y.K. Tan Z.R. Ang, "Microcontroller Based Voice- Activated Powered Wheelchair Control", ACM ublishers, 2007.

[10] A. AnandKumar "BasicFundamentals of Digital Circuits" Second Ed. PHI Learning.