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FLEX SENSOR BASED GESTURE CONTROL WHEELCHAIR FOR STROKE AND SCI PATIENTS

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ABSTRACT

The design of wheelchair in a real time system to make a simple hand gesture recognition method to be used in rehabilitation of people who have mobility issues particularly Spinal Cord Injury (SCI) and some of the Stroke Patients. The idea is to implement a low cost control device called Hand Gesture or by using touch sensor for the patients to control the wheelchair and they can survey themselves for their basic needs and they need not to depend on others to guide those patients. The system was developed to indicate the directions for the patients to move on the flat surface and also measure the patient heart beat pulse. If the patient able to use their hand or finger means by using a Gesture control method or else flex sensor helps to move in a desired directions.

KEYWORDS: wheelchair, Flex sensor, Hand gesture, stroke patients, SCI patients.

INTRODUCTION

Hand gesture based recognition methods and systems are more in number which are based on Joystick based accelerometers; MEMS based accelerometers, Laser based, Ultrasonic sensor, Vision sensor etc. They also involved several different algorithms and techniques including pattern matching histogram, fuzzy based, FSM based and HMM based etc. are used for hand gesture identification. But here the purpose of accelerometer is to control the wheelchair based on the desired directions. The technology advanced on Sensors, enables the design of gesture control wheelchair for SCI as well as the stroke patients. The system design consists of an Arduino controller, Accelerometer and WPT (wireless power transmission). The WPT is designed as efficient power source for usage of power for all the sensors and controllers without the usage of any plug devices also using RF (Radio Frequency) for transmitting and receiving purpose. The flex sensor is used here to move the wheelchair without using the hand and also program modifications takes place. Glove based hand gesture device uses flex sensor that are attached to the glove for the users to wear and use. In this paper the heart beat range of the patients are also measured by using an Pulse sensor which are attached to the wheelchair and motor driver are used to control the speed of the wheelchair.

RELATED WORKS

Several researches have been done the joystick based, gesture based and chain based control mechanisms. The process involved here are the user is expected to wear them in one form or undergo training in using them. However the gesture based interfaces are highly effective and are crucial for them to recognize the actual gestures accurately. They also proposed a new device based on the Doppler effect for the recognition of one hand gestures and the device consists of Acoustic Doppler sonar (ADS) including some of the Ultrasonic transmitting and three receiving purposes. By using an transmitter that emits an Ultrasonic tone that is reflected by the hand whereas the reflected tone that depends on the Doppler frequency shift on the current velocity on the hand. The velocity of the hand in multiple directions as the functions of time and the signals are captured by the three receivers used to recognize the specific gestures. The accelerometer based gesture recognition systems are using the continuous hidden Markov models (HMMs). An accelerometer based gesture recognition system that uses only a single 3-axis accelerometer to recognize the gesture here are hand movement.

Other method are also being designed a wearable gesture captured device and then gesture based interface for a mobile phone are realized to demonstrate the feasibility of gesture based interaction in the mobile communication.

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The sensors are used to develop the sign language recognition and human computer interaction. The Intelligent wheelchair is controlled by using Adaboost algorithm. The major advantage of this algorithm is the human body is limited and the environment situation is noisy the intelligent wheelchair is control by the head gesture. Here the prototype has been validated with the five healthy subjects such as screening, virtual environment driving and driving session with the wheelchair.

PROPOSED WORK

The main objective of the proposed system is to reduce the work of visiting the Stroke and SCI patients for their usual needs. Database can be developed to monitor the health of the patients that can be classified based on the type of illness specified. Distributed database can be used to analysis and provide best and effective means of treatment that can be useful to safe of many people.

The robot chassis is a type of wheelchair used to fix all commands and the programs should be dumped on the controller kit. The function of the wheelchair should be like a robot whatever the commands given to the Arduino for programming code and the command will be displayed on the LCD display.

The LCD display is used to show the process of command that we are given on the program that is the need of the patients will be displayed on the LCD board. The accelerometer used to control the total wheelchair. The accelerometer module is based on the popular ADXL335 with three axis analog IC, which reads of the axis X,Y and Z acceleration as the analog voltages. There are two type of acceleration one is static acceleration used to measure the gravity in tilt sensing applications, and another one is dynamic acceleration based on the motion, shock or vibration. The datasheet used on the accelerometer are small, thin and low power consumption.

The Arduino is open source platforms which are easy to use in both hardware and software. The boards are able to read input and output pins with ICSP header and a reset button. The Arduino UNO is for transmitting and receiving purpose of the controller. In an RF transmitter involves direct conversation with the receiver family. They involve good in performance mode and flexible power.

Using an RF module the given data are transmitted through the wireless mode. The RF encoder and decoder are used to store set of address and data on the controller. In that the encoder is used to transmit the four set of data in to a single data based on the direction, flux value, etc. The RF decoder is opposite to the encoders work which involves a single data can be separated by four set of data on the receiver side.

APR33 is a voice board used for 8 channel storage in which it takes one minute record for each channel storage device. Here Bazzer is used indication of wheelchair moving.

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The block diagram of the proposed system consists of the Arduino UNO for transmitting and the Arduino Mega for receiving the signal through the controller. Hand gesture control method is used instead of the Joystick control method because they restricted only to users who can exert certain amount of force to push in any direction. By using a Touch sensor it involves under a previous voice selection output. Based on wireless transmission in an RF control method for transmitting data based on hand movement.

Arduino Uno.

Arduino Uno is a microcontroller based on the datasheet. It has 14 digital input or output pins of which 6 can be used as Pulse Width Modulation (PWM) as output, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, an ICSP header and a reset button.

Figure 1: Arduino

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The Microcontroller simply connected to the computer with a USB cable or a power with an AC to DC adapter or battery to get started. Here the purpose of arduino is used to transmit the command through the signal.

The Arduino Mega is a microcontroller board based on the Atmega 2560. It has 54 digital input or output pins of which 15 can be used as Pulse width Modulation (PWW) outputs, 16 analog inputs, 4 UARTs and remaining are same as the Arduino Uno.

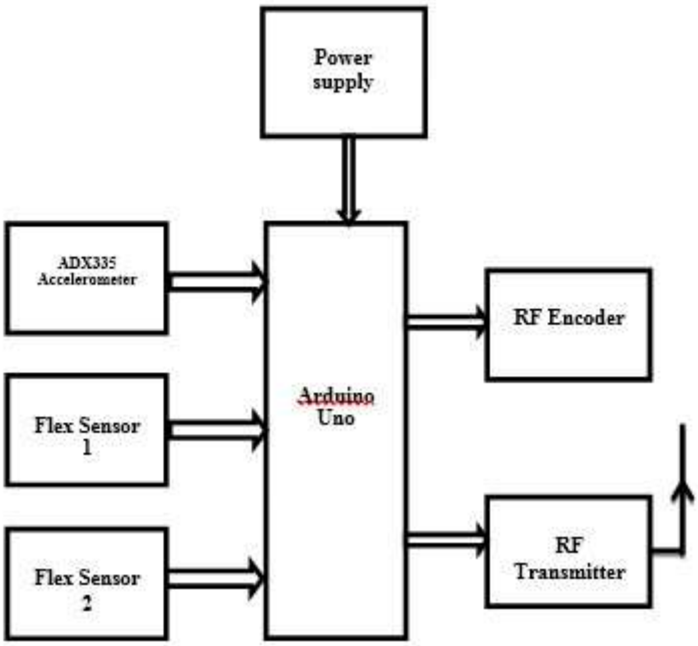

Figure 2: Block Diagram for Transmitter

Power Supply.
It is a component that supplies power between 7volt to 12 volt typically it converts one type of electrical power to another.

ADXL335 Accelerometer.
It is a small, thin, low power; complete 3 axis accelerometer with signal conditioning voltage the wheelchair is fully controlled by the accelerometer.

RF Encoder and Transmitter
The Encoder stores the set of address and data for transmitting. It transfers four set of data in to a single data in a desired directions.

Flex Sensor.
The sensor bends and flexs physically with motion devices. It is used to modify the commands on the controller. The patient can handle the wheelchair without using the hand. The possible uses such as Robotics, Gamming that are virtual motion, Medical devices, physical therapy, Robotics, Musical instruments, etc.

Figure 3: Flex Sensor Arduino

It is simple to construct and are low profile. Life cycle of the flex sensor is greater than one million. The temperature range are also moderate. The sensor moves at an flat resitance will be 10kΩ. The tolerance resistance of the sensor will be ±30%. The power rating value be 0.50W continuous and 1W peak. The battery provides the power or electricity to the circuit or object to provide energy for the current to flow.

RF Decoder and Receiver.
The Decoder receives the set of address and data. It receives single data in to a four different set of data in the controller based on transmitting signal.

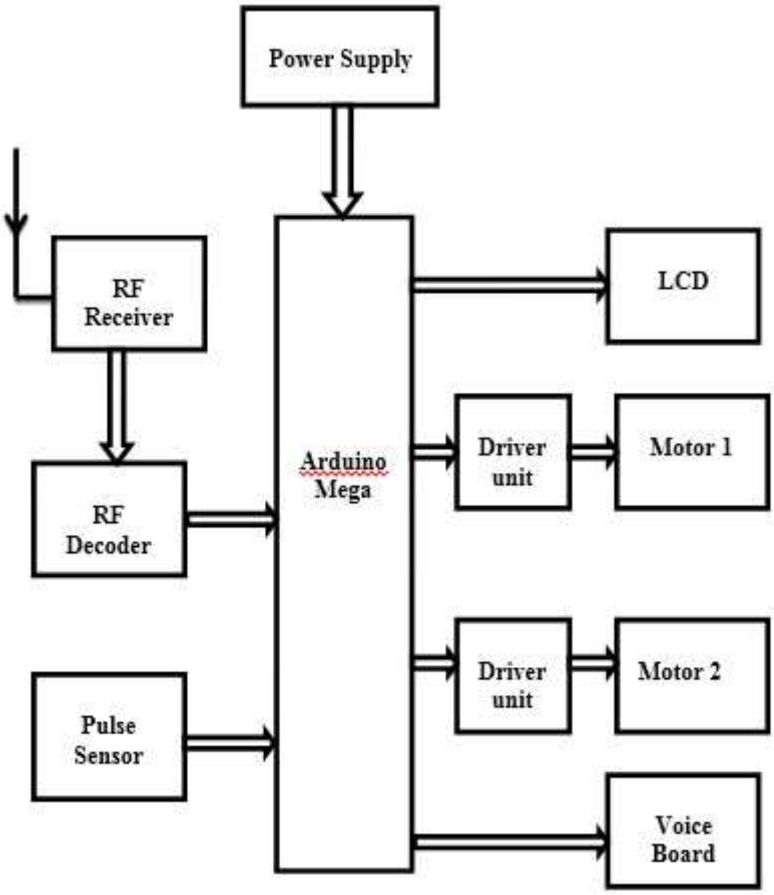

Figure 4: Block diagram for Receiver Arduino Mega.

Pulse sensor
Heart beat sensor works on the basic principle of optoelectronics. It is used to measure the heart rate in a pair of LED, LDR and a microcontroller. The sensor is holed by hands they feel the pulse in the nerve and watch the count of the heart beats per minute.

Motor Driver.
The motor driver is used to control the speed of the current flow and then it should be connected by the controller. If the motor is directly connected by the controller it burst, so we are using motor driver to connect. The motor having two connections one is clockwise and another one is anticlockwise.

MODELLING AND RESULT
The hardware result shows the effective working of the proposed Flex sensor based Gesture control wheelchair. The Aurdino Mega and Uno involved in the process of both transmitting and receiving the signal. The low power bipolar transistor involves the process as on- off the relay to enable the voice. Push-Pull four channel driver with diodes for analog signal. In an simulation, the sensor used as temperature sensor (LM 35). Instead of the

accelerometer interactive DPDT switch is used, based on the position gives an value on analog with its three axis value X,Y and Z. simple DC motor are used between 7volt to 24 volt.

Table 5.1 Movement of Wheel chair based on hand gesture.

375<X<390	400<Y<425	FORWARD
365<X<385	280<Y<300	REVERSE
430<X<455	310<Y<350	LEFT
290<X<300	360<Y<380	RIGHT

X,Y indicates hand movement

Table 5.2 Need of the patients.

250<F1<270	190<F2<210	FOOD
230<F1<250	170<F2<195	WATER
245<F1<255	210<F2<230	REST ROOM
250<F1<260	215<F2<225	HELP

F1, F2 indicates the movement of the finger

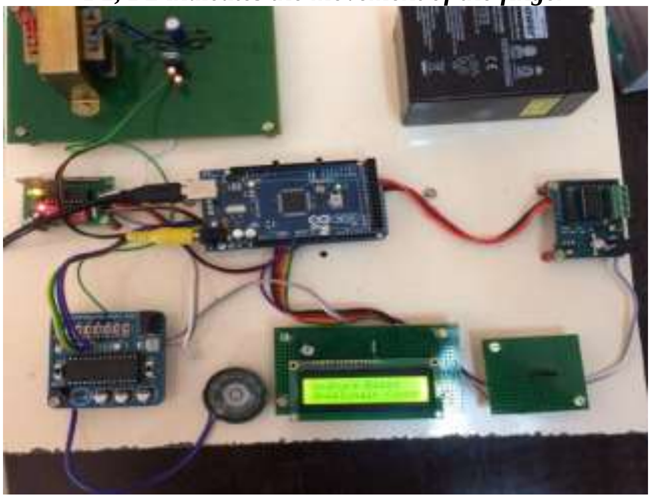

Figure 5 (a) Full View of Gesture Control Wheelchair

Figure 5 (b) Hand gloves

The RF module, transmitter using an 12v power signal working voltage value between 3v-12v for maximum, here the maximum current flow in the circuit are as less than 40mA. The working of RF module frequency is 315MHz or 433MHz. and the velocity is less than 10Kbps.This module will transmit up to 90m in open area.

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The RF module, receiver working at an 5.0VDC and 0.5v. Here the current flows maximum at an 5.5mA. In an receiver side the working frequency range are between 315MHz to 433.92MHz.

The Flex sensor used here to give the commands or by modifying the commands either by hands or without using an hand to move the wheelchair. By using the sensor condition the Gesture controlling an wheelchair in an various directions such as Right, Left, Forward and Reverse directions. Also it should involve helping the patients such as if the patient needs food, water and measuring the pulse rate it displayed on LCD or giving Voice message.

CONCLUSION

This Project indicates the feasibility of simple hand gesture control for navigation in powered wheelchair for patients with mobility issues. The word 'HanGes ' gpaD mechanism is based on hand gesture, the gpaD fully controlled by hand based on Wireless Transmission. A pad which has a smooth glossy surface called gpaD was designed to identify the hand gestures of users who can move their hands only to a certain extent including stroke and SCI patients, as against the hand movements of healthy person. As gpaD is designed with Flex sensor, Pulse sensor (Heart Beat Measuring) and RF detectors and an MCU (Multipoint Control Unit) along with few other simple electronic components are used at low cost. As the size and the movement of the hand varies depending on the severity of the stroke and the SCI affected patients, the gpaD design can be customized for either of the hands or without using the hands.

REFERENCE

[1] Ahmad Akl, Chen Feng, and Shahrokh Valaee (2011), 'A Novel Accelerometer-Based Gesture Recognition System', IEEE Trans Vol. 59, No. 12, pp. 6197 – 6205.
[2] Ben W. Miners, Otman A. Basir, and Mohamed S. Kamel (2005), 'Understanding Hand Gestures Using Approximate Graph Matching', IEEE Trans., Vol. 35, No. 2.
[3] Brice Rebsamen, Cuntai Guan, Haihong Zhang, Chuanchu Wang, Cheeleong Teo, Marcelo H. Ang, Jr., and Etienne Burdet (2010), ' A brain controlled wheelchair to navigate in familiar environments', IEEE Trans., Vol. 18, No.6, pp. 590 – 598.
[4] Chern-Sheng Lin ; Chien-Wa Ho ; Wen-Chen Chen (2010), 'Chuang-Chien Chiu ; Mau-Shiun Yeh, Powered wheelchair controlled by eye-tracking system', Vol. 36, pp. 401-412.
[5] Ching-Lung Chang ; Chiou-Chi Chen ; Chang-Yi Chen ; Bo-Shiu Lin (2008), 'Kinect-based Powered Wheelchair Control System', Int. Conf., pp. 186-189.
[6] Eshed Ohn-Bar and Mohan Manubhai Trivedi, Fellow, IEEE(2011), 'Hand Gesture Recognition in Real-Time for Automotive Interfaces: A Multimodal Vision-based Approach and Evaluations', IEEE Trans., pp. 2368 – 2377.
[7] Garcia, J.J. ; Urena, J. ; Hernandez, A. ; Mazo, M. ; Garcia, , JC ; Alvarez, F. ; Jimenez, J.A. ; Donato, P. ; Perez, M.C.,(2004), 'IR sensor array configuration and signal processing for detecting obstacles in railways', pp. 216-220
[8] Garg, R.; Shriram, N. ; Gupta, V. ; Agrawal, V. (2009), 'A smart mobility solution for physically challenged', IEEE Int. Conf., pp. 168-173.
[9] Ghosh, D.K. ; Ari, S.(2007) 'A static hand gesture recognition algorithm using k-mean based radial basis function neural network', Int. Conf., pp. 1-5.
[10] Hasan Al-Nashash, Noreen A. Fatoo, Nabil N. Mirza, Rabi I. Ahmed, Gracee Agrawal, Nitish V. Thakor, Angelo H. All. (2009), 'Spinal Cord Injury Detection and Monitoring Using Spectral Coherence', IEEE Trans., Vol. 56, No. 8, pp. 1971 – 1979
[11] Hasanuzzaman, M.; Zhang, T. ; Ampornaramveth, V. ; Kiatisevi, P. ; Shirai, Y. ; Ueno, H.,(2004), 'Gesture based human-robot interaction using a frame based software platform', IEEE Int. Conf., Vol. 3, pp. 2883-2888.
[12] Igorevich, R.R., Pusik Park, Dugki Min, Yunjung Park, Jongchan Choi, Eunmi Choi,(2010), 'Hand gesture recognition algorithm based on grayscale histogram of the image', Int. Conf., pp. 1-4.
[13] Inake Ituratte, Javier M Antellis, Andrea Kubler and Javier Minguez,(2009), ' A Noninvasive brain actuated wheelchair based on a P300 Neuropsychological protocol and Automated Navigation', IEEE Trans., Vol. 25, No. 3, pp. 2318-2325.
[14] Kaustubh Kalgaonkar, Bhiksha Raj (2009), 'One-Handed Gesture Recognition Using Ultrasonic Doppler Sonar', Int. Conf., pp. 1889 – 1892.
[15] Lekova, A.K. ; Dimitrova, M.I. (2013), 'Hand gestures recognition based on lightweight evolving fuzzy clustering method', IEEE Int. Conf., pp. 505-510.

[16] Megalingam; Rajesh Kannan; Ramesh Nammily; Prakhya; Sai Manoj; Mohan; Mithun.;.(2012),'Gest-Bot-A Highly Convinent Locomotive Solution for the Elderly and Physically Challenged', IEEE Trans., pp. 350-355.
[17] Meyer R.; Just F, Decarlo R.A.; Zefran M.; Oishi M. ; (2014),'Notch filter and MPC for powered wheelchair operation under Parkinson's tremor', Conf., pp.4114-4120.
[18] Panagiotis.; Kitsoulis; Georgios Paraskevas; Kalliopi Iliou; Panagiotis Kanavaros and Aikaterini Marini; (2011), 'Clinical study of the factors affecting radioulnar deviation of the wrist joint', IEEE Trans., pp. 9-11.

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