Wireless Gesture Controlled Robot Car using Arduino Microcontroller

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Abstract: **This paper is to develop a wheel chair control which is useful to the physically disabled person with his hand movement or his hand gesture recognition using Acceleration technology. Tremendous leaps have been made in the field of wheelchair technology. However, even these significant advances haven"t been able to help quadriplegics navigate wheelchair unassisted. It is wheelchair which can be controlled by simple hand gestures. It employs a Flex sensor which controls the wheelchair hand gestures made by the user and interprets the motion intended by user and moves accordingly. In Acceleration we have Acceleration sensor. When we change the direction, the flex sensor are changed and that values are given to microcontroller. Depending on the direction of the Acceleration, microcontroller controls the wheel chair directions like LEFT, RIGHT, FRONT, and BACK. The aim of this paper is to implement wheel chair direction control with hand gesture reorganization. According to a research there are about 6 million populations in the world who are paralysed and needs a wheelchair for their mobility. Earlier the wheel chairs had to be moved and be externally supported by any person. To help overcome this "joystick-controlled wheelchairs" are developed. But in regular use, these joystick-controlled wheelchairs became difficult to use. Especially in the case of paralysed people, the use of joystick became more difficult due to the hard buttons and unidirectional use of the joysticks. To overcome these problems, we've tried to develop a "gesture-controlled wheelchair" which can be moved with a slight tilt of the hand. This can be used in both hands and can be controlled to come to the user from a distance. The current work is implemented with Arduino based devices such as Arduino and UNO processors and programmed through Arduino IDE.**

Index Terms **– Flex Sensor, NRF Transceiver, Arduino, Ultrasonic Sensor, etc.**

1. INTRODUCTION

This paper proposes an integrated approach to real time detection, tracking and direction recognition of hands, which is intended to be used as a human-robot interaction interface for the intelligent wheelchair. This paper is to demonstrate that accelerometers can be used to effectively translate finger and hand gestures into computer interpreted signals. For gesture recognition the accelerometer data is calibrated and filtered. The accelerometers can measure the magnitude and direction of gravity in addition to movement induced acceleration. In order to calibrate the accelerometers, we rotate the devices sensitive axis with respect to gravity and use the resultant signal as an absolute measurement. Integrating a single chip wireless solution with a MEMS accelerometer would yield an autonomous device small enough to apply to the fingernails, because of their small size and weight. Accelerometers are attached to the fingertips and back of the hand. Arrows on the hand show the location of accelerometers and their sensitive directions, that the sensitive direction of the accelerometer is in the plane of the hand. The gesture based wheelchair is suitable for the elderly and the physically challenged people who are unfortunate to have lost ability in their limbs due to paralysis or by birth or by old age. Elders find it tough to move inside the house for day to day activities without help or external aid. Our proposed system makes use of a wheelchair that can be used by elderly or physically challenged to move inside the home without difficulty and without external aid. The elders may also forget the way to the different rooms in house due to the increase in forgetfulness as they become older. The physically challenged, find difficult to move the wheel chair without help from others. By making use of the system, the elderly and the physically challenged can go to different rooms in the house like kitchen, living room, dining room etc by just showing a gesture which is predefined to that particular room. It is also a virtue of the system that even the foot can be substituted in place of the hand for users who might find that more convenient.This sensor finds the tilt and makes use of the accelerometer to change the direction of the wheel chair depending on tilt. For example if the tilt is to the right side then the wheel chair moves in right direction or if the tilt is to the left side then the wheel chair moves in left direction. Wheel chair movement can be controlled in Forward, Reverse, and Left and Right direction along with obstacle detection using ultrasonic sensor. Automation is the most frequently spelled term in the field of electronics. The hunger for automation brought many revolutions in the existing technologies. One among the technologies, which had greater developments, is the sensor.

2. PROBLEM DEFINITION

The objective of this paper is to potray the control of the robot using the accelerometer with the help of human hand tilting. Accelerometer signals are received and assisted with wired correspondence. The robot moves depends upon the signal made by your hand and from a separation. In this paper we describe approximately the gesture manage robot which may be managed through your everyday hand gesture Here, the program is designed by using Arduino Uno.

3. SCOPE OF THE PROJECT

This paper to develop a wheel chair control which is useful to the physically disabled person with his hand movement or his hand gesture reorganization. With the help of the wheel chair physically disabled person would able to move himself to the desired location with the help of hand gestures which controls the movement of the chair. This paper aims to provide a feasible solution to those handicapped people who do not have the ability to maneuver the wheelchair by themselves. These include people with serious paralytic condition. Wheelchair automated control systems proved to be versatile tools for many problems in human-computer interface systems. Basically, they are used for providing better usability of a computer or a system for people, including disabled people.

4. LITERATURE SURVEY

When an unfortunate event affects the motor capacity of a person, it is necessary to use devices like wheelchairs that offer a means of displacement for patients with motors problems of the lower limbs. Tremendous leaps have been made in the field of wheelchair technology. However, even these significant advances haven‟t been able to help quadriplegics navigate wheelchair unassisted. Some patients that cannot manipulate the wheelchair with their arms due to a lack of force or psychomotor problems in the superior members, request electric wheelchairs, frequently manipulated with joysticks; however the joystick manipulation is even not practical and frequently it must be handle with the mouth.

The present article presents the partial results in the development of a wheelchair controlled by an intuitive interface, where the instructions are given by hand gesture instructions. The advances are presented in the realization of the control software using a Webcam and some distances and presence sensors controlled by a PIC microcontroller that establishes the communication with a program developed in Lab view. This paper is inspired from an IEEE Research Paper Titled „A Wearable Head- Mounted Sensor-Based Apparatus for Eye Tracking Applications‟ that was presented in the IEEE International Conference on Virtual Environments, Human-Computer Interfaces, and Measurement Systems Istanbul, Turkey, dated 14-16 July 2008. The above paper approach was dealing with wheelchair control using eye ball movement with slight modification to it. Our paper deals with the control of wheelchair motion by hand gesture.

5. PROPOSED SYSTEM

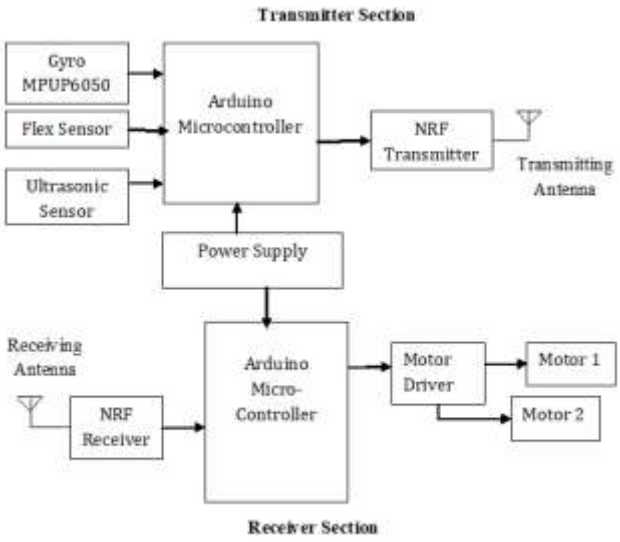

Fig.1 Proposed Block Diagram

I. WORKING

The gesture controlled robot is a wireless operated robot and has two parts: Transmitter and Receiver. When the robot is powered on, the transmitter part, which consists of Arduino, MPU6050, Encoder and RF Transmitter, will continuously monitor the MPU6050 sensor. This data is captured by the Arduino, which then transmits a corresponding data to the Encoder, based on the orientation of the MPU6050 Sensor. The parallel data received by the encoder is converted into serial data and this serial data is transmitted by the RF Transmitter. At the receiver section, the RF Receiver receives the serial data and transmits it to the Decoder IC. The Decoder will convert the serial data to parallel data and this parallel data is given to the motor driver IC. Based on the data, the movement of the motors, and hence the movement of the robot is defined

II. HARDWARE DESCRIPTION

A. Arduino

The programs are embedded with Arduino IDE and it is very easy to interface with system using simple USB cable.

Fig.2. Arduino Microcontroller

B. Flex sensor

A flex sensor or bend sensor is a sensor that measures the amount of deflection or bending. Usually, the sensor is stuck to the surface, and resistance of sensor element is varied by bending the surface

Fig.3. Arduino Microcontroller

C. DC Motor driver

The DC motor-driver (L293D) controls the DC motor in possible rotations. In the present work the motor-driver controls two DC motors simultaneously. That means it controls the direction of two motors simultaneously which will help in moving vehicle wheels synchronously.

Fig.4. Motor Driver

D. DC Motors

The basic principle of DC motor is it converts electrical signals into mechanical energy.

Fig.5. DC Motor

E. Ultrasonic Sensor

The proximity of the object is detected by ultrasonic technology. The transducer sends ultrasonic signals and senses them after reflection, when there is an object across the ultrasonic signal path.

Fig.6. Ultrasonic Sensor

F. NRF Transceiver

A Radio transmitter-receiver that uses many of the same components for both transmission and reception connect VCC pin on the module to 3.3V on the Arduino and GND pin to ground. The pins CSN and CE can be connected to any digital pin on the Arduino. In our case, it's connected to digital pin#8 and #9 respectively. Now we are remaining with the pins that are used for SPI communication.

Fig.7. NRF Transceiver

III. ADVANTAGES

- The robot car detects the obstacle at the front and stops the movement within a range of 50 CMs.
- Without any external help the paralyzed person can operate his own carr.
- The prototype of the system is successfully developed to move the wheel chair Left, Right, Forward, and Backward directions or stay in the same position.

IV. APPLICATIONS

- Wireless controlled robots are very useful in many applications like remote surveillance, military etc.
- Hand gesture controlled robot can be used by physically challenged in wheelchairs.
- Hand gesture controlled industrial grade robotic arms can be developed.

6. EXPERIMENTAL RESULTS

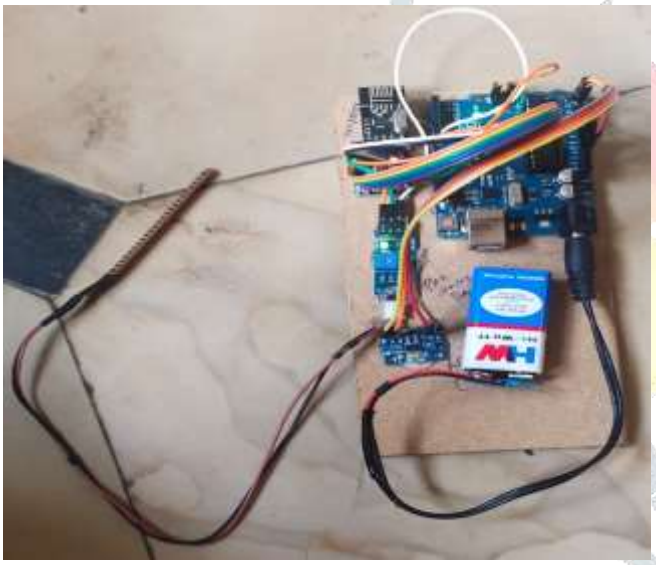

Fig.8. Prototype of the Transmitter

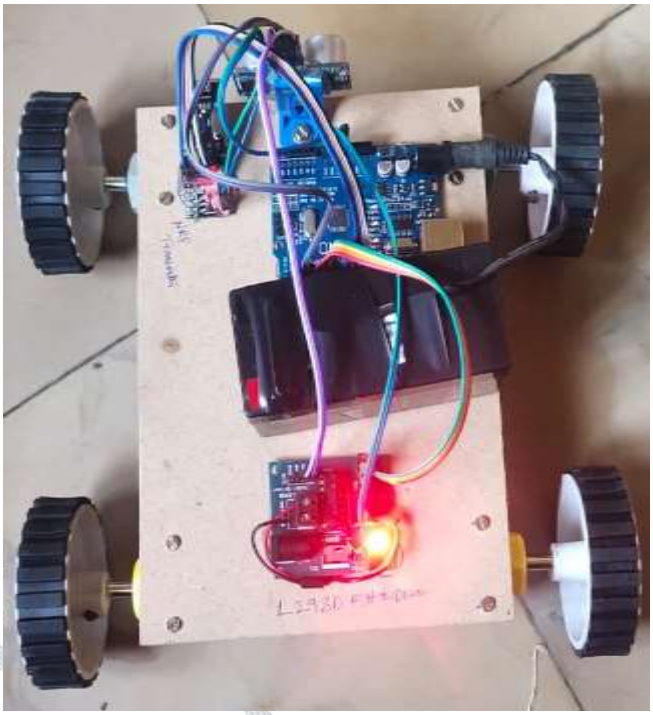

Fig.9. Prototype of Receiver

The functional operations are implemented in the Arduino IDE software. The description/action of various commands used in the program is shown in table 1. Table 1 reflects the various control functions used to control and movement and direction of the vehicle in desired direction. The functions are developed in such a way that they able to provide more accurate sensitivity and response in moving and direction change. The response time of the functions with respect to the sensors is tested for several times and designed and modified the program inorder to achieve good results.

The back() and front() functions are developed to control the direction of the vehicle both in forward and backward direction. Similarly, the functional commands left() and right() are developed to the control the direction of the vehicle in right and left direction. The functions reads the input signals from various sensors through analog inputs and sends output to output devices like motors to control the wheels rotation.

Table 1: functional Table

Gesture Movement	Function	Action
Upward	Back()	Robot moves forward
Downward	front()	Robot moves backward
Left	left()	Robot moves right
Right	right()	Robot moves left
Horizontal	stop()	Robot stops

7. CONCLUSION

The gestured detection based wheel chair is designed with two Arduino processor and controlled left, right, forward, and backward move. Unlike traditional design the present method is successful in carrying paralysed people without meeting any error. The functions invoked and respective directions are shown in table 1. Automated wheel chair can be used to help handicap people and the present work is aimed to help the paralysed people who can only move one side of their body or partially paralysed and help them to be able to move. In the present work the wireless system is successfully developed to move the wheel chair in various direction i.e., Forward, Backward, Left, and Right, or Stay in Same Position and also stop automatically when any obstacle is detected.

Future Scope

- Instead of using acceleration motion optical sensor can be used to detect eye retina to move wheel chair accordingly.
- On road driving need multi-dimensional parameter estimation to avoid risks.
- Voice command IC's can be used to interface with microcontroller
- The GSM can be embedded in to the present work to extend its feature such as sending messages during emergency
- Research is going on development of handicap wheel chair using nervous system of human

REFERENCES

[1] Sndeept and supriya, "Wheel-Chair Control Using Accelerometer Based Gesture Technology", International Journal of Advance Research in Computer Engineering and Technology (IJARCET) Volume 4 Issuse 5, May 2015.

[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] V. Rajesh et al., "SEMG based human-machine interface for controlling a wheelchair by using ANN", proceedings of Control Automation Communication and Energy Conservation 2009. INCACEC 2009.2009 International Conference.

[4] Rajesh KannanMegalingam, Ramesh Nammily Nair, ―Automated Voice based Home Navigation System for the Elderly and the Physically Challenged‖ Feb. 13~16, 2011

[5] Rajesh KannanMegalingam et al., "Wireless gesture controlled wheelchair",2017 4th International Conference on Advanced Computing and Communication Systems (ICACCS), 24 August 2017, Coimbatore, India

[6] Prof.Chittep.p et al., "A hand gesture based wheelchair for physically handicapped person with emergency alert system", International Research Journal of Engineering and Technology (IRJET), Volume: 03 Issue: 04, Apr-2016

[7] Prof. Vishal V. Pande et al., "Hand Gesture Based Wheelchair Movement Control for Disabled Person Using MEMS", Int. Journal of Engineering Research and Applications, Vol. 4, Issue 4(Version 4), April 2014, pp.152-158

[8] A. Murarka, M. Sridharan and B. Kuipers. 2008. "Detecting obstacles and drop-offs using stereo and motion cues for safe local motion".IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS08).

[9] http://avrchip.com/arduino-nano-datasheet-and-tutorial/

[10] N. Suresh Kumar *et al.*, "A New Method to Enhance Performance of Digital Frequency Measurement and Minimize the Clock Skew" ,*IEEE Sensor Journal*, vol. 11, no. 10, 2011.