Hand Gesture Recognition Based Social Assistive Robot Controls for Wheelchair Applications

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Abstract

Hand gesture Recognition is one of the method used in wheelchair applications, which is controlled by robot with AVR ATmega232 microcontroller. In this paper we are giving hand gesture as input signals to drive the robot in different directions and display the direction of movement of the robot in a 16X2 alphanumeric LCD. An Android phone with accelerometer sensor recognises the gesture and sends to robot via Bluetooth.

Index Terms-Hand gesture recognition, wheelchair, AVR, Android phone, LCD, Bluetooth.

1 INTRODUCTION

Natural way of Human and Machine interaction is gesture recognition, it is the fastest growing field of today's research which is in the form of actions and expression to express the information to the other without saying it. Gesture is common communication media that people used easily anywhere such as thumb up, thumb down etc.

Wheel Chair is often abbreviated just Chair is a chair with wheels, which is used when walking is difficult or impossible to walk due to illness, injury or disability. Every time find it complicated to navigate through their house without the assistance of someone. But to navigate through one's own home without contribute of any one all time can be demoralizing for the person as well. It can be handled wirelessly with hand gesture methods.

Gesture control wheelchair is divided into two parts

1.Transmitter: the hand gesture

2.Receiver: The wheel chair.

A gesture is a form of non-verbal communication in which visible bodily actions communicate particular messages. Gesture include movement of face or other parts of the body. The movement of the gesture can be used to interact with technology, using Android phone. Gesture recognition can be seen as a way for computers to begin to understand human body language, thus building a richer bridge between machines and humans. The movement of the gesture s can be used to interact with technology, using touch or multi- touch popularized by the Android phone, physical movement detection and visual motion capture, used in video game consoles. To recognize gesture and control the wheelchair by using Internet of Things.

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2 LITERATURE SURVEY

The system comprises of two major units. The first unit is a simple user of two hand gesture unit. The second unit is the wheelchair unit. The first gesture unit consists of ARM7 controller which monitors the motion of fingers and transmits the corresponding control signal to the wheelchair unit. The wheelchair unit also consists of ARM7 controller for controlling the movement of wheelchair. The second gesture unit consist of ARM7 controller which can detect the audio announcement.

- U. Rajkanna and M. Mathankumar [1] introduced Hand Gesture based Mobile Robot Control using PIC Microcontroller. In this work, gesture of the user controls the movement of the mobile robot. The developed system is classified into gesture unit and mobile robot unit.
- Prof. Vishal V Pande, Nikita S. Ubale, Darshan P. Masurkar, Pragati P. Mane [2] proposed Hand Gesture based Wheelchair Movement Control using MEMS, using Acceleration Technology.
- Shirke Swapnali and P. G. Chilveri [6] presented Hand Gesture Recognition using Accelerometer Sensor for Traffic Light Control System (TLC). Thresholding algorithm is used for recognition purpose.
- Hanine El Hayck, Jessica Nacouzi and Abdallah Kassem [5] signed a letter Translator system using a Hand glove which can be used by any deaf or/and mute person to communicate with people that do not understand sign language.
- Gawthaman A1, Ranjith Kumar. R1, Varunaranjan. MV1, Ganesh Babu.P2 [4] presented Wheelchair Motion Control Based on Hand Gesture recognition. The acceleration of a hand in motion in three perpendicular directions are detected by a MEMS accelerometer and transmitted to a PC via Bluetooth wireless protocol.
- Manisha Devi, B. Anil kumar [3] presented Accelerometer based Direction Controlled Wheelchair using Gesture Technology. The system consists of Gesture Controlled using Interface (GCUI) and identifies trends in technology, application and usability.
- Nakul K Patel1, Saurabh B Patel1, Mansuri Ammar1 [7] described Accelerometer based Gesture Controlled Wheelchair with GPS, GSM navigation which can interface gesture with microcontroller.
- Pratap. Prab, Sanika kinalchar, Rohit Chavan, Deep Sharan, Shubhadha Deshpande [8] presented Hand Gesture recognition using Microcontroller and Flex sensor. It is based on the need of developing an electronic device that can translate sign language into commands for communication.
- Shruthi Warad, Vijayalaxmi Hiremath, Preethi Dhandargi, Vishwanath Bharath P. B. Bhagavati [9] presented Speech and Flex sensor-controlled wheelchair for physically disabled people. Speech commands like "forward, backward, maximum, medium, minimum and stop" are used to drive the wheelchair. The direction of the wheelchair is controlled by flex sensor application.

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- D. Anjaneyulu, Mr. B.V.N.R. Sivakumar [10] presented Hand movement-based control of an intelligent Wheelchair using Accelerometer, obstacle avoidance using ultrasonic and IR sensors. The MEMS sensor is used to sense the angle of the hand, i.e. according to the tilt of hand it gives voltages to microcontroller.
- Shivam Khare [11] proposed Finger Gesture and Pattern Recognition Based Device Security System. In this system, a hand gesture recognition-based system to recognize real time gestures in natural environment and compare patterns with image database for matching of image pairs to trigger unlocking of mobile devices.

3 Proposed Method

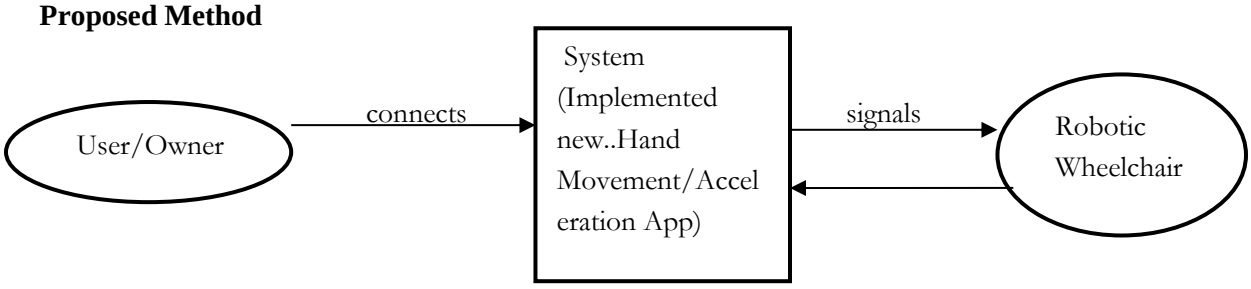

Fig 2.1: Overall System Architecture

Here, the user gets connected with wheelchair through accelerometer via Bluetooth and sends gestures. These gestures are sent as signals to the motor in the wheelchair and movement is controlled. Motor internally sends signals to accelerometer to indicate that the particular movement is done and is ready for next movement.

3.1 Bluetooth Interfacing

Bluetooth is a wireless technology standard for exchanging data over short distances (using short-wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz) from fixed and mobile devices and building personal area networks(PANs). Invented by telecom vendor Ericsson in 1994, it was originally conceived as a wireless alternative to RS-232 data cables. It can connect several devices, overcoming problems of synchronization. HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. HC-05 is 6-pin Module. The module has 6 pins labelled on the back, but most modules only have 4 of those populated with pogo pins. Here we use Bluetooth to transfer signal from mobile(android smartphone) to ARDUINO for movement of wheelchair.

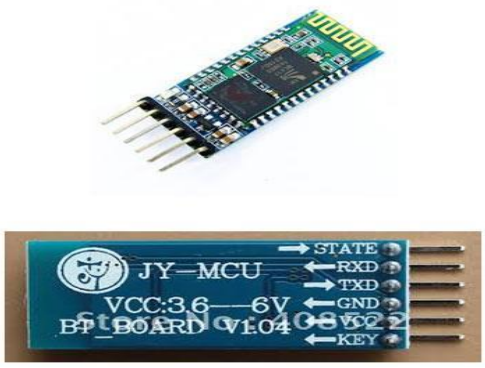

Fig 2.2.1: Bluetooth Interfacing

3.2 Liquid Crystal Display

Fig 2.2.2: 16x2 Liquid Crystal Display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.A 16x2 LCD means it can display 16 characters per line and there are 2 such lines.

We use LCD to display the direction of movement done by the wheelchair.

3.3 Accelerometer Sensor

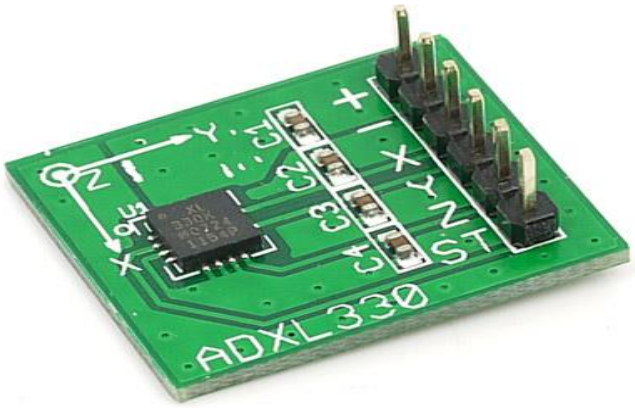

Fig 2.2.3: Accelerometer Sensor

One of the most common inertial sensors is the accelerometer, a dynamic sensor capable of a vast range of sensing. Accelerometers are available that can measure acceleration in one, two, or three orthogonal axes. They are typically used in one of three modes:

- As an intertial measurement of velocity and position;
- As a sensor of inclination, tilt, or orientation in 2 or 3 dimensions, as referenced from the acceleration of gravity (1 g = 9.8m/s2);
- As a vibration or impact (shock) sensor.

We use accelerometer sensor to get the movements done by the hand and then according to the movements rotate or move the wheelchair in that particular direction.

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4 CONCLUSIONS

The robot is applied in a wheelchair where the wheelchair can be driven by the movements of rider's hand. Motion sensors and obstacle sensors are incorporated to control movement and to prevent the robot from falling on any surface. People unable to walk, injured or elderly people who have difficult in walking can use this approach.

Can be implemented in hospitals which helps patients to be independent. Comparatively reasonable, so middle class people can afford. But this doesn't work in apple phones. So in future, we can improvise the application to apple phones

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