VOICEANDACCELEROMETERCONTROLLEDWHEELCHAIR

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Abstract

Wheel chairs are the way of re-incarnating life in the lives of physically disabled people. The number of people, who wants to move around with the help of some artificial means, whether through illness or an accident, is continuously increasing. It becomes difficult for a normal person to drive the wheel_chair in domestic environment and hence it be- comes still more difficult for a person with hand and leg impairments. The main aim of this paper is assist paralyzed (quadriplegic and paraplegic) people and physically challenged people. The prototype developed consists of user dependent voice recognition system and accelerometer interfaced, which is being further extended for real time implementation. Intended users control the chair by wearing a glove fitted with accelerometer for controlling the movement and direction of the wheelchair. The wheel chair is also assisted with a Voice recognition kit, with the help of which the user can guide the wheelchair through voice commands. Ultrasonic sensors are used for real-time obstacle detection

Keywords: *Accelerometer, Voice recognition kit, Ultrasonic sensor*

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1. INTRODUCTION

In the following paper of Accelerometer and Voice controlled wheel chair we intend to find a cost effective design to build a wheel chair for paraplegic and quadriplegic people, who would find hard to use their energy in moving the wheelchair for their displacement. This paper describes a wheelchair for physically disabled people developed using voice recognition kit and MEMS motion sensor. A user dependent voice recognition system has been integrated in this wheelchair. In this way we have obtained a wheelchair which can be driven using both motion and voice commands. The possibility of avoiding obstacles with removed by ultrasonic sensor which detects obstacles within 25cm range. The wheelchair has also been developed to allow manual driving.

Voice and accelerometer controlled wheel chair enables a disabled person to move around independently, using a motion sensor and a voice recognition application which is interfaced with motors. The prototype of the wheelchair is built using a micro-controller, chosen for its low cost, in addition to its versatility and performance in mathematical operations and communication with other electronic devices. The system has been designed and implemented in a cost effective way so that if our paper is commercialized the needy users in developing countries will benefit from it.

2. LITERATURE REVIEW

The goal in developing the automated wheelchair is to try to provide the user with an appropriate level of motion assistance that allows them to independently operate a powered wheelchair.

The thought of realizing Automation in a wheelchair at lower cost lead us to study various papers related to automation of wheelchair. Some of the points which caught the sight from referred materials are listed below.

- The Nav-Chair Assistive wheelchair navigation System [1] The Nav-Chair has application to the development and testing of shared control systems where a human and machine share control of a system and the machine can automatically adapt tohuman behaviors. The Nav-Chair shares vehicle control decisions with the wheelchair operator regarding obstacle avoidance, safe object approach, maintenance of a straight path, and other navigational issues, to reduce the motor and cognitive requirements for operating a power wheelchair.

- Touch Screen Based Direction and Speed Control of Wheelchair for Physically challenged[2] This paper describes an intelligent motorized wheel chair for handicapped person using touch screen technology. It enables a disabled person to move around independently using a touch screen application which is interfaced with motors through micro-controller. Based on the input given on the touch screen, micro-controller controls the wheel chair directions. The speed controller works by varying the average voltage sent to the motor. This is done by switching the motors supply on and off very quickly using PWM technique.

3. METHODOLOGY

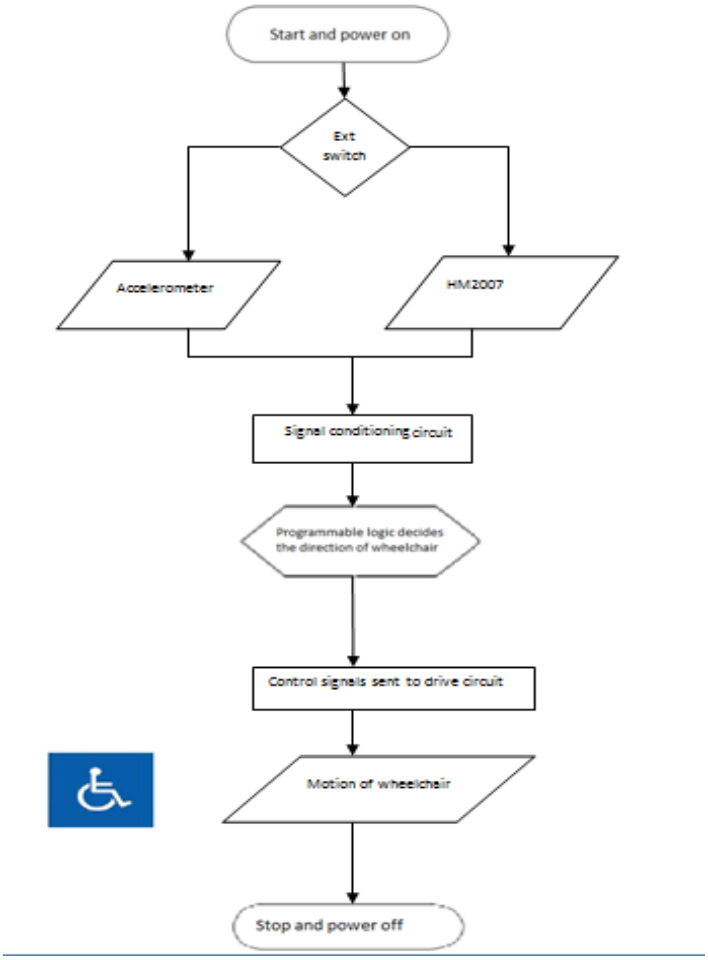

Fig. 1 Flow Chart

The methodology consists of a thorough study and analysis of electric powered and joy-stick controlled wheelchairs, and the control law used to maneuver these vehicles. The methodology followed is as follows

- The Wheelchair operates with head or hand movement, taking action as an input signal for the movement of wheelchair in a particular direction. An Accelerometer (Motion Sensor) is used to track these movements. This sensor is tied as a band to hand/head.[3]

- The wheelchair also operates based on voice input given by the user. The voice recognition kit (HM2007) is used to recognize voice uttered by the user [4]

- The variations of the sensor are trapped and those signals are fed as inputs to the signal conditioning circuit. Now based on these variations the micro-controller is programmed to take decisions which in turn control the movement of wheelchair.

4. IMPLEMENTATION OF WHEEL CHAIR

Based on the proposed sketch of algorithm and its flow, we now propose a detailed block level design. This section defines the functional ideas required in designing the chair. The block level design is shown below.

4.1. Block Level Design

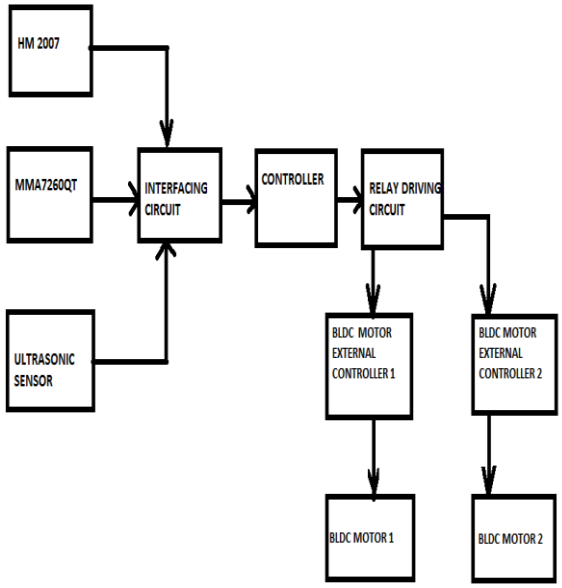

Fig 2 Block Representation of Detailed Design

4.1.1. MEMS accelerometer unit

This unit is the sensing unit. Here based on the direction in which the motion sensor is moved there will be change in output voltage. This output voltage is given to signal conditioning circuit.

4.1.2. Voice Recognition Kit

The voice recognition kit REF stores the voice command in memory. Then analog voice signals are converted into digital signals using ADC. This digital input now should have the voice commands in binary form which is given as an input to the micro-controller.

4.1.3. Interfacing Circuit

The interfacing circuit consists of a differential amplifier. The output voltage of MEMS accelerometer is given as input to non inverting terminal of differential amplifier. The differential amplifier compares the input voltage with reference volt- age and gives the output. This output voltage is given to micro-controller.

4.1.4. Micro-Controller

The output of interfacing circuit is given to micro-controller. The micro-controller gives the output signal to motor driving circuit based on fixed program stored in ROM.

4.1.5. Relay Driving Circuit

The output of micro-controller is given to relay driving circuit. The relay switches based on signal given by micro- controller.

4.1.6. BLDC Motor

The output of relay driving circuit is given to BLDC motor external controller for low voltage interfacing. Based on the signal given by relay driving circuit the controller switches the motor accordingly. The ultrasonic sensor senses obstacle and sends a signal to micro-controller to stop the chair.

5. RESULTS AND DISCUSSION

5.1. Accelerometer

After completion of our design first the wheel chair was tested by using MEMS motion sensor. Here based on the gesture of the hand the wheel chair moved in front, left, right and back-ward direction. Here in this mode the wheel chair worked properly without any problems.

5.2. Voice Recognition

The voice recognition system was initially tested in a quiet room with a single user. All words were correctly recognized. Next we tested the system in a noisy room by turning on some music in that room. When the music was light there was no problem in correctly recognizing the words but when we turned the volume high the recognizer found it difficult to recognize the user's voice and often took commands from what it heard in the song.

5.3. Manual Mode

The manual mode through joystick control was full proof and worked perfectly in all cases with no problems.

5.4. Obstacle Detection

Initially the chair was first tested indoors using easy to spot obstacles like chairs, flower pots, walls and people. With these objects the obstacle avoidance worked without any error.

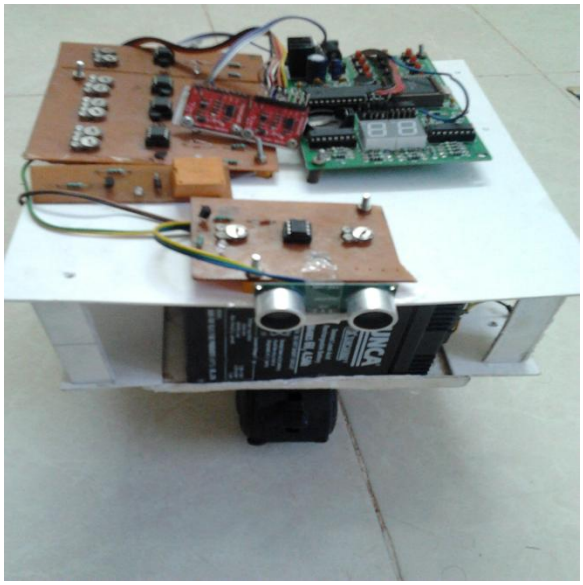

Fig 3 Prototype model

6. CONCLUSIONS

In this paper, we have addressed the problem of wheelchair for physically disabled people. Our design shows that the motion and voice controlled wheelchair can guide the paraplegic to head towards their will and wish with the help of the voice command wheelchair. Thus, we conclude that in this paper:

- We have provided a design that is efficient in helping the quadriplegic and paraplegic people without putting their strengths and efforts to pull the wheelchair, by commanding it on their voice.
- We have also shown that it can be controlled even in the uneven case of events by providing a manual control of the wheelchair.

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