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Embedded Based Smart Wheel Chair with Voice Recognition

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ABSTRACT

Wheelchairs are a way of reincarnating the purpose of life in the lives of disabled people. Instead of using joystick controlled wheelchair, the wheelchair can be embed a with instrumented glove along with voice recognition system. In this we designed a cost-effective wheelchair for the person who having major disabilities. The user wearing an instrumented glove embedded with flex sensor for controlling the movement and direction of the wheelchair and can also give voice instructions to by using smart phone or an tablet installed in wheel chair which take instructions and pass it to embedded control of wheel chair. RF wireless communication exists between the glove and controller which is sandwiched between user seat and wheels. We include an obstacle sensor it performs that if any object is detected in the path, it will halt the operation. Therefore the wheelchair comes to be in standstill. . In addition to this we have introduced navigation map which will guide the user for direction along with an alarm button which on pressed in emergency will send SMS to the person's relatives about persons present location via GSM and GPRS system. With this wheel chair person can have a complete and safe journey.

Keywords- Flex sensor, voice recognition, microcontroller, obstacle sensor.

1. INTRODUCTION

Most of the people worldwide, with physical disabilities require the assistance of a wheelchair but only a small percentage of them actually own or have the liberty of buying one. Although manual wheelchairs have proven to be beneficial for the disabled but it has only served the purpose of people with minor disabilities. Consider for a moment, a person suffering from partial tetraplegia or sclerosis. It becomes extremely difficult for such a person to maneuver the chair, even within the confines of a house. Such a person would require the assistance of other people, even to carry out his daily chores. Another alternative would be an electric wheelchair controlled by a joystick.

Although the electric powered wheelchair is a much improvised vehicle and an easier-to-control device, but it might not help the cause of severely disabled. Common experience shows that a joystick requires a relatively large force which is more than the threshold for severely disabled people. Taking into consideration, the force and the whopping cost of wheelchairs available in the market, this paper describes the design of a cost-effective and easier-to-control wheelchair.

The paper presents a control-method to maneuver a motorized wheelchair merely by the movement of fingers and Voice recognition. It aims at incorporating the modern ways of wheel chair dynamics and control and at the same time making it cost effective, so that it is affordable to the common masses. The goal of this research is to develop a wheelchair system which controls its movement by the mere bending of a person's fingers. Special type of sensors known as 'flex-sensors' are embedded into a hand glove in order to achieve the desired goal. In this research a prototype of an affordable and technologically advanced wheelchair is to be designed and developed. This is to aid the communication of severely disabled people and enhance the manoeuvring of the vehicle with the use of hand movements. The proposed prototype will be communicating wirelessly between the controller and the plant and it will also replace the traditional joystick by the Implementation of user hand glove and voice recognition.

2. LITREATURE REVIEW

A 'Motorized Chair' consists of a chair with the two motors and a joystick controller. A microcontroller outputs the speed and direction to the motors. Most wheelchairs are controlled from their back wheels. The front wheels respond direction of rotation of motors and rotate in accordance to the back wheels. As the controller is moved, the micro-controller senses the movement, do the calculations for power and direction and the motors move accordingly. A motor-control circuit controls the speed.

The Wheel chair has an instrumented glove with wide range of applications in the field of robotics. The glove measures the force exerted by the wearer of a material handling robot. Once the force is sensed and measured, it is broadcasted to the controller. The function of the magic glove is to allow the user to apply a minimal force on an object while transporting it from one place to another. The human or the wearer of the gloves just mimics the action to be done, while the actual lifting and placing is left for the actuator to be done. Radio Frequency (RF) technology is used to transit the signals from glove to the Micro controller.

Various methods for the advancement of wheelchair technology have been discussed and analysed herewith. It is apparent that the control of a wheelchair can be further improved by the combination of different technologies such as the incorporation of an instrumented glove with voice recognition hence replacing the need for joysticks and creating an independent controller, which is easier-to-control and portable at the same time, for the end user

3. BLOCK DIAGRAM DESCRIPTION

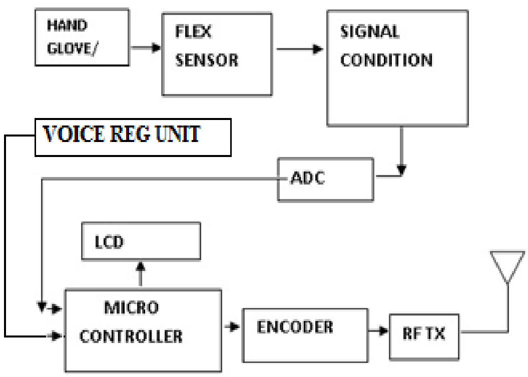

Fig. 1 Hand Side

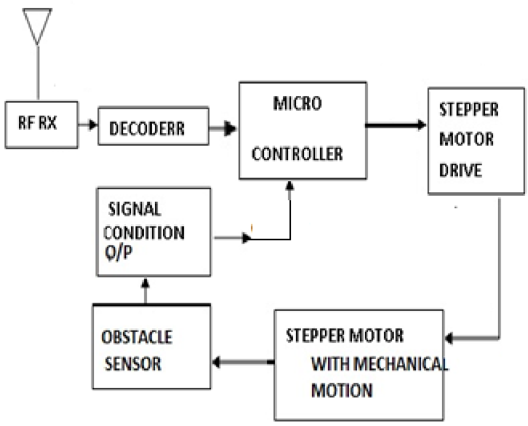

Fig. 2 Wheel Chair Side

The method chosen to design the controller here is open The block diagram representing the complete system. It consists of flex sensor circuit, microcontroller, wireless transmitter and receiver combo, motor drive circuit and motors. The bending of the flex-sensors attached to the hand-glove initiates the process. From the block diagram, we assigned the fingers or voice as input . Here we use LPC2148 ARM7 microcontroller which is developed in 2006, it has the ability to read the instruction and modify it if required at a high speed with accuracy since multi-tasking can be done in parallax propplee it would possible to work on finger movement and voice recognition. From that we give the input by bending the index finger, the LCD displays move forward and the RF transmitter transmits the signal to RF receiver. As same way, all other fingers have the specific task to perform. As the fingers are bent and hence the flex sensors, a voltage is developed across the constructed flex sensor circuit.

Hand glove flex sensor is function by varying the voltage levels to intimate the task to do. Already we seen each finger has the separate task, by varying the voltage of one finger it gives instruction to ADC circuit. From ADC circuit, it transfers the analog signal to digital signal to microcontroller. From microcontroller, it passes the message to LCD and Encoder. This encodes the obtained information and sends this information to the RF transmitter through RF transmission medium. RF transmitter sends the message to RF receiver to perform the task.

RF receiver sends the message to the microcontroller on the wheel chair side. The RF receiver receives the transmitted message it sends to decoder. After that the received information is decoded into original message and send as an input to microcontroller. This controller sends this to wheel chair by using the stepper motor drive to perform. Hence, the wheel chair performs the task by giving the input of hand glove flex sensor of using embedded microcontroller. Apart from the above process the microcontroller checks the status of the obstacle sensor if any detected it stops and alert the person. If the person is severely disabled there is a special voice recognition to wheel chair control which has a program to feed user voice. As the user gives instructions it will move accordingly.

3.1 Flex Sensor

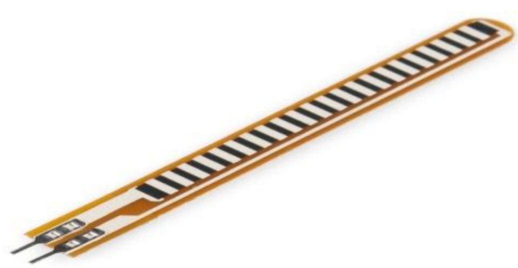

Fig. 3 Flex sensor

A simple flex sensor 2.2" in length. As the sensor is flexed, the resistance across the sensor increases. Patented technology by Spectra Symbol - they claim these sensors were used in the original Nintendo Power Glove. The resistance of the flex sensor changes when the metal pads are on the outside of the bend. Please refrain from flexing or straining this sensor at the base. The usable range of the sensor can be flexed without a problem, but care should be taken to minimize flexing outside of the usable range. For best results, securely mount the base and bottom portion and only allow the actual flex sensor to flex.

3.2 Voice Recognition Unit

A computer peripheral device that recognizes a limited number of spoken words and converts them into equivalent digital signals which can serve as computer input or initiate other desired actions.\

3.3 RF Transmitter and Receiver

Radio frequency (RF) module is a small electronic device used to transmit and/or receive radio signals between two devices. In an embedded system it is often desirable to communicate with another device wirelessly. This wireless communication may be accomplished through optical communication or through Radio Frequency communication. For many applications the medium of choice is RF since it does not require line of sight. RF communications incorporate a transmitter and/or receiver.

RF modules are widely used in electronic design owing to the difficulty of designing radio circuitry. Good electronic radio design is notoriously complex because of the sensitivity of radio circuits and the accuracy of components and layouts required to achieve operation on a specific frequency.

3.4 Microcontroller

A microcontroller is small computer on a single integrated circuit containing a processor core, memory, and programmable input/output peripherals.

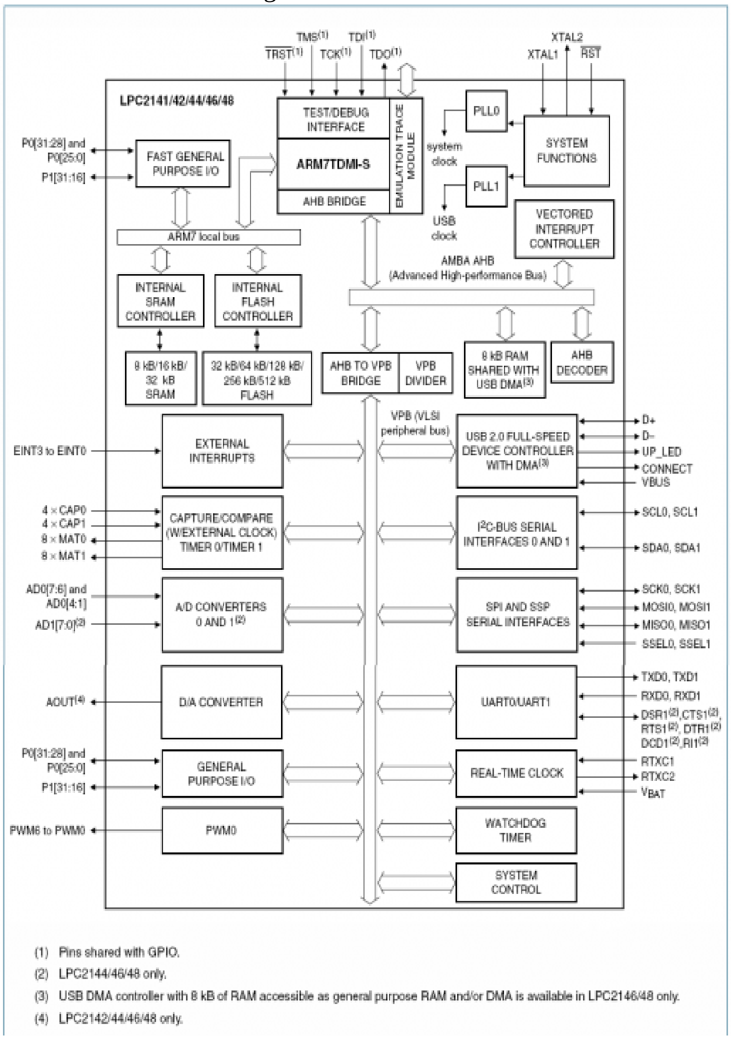

Fig 4 Block diagram of LPC2148

Program memory in the form of NOR flash or OTP ROM is also often included on chip, as well as a typically small amount of RAM. Microcontrollers used for this application is LPC2148 ARM7 microcontroller.

4. RESULTS

Figure 5 shows the plot of the resistance of the flex sensor and the bending of fingers. As the fingers are bend, the resistance of the sensor increases linearly causing an increase in the speed of the vehicle. The plot of velocity against the bending angle as shown in figure 6 for the no load condition.

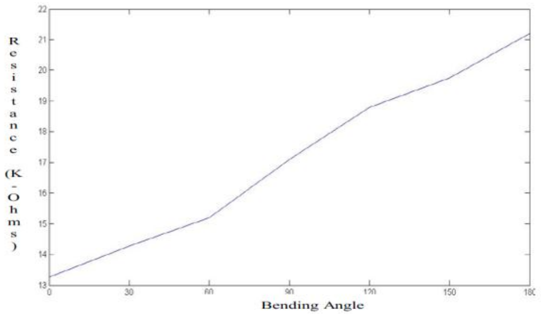

Fig. 5 Plot of sensor resistance (vs.) Bending Angle

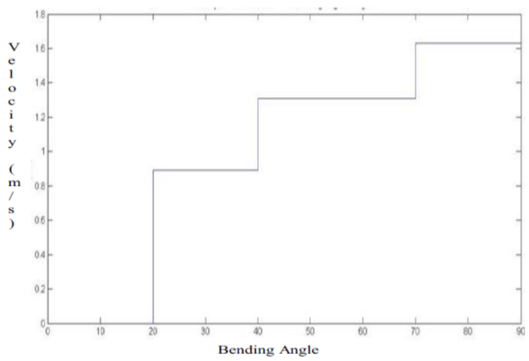

Fig. 6 Plot of velocity (vs.) Bending Angle (Under No Load)

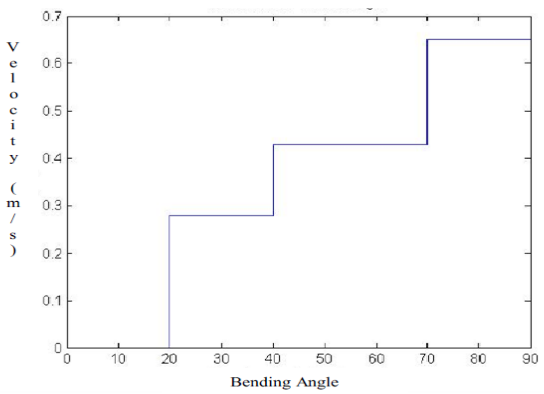

Fig. 7 Plot of velocity (vs.) Bending Angle (Under Load)

Figure 7 shows the plot of the linear velocity of the wheelchair subjected to weight of 60kg. The speed increases with the increase of bending angle. However, it is reduced in comparison to the no- load condition.

5. CONCLUSION

In this paper hand glove controlled Smart Wheelchair is discussed. A model of the system has been developed which is believed to provide better control to people with severe disabilities in comparison to the traditional joystick-controlled because of the lesser amount of force required to manipulate the hand glove in contrast to the joystick and it includes the integration of an obstacle avoidance and collision detection system. Voice recognition, navigation along with GSM and GPRS system are added for more comfortability and safety.

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