

Voice and Touch Screen Based Direction and Speed Control of Wheel Chair for Physically Challenged Using Arduino

M.Prathyusha^{#1}, K. S. Roy^{#2}, Mahaboob Ali Shaik^{*3}

[#] Dept. of E.C.E, K. L. University
Guntur, India

^{*}Vyas Informatics
Hyderabad, India

Abstract— This paper is to describe an intelligent motorized wheel chair for handicapped person using voice and touch screen technology. It enables a disabled person to move around independently using a touch screen and a voice recognition application which is interfaced with motors through microcontroller. When we want to change the direction, the touch screen sensor is modeled to direct the user to required destination using direction keys on the screen and that values are given to microcontroller. Depending on the direction selected on the touch screen, microcontroller controls the wheel chair directions. This can also be controlled through simple voice commands using voice controller. The speech recognition system is easy to use programmable speech recognition circuit that is the system to be trained the words (or vocal utterances) the user wants the circuit to recognize. 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. The methodology adopted is based on grouping a microcontroller with a speech recognition system and touch screen.

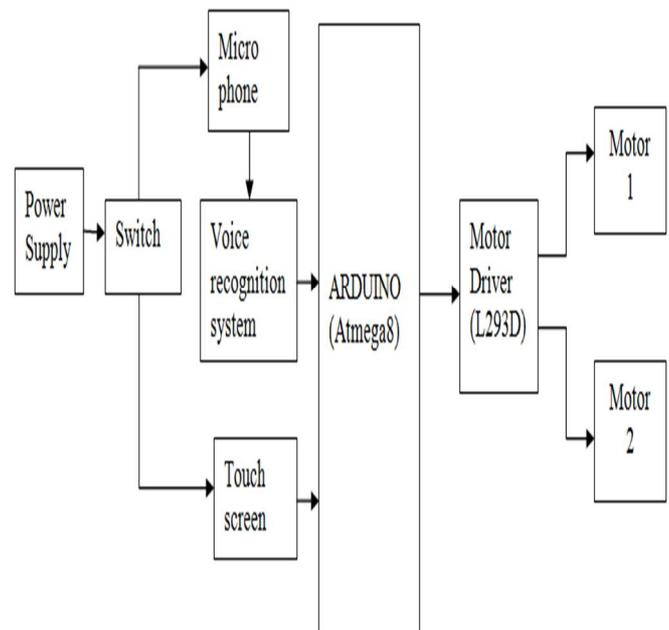
Keywords— Speech recognition system, Touch Screen sensor, PWM technique.

I. INTRODUCTION

Driving a wheelchair in domestic environments is a difficult task even for a normal person and becomes even more difficult for people with arms or hands impairments. Some patients who cannot manipulate the direction of the wheelchair with their arms due to a lack of force face major problems such as orientation, mobility etc. Therefore the Robotic wheel Chair is developed to overcome the above problems allowing the end-user to just perform safe movements and accomplish some daily life important tasks. This is a dual input type operated wheel chair that is made to work based on voice and touch screen commands. Since the motorized wheelchair can move at a fair speed, it is important to control the speed of the wheel chair as per the end-user requirement. Thus the speed of the motors is controlled by using PWM method. The voice recognition is done by HM2007 voice recognition IC. The microphone is directly connected at the analog input of voice recognition IC HM2007 keeping the mode selection key in the record mode. The microcontroller ATMEGA8 along with motor driver L293D is used to drive and control the two DC motors. As it

is a dual input type the system is designed such that based on the switch state the input is selected.

II. BLOCK DIAGRAM



III. WORKING

In this system there are two input devices, speech recognition system and touch screen. In order to select a specific input device we are using a switch that is when the switch=1 voice recognition system is considered and when switch=0 touch screen is considered. The output of the touch screen is analog in nature, to digitize these signals we are using in-built six channel ADC of ATMEGA8 micro controller. On receiving the Signal the microcontroller directs the motors through the control circuit. In this, two DC brushless motors are used for controlling the the two wheels of the chair independently.

The different directions of motions possible are:

- **Forward:** Both the motors in the forward direction.

- **Backward:** Both the motors in the reverse direction.
- **Left:** Left motor stopped/Right motor in the forward direction.
- **Right:** Right motor stopped/Left motor in the forward direction.

The code is written in arduino such that the speed of the motors is controlled by using PWM output pins of arduino. The motors are controlled with four different speed levels that is with 100% duty cycle, 75% duty cycle, 50% duty cycle, 25% duty cycle.

IV. HARDWARE DESCRIPTION

A. HM2007

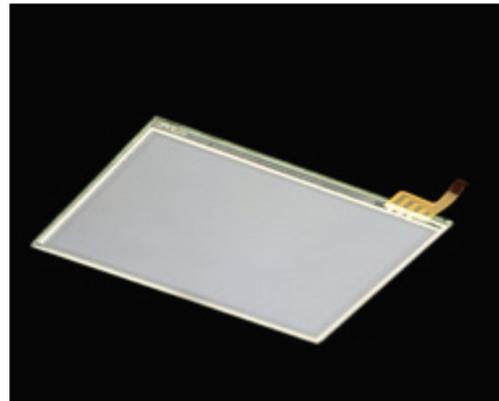
The voice recognition IC HM2007 is capable of operating in speaker independent speech recognition mode. In speech recognition mode, first, the voice is recorded to the external SRAM attached to the IC with the help of a directly connected microphone at the analog input terminal of HM2007 keeping the mode selection key in the record mode. In this way 40 0.9-second long words or 20 1.92-second long words or phrases can be recorded into the memory. After training the voice recognition IC like above the mode selection key is switched to voice input mode. Here at a particular instant the speech through the microphone is compared with the recorded sound and according to that digital output is generated. The output of voice recognition IC is then fed to the digital input ports of the ATMEGA 8 microcontroller. The microcontroller on receiving the Signal directs the motors through the control circuit. The control of speed and direction are done in this way. The change of direction is achieved by changing the direction of current flow through the motor and speed control is achieved by varying the current through the motor.

The Communication of HM2007 with microcontroller follows the protocol given below:

1. Microcontroller indicates on the S-bus that it is ready to receive the HM2007's status.
2. HM2007 indicates its status on the K-bus.
3. Microcontroller switches its pins connected to the HM2007's K-bus to inputs and reads status from the K-bus.
4. Microcontroller switches its pins connected to the HM2007's K-bus to outputs and writes a command to the K-bus.
5. Microcontroller indicates on the S-bus that the HM2007 should read the K-bus for a command.
6. HM2007 reads the K-bus for the command.
7. HM2007 responds to the command and places the results on the K-bus.
8. Microcontroller reads the K-bus to determine the result of the command.

B. Touch Screen Sensor

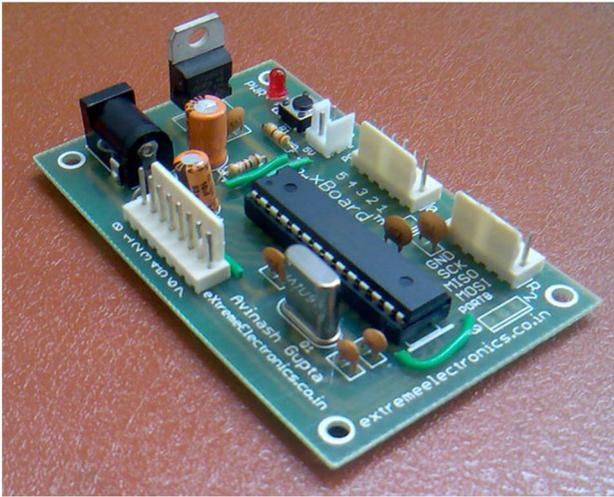
This is a 4-wire analog resistive touch screen. That is by touching the screen at one point, resistance between edges is formed for both the x and y axis. As you move your finger across the screen the resistance changes between opposite sides of each axis. By applying voltage across each axis, a change in resistance results in a change in voltage. Thus a simple ADC with a microcontroller can be used to find x and y positions. Add this touch screen to any LCD of requirement. Readings are taken by applying 5V across two of the pins and performing an analog to digital conversion on the other two pins. The full X and Y position can be achieved by using only 4 GPIOs.



In this project we are using touch screen as an input device for the system. First we will observe the analog values for different positions on touch screen. Depending on these values complete touch screen module is divided into eight quadrants. Among them four quadrants are used for direction control that is for forward, backward, left and right. Remaining four are used for speed control where for each quadrant we will assign the duty cycle at receiver end. when we touch in 1st quadrant motor runs with 100% duty cycle, when we touch in 2nd quadrant motor runs with 75% duty cycle, when we touch in 3rd quadrant motor runs with 50% duty cycle, and when 4th quadrant is pressed motor runs with 25% duty cycle.

C. Arduino(ATMEGA 8)

The microcontroller on the board is programmed using the arduino programming language and arduino development environment. Arduino programming provides a number of libraries to make programming easier. The most simplest of these are functions to control and read the I/O pins. In this project touch screen output is connected to analog pins of the arduino and the speech recognition sensor output is connected to the digital pins of the arduino. The arduino programming is written such that, based on the switch state the touch screen or the speech recognition sensor output values are processed and the direction and speed of the motors and thus the wheels are controlled through the motor driver circuit.



- [2] Journal by Takashi Gomi and Ann Griffith, applied AI Systems, Inc. "Developing Intelligent Wheelchairs for the Handicapped".
- [3] Vasundhara G. Posugade, Komal K. Shedge, Chaitali S. Tikhe, "Touch-Screen Based Wheelchair System", International Journal of Engineering Research and Applications (IJERA).
- [4] Tong Yi bing, Liu Jing dou, "Study of continuous control of space voltage vector PWM during over modulation period", Electric drive for locomotives, China. 2004, 3 : 21-23.
- [5] Ming-Ching Tsai; Kai-Sheng Wu; Po-Wen Hsueh. "Synchronized Motion Control for Power-Wheelchairs" Proc Int'l Conf. Innovative Computing, Information and Control (ICICIC), Dec. 2009, pp. 908-913.
- [6] Journal by D. K. Prabitha, Chidananda Murthy. M. V & M. Z. Kurian, "Speech Recognizing Powered Wheelchair for Disabled".
- [7] Smart Wheelchairs: A literature Survey, July/August 2005 Journal of Rehabilitation Research & Development.
- [8] Jizhong Liu ; Hua Zhang ; Bingfei Fan; Guanghui Wang; Wu,J., "A Novel Economical Embedded Multi-mode Intelligent Control System for Powered Wheelchair", Proc Int'l Conf. Computing, Control and Industrial Engineering (CCIE), June 2010, vol. 1, pp.156-159.

V. ADVANTAGES

- Using an arduino simplifies the amount of hardware and software development you need to do in order to get a system running.
- Very useful to the patients with lack of force to do their own work.
- As it is a dual input type wheel chair it can be operated by either of the two ways by using a simple switch as required by the end user.

VI. CONCLUSION AND FUTURE SCOPE

Recent advancements in the technology are making lives easier for everybody. This work is to help the disabled persons by implementing touch screen and voice command based control system for the wheelchair and providing alternative methods to control the equipment either by touch or through voice, thereby serving many disabilities. Thus the wheelchair understands the signals coming from the control system and reacts accordingly. Functional intelligent wheelchair is practical and helpful to people with certain types and degrees of handicap. Though we are mainly focusing on touch screen and voice recognition based system interface, more advancements can be done through more research. The efficiency of the voice command control system can be further improved by implementing neural network based algorithms.

ACKNOWLEDGEMENT

I am highly indebted to Mr.Sripath roy and Mr. Mahaboob Ali Shaik for their contribution in working on this paper.

REFERENCES

- [1] Saranghi P. Parikh; Valdir Grassi Jr.; R. Vijay Kumar Jun Okamoto Jr., "Integrating Human Inputs with Autonomous Behaviors on an Intelligent Wheelchair Platform", IEEE Trans., April 2007, Volume 22, Issue 2, pages 33.