VOICE CONTROLLED WHEELCHAIR FOR DISABLED PEOPLE

Submitted in partial fulfillment of the requirements
of the degree of

Bachelor of Engineering

by

KHAN AYAZ AHMED
MOHSIN NAWAZ
MUKADAM SAIF
SHAIKH SAIF S

Supervisor:

Asst Prof. Rahul Khadase

Department of Electronics & Telecommunication

AIKTC

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Project Report Approval for B.E.

This project report entitled ***Design of Voice Controlled wheel chair*** by ***Khan Ayaz, Mohsin Nawaz, Mukadam saif, Shaikh saif*** is approved for the degree of ***B.E. in Electronics & Telecommunication***.

Examiners

1.---------------------------------------

2.---------------------------------------

Supervisor

1.---------------------------------------

Chairman

Date:

Place:

Declaration

I declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Mohsin Nawaz(12ET38)

Khan Ayaz(12ET25)

Mukadam Saif(11ET36)

Shaikh Saif(12ET53)

Date:

Abstract

This project is on automatic wheelchair for physically disabled people. A dependent user recognition voice system and ultrasonic and infrared sensor systems has been integrated in this wheelchair.

In this way we have obtained a automatic wheelchair which can be driven using voice commands and with the possibility of avoiding obstacles by using infrared sensors and down stairs or hole detection by using ultrasonic sensors.

The wheelchair has also been developed to work on movement of accelerometer which will help for the person whose limbs are not working. Accelerometer can be attached to any part of body of physically disabled person which he can easily move like head, hand etc. It has also provision of joystick for disabled person who can easily move his/her hand.

Electronic system configuration, a sensor system, a mechanical model, voice recognition control, accelerometer control and joystick control are considered.

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INTRODUCTION

1.1 Problem statement

Recently, the old person and the physically handicapped person who use a wheelchair are increasing. However, only two type wheelchairs by the hand operating and operating the joystick have come into wide use. The former type needs muscular strength for the operation and the latter type needs the skill. Therefore, there is a problem that it is difficult for the old and the handicapped person to use these interfaces.

For handicapped people human found a wheel chair which can be moved by using hands for those who don't have legs. But the peoples who don't have legs as well as hands cannot move their wheel chair self. They need some other person to move their wheel chair. But sometimes such person faces so many problems if they didn't get any person to move their wheel chair

1.2 Project objectives

The objectives of this project are:

- The main purpose of this project is to design a voice based wheelchair system so we can help.
- Arm amputees, legs amputees or both to move freely in as low cost as possible.
- We can also help people suffering from Spinal cord injuries, Traumatic Brain.
- Patients of Quadriplegia, Tetraplegia and Stroke.

1.3 Project overview

In this project we are going to make a wheel chair which can be controlled automatically as well as manually. This wheel chair controlled manually through head of the person sitting on it. He/ she just need to move his/her hand into the direction it wants to move by using accelerometer. In automatic control user just need to press keys for saved destination. Then the wheel chair will automatically move into the direction of saved destination by using encoder wheels.

This chair also provide the another feature i.e. it can be operated by speech. The proposed Speech Recognition Based Wheelchair Operation allows physically disabled person to control the wheelchair easily without the need to use hands. The movement of the powered wheelchair depends on the motor control and drive system which consists of microcontroller and motor driving. Once the voice recognition system recognizes the voice commands in comparison to the stored memory, the respective coded digital signals would be sent to the microcontroller which then controls the wheelchair accordingly.

1.4) Literature survey:-

LITERATURE SURVEY

NAME	YEAR	AUTHORS
Sip and Puff Wheelchair.	2013	Imad Moghaerbail Racha-El-Hajj Houda Gharmouch Houda Gharmouchh
Head movement wheelchair	2006	Yoda J. Tanaka B- Ratchev K- Sanuka
Joystick operated wheelchair	2013	Yasin Rabli Makram Merabett
Chin operated wheelchair	2006	R.A. Cooper S. Gou,

2. SPECIFICATION FOR SYSTEM DEVELOPMENT

In this section, we would like to highlight the targeted hardware platform, software platform and programming languages which are intended to use for development of propose embedded system.

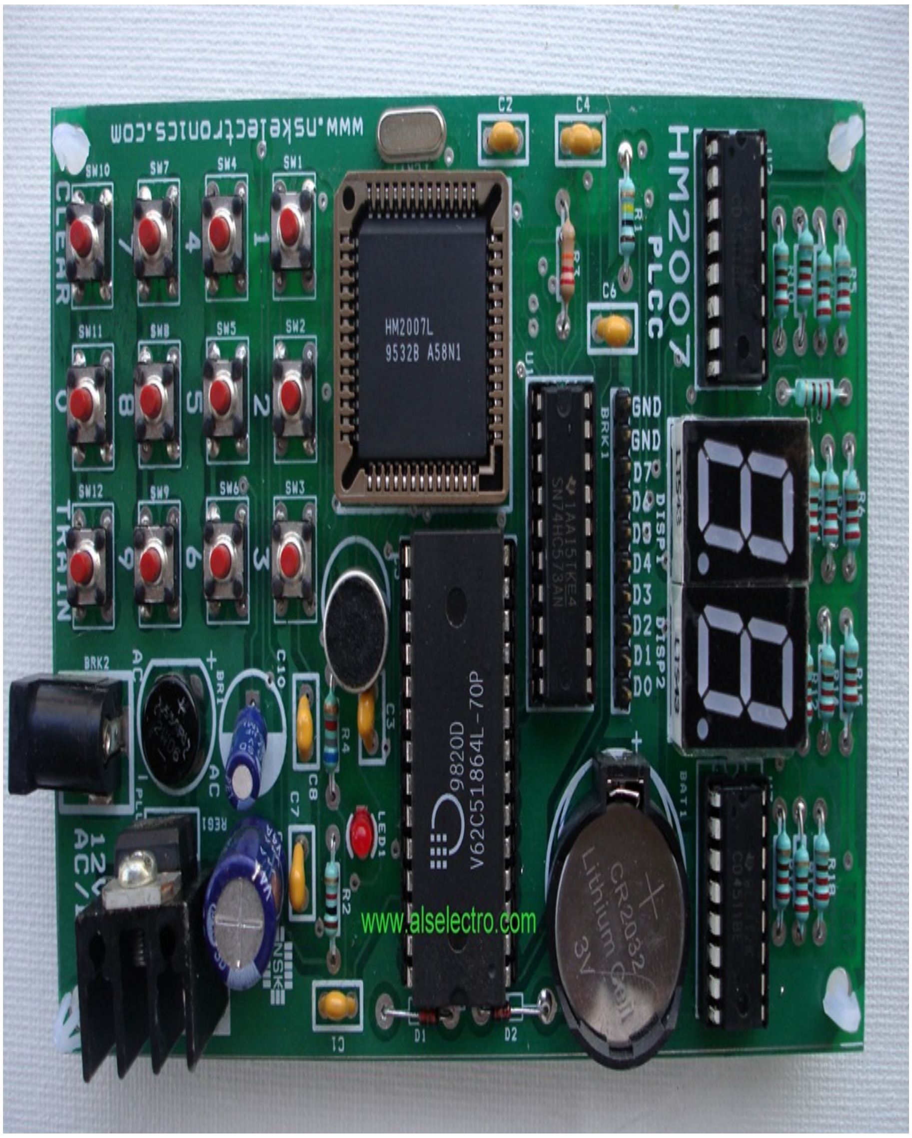
2.1 Hardware Specification

2.1.1) Voice Recognition Chip:

It is the heart of the entire system. HM2007 is a voice recognition chip with on-chip analog front end, voice analysis, recognition process [1] and system control functions. The input voice command is analyzed, processed, recognized and then obtained at one of its output port which is then decoded , amplified and given to motors of robot.

If the computer's CPU time. When the HM2007 recognizes a command it can signal an interrupt to the host CPU and then relay the command code. The HM2007 chip can be cascaded to provide a larger word recognition library. The circuit we are building operates in the manual mode. The manual mode allows one to build a standalone speech recognition board that doesn't require a host computer and may be integrated into other devices to utilize speech control.

The HM2007 is a single-chip complementary metal-oxide semiconductor (CMOS) voice recognition [2] large-scale integration (LSI) circuit. The chip contains an analog front end voice analysis, recognition, and system control functions. The chip may be used in a stand-alone or connected.



(Fig no.2.1)

Features:

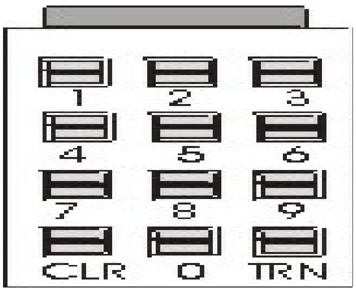
1. Single-chip voice-recognition CMOS LSI.
2. Speaker-dependent
3. External RAM support
4. Maximum of 40-word recognition
5. Maximum word length of 1.92 s
6. Microphone support
7. Manual and CPU modes available
8. Response time less than 300 milliseconds (ms)
9. 5 volt (5V) power supply

2.1.2) Microphone:

It takes the analog voice commands and sends it to voice recognition chip (HM 2007) in the form of electrical signal. The human ear has an auditory range from 10 to 15,000 Hz. Sound can be picked up easily using a microphone and amplifier.

2.1.3) Keypad:

It is used for training/programming the chip. It also allocates definite memory locations to voice commands. The keypad is made up of 12 switches. The figure of keypad is shown in fig. (2.1).



(Fig 2.2)

2.1.4) 7-segment Display:

It is used to test the voice recognition circuit. The 7 segment display is used as a numerical indicator on many types of test equipment. It is an assembly of light emitting diodes which can be powered individually. They most commonly emit red light. Powering all the segments will display the number 8.

2.1.5) Applications and Drivers:

A numeral to be displayed on a seven segment display is usually encoded in BCD form, and a logic circuit driver ON or OFF the proper segments of the display. This logic is also called decoder. Various decoders are available to drive common anode and common cathode displays. One of the easily available decoder is 7447 AND 7448 TTL decoders.

2.1.5.1) **Relay Circuit:**

A typical relay switch circuit has the coil driven by a NPN transistor switch, TR1 as shown depending on the input voltage level. When the Base voltage of the transistor is zero (or negative), the transistor is cut-off and acts as an open switch. In this condition no Collector current flows and the relay coil is de-energized because being current devices, if no current flows into the Base, then no current will flow through the relay coil.

Note that the relay coil is not only an electromagnet but it is also an inductor. When power is applied to the coil due to the switching action of the transistor, a maximum current will flow as a result of the DC resistance of the coil as defined by Ohms Law, (I = V/R). Some of this electrical energy is stored within the relay coil's magnetic field.

When the transistor switches "OFF", the current flowing through the relay coil decreases and the magnetic field collapses. However the stored energy within the magnetic field has to go some where and a reverse voltage is developed across the coil as it tries to maintain the current in the relay coil. This action produces a high voltage spike across the relays coil that can damage the switching NPN transistor if allowed to build up.

So in order to prevent damage to the semiconductor transistor, a "flywheel diode", also known as a freewheeling diode, is connected across the relay

coil. This flywheel diode clamps the reverse voltage across the coil to about 0.7V dissipating the stored energy and protecting the switching transistor. Flywheel diodes are only applicable when the supply is a polarized DC voltage. An AC coil requires a different protection method, and for this an RC snubber circuit is used.

The previous NPN transistor relay switch circuit is ideal for switching small loads such as LED's and miniature relays. But sometimes it is required to switch larger relay coils or currents beyond the range of a BC109 general purpose transistor and this can be achieved using Darlington transistor.

The sensitivity and current gain of a relay switch circuit can be greatly increased by using a Darlington pair of transistors in place of a single switching transistor. Darlington Transistor pairs can be made from two individually connected Bipolar Transistors as shown or available as one single device with standard: Base, Emitter and Collector connecting leads.

The two NPN transistors are connected as shown so that the Collector current of the first transistor, TR1 becomes the Base current of the second transistor TR2. The application of a positive base current to TR1 automatically turns "ON" the switching transistor, TR2.

Relay Switching Circuit Summary:

In this tutorial we have seen how we can use both Bipolar Junction Transistors, either NPN or PNP and Enhancement MOSFETs, either N-channel or P-channel as a transistor switching circuit.

Sometimes when building Electronic or Micro-controller circuits we want to use a transistor switch to control a high-power device, such as motors, lamps, heating elements or AC circuits. Generally these devices require larger currents or higher voltages than a single power transistor can handle then we can use a relay switching circuit to do this.

Bipolar transistors (BJT's) make very good and cheap relay switching circuits, but BJT's are current operated devices as they convert a small Base current into a larger load current to energise the relay coil.

However, the MOSFET switch is ideal as an electrical switch as it takes virtually no Gate current to turn "ON", converting a Gate voltage into a load current. Therefore, a MOSFET can be operated as a voltage-controlled switch.

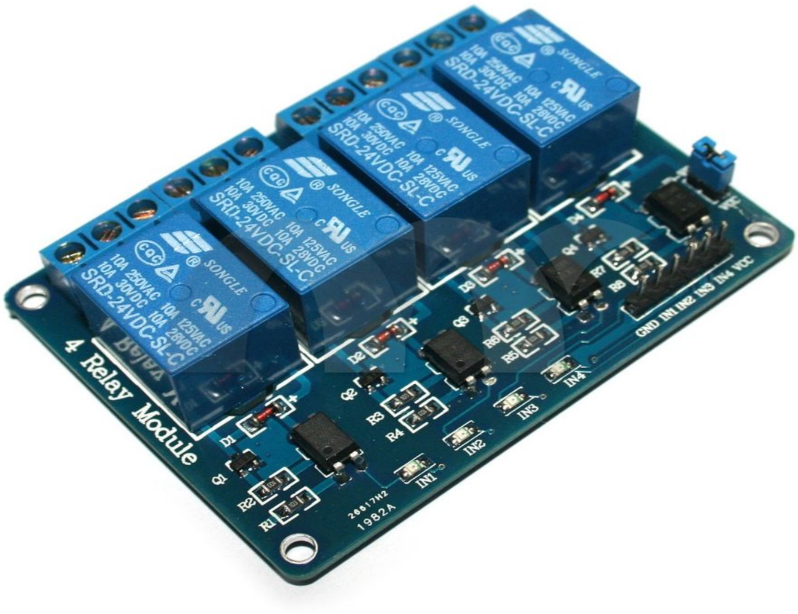
In many applications bipolar transistors can be substituted with enhancement-type MOSFETs offering faster switching action, much higher input impedance, and probably less power dissipation. The combination of a very high Gate impedance, very low power consumption in its "OFF" state, and very fast switching capability makes the MOSFET suitable for many digital switching applications.

However, because the gate of an E-MOSFET is insulated from the rest of the component, it is especially sensitive to static electricity which could destroy the thin oxide layer on the Gate. Then special care should be taken either when handling the component, or when it is in use and that any circuit using e-MOSFETs includes appropriate protection from static and voltage spikes.

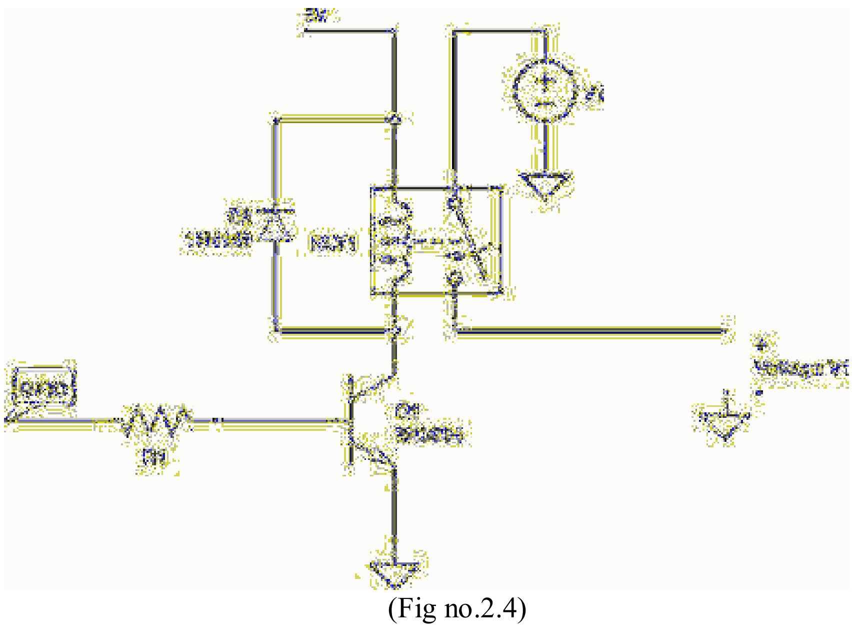
Also for additional protection of either BJT's or MOSFETs, always use a flywheel diode across and relay coil to safely dissipate the back emf generated by the transistors switching action.

2.1.6) Features of Relay Circuit:

1. The normal working voltage of this module is 5V.
2. 4 mechanical relays with status indicator LED.
3. This circuit is just a switch to toggle on off.
4. The output supply has a wide range from 5V to 110V dc.



(Fig no.2.3)



(Fig no.2.4)

2.1.7) Microcontroller 8051:

Basic pins:

PIN 9: PIN 9 is the reset pin which is used to reset the microcontroller's internal registers and ports upon starting up. (Pin should be held high for 2 machine cycles.)

PINS 18 & 19: The 8051 has a built-in oscillator amplifier hence we need to only connect a crystal at these pins to provide clock pulses to the circuit.

PIN 40 and 20: Pins 40 and 20 are VCC and ground respectively. The 8051 chip needs +5V 500mA to function properly, although there are lower powered versions like the Atmel 2051 which is a scaled down version of the 8051 which runs on +3V.

PINS 29, 30 & 31: As described in the features of the 8051, this chip contains a built-in flash memory. In order to program this we need to supply a voltage of +12V at pin 31. If external memory is connected then PIN 31, also called EA/VPP, should be connected to ground to indicate the presence of external memory. PIN 30 is called ALE (address latch enable), which is used when multiple memory chips are connected to the controller and only one of them needs to be selected.We will deal with this in depth in the later chapters. PIN 29 is called PSEN. This is "program store enable". In order to use the external memory it is required to provide the low voltage (0) on both PSEN and EA pins.

Pin 29: If we uses an external ROM then it should has a logic 0 which indicates Micro controller to read data from memory.

Pin 30: This Pin is used for ALE that is Address Latch Enable. If we uses multiple memory chips then this pin is used to distinguish between them. This Pin also gives program pulse input during programming of EPROM.

Pin 31: If we have to use multiple memories then by applying logic 1 to this pin instructs Micro controller to read data from both memories first internal and afterwards external.

Ports:

There are 4 8-bit ports: P0, P1, P2 and P3.

PORT P1 (Pins 1 to 8): The port P1 is a general purpose input/output port which can be used for a variety of interfacing tasks. The other ports P0, P2 and P3 have dual roles or additional functions associated with them based upon the context of their usage. The port 1 output buffers can sink/source four TTL inputs. When 1s are written to portn1 pins are pulled high by the internal pull-ups and can be used as inputs.

PORT P3 (Pins 10 to 17): PORT P3 acts as a normal IO port, but Port P3 has additional functions such as, serial transmit and receive pins, 2 external interrupt pins, 2 external counter inputs, read and write pins for memory access.

PORT P2 (pins 21 to 28): PORT P2 can also be used as a general purpose 8 bit port when no external memory is present, but if external memory access is required then PORT P2 will act as an address bus in conjunction with PORT P0 to access external memory. PORT P2 acts as A8-A15, as can be seen from fig 1.1

PORT P0 (pins 32 to 39) PORT P0 can be used as a general purpose 8 bit port when no external memory is present, but if external memory access is required then PORT P0 acts as a multiplexed address and data bus that can be used to access external memory in conjunction with PORT P2. P0 acts as AD0-AD7, as can be seen from fig 1.1

PORT P10: asynchronous communication input or Serial synchronous communication output.

PIN 11: Serial Asynchronous Communication Output or Serial Synchronous Communication clock Output.

Features of 8051:

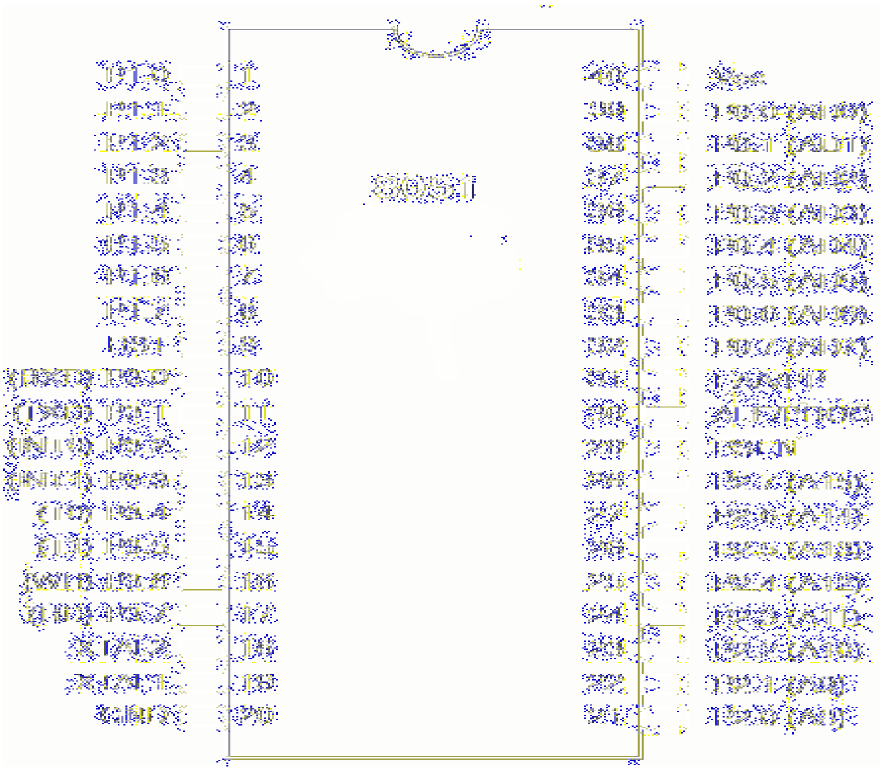
The 8051 architecture provides many functions (central processing unit (CPU), random access memory (RAM), read-only memory (ROM), input/output (I/O), interrupt logic, timer,etc.)in one package:

- 8-bit arithmetic logic unit (ALU) and accumulator, 8-bit registers (one 16-bit register with special move instructions), 8-bit data bus and 2×16-bit address bus/program counter/data pointer and related 8/11/16-bit operations; hence it is mainly an 8-bit microcontroller
- Boolean processor with 17 instructions, 1-bit accumulator, 32 registers (4 bit-addressable 8-bit) and up to 144 special 1 bit-addressable RAM variables (18 bit-addressable 8-bit)[3]
- Multiply, divide and compare instructions
- 4 fast switchable register banks with 8 registers each (memory mapped)
- Fast interrupt with optional register bank switching
- Interrupts and threads with selectable priority[4]
- Dual 16-bit address bus – It can access 2 x 216 memory locations – 64 KB (65,536 locations) each of RAM and ROM
- 128 bytes of on-chip RAM (IRAM)
- 4 KiB of on-chip ROM, with a 16-bit (64 KiB) address space (PMEM). Not included on 803X variants
- Four 8-bit bi-directional input/output port, bit addressable
- UART (serial port)
- Two 16-bit Counter/timers
- Power saving mode (on some derivatives)

MICROCONTROLLER 8051:

(Fig no.2.5)

2.1.7.1) Pin Diagram:



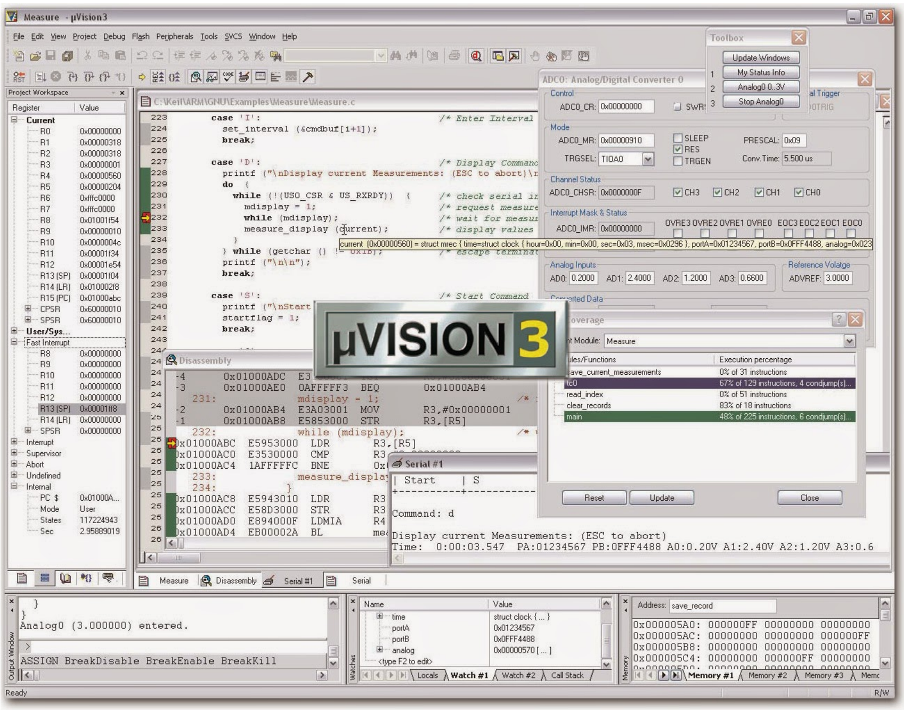
(Fig no.2.6)

3) SOFTWARE:-

Required software's are mentioned as follows:

3.1) KEILuVision4:

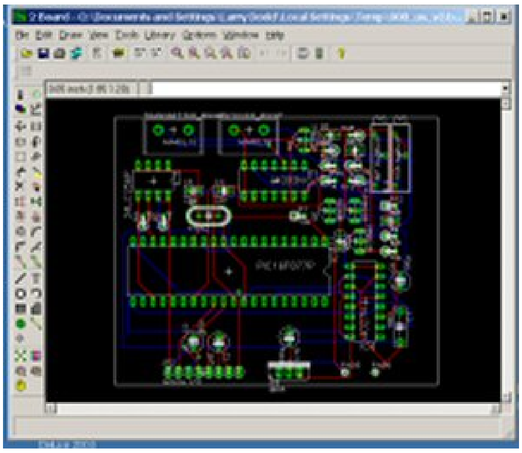
The new Keil µVision4 IDE has been designed to enhance developer's productivity, enabling faster, more efficient program development. µVision4 introduces a flexible window management system, enabling you to drag and drop individual windows anywhere on the visual surface including support for Multiple Monitors. The µVision IDE from Keil combines project management, make facilities, source code editing, program debugging, and complete simulation in one powerful environment. The µVision development platform is easy to use and helping you quickly creates embedded programs that work. The µVision editor and debugger are integrated in a single application that provides a seamless embedded project development environment.



(Fig no.2.7)

3.2) Eagle:

EAGLE contains a schematic editor, for designing circuit diagrams. Parts can be placed on many sheets and connected together through ports.



(Fig no.2.8)

3.1) Programming:-

```
#include<reg51.h>

sbit S1=P1^0;                    ////voice command

sbit S2=P1^1;                    ////voice command

sbit S3=P1^2;                    ////voice command

sbit S4=P1^3;                    ////voice command
//sbit Button=P2^1;

sbit IR=P2^0;                    ////Sensor

sbit M1=P3^0;                  ////right motor +ive terminal

sbit M2=P3^1;                  ////right motor -ive terminal

sbit M3=P3^4;                    ////left motor +ive terminal

sbit M4=P3^5;                    ////left motor -ive terminal

void main()

{
S1=S2=S3=S4=0;

   M1=1; M2=1;

           M3=1;  M4=1;
     while(1)

 {

if(S1==1 && S2==1 && S3==0 && S4==0 && IR==1)////////03

{
  M1=0; M2=1;

           M3=0;  M4=1;              ////moving forward

 }
```

```
 else if(S1==1 && S2==0 && S3==0 && S4==0
&&IR==1)////////01

 {


             M1=0; M2=1;

             M3=1;  M4=0;               ////moving left

 }

 else if(S1==0 && S2==1 && S3==0 && S4==0 &&
IR==1)///////02

 {

  M1=1; M2=0;

             M3=0;  M4=1;               ////moving right

 }

 else if(S1==0 && S2==0 && S3==0 && S4==1 &&
IR==1)/////00

 {

    M1=1; M2=1;

             M3=1;  M4=1;               ////stop

 }
 else if(S1==1 && S2==1 && S3==1 && S4==0 &&
IR==1)/////07

 {

   M1=1; M2=0;

            M3=1;  M4=0;               ////moving reverse


}
```

```
else if(IR==0)/////00
 {
  M1=1; M2=1;
              M3=1;  M4=1;                 ////stop
}
}
}
```

PROPOSED SYSTEM:

The block diagram can be described as follows:

1) The speech is recognized by the HM2007 IC and processed thus giving commands to the microcontroller accordingly and hence to the robot.

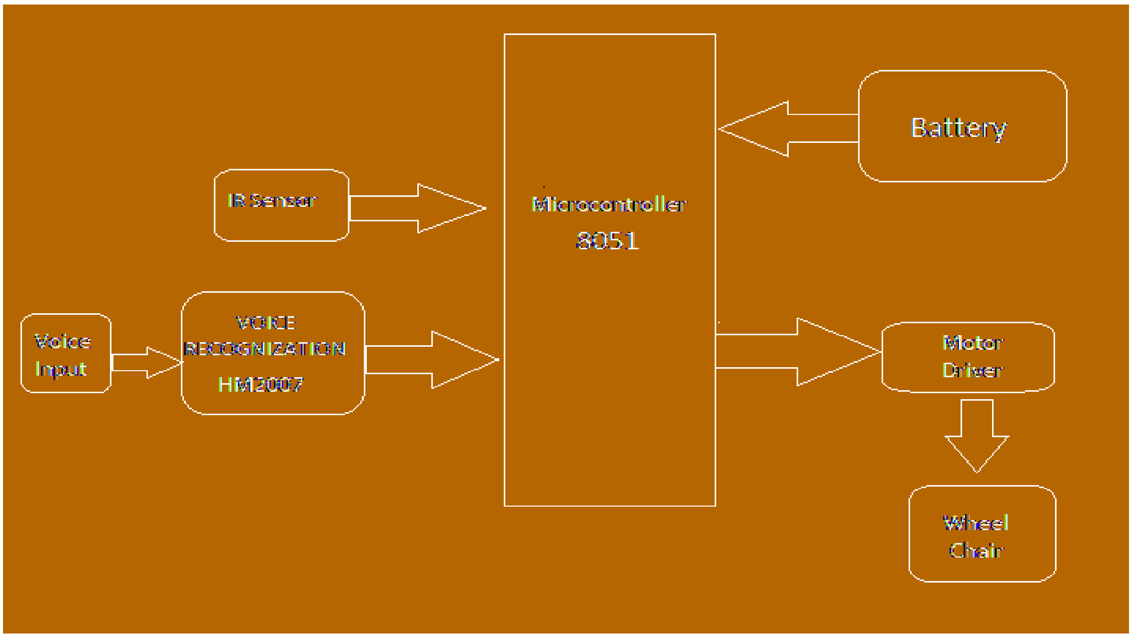
2) When the HM2007 detects voice commands (forward, backward, left, right, stop) the relay driver drives motor according to it.

3) Infrared sensors is used detect the obstacle .If any obstacle is detect then it gives signal to arm7 and it will stop the motors.

4) Microcontroller controls the movements of the robot.

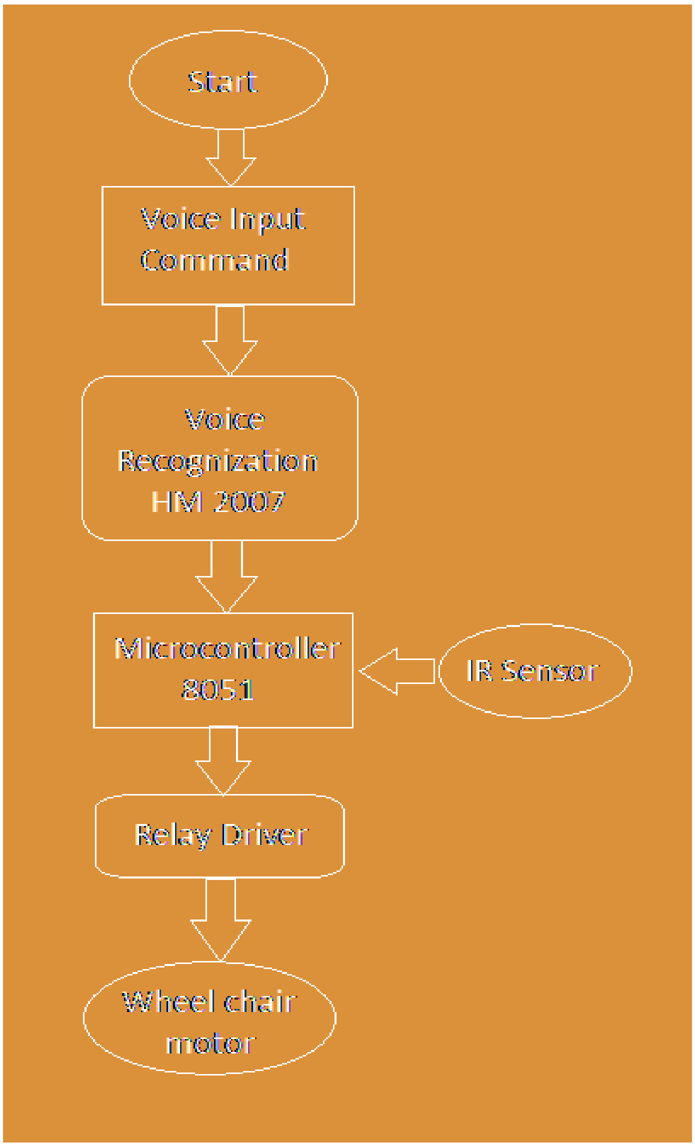
The diagram of system structure is shown in fig. (4.1) below

SYSTEM STRUCTURE OR SYSTEM ARCHITECTURE



(Fig no.2.9)

Flow chart:-



(Fig no.2.10)

Future Scope:

- Further advancement in this wheel chair are possible by decreasing the power requirements of the wheel chair.

- Finding a way to automatically charge the battery with the help of motion of the wheel chair.

- Accelerometer and Joystick can also be interfaced to MC 8051 and can be controlled.

- We can also install Ultrasonic and other feedback to avoid collision.

CONCLUSION:-

We are implementing automatic wheelchair which has various advantages. It is operating in three different modes i.e. joystick mode, accelerometer mode and voice recognition mode. Also there two types of sensors which increases accuracy of wheelchair. This Wheelchair will be economical and can affordable to common people. We can also add new technology in this wheelchair. A system for reliable recognition of speech and face has been designed and developed. This system can be made highly efficient and effective if stringent environmental conditions are maintained. The setup for maintaining these environmental conditions will be a onetime investment for any real life application. The running cost of this system is much lower as compare to other systems used for the same purpose.

References:

[1] "Design and development of voice/joystick operated microcontroller based intelligent motorized wheelchair" H.R. Singh, Abdul Mobin, Sanjeev Kumar, Sundeep Chauhan" and S.S. Agrawal Central Electronics Engineering Research Institute, CSIR Complex, Hillside Road, New Delhi-110 012, India.

[2] "Interacting with computers by voice: automatic speech recognition and synthesis" by O'Shaughnessy.

[3] H. He, S. Huang and Z. Huang, 2003. The Present Status and Trend of Intelligent wheelchair Research. Journal of Robot Technique and Application, No.2, pp.12~16