DEVELOPMENT OF ALTERNATIVE COMMUNICATION DEVICE FOR PARALYSIS & DUMB PEOPLE USING BREATH PATTERN

[1]Nandhini.S, Muralikrishna.B, Chitra.S, [2]Gowrishankar. K

, [1]UG scholar, [2]Professor and Head
[1&2]Department of Biomedical Engineering,
[1]Rajiv Gandhi College of Engineering and Technology, Pondicherry, India

Abstract : In this paper, a new communication prototype is proposed that transforms a breath signal into a predefined phrases or comments to help a person who are affected by paralysis and a person who are dumb. Here mainly, the study should be concerned for stroke and dumb people who doesn't have any loss in their cognitive function. The prototype is used to recognize the vocal of the person through their own breath patterns. Depending upon the minimum and maximum threshold of the breath pattern, the comments will be heard and displayed. The threshold of the pattern should be digitalized and the predefined phrases are considered according to the range of digital value of the breath pattern. Based on this, the proposed prototype proposes a Microcontroller to initialize this project.

IndexTerms - **Prototype, Paralysis, Dumb, Breath Patterns, Threshold, Microcontroller**

I. INTRODUCTION

According to the statistics of The Ministry of Statistics and Programme Implementation of India last 2016, out of 130 Cr population, about 2.21% are corresponds to disability. The major leading causes of disability are paralysis. Most of the case paralysis leads to speech impairment of patients. Often this speech impairment will causes a frustration and stresses to the patient in order to express their own thoughts and thinking. To overcome these struggle faced by patients, many researchers has developed many innovative idea to get back their art of communication.

To improve the communication for a speech impairment people an electronic speaking glove is designed by the researchers B. Ali, S. Munawwar, B. Nadeem in which the movement from the hand is converted into a word and audible to everyone through the speaker [1]. A device called Wearable Augmentative and Alternative Communication (AAC) were developed by Philippines researcher in which it aids the paralysis victim by converts the discrete breathing pattern into predefined words. They develop software such as Brute Force Algorithm to convert 4-bit patterns into comments. And moreover setting the threshold is not quite easy in this device. The threshold may vary for person to person. Hence this device cannot be used by different persons without uploaded their breathing threshold value while initializing the device [2].

A system which make uses six AG-500 articulograph sensor. These sensors are located near the surface of the lips. When the patient try to speak by moving his/her tongue, the movement of the tongue provide an impact in the distance between the sensor and this distance is plotted in equivalent SAMPA code generating a voice according to the software [3]. Using vocal cord vibrations in which a device that converts the vibrations into a words using an acoustic plate [4]. According to the Serbian Journal, the electrical signal of the breath pattern varies in amplitude. This variation in amplitude is depends upon the air pressure in it [5]. The electronic speaking system is developed to reduce the continuous monitoring of the paralysis and dumb patient. When a person seeks a help from attender he /she may move his /her head or hand to call them. This movement will convert into voice and reaches the attender [6].

On the account of this problem, we propose a system that helps the paralysis victims and dumb people to regain their communication by transforms the breath signal into predefined phrases using an Arm Processor. This does not require any variable threshold value since it follows only a constant threshold values for all persons. A single breath signal is enough to frame a sentence hence it doesn't cause any respiratory problems to the user. It is cost effective because it uses only simple methodology and elements.

II. TECHNICAL BACKGROUND

In order to live, breathing is the important process. In this paper, idea and implementation of our proposed system will regain the art of communication for the person who has been paralyzed and dumb. The source of the proposed system will be the user breath signal. This system receive breath signal using Microphone Sound Sensor Module and they amplified. This amplified signal converted into electronic signal. The amplitude of the breath signal varies with respect to the pressure [5]. Then it is digitalized and depends upon the digital value of the breath signal their corresponding comments are displayed in LCD. This device is cost effective and it uses simple component to aid the speech impairment and paralysis patient has been the main concerned of this paper. Fig. 1 represents the various components used in the proposed system.
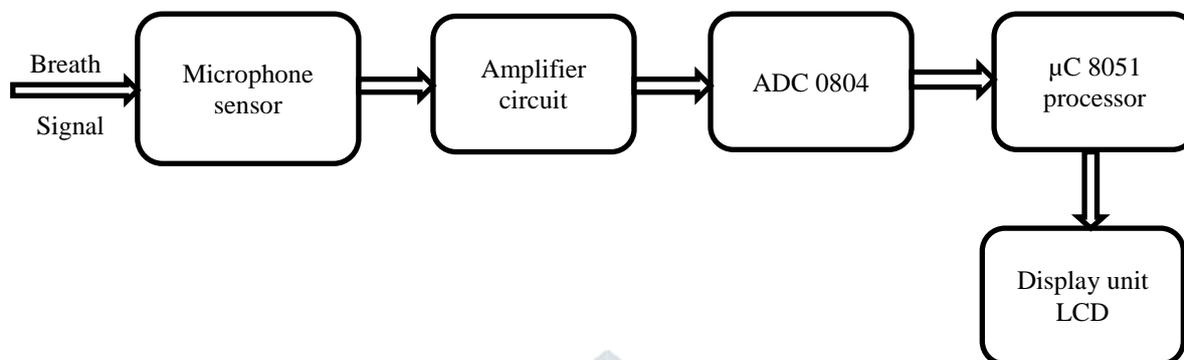
.**Fig. 1 Block Diagram of Proposed System**

2.1 Hardware implementation

2.1.1 Microphone Sensor Module

This module acts as an electric transducer. Many microphones are available but condenser microphone has high sensitivity and its response is found to be fast. They are operated at the voltage of +5V [7]. And their operating current is 8 mA. It contains LED which indicates the output and power. It also provides accuracy with good consistency. It contains pre-defined amplifier circuit which amplified the breath signal in efficient manner. The most vital part in this module is microphone. In order to acquire accurate data/signal, the microphone should be protected from surrounding environment and damages.

2.1.2 Analog to Digital Convertor ADC 0804

ADC 0804 is a single channel analogue to digital converter. It has 8 bit resolution. The higher resolution of ADC gives the smaller step size. Step size is smallest chance that can be measured by an ADC. The step size is 19.53 millivolts. The time taken by the ADC to convert analog to digital depends on the frequency of clock source. They are operated at the voltage of +5V. This IC has Dual Inline Package (DIP) with 20 pins. Normally, the conversation time is 100μs to convert from analog to digital signals. It is used to digitalize the electric breath signal. It has the output ranges from 0-255. This digitalized signal has been brought into these ranges. It can easily interface with the processor.

2.1.3 Microcontroller 8051

The microcontroller 8051 is a very popular 8-bit microcontroller which was introduced by Intel in 1981. It has become almost the level nowadays. The 8051 is based on an 8-bit CISC core with Harvard architecture. It is optimized for control applications. It has 40-pin DIP chip and work at +5v DC. It has 4KB of ROM and 128 bytes of RAM. It has four 8-bit bidirectional input/output ports. It also contains two 16 bit timer/ counter. Here, it will execute the pre-defined command according to the voltage range of breath signal. In addition to this many components such as ADC and LCD are directly interfaced with it.

2.1.4 Liquid Crystal Display (LCD)

The LCD is an electronic display screen which is widely used in many applications as an output unit. A 16×2 LCD display is a primary module used to display 16 characters in a row. This contains two rows. Each character in LCD is displayed in a matrix which contains a pixel of 5×7. There are 16 pins are available in 16×2 LCD and it interfaced with microcontroller using its 8 data pins (D0-D7) from pin number 7 to 14. The three control pins are RS, RW and EN pins. The power supply for the LCD is +5V. The contrast of the display can also be adjusted by connecting the potentiometer at pin number 3. For backlight of the screen, two pins are available in LCD.

III. Methodology

In this paper, the methodology of the proposed system will use a microcontroller 8051 which was manufactured by Intel in 1980. It also termed as MCS-51. It plays a major role in embedded system design. It is 40 pin IC with Dual Inline Package (DIP). It is 8bit processor. Initially it was developed in NMOS technology but it was not operate in effective manner. Later it was developed in CMOS technology and noted the processor as 80C51. It has vast applications in various industries and domestic purpose because of its "System on a chip". It follows Harvard architecture.

3.1 Features of microcontroller 8051:

It has 4KB of ROM and 128 bytes of RAM. These RAM and ROM are present at on chip. In total 128 bytes of RAM, 32 bytes are dedicated to registers then another 16 bytes are used for addressable memory and remaining 80 bytes are used for general purpose memory. It contains 8 bit data bus and 16 bit address bus. It usually have two 16 bit timer/counter. This microcontroller has 5 interrupts in which 3 used as internal interrupt and 2 used for external interrupt. For data transmitting and receiving, it has

four 8 bit input/output ports. It has a clock frequency of 11.0592 MHz. It contains two external oscillators. The DC supply to the IC is 5V or 12V. The pins EA/VPP, PSEN and ALE/PROG are used to connect external ROM for microcontroller.

The basic circuits required to operate a microcontroller was power circuit, oscillator circuit and reset circuit. Fig. 2 represents the Power circuit which is responsible for voltage supply to the microcontroller. Oscillator circuit provides necessary clock pulse to the controller. Reset circuit is used to reset the controller to the starting position.

3.2 Power Circuit
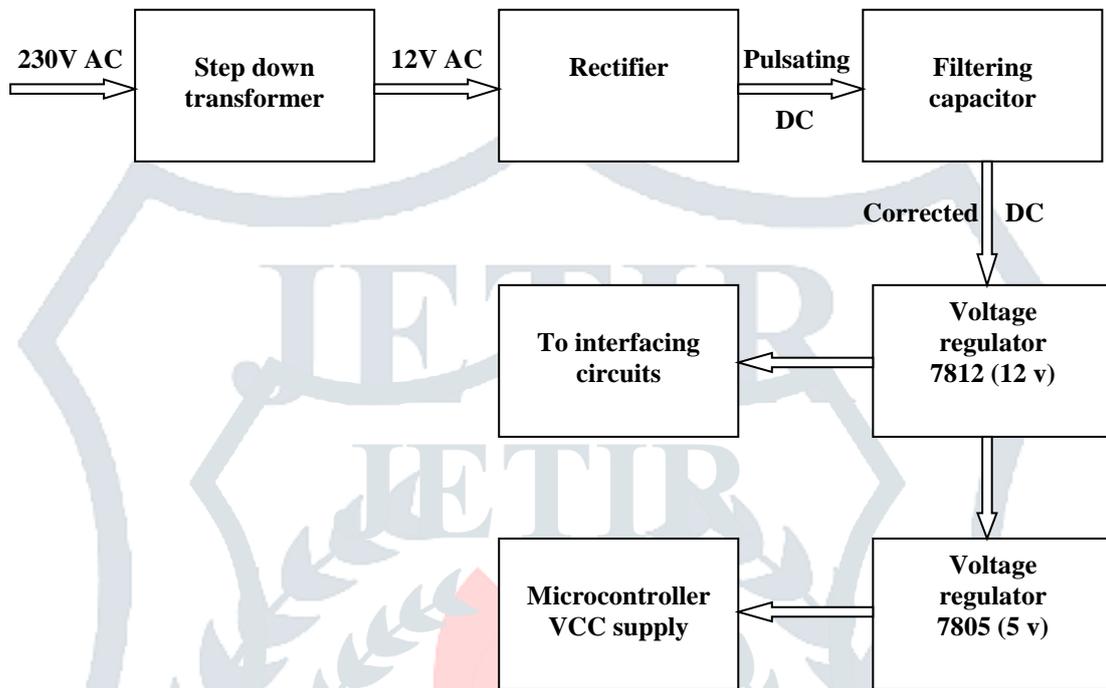
Fig. 2 Power Circuit of the Microcontroller

3.3 Oscillator Circuit

Pin 18 and pin 19 are the oscillator pins. Fig. 3 represents the Oscillator circuit which is used to generate a clock pulse with a frequency of 11.0592 MHZ. Crystal oscillator is used here. The clock pulse from the circuit is used to execute the instruction /program code in the microcontroller. The capacitor in the circuit is used for stability
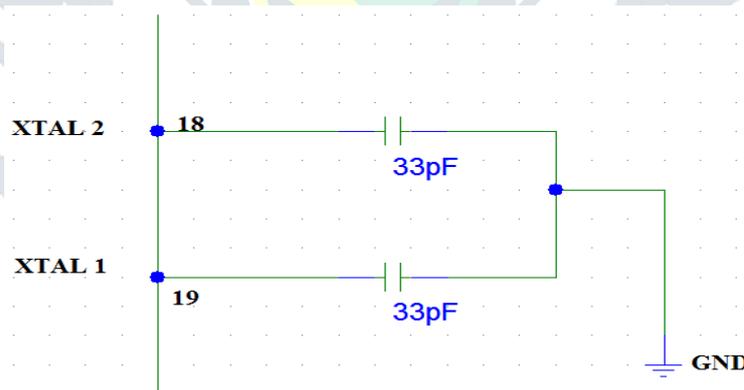.

Fig. 3 Oscillator Circuit of the Microcontroller

3.4 Reset Circuit

Pin 9 is the reset pin. Fig. 4 represents the Reset circuit which is used to reset the microcontroller. That is the hexadecimal format of the program will be initiated from 0000h value. Reset pin will be active high always with 5V. RC coupled circuit and a switch is used for resetting. When the switch is ON the closed circuit will be formed, so that 5V supply will be there in the circuit and vice versa. The capacitor will be discharged slowly.
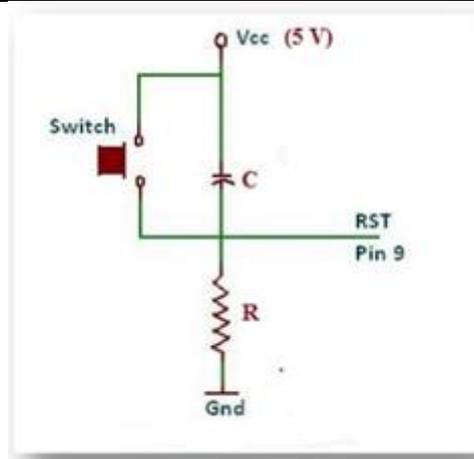
Fig. 4 Reset Circuit of the Microcontroller
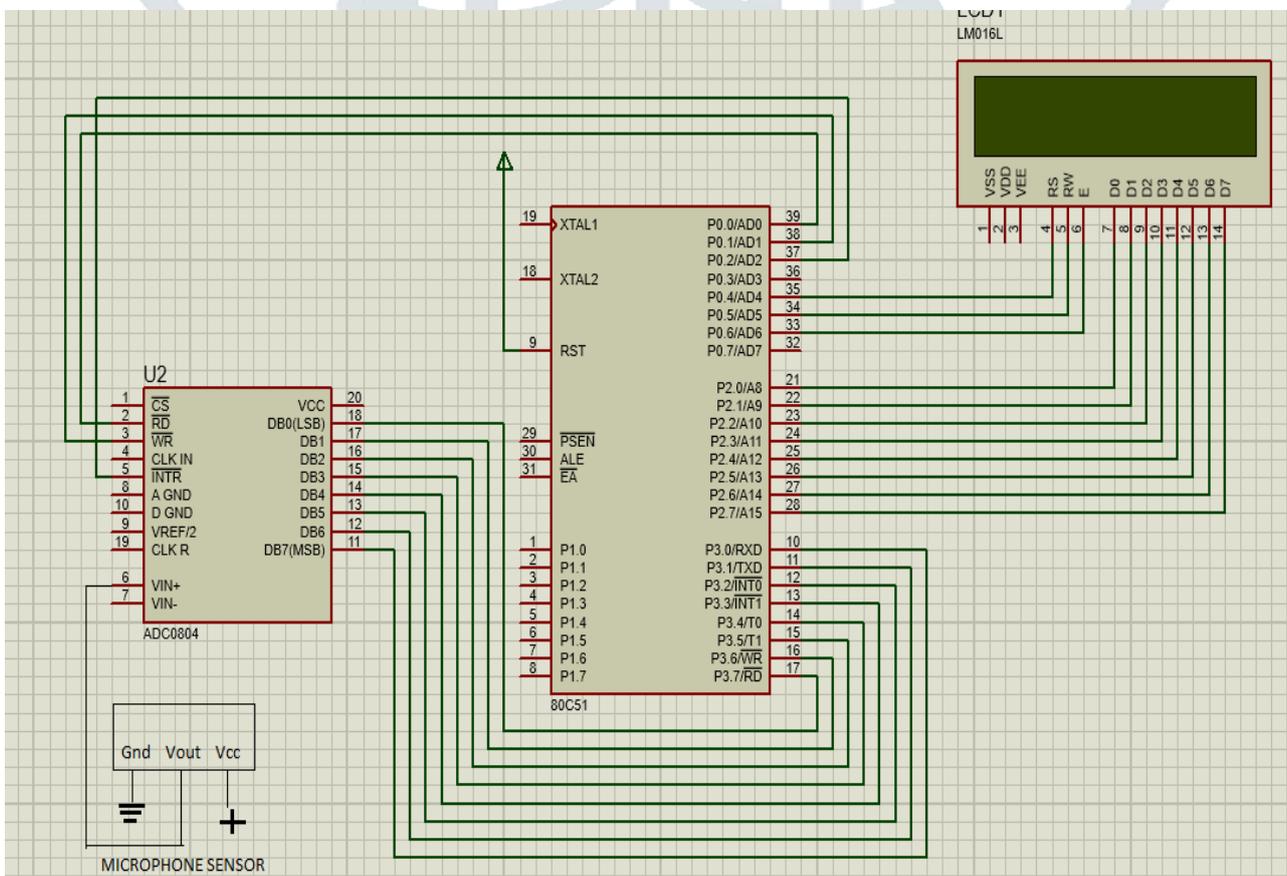
3.5 Schematics of Proposed System

Fig. 5 Schematic Diagram
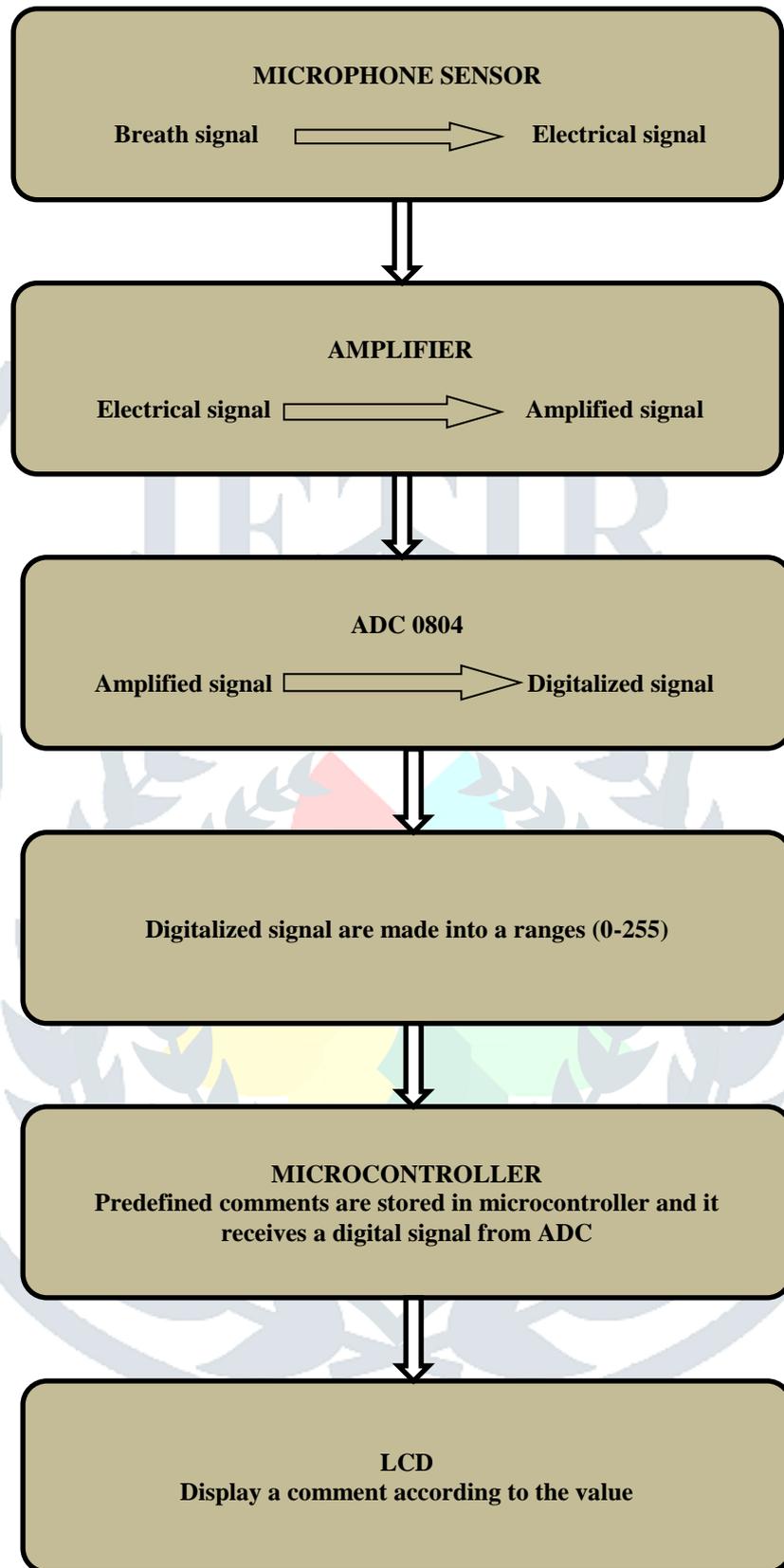
3.7 Flow Diagram of Proposed System

Fig. 6 Flow Diagram of the Proposed System

3.8 Methodology Explanation

Fig.5 shows the schematic diagram of proposed system. The Microphone Sensor Module is working when 5V supply given at the VCC pin. The VOUT pin of the microphone sensor module is connected to the 6th pin of ADC0804 which is analog non-inverting input pin. Here, the analog breath signal is converted into digital signal. Then the data pins from pin 11 to pin 18 of ADC0804 is connected to any one of the ports of microcontroller. The RD, WR and INTR pins are major pin in ADC which is

connected to any one of the ports of 8051. RD pin is used to read the digital signal after conversion. WR pin is used to start the conversion when low to high pulse is given. The data pin of ADC is used for transmitting the digital signal to the 8051 microcontroller. The microcontroller works according to the software loaded. It initially classifies the digital values in a set of ranges and recognizes the phrases/comments suitable for that breath signal. To view the result, output unit is interfaced with microcontroller 8051. The output unit is LCD whose data pin is also connected to 8051. From pin 7 to pin 14 are referred as data pins of LCD. RS, RW and E pins are connected to the ports of 8051. RS is register select pin which contain two registers such as command register and data register. Command register store the command instruction and Data register stores the data that to be displayed on LCD. Enable pin is used to execute the instructions given to LCD. Then the output is viewed by using the two rows of LCD which able to produce 32 characters at a time.

IV. Result and Discussion

4.1 Result

Fig. 7 shows the Microcontroller Developer Board, that is, the 8051 Development board is the major kit used in this system. Microphone sensor and ADC 0804 are operating using the 5 volt supply. The schematic diagram shows the connection of the proposed system.

According to the Fig. 6, the breath signal is picked up with the help of microphone sensor module. The microphone sensor module is operated at the voltage of +5v. It is a transducer that converts sound into an electrical signal. Several different types of microphone are in use, which employ different methods to convert the air pressure variations of a sound wave to an electrical signal. It typically needed to be connected to a preamplifier before the signal can be recorded or reproduced.

The breath signal which is the analog signal is amplified using a preamplifier circuit which is inbuilt with the module which is shown Fig. 8. The pre-amplified breath signal is fed to the amplifier circuit. Then the amplified electrical output is given to the ADC0804. ADC is the analog-digital convertor which converts analog signal into a digital output. It is an electronic device that converts an input analog voltage or current to a digital number representing the magnitude of the voltage or current. Typically the digital output is a two's complement binary number that is proportional to the input, but there are other possibilities. ADC0804 is 8 bit IC which has the output range from 0 to 255.

The digital output from ADC is interfaced with the 8051 microcontroller using any of its port. There are three different circuits used to operate a microcontroller 8051. They are:

- Power circuit
- Oscillator circuit
- Reset circuit

The digital data are stored in any port of microcontroller 8051. The 8bit ADC has the output range from 0 to 255 which is divided into four categories such as 0 to 50, 50 to 100, 100 to 150, and 150 to 255.

Table 1 Status of the breath signal

THRESHOLD	BLOW RANGE
very low	0-50
Low	51-100
Moderate	101-150
High	151-255

Depending upon the blow ranges different types of predefined comments are displayed in LCD. The 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. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. Fig. 9 shows the ADC and LCD interfacing with Microcontroller 8051. Table 1 shows the condition of the breath signal with respect to their blow ranges.
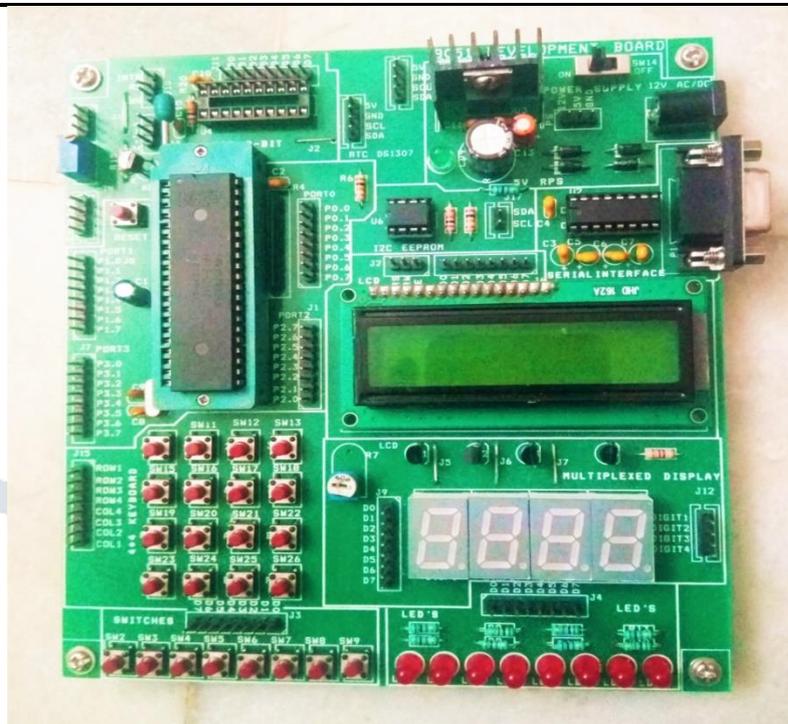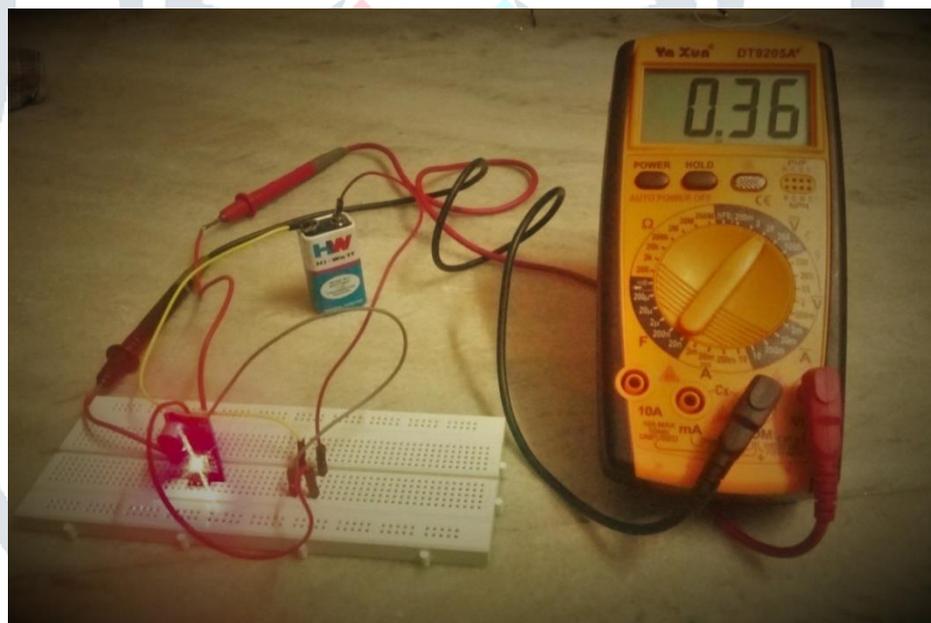
Fig. 7 8051 Development Board

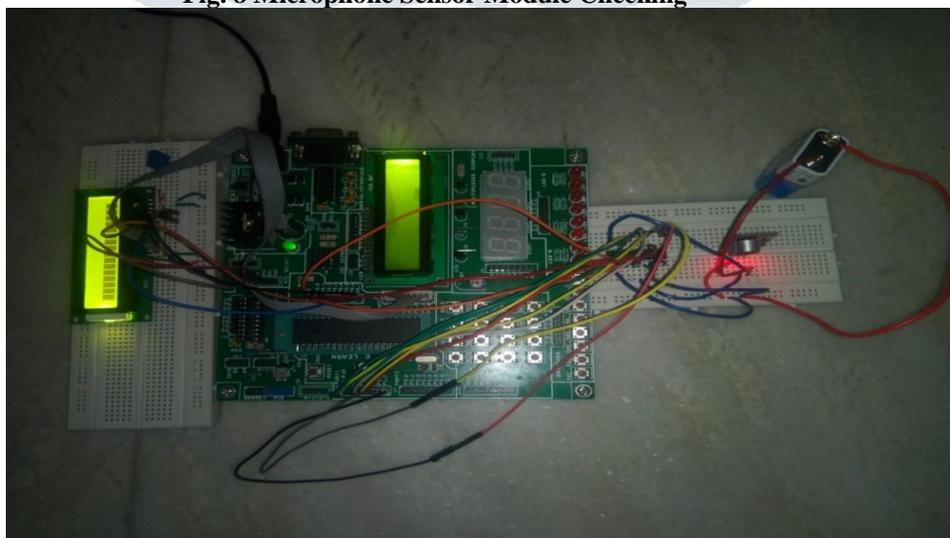**Fig. 8 Microphone Sensor Module Checking**

Fig. 9 LCD, ADC 0804 & Microphone Interfacing with 8051

Table 2 Ranges of Value with Equivalent Phrases

DIGITAL VALUE (in ranges)	PREDEFINED COMMENTS / PHRASES
0-50	WATER
51-100	HUNGRY
101-150	HELP
151-255	EMERGENCY

4.2 Discussion

This project is useful for the persons who are affected by paralysis and dumb people with no loss of cognitive functions. This idea will reduce the stress caused due to the inability of expressing their own thoughts because they can communicate with others using their own breath patterns. It allows the user to control how he or she wishes to communicate effectively enabling them to create their own language by varying the speed of their breathing.

REFERENCES

[1]   B. Ali, S. Munawwar, B. Nadeem, "Electronic Speaking Glove for Speechless Patients", IEEE Conference On Sustainable Utilization And Development In Engineering And Technology, IEEE, pp. 56-60, August 2010.

[2]   Ramon G. Garcia1, Joseph Bryan G. Ibarra, Charmaine C. Paglinawan, Arnold C. Paglinawan, Leonardo Valiente, "Wearable Augmentative and Alternative Communication Device for Paralysis Victims Using Brute Force Algorithm for Pattern Recognition", 2017 IEEE 9th International Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control Environment and Management (HNICEM), IEEE, pp. 1-6, December 2017.

[3]   K.Rajeswari , E.Jeevitha , MR.Meenakshi , V.K.G. Kalaiselvi, "Voice For The Voiceless", The 6th International Conference on Computer Science & Education (ICCSE), IEEE, pp. 504-507, August 2011.

[4]   Aparna P, Mohana priya P, Usha Rani T, Jeba Jaculin B, Pradeep Raja B, "Development of an Assistive Aid for Speech Impaired", International Journal of Scientific and Research Publications, Vol. 2, No. 3, pp. 1-4, 2012.

[5]   I. Bozic, D. Klisic, and A. Savic, "Detection of Breath Phases," Serbian Journal of Electrical Engineering, Vol. 6, No.3, pp. 389-398, 2009.

[6]   Dr.M.Sabrigiriraj, R.K.B.Nirmal Krishna, S.Arun Kumar and A.J.Aashif, " An Electronic Support System for Dumb and Paralyzed Person", Asian Journal of Applied Science and Technology (AJAST), Vol. 1, No. 2, pp. 277-278, 2017.

[7]   TkkrLab, "Microphone Sound Sensor Module, 2016.