International Journal of Engineering and Technology Vol. 1, No. 2, June, 2009
1793-8236

Non Invasive Technique for Identification of Wheezing using Capacitance Sensors

N.R.Shanker, K.Prabakaran, and P.Arul,

***Abstract*—Non invasive method of wheezing detection using a simple and cost effective technique based on capacitance sensing methods, in which the instrument is supported by the software toolkit. The contraction and retrenchment of lungs are recorded using the data acquisition card through the capacitance sensors in the form of signals, at various locations in the lungs region for the breathing pattern signals. The recorded signal is processed using signal analyzing software sigview. The signal captured form the various parts of the lungs are analyzed using statistical signal tools. The statistical parameter gives a deviation in the data for the normal person and the wheezing affected patients. The area of deviation is studied for more number of the subjects from which the unsupervised classifier of wheeze is evaluated. This method of diagnosing the wheeze can replace the high cost tests like pulmonary function test.**

***Index Terms*—capacitance sensor, breathing patterns, unsupervised classifier**

I. INTRODUCTION

Wheezing is an outcome of obstructive noise while breathing. The obstructive sound is of two types namely stridor and Stertor the former may lead to a Harsh higher pitched noise and later leads to a low pitched noise. The noise as a result of wheezing is harsh higher pitched noise, STRIDOR. Stridor is due to Laryngomalacia, deficient cartilage rings and narrowing of trachea during expiration. The noises will bring the change in the breathing pattern. Physician's diagnosis wheezing only by analyzing the result obtains from PFT or Spiro meter test, which are costly. Although the results obtained are accurate, these tests are done only for confirmation of wheezing. So with the sensor based breathing patterns can give the confirmation of wheezing and also to detect the stages in wheezing and condition of the lungs cavities can be examined. Status of the lungs cavities using non invasive can be done at any time and to also to see the performance of the lungs with exact statistical values.

II. .METHODOLOGY

The respiratory sensor working on the principle of Capacitance effect, the sensor is kept in an elastic belt and it is fixed the to subjects. Inhale and Exhale of air in the lungs, for the diffusion of gases in the alveoli. The expanding of the lungs will lead to change in the capacitance sensor due to the distance change between the plates of the sensor. The variable air capacity in lungs can bring the changes in the capacitance sensors. The colpitt's oscillator is the part of sensor for different changes in the capacitance due to change in air capacity in the lungs for its stability. This belt is tied around the chest of the subject. At first locating the center of the belt in the left side of the chest and as the patient's starts for breathing. The signal are recorded as its abdominal cavity expands and contractions during the inhale and exhales. Due to this the voltage variation was observed. This variation of voltage was recorded as the Microsoft wave signal using the sigview software. Initially the sensor is provided with 12V power supply connected to its input terminal. A 2.1 sound card pin was connected at the output terminal of the sensor, which acts as the connection between the sensor and the computer for Data analysis.

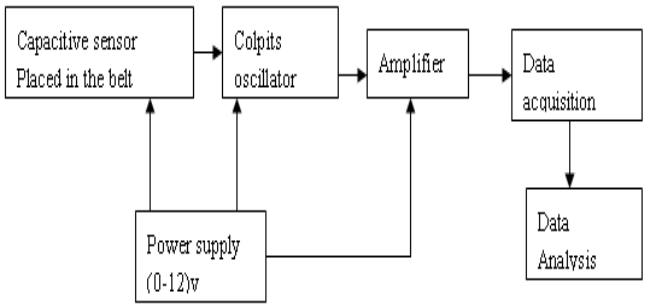

Fig.1Block Diagram for the data acquisition

The signal was recorded for 250 subjects with age normally ranging from 30 to 60, with a mean of (45+/-15 SD) .Similarly the recording of the signals are done with different locations of the patient's body such as right side, back side, abdominal cavity. The signal variation recorded from the back side of the subject will be more clear than recordings from any other locations of the body. Sigview signal analyzing software is used to analyze the signal recorded from the subjects from different location to capture signal in the lungs for statistical analysis. Here we are considering the time as a parameter to analyze the signal. In more specific the RMS value of time of the samples signal are considered and analyzed.

Manuscript received April 13, 2009.This work was supported by Aalim Muhammed salegh Trust.Avadi.
N.R.Shanker is with Aalim Muhammed salegh college of Engineering
Phone:+91449444200777

Fig.2 Photograph of the signal acquisition form the human body

III. RESULTS AND CONCLUSION

From the data analysis of two hundred subjects which includes of both normal and wheezing subject. It is identified from the data analysis of the signals form different locations of the lungs has given the classification as mentioned below. The data analysis of the signal show in figure 3, the first signal is captured form the front side of the lungs right side and the next signal form the left side of the lungs and other two remaining signals are the back side of the body in the left and right region of the lungs of wheezing patients. Similarly in the figure 4 under the same locations signals are analyzed for the normal person. The Root Mean Square values of the corresponding signals are also shown in the Table 4. Still the Databases of more number of subjects can be collected and classification through Neural Network can be done for the fine tuning of result.

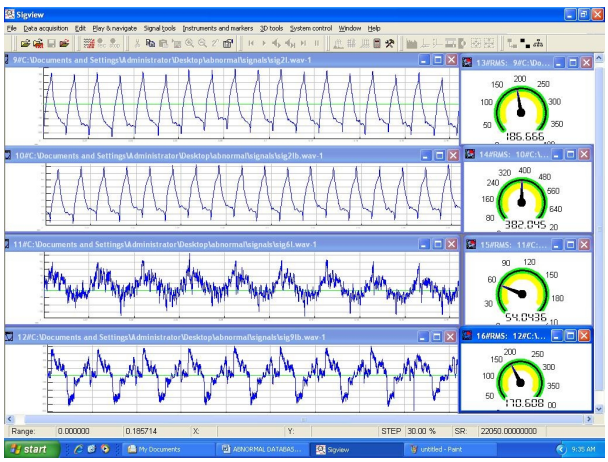

Fig.3 Signals of the lungs form wheezing subject

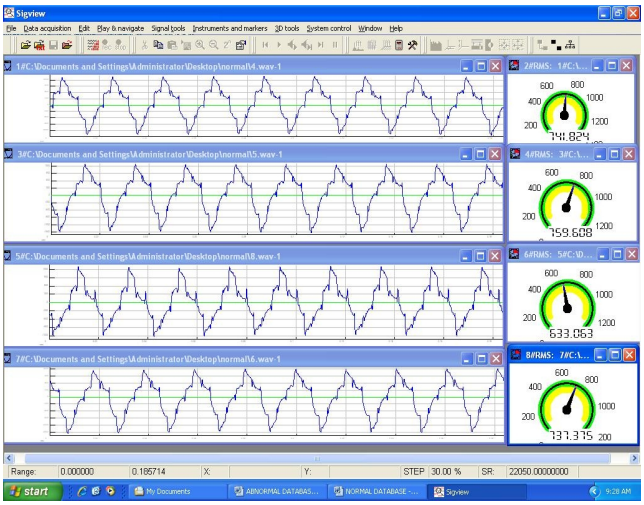

Fig.4 Signals for the normal subject

TABLE1: AVERAGING MEAN VALUES

Sensor Locations	Mild Wheezing	Wheezing	Normal
Right side	16 to 20	10 to 20	20to 24
Left side	8 to10.5	6 to 10.5	10.5 to 14
Right side	11.5 to 13	10 to 13	13 to 20
Left side	1.8 to 2.3	1.5 to2.3	2.3 to 5

TABLE 2: STANDARD DEVIATION

Sensor Locations	Mild Wheezing	Wheezing	Normal
Right side	640 to 648	615 to 648	648 t0 789
Left side	205 to 211	203 t0 211	211 to 234
Right side	196 to 202	193 to 202	202 to 220
Left side	49 to 52	45 to 52.5	52.5 to 68

TABLE 3: CREST FACTOR

Sensor Locations	Mild Wheezing	Wheezing	Normal
Right side	2.91 to 2.94	2.86 to 2.94	2.94 to 3.1
Left side	2.15 to 2.18	2.09 to 2.18	2.18 to 2.25
Right side	1.88 to 1.9	1.82 to 1.9	1.9 to 1.95
Left side	2.92 to 2.98	2.72 to 2.98	2.98 to 3.12

TABLE 4: RMS VALUES

Sensor	Mild	Wheezing	Normal

Locations	Wheezing		
Right side	248 to 259	208 to 259	259 to 320
Left side	172 to 178	142 to 178	178 to 190
Right side	197 to 201	176 to 201	201 to 256
Left side	286 to 294	237 to 294	294 to 382

ACKNOWLEDGEMENT

Aalim Muhammed salegh College Of Engineering, I.A.F, Avadi, and Chennai-55 fund this project. The authors of this paper are gratefully to acknowledge the Founder and Chairman Janab Dr. S. M. ShaikNuruddin, Corresponded Janab S.Segujamaludeen, and the Managing trustee Shaik Athaullah of Aalim Muhammed salegh college of Engineering, I.A.F., avadi Chennai.-55.

REFERENCE

[1] Eddy Current Based Flexible Sensor for Contactless Measurement of Breathing Alex Richer, Andy Adle, School of Information Technology and Engineering, University of Ottawa, Ontario, adaadler@site.uOttawa.ca

[2] *http://www.transmitter.com/*

[3] *www.**lung**usa.org/**diseases**/*

[4] *www.healthinsite.gov.au/topics/**Lung_Diseases***

Shanker.N.R., completed Bachelors degree in Electronics and Communication Engineering(1998) from Madras University, Chennai, India. Masters degree in Remote Sensing (2003) form Anna University, Chennai, India. Perusing PhD degree in Anna University Chennai, India. Presently working as a Asst.Professor in Aalim Muhammed Salegh College of Engineering, I.A.F., Avadi, Chennai.

Prabakaran .K., completed Bachelors degree in Electrical and Electronics Engineering (1997) from Madras University, Chennai, India. Masters degree in Energy Engineering(2004) fr om VIT university, Vellore, India. His area of interest is Embedded Systems, Energy Management Presently working as lecturer in Aalim Muhammed Salegh College of Engineering

P.Arul, Completed his Bachelors Degree in Electronics and Communication Engineering, from Madurai Kamarj University, Maduri.Masters Degree in Medical Electronics, AnnaUniversity, Chennai-25, Presently working as lecturer in Aalim Muhammed Salegh College of Engineering