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Earlier Detection of Sinusitis in Breathing Signals Using TMS32050 Processsor

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Abstract: The diagnosing system for sinusitis in a human being consists of a simple system that includes a Digital Signal Processor TMS320C50. A respiratory signal is caputered by the breathing sensor and it is given as an input to the digital signal processor for the fast fourier transform computation, the output of the digital signal processor output is been plotted using the signal analysis software sigview. From the signal anlysis software the statistical parameters are calculated for the subjects for the identification of the sinusitis and they are compared with statistical values of a normal person. Any change beyond these normal statistical values then indicates the presence of sinusitis. The peculiarity of this system when compared to others is that it makes an early detection of sinusitis in the affected person.

Key words: Detection · Sinusitis · Breathing Signals · TMS32050 Processsor

INTRODUCTION

Sinus is a condition, which cannot be identified earlier. A severe headache, neck pain, cold, cough, sneezing and tiredness are the basic symptoms of sinus. One cannot tell confidently if the condition prevailing is sinus or not, without taking the X-ray or CT scan. Normally one takes it to be common cold and takes antibiotics for relief, but there will be no good relief, hence the doctor is approached. The doctor advises to take an X-ray to identify the condition, which is an expensive procedure. A simpler and cost effective way for early detection of sinusitis is done using DSP Processor. Among adults ages between 30 to 60 years, 24% of males and 9% of females present sleep disordered breathing (SDB) conditions [1], while 82% of males and 93% of females with moderate to severe SDB remain undiagnosed [2]. SDB symptoms are loud snoring, excessive daytime sleepiness and observed pauses in breathing. Usually, the patients are not aware that they are exhibiting these symptoms can remain undiagnosed for SDB. Untreated SDB can lead to adverse health and behavioral changes, including hypertension, day-time hypersomnolence, low cognitive performance, metabolic syndrome and stroke [3-7]. Furthermore, the sleepiness and fatigue increase involved SDB patient in workplace and traffic accidents [7], [8]. Studies show undiagnosed SDB patients using twice as many health care facilities for comorbidities of SDB prior to the diagnosis of SDB than geographically matched controls [9]. Due to its high prevalence, serious health consequences and the diagnosis difficulty, SDB has become a public health care concern. The SDB pathological occurs via full or partial multiple episodes reduction of respiratory flow. SDB events coincide with blood oxygen saturation and/or an EEG arousal reduction. The SDB diseases standard test, polysomnography (PSG), requires multiple physiological measuremalests to be recorded during a full night's sleep to assess breathing and sleep. PSG is labor intensive, time consuming and expensive, thus it is impractical as a screening test. A number of screening techniques have been proposed using measuremalests of blood oxygen saturation, thoracic movemalest, snoring and airflow measuremalests [11-13].

In recent years, a number of single-channel airflow measuremalest-based methods have been developed for home-based automated assessmalest of SDB [13-16]. For greater reliability, features used in automated scoring algorithms need be relatively invariant to both 1) nonstationarity in breathing during sleep such as the variability present in rapid eye movemalest sleep stage and 2) Due to sensor movemalests intrumalestation introduced nonlinear transformations signals [17]. The respiratory rate and the peak amplitude variation features may fail to identify SDB events due to nonstationarity and nonlinearity, respectively. Many studies do not report the

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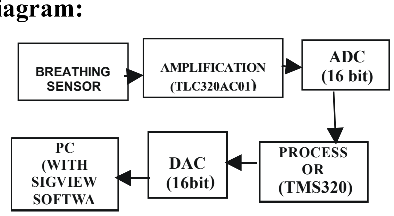
algorithms used for the diagnosis [14-16]. A recent study done by Nakano *et al.* [13] measure three channel malests, namely, thermal sensors, thermocouples and nasal pressure (NP), to detect data segmalests containing SDB events. Each channel taken one at a time provided reported sensitivity/specificity values of 96%/76%, 88%/80% and 97%/77%, respectively. The algorithm developed by Nakano *et al.* uses power spectral analysis to express variation in the signal amplitude.

Depiction: The system consists of the following major units: Sensing unit: It consists of a breathing sensor. Amplification unit: The IC TLC320AC01 in the DSP processor is used for amplification purpose. Conversion unit: 16-bit ADC and DAC of the DSP processor. Processing unit: The IC TMS320C50 in the DSP kit is used for processing and software for analysis (SIGVIEW). Display unit: It is used to view the final output and showcasing the severity of sinusitis in the affected person.

MATERIALS AND METHODS

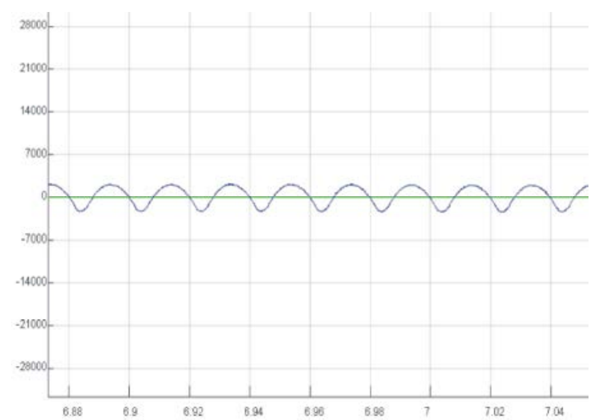
The breathing sensor is placed near the nostrils and the breathing signal of the sample is fed to the processor and the FFT program is run. The DSP TMS320C50; through the analog input port takes the breathing signal as input. This signal is feeble so the TLC320AC01 chip amplifies the input signal. This amplified signal is then converted to digital signal using the 16bit ADC. Now the digital signal is processed with FFT in TMS320C50. This signal is converted to analog form using a 16bit DAC. The processed FFT signal is then analyzed using the SIGVIEW software in the PC. Mean of the analyzed signals of various samples with different severity of sinusitis is taken and these values are compared with the mean value of the normal person and classification is done.

Block Diagram:



Illustrations: In the cranial(head) bones we found Sinuses paired air cavities/spaces (pockets). Sinuses are also stated as "paranasal sinuses" Depending sinus cavities locations. There are four types: 1) Ethmoid sinuses: These sinus cavities present between the eyes and grow with person age. 2) Frontal sinuses: These sinus cavities are located above the eyes in forehead region and develop around seven age years. 3) Maxillary sinuses: Maxillary sinuses found either nostrils in the cheekbones and present at birth also grow as we grow. 4) Sphenoid sinuses: These sinus cavities lie behind the ethmoid sinuses and the eyes. It develops during adolescence. Depending the sinusitis severity there are two types: Acute sinusitis and Chronic sinusitis. A vital infection cause usually Acute (sudden) sinusitis and often develops rapidly for 4 weeks or less. A bacterial or fungal infection cause chronic (long-term) sinusitis and may be difficult to treat for longer. The FFT program is run in the Kit using Topview Debugger and the data acquisition is done using SIGVIEW software.

Sample Recording using SIGVIEW software from the Breathing sensor:



The data acquisition window is opened in SIGVIEW software and the recording time period is set. The input signal is then recorded using the record option. The FFT spectrum of the processed signal is plotted using signal tools from the menu bar. Using Instruments and markers tool the mean of the signal is calculated. A database is created using the results of different samples. From the database a classification is done and the range for normal and sinus affected person is determined.

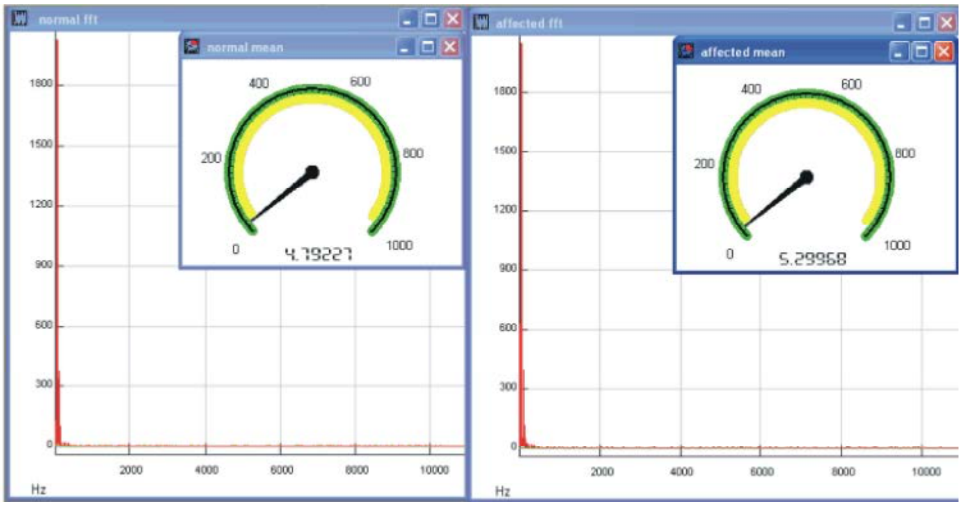


Figure: FFT and Mean plots for the normal person and the sinusitis person

CONCLUSION

The sensitivity of the sensors input to the processors is very high, since we use the dsp processor, the instrument is less cost, when compared to the existing systems like CT scan, ray machines, This instrument also detects the low frequency signals for the analysis. The result execution is also very fast. The instrument is also an user-friendly equipment. On a database of 100 subjects, the following results are categorized into two: normal and sinus affected between the age of 21-25. Still the instrument can be programmed for the wavelet transform for identification of the other diseases

Condition	Mean
Normal	4-5
Sinusitis	Above 5

REFERENCES

1. Young, T., M. Palta, J. Dempsey, J. Skatrud, S. Weber and S. Badr, 1993. "The occurrence of sleep-disordered breathing among middle-aged adults, " N. Engl. J. Med., 328(17): 1230-1235.
2. Young, T., L. Evans, L. Finn and M. Palta, 1997. "Estimation of the clinically diagnosed proportion of sleep apnea syndrome in middle–aged men and women," Sleep, 20: 705-706.
3. Nieto, F.J., T.B. Young, B.K. Lind, E. Shahar, J.M. Samet, S. Redline, R.B. DA´ gostino, A.B. Newman, M.D. Lebowitz and T.G. Pickering, 2000. "Association of sleep-disordered breathing, sleep apnea and hypertension in a large community-based study, " *JAMA*, 283: 1829-1836.
4. Guilleminault, C., R. Stoohs, A. Clerk, M. Cetel and P. Maistros, 1993. "A cause of excessive daytime sleepiness. The upper airway resistance syndrome, " Chest, 104(3): 781-787.
5. Fulda, S. and H. Schulz, 2001. "Cognitive dysfunction in sleep disorders, " Sleep Med. Rev., 5(6): 423-445.
6. Peker, Y., J. Hedner, H. Kraiczi and S. L¨oth, 2000. "Respiratory disturbance index is an independent predictor of mortality in coronary artery disease," Amer. J. Respir. Crit. Care Med., 162: 81-86.
7. Krieger, J., N. Meslier, T. Lebrun, P. Levy, F. Phillip-Joet, J.C. Sailly and J.L. Racineux, 1997. "Accidents in obstructive sleep apnea patients treated with nasal continuous positive airway pressure-A prospective study," Chest, 112: 1561-1566.
8. Krieger, J., W.T. McNicholas, P. Levy, W. De Backer, N. Douglas, O. Marrone, J. Montserrat, J.H. Peter and D. Rodenstein, 2003. "Public health and medicolegal implications of sleep apnoea," Eur. Respir. J., 20(6): 1594-609.
9. Ronald, J., K. Delaive, L. Roos, J. Manfreda, A. Bahammam and M.H. Kryger, 1999. "Health care utilization in the 10 years prior to diagnosis in obstructive sleep apnea syndrome patients, " Sleep, 22(2): 225-229.
10. "Sleep-related breathing disorders in adults: Recommendations for syndrome definition and measurement techniques in clinical research. The report of an American Academy of Sleep Medicine Task Force, " Sleep, 22: 667-689, 1999.

11. Flemons, W.W., M.R. Littner, J.A. Rowley, P. Gay, W.M. Anderson, D.W. Hudgel, R.D. McEvoy and D.I. Loube, 2003. "Home diagnosis of sleep apnea: A systematic review of the literature. An evidence review cosponsored by the American academy of sleep medicine, the American college of chest physicians and the American thoracic society, " Chest, 124: 1543-1579.
12. Abeyratne, U.R., A.S. Wakwella and C. Hukins, 2005. "Pitch jump probability measures for the analysis of snoring sounds in apnea," Physiol. Meas., 26: 779-798.
13. Nakano, H., T. Tanigawa, T. Furukawa and S. Nishima, 2007. "Automatic detection of sleep-disordered breathing from a single-channel airflow record," Eur. Respir. J., 29: 728-736.
14. Shochat, T., N. Hadas, M. Kerkhofs, A. Herchuelz, T. Penzel, J.H. Peter and P. Lavie, 2003. "The SleepStrip: An apnoea screener for the early detection of sleep apnoea syndrome, " Eur. Respir. J., 19: 121-126.
15. De Almeida, F.R., N.T. Ayas, R. Otsuka, H. Ueda, P. Hamilton, F.C. Ryan and A.A. Lowe, 2003. "Nasal pressure recordings to detect obstructive sleep apnea, " Sleep Breath, 10: 62-69.
16. Erman, M.K., D. Stewart, D. Einhorn, N. Gordon and E. Casal, 2007. "Validation of the ApneaLink*T M* for the screening of sleep apnea: A novel and simple single-channel recording device, " J. Clin. Sleep Med., 3(4): 387-392.
17. Redline, S., R. Budhiraja, V. Kapur, C.L. Marcus, J.H. Mateika, R. Mehra, S. Parthasarthy, V.K. Somers, K.P. Strohl, L.G. Sulit, D. Gozal, M.S. Wise and S.F. Quan, 2007. "The scoring of respiratory events in sleep: Reliability and validity, " J. Clin. Sleep Med., 3(2): 169-200.