SOUND RECOGNITION USING DEDICATED MICROPROCESSOR ARCHITECTURE

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Abstract. In this paper we present a novel approach for a healthcare monitoring system. The proposed system use a hierarchical monitoring of the patient health using wearable devices and a signal array PsoC embedded in a system architecture. Patterns are analyzed using filtering and wavelet decomposition. Abnormal situation are send using Internet communication card and TCP/IP stack that are part of the system architecture. Signal processing is made locally using wavelets and personalized statistical approach.

Keywords: lung sound, PsoC, e-health, wavelets, respiratory dysfunction

INTRODUCTION

The e-health and monitoring system offer the advantage to have a temporary or permanent connection beween medic and the pacient with no absolutely necessary transportation from home or other institutions to medicin's office. This is the moste frequent case in the rehabilitation after a surgical intervention or due to aeging of the patient.

The most common signals that are monitoring in e-healt are the Electrocardiogram (ECG), the Hearth sounds and lung sounds [6]-[7]. Other signals are usually subject to specialized conditions and qualified medical personal. In the recent years solutions for monitoring have been proposed using more or less sophisticated system architectures.

Hung [4] proposed to use a remote patient monitoring using Bluetooth™-based ECG monitor.

Brown [1] developed a system for obesrvation of lung sound using a Personal Computer (PC). A PC, signal conditioning system, pneumotachograph and chest microphone was used in order to detect crackles and wheezes. A system using PC also and LABVIEW has been proposed in [9].

We propose a system that use wavelet patterns extracted fom lung sound in order to detect respiratory disfunctions. Respiratory disfunctions are singaled both to patient a remote medic via Internet device. The experimentally results showed an accuracy of 65% acuracy with 5% ambigous case.

EXPERIMENTAL

Microphones with coupling chambers and accelerometers are usually used for lung sound measurement. Lung sound was acquired with microphone in this stage. The Morlet, Daubechies, and Meyer family of wavelets have been used in our experiments.

The implementation of wavelet patterns in mixed signal array PsoC [10] are made by linear approximation using tabels. The PsoC has a configurable architecture includin module with different functionality. The real-time operating sistem include in this embeded device offer primitived that are used by ouar aplication software in TCP/IP communication protocol.

We used a simple signal, conditioning system, a simple FIR filter in this stage. More complex filters with good results [3]-[5] are difficult to implements using a low cost device.

RESULTS AND DISCUSSION

The experimentally results showed an accuracy of 65% accuracy with 5% ambiguous case. In fact, we used 20 cases with 5 measurement each, 11 subjects with 3 different respiratory dysfunction and 9 subjects with no respiratory problem.

The classifier based on SVM (support vector machine algorithm) that make discrimination among fourth cases (healthy, crackle, wheeze and asthma) is in progress.

The respiratory signal difer from person to person. The signal depends on the age of the subject and even for the same person the signal presents difference according cronobiological rithm. A personalized monitoring system needs a database enough large that include all theese variations. The flash memory cannot store this large amount of information, so the connection with a remote PC is necessary.

CONCLUSIONS

We proposed an implementation of low cost monitoring system using PSoC as minimal allert system. The system produced satisfactory results but the accuracy should be improved. Separation of the lung sound from hearth sound is in progress. A complex sound analyse require more resources that make the system costly.

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