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Signal Processing Platforms and Algorithms For Real Life Communication

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Abstract: Design of modern electronic communication systems involves diversified scientific areas including algorithms, architectures, and hardware development. Variety of existent multimedia devices gives rise to development of platform-dependent signal processing algorithms. Their integration into existent digital environment is an urgent problem for application engineers. Signal processing plays a key role in the evolution of modern technological breakthrough in almost all disciplines. We resort to automated processing and analysis techniques to aid our day to day activities with the emergence of various facilities; advanced signal processing has become ever increasingly important for low complexity, low power and efficient physical implementations of future products. Real time applications utilizing such benefits have become an integral part in one's life. The state of the art techniques that has led to such an evolution is therefore of outmost importance. With this in view, the notable contributions made in the field of signal processing should be given priority in order for this trend of research and development to be in process.
Keywords – Digital Environment, Signal Processing, Algorithms, Architectures.

I. INTRODUCTION

Signal Processing is one of the fastest growing fields of technology and computer science in the world, with typically a growth rate in excess of 30%. The growth of the computer industry has affected every corner of daily life and everyone is aware of this effect. In today's western world almost everyone uses DSPs in their everyday life, but unlike users of PCs almost no one knows that they are using DSPs. Digital Signal Processors (DSPs) are special purpose microprocessors and they are used in every form of electronic product, from mobile phones and CD players to the automotive industry; medical imaging systems to the electronic battlefield and from dishwashers to satellites. The some of the applications are

- Speech modeling, analysis, and synthesis, Signal processing for hearing aids and natural hearing, Text-to-speech synthesis, Speech-based assistive technologies, Hardware platforms for real-time signal processing
- Consumer Electronics (watermarking for copyright protection, speech recognition, image enhancement)
- Military (target tracking, detection)
- Finance (risk minimization, pricing)
- Medicine (computer-guided procedures, medical image analysis for diagnostic purposes)
- Law Enforcement (superresolution of low-quality video from surveillance cameras, signal enhancement)

II SIGNAL PROCESSING IN REAL TIME APPLICATIONS

There are many reasons why we process these analog signals in the digital world (or domain) but these can all be reduced to two primary reasons, which are : Cost - DSP systems are almost always cheaper than analog. Functionality - DSP systems can perform many operations that are impossible in the analog world.

WEARABLE SENSOR SYSTEMS FOR INFANTS

Continuous health status monitoring of infants is achieved with the development and fusion of wearable sensing technologies, wireless communication techniques and a low energy-consumption microprocessor with high performance data processing algorithms.

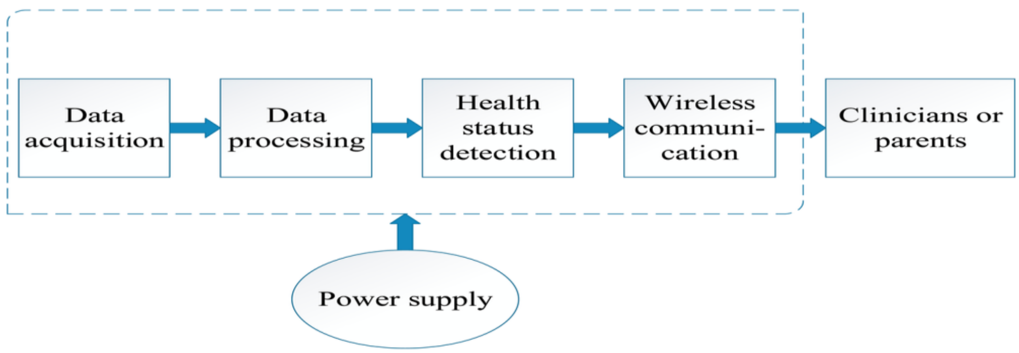

Fig1 block diagram of wearable sensor

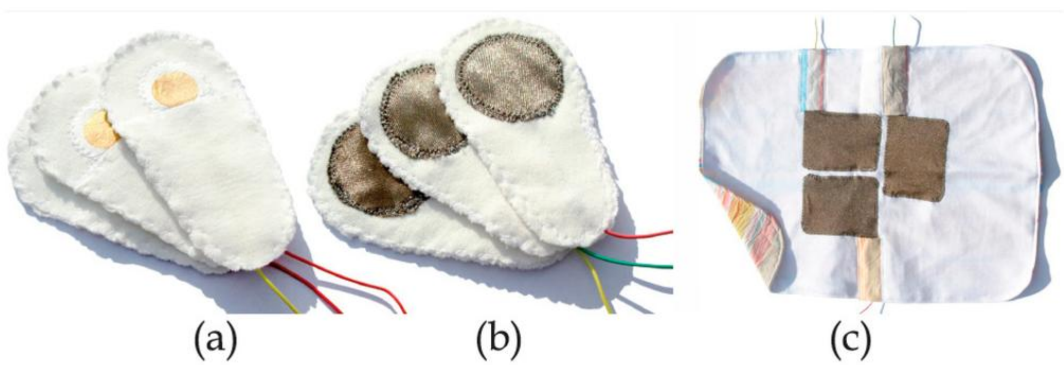

Fig2_Wearable sensor

IMAGE COMPRESSION

82 The FBI has approximately 30 million sets of fingerprints (300 million fingers) which need to be stored, and 40,000 new sets arrive every day. These papers, stored in file cabinets, used to occupy a whole floor in the FBI building. Digitized at 500 dots per inch, the eight-bit grayscale image of a single fingerprint can be as large as 10Mb. Electronic storage of this data base would therefore require roughly three million Gb. An effective image compression algorithm is

needed. A key requirement for any such algorithm is that it must preserve all the image features which are required by law enforcement experts in order to identify a fingerprint. The FBI fingerprint compression standard uses wavelets, resulting in acceptable image quality at compression ratio of about 15.

WEARABLE SENSING OF HUMAN PHYSIOLOGICAL SIGNAL

Wearable sensing of human physiological signals is becoming an essential part of nowadays monitoring systems [1–3] (see references in the same issue of the IEEE EMB Magazine), [4–8]. These revolutionary systems should allow clinicians, physiologists, psychologists, social institutions and people themselves to have access to a lot more information on the human body function than ever before.

FIG 2. SMART TEXTILE

A communication channel is established between the on-body electronics (which centralize and process the data from different nodes) and a mobile 'phone. The communication is performed using Bluetooth, since this technology is widely available on current GSM phones.

Electrocardiogram (ECG) is one of the most relevant biological signals: the heart beat rate (HR) is easily extracted from the ECG and the continuous evolution of the ECG waveform is used to diagnose several cardiac disorders.

Knowledge of the activity being performed by the monitored subject is crucial for the correct interpretation of ECG variability: while a sudden increasing heart rate should generate a tachycardia alarm during resting periods, it should not be specially handled during sport activities. An automatic activity classification algorithm is therefore mandatory for the segmentation of cardiac data and for supporting alarm generation.

Based on the data obtained by a single-axis accelerometer embedded in the on-body electronics, the algorithm provides a continuous classification of the activity and estimates an index of activity intensity. The activity classes being currently recognized are: resting, lying, walking, running and going up/downstairs.

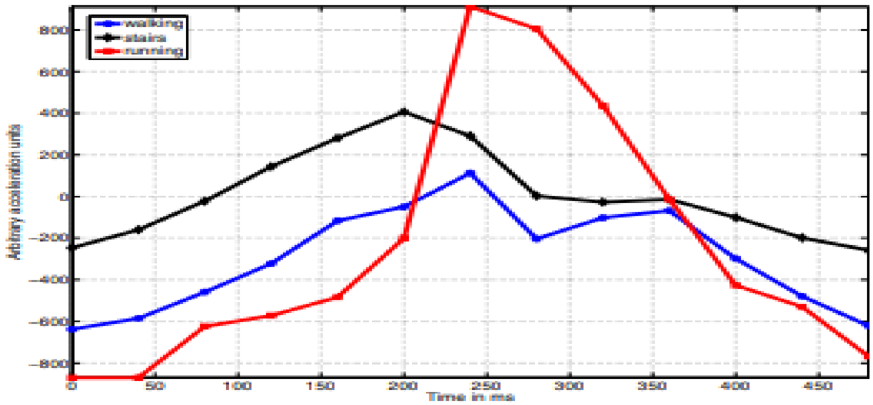

Fig.3 Some basic acceleration patterns of human motion: walking, running and going upstairs

BODY SENSOR NETWORKS

Monitoring systems sensing human physiological signals relying on wearable sensing are currently being developed by many organizations. Wearable systems have several advantages compared to standard monitoring approaches: these include better sensor placement and an increased number of sensors without compromising garment comfort.

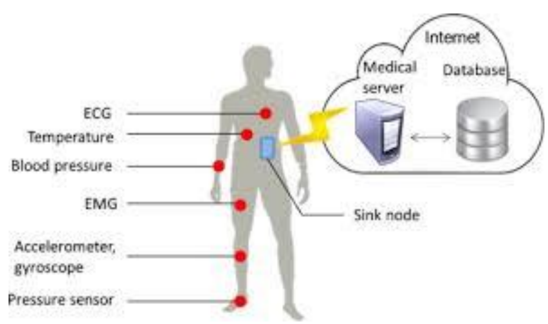

Fig.4 Body Sensor Networks

One of the main advantages of body sensor networks on sensorized garments is that sensor modules can be supplied with power from a single centralized source, avoiding the presence of several distributed batteries. Moreover, onbody communication can be performed over a "wired" network. The sensor nodes can therefore be reduced in size, since they require neither a local battery [2] nor an additional wireless communication module.Compared to conventional point to point links, network-based solutions exhibit several further interesting advantages [1]

CONCLUSIONS:

The medical and technical potential of smart clothes in the field of 24h monitoring has been presented in this work. After defining the specifications required by a network of several distributed body-sensors, two medical applications to such architecture have been exposed: the processing of the textile-ECG and the classification of continuous motion activity. Wearable sensing is far from being mature and needs lots of improvements concerning the power distribution and the ergonomics of the systems. User functionality performances and clinical relevance of the extracted information will impinge on the final market potentials, rather than the individual sensor technical performances.

Communication between wearable units is largely governed by the special needs of signal processing of sensory information. If there are adequate solutions running on wires, existing wireless solutions do not comply with the requirements. Even in the case of wireline solutions, some progresses should be made to reduce further the power consumption and cope with the special nature of fabric embedded connections. This paper has shown the emerging technological architectures, possibilities and limitations of wearable biosensing. Without doubts, within 5 to 10 years, some of these systems will become available on the market, and CSEM is aimed at playing a central role concerning the electronic and signal processing in wearable biosensors and system

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