A CRITICAL REVIEW OF DESIGN OF ECG ACQUISITION AND HEART RATE MONITORING

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ABSTRACT:

Aging of human beings is expected to cause a significant increase in medical expenses in the next years. In the European Union, for instance, the population over 60 years will be around 60 million people in 2020 and medical expenses are expected to grow from 9% to 19%. Other regions are also expected to follow similar trends. This scenario has fostered the development of many novel techniques for noninvasive physiological monitoring intended to perform periodic measurements of basic physiological parameters at home or in other non-clinical environments. These parameters have been proven to be very valuable to assess individual wellness and a long term analysis of this kind of data has been proven to be of great help in preventing possible future disorders and diseases and consequently in reducing the overall medical costs these techniques can allow a more frequent supervision of patients with health troubles or also can allow patients to make part of the hospitalization at home, hence reducing the hospital occupancy and improving their quality of life. A extensive review has been done in this paper by author and suggested plastic wheel wireless heart monitoring system.

KEYWORDS: Heart rate monitoring, plastic steering wheel, ECG analysis etc.

INTRODUCTION:

A sample picture of the wireless node prototype is shown in Fig. 1. Four dry stainless steel electrodes are mounted in pairs on a plastic wheel according to the dual ground configuration. In this configuration, a ground electrode is placed very close to each of the two recording electrodes. Using this configuration has the advantage of a reduced 50/60 Hz interference with respect to the typical three electrodes configuration for the Lead I ECG, which uses one ground electrode placed in the right leg. Furthermore, this configuration has the key advantage of allowing us to acquire the EGC signal simply by placing the left and right hands on the electrodes with no right-leg electrode and without any previous preparation procedure, as required for the easy-to-use method presented.

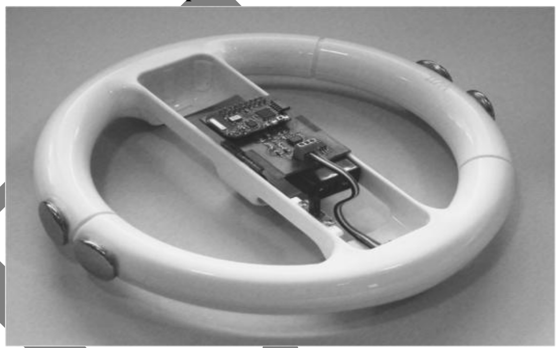

Fig. 1. Steering wheel wireless node prototype

Prevention is especially critical for cardiovascular diseases and electrocardiogram (ECG) is the most undisputed and widely accepted tool to detect and diagnose them. Apart from their enormous impact in older people life expectancy, cardiovascular diseases are also the main cause of death for the population among 44 and 64 years and detecting their symptoms in time is critical to avoid irreparable damages or death. Never the-less, methods and systems to acquire an ECG signal with good enough quality in a fast and easy-to-use manner, so that they can be used in domestic or other non-clinical environments, are nowadays far from common. The reason behind, is because conventional ECG acquisition systems usually require the use of several cables and electrodes attached to the body, sometimes with conducting gel to increase the contact, making them embarrassing and difficult to use.

LITERATURE SURVEY:

I. Korhonen, J. Parkka, and M. Van Gils: In this paper author has discussed the health monitoring as potential application field using wearable sensors. Author has also presented various models for monitoring of health and discussed all the detail technical requirements for health monitoring based on ambient sensor or wearable technology. The wearable technology and ambient are proven to be useful for measurement of health related data in day to day life and its users and patients. The sensors can also be equipped with remote monitoring which make it unique and that has become possible as smart phones are in everyone's hand. This technique will be frequently used by all the users worldwide in day to day life in coming days.

M. Ishijima: Monitoring of important signs for older people in home is very important electrocardiogram (ECG) or even respiratory system behavior throughout day. Monitoring of ECG and respiratory systems is very important it helps in locating undetermined or acute disorders before they become fatal. According to research based in this paper many health monitoring devices can be mounted on the appliances and furniture, this are the some devices comes directly in contact with human body without any obstruction in everyday in everybody's life. The data gathered by this method is not pure needs to apply statistical and data filtering methods to obtain desired results.

A. Searle and L. Kirkup: Various ways for the traditional wet electrode types are mostly sought in medical field for the use of physiological research, this is done in order to achieve long time records of biosignals is required. Author in this paper given a comparison of different three types of bio electrode namely 1. Wet 2. Dry and 3. Insulating. The comparison is made is done after carrying out few tests on all three types of electrode, tests involves static interference, motion artifact induced by various means and electrode impedance. Data for three types of electrodes is collected simultaneously. The same environmental conditions are maintained for all three types of electrode while carrying out the tests. Author has commented on the basis of obtained results the performance of dry and insulating electrodes are much better than wet electrodes.

PRESENT THEORIES AND PRACTICES:

Traditional ECG acquisition systems usually require the use of several cables and electrodes attached to the body, sometimes with conducting gel to increase the contact, making them embarrassing and difficult to use. Furthermore, most of these systems have the additional drawback of being unable to transmit or store digitized data. Some of these problems have been reduced in the recent times by implementing wireless ECG systems. Nevertheless, as most of these systems are designed to be worn on the thorax, they require considerable preparation time and skill to acquire the ECG signal. ECG signal monitoring. Incoming Signals are provided by limb leads only R- Arm, L- Arm, R -Leg and L- Leg. Amplitude dispersion medians are in range 5 to 30 micro volts, being significantly lower than ECG wave amplitude medians. Special analysis of such low amplitude signals (ECG fluctuation) ensures the reliable identification of slight deviations in myocardium polarization and re-polarization processes. This analysis is related to ECG (electrocardiogram) fluctuations with myocardial metabolism.

Monitoring of ECG fluctuations provides indirect conditional assessment of antioxidant systems, electrolyte shifts, ATP (adenosine triphosphate) concentration and other parameters of metabolism as an integral coefficient of metabolic changes. The change of this coefficient allows determining even a minor disorder of myocardial depolarization and repolarization processes which are not available in other methods of ECG analysis.

In DM (dispersion mapping) technique of ECG analysis even minor disorders are effective indicators of pathological changes of myocardium which are not sufficiently expressed in conventional ECG characteristics. As a result of such analysis you will get a map, showing deviations of low-amplitude characteristics with amplitude of such deviations and their presumable location by parts of the heart.

HEART RATE TECHNIQUE IMPLEMENTATION:

The heart rate detection algorithm will be implemented based on the use of the CWT. Wavelet analysis, continuous or discrete, has been applied to ECG signals, among many other purposes, to obtain the heart rate. The more recently developed wavelet based algorithms overcome some of the drawbacks of the classical detection algorithm such as the differences on QRS frequency bands between users and the overlap of noise on the same frequency bands of the signal. The new algorithm proposed is specially suited to the particularities of acquired signal in the wireless steering wheel, which is an EMG noise and baseline wander levels higher than in traditional systems.

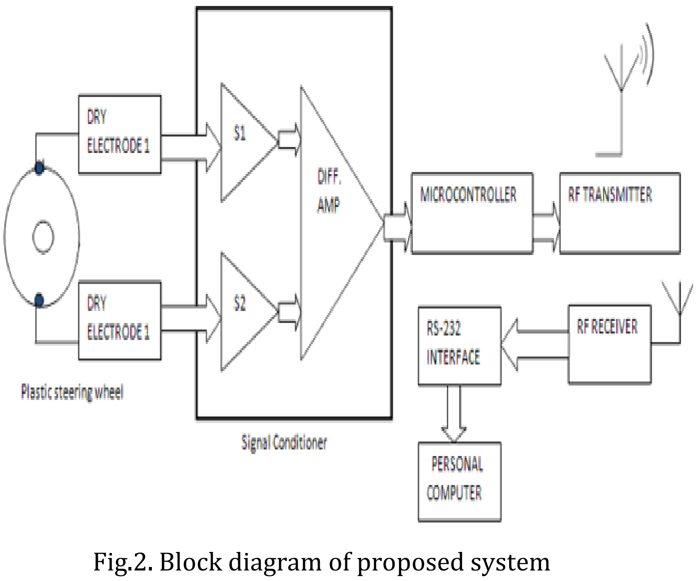

Fig.2. Block diagram of proposed system

The proposed algorithm takes profit on the fact that the different scales of a CWT show different features of the signal, and uses two different scales to detect separately the QRS complex of the ECG overlapped with electromyographic noise at one scale, and the T wave of the ECG in the other.

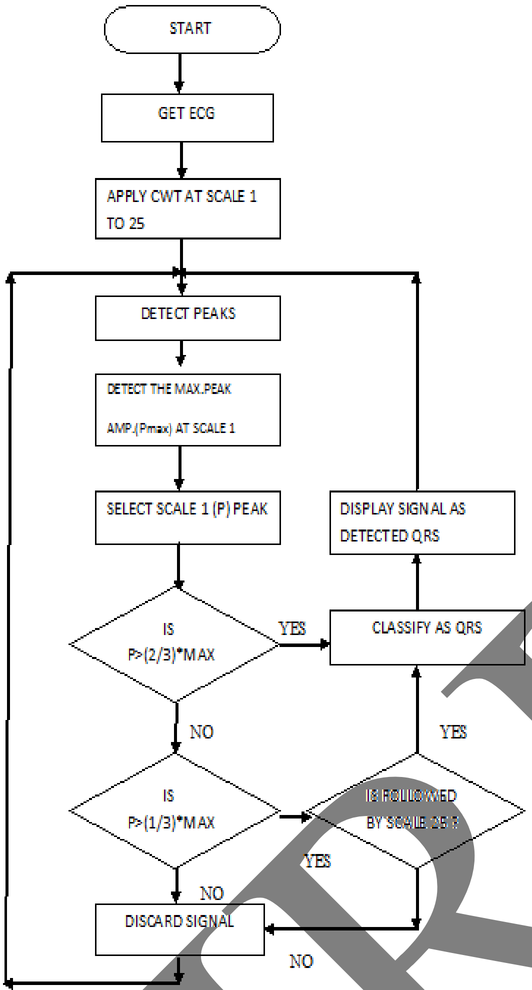

Fig.3. flow chart of heart rate implementation technique

APPLICATIONS:

- To locate the electric axis of heart.
- To monitor the heart rate of patients
- To diagnose disorders such as Arrhythmias

CONCLUSION:

On the basis of studies carried out and mention in literature survey author is planning to implement a system for heart rate monitoring using plastic steering wheel. Authors are trying to implement system which will be wireless and remotely operated. As suggested in the literature review out of three electrodes, dry type electrode is used in the project to be carried out.

REFERENCES:

1) EU Ageing Working Group, Brussels, Belgium, *"The 2009 Ageing Report: Economic and budgetary projections for the EU-27 Member States (2008–2060)—ECFIN—European Commission," 2009.*
2) I. Korhonen, J. Parkka, and M. Van Gils, *"Health monitoring in the home of the future,"* IEEE Eng. Med. Biol., vol. 22, no. 3, pp. 66–73, May/Jun. 2003.
3) M. Ishijima, "*Unobtrusive approaches to monitoring vital signs at home,"* Med. Bio. Eng. Comput., vol. 45, pp. 1137–1141, 2007.
4) A. Searle and L. Kirkup, *"A direct comparison of wet, dry and insulating bioelectric recording electrodes," Physiol. Meas.*, vol. 21, pp.271–283, 2000.
5) J. C. Huhta and J. G. Webster, "*60-Hz Interference in Electrocardiography,"IEEE Trans. Biomed. Eng.*, vol. 20, no. 2, pp. 91–101, Mar.
6) D. Díaz, . Casas, and R. Pallàs-Areny, "*Interference reduction in ECG recordings by using a dual ground electrode,"* in *Proc. XIX IMEKOWorld Congr. Fundam. Appl. Metrology*, 2009, pp. 1695–1700. and U. Fidan, "*Wireless transmission of ECG signal,"* J. Med. Syst., vol. 30, pp. 231–236, 2006.
7) D. Bansal, M. Khan, and A. K. Salhan, "*A computer based wireless system for online acquisition, monitoring and digital processing of ECG waveforms,"* Comput. Biol. Med., vol. 39, pp. 361–367, 2009, 4.