Instantaneous Heart Rate Variability(HRV) Signal Cloud Portable Flat Panel Observation

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Abstract--**This study is an instantaneous heart rate variability (HRV) signal cloud portable flat panel observation. HRV applications reflect the heart and cardiovascular disease. Patients with essential hypertension and myocardial infarction, vagal decay are reflected in the heart rate variability. Heart rate variability is also used as a predictor. Neurology, heart rate variability can reflect a variety of central nervous autonomic disorders. Such as Parkinson's disease, chronic alcoholism, limb paralysis and so on. Cardiomyopathy caused by diabetes mellitus and diabetes mellitus will reduce heart rate variability. The decrease in heart rate variability is before the onset of clinical conditions.**

I. INTRODUCTION

Heart Rate Variability (HRV) is the rate at which the heart beats. By observing changes is in heart rhythm normal or not. It is to determine the human body with or without abnormal physiological regulation. The heart is not very regular bounce once per second, taking one minute as an example. It is actually measured heart rate variability can be found. Therefore, the heartbeat interval will not be immutable. The same two people with the same heart rate, the heart rate variability may not be the same. The rate of change in heart rate can be used medically as a physiological basis for some signs of illness. Such as heart disease and cardiovascular disease, neurology, diabetes ... and so on. Frequency domain analysis of heart rate variability (HRV) is the most commonly used calculation method for fast Fourier transformation (FFT). It is based on the power spectral density (Power Spectral Density, PSD) performance. It analyzes the distribution of power (variation) at different frequencies [1-5]. It refers to the measurement of heart rate variability, physiological significance as published by a special working group established by the European Society of Cardiology and the north american society of pacing and electrophysiology in 1996 and clinical application "of international standards and literature [6-10].

II. SYMPATHETIC AND PARASYMPATHETIC

Low-frequency power, conventional low-frequency power ratio, high-frequency power, conventional high-frequency power ratio can represent the sympathetic and parasympathetic balance, the degree of activation. Conventional low-frequency power ratio and conventional high-frequency power ratio calculation process is the use of high and low frequency power in addition to the frequency domain power. It can avoid changes in the balance of sympathetic and parasympathetic, the total power also followed the change can not truly reflect the balance of the autonomic nervous system.

Both sympathetic and parasympathetic activity with emotion is a great relevance. The greater the sympathetic activity is the more emotional tension, hyperactivity, anxiety. Parasympathetic activity is greater on behalf of the more emotional pleasure, calm, ease, burnout state. The frequency domain analysis of this argument corresponding to the degree of variation of the heart rate shows that the majority of the proportion of the low frequency component indicates that the emotion belongs to the state of being excited, nervous and anxious. In contrast, the proportion of high-frequency components accounted for the majority is that emotions are pleasant, calm, ease, burnout state.

III. EXPERIMENT AND RESULTS

Autonomic nervous system can be divided into sympathetic system and parasympathetic system. The two systems are antagonistic to each other. Both doubly dominated most of organs. Sympathetic nerves dominate the entire internal organs, leaving the individual in a state of readiness and stress (pupil enlargement, hair shaft contraction, bronchial relaxation, increased cardiac contractility and heart rate, and secretion of adrenal medulla). Parasympathetic nerve is to relax the individual was in a state of rest. Autonomic Nerve Control of Heart Rate: Parasympathetic Effect High frequency band (parasympathetic activity of the HF) at the parasympathetic power in the frequency domain analysis of HRV. Sympathetic effects In the frequency domain analysis of HRV is the low frequency band at sympathetic power (LF: Table Sympathetic Activity).

ECG signal is to monitor heart rate changes. EMG signal is muscle contraction will produce a signal. The detected signal is the muscle activity that represents the electrode's location. It is a more natural way to command. The first phase of development is to capture brain waves, heart rate EMG signaling system. Pre-verification through the capture circuit to get accurate heart rate and EMG signal map. In the second phase, the human-computer interface system combining brain wave and heart rate electromyography was taken as the research and development spindle.

It is ECG signal to determine cardiac heart rate related information and can be wirelessly transmitted by human-machine interface to personal smart phone as shown in Fig.1

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and Fig. 2..

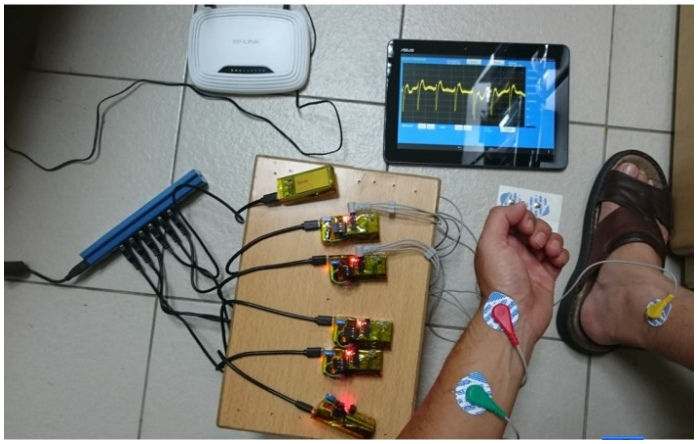

Fig. 1 Human-machine interface to personal smart phone

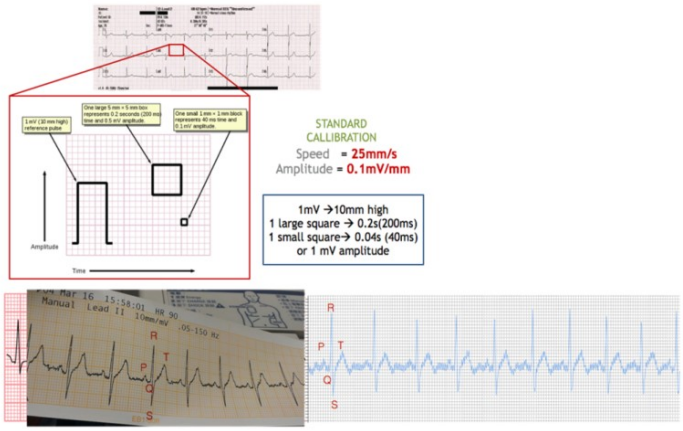

Fig. 2 HRV signal cloud portable flat panel observation

The heart is an organ made up of muscles. It consists of myocardium. When the myocardium is in motion, it is the current that occurs when the heart beating, and recording the change in current as a graph is the electrocardiogram. ECG can diagnose arrhythmias and heart disease caused by a variety of changes in the shape of the heart. From the ECG changes, it is possible to know whether the law of the heart beating, there is no heart disease.

IV. Conclusion

Heart rate variability can be used as an indicator of early warning of diabetes. Work pressure, poor work environment, such as: ergonomic working methods, overwork, poor working atmosphere, depression, fatigue, lack of social support, instability of psychological control mechanisms, poor family and social relations, etc. . These factors are to reduce heart rate variability. Heart rate variability can use as a quantitative assessment and control of these factors. Therefore, heart rate variability analysis (HRV) can not only detect the stress index, cardiovascular disease and diabetic neuropathy caused by autonomic neuropathy, but also early detection to achieve early detection, early treatment of health check.

References

[1] Benhur Aysin; Elif Aysin,"Effect of Respiration in Heart Rate Variability (HRV) Analysis",2006 International Conference of the IEEE Engineering in Medicine and Biology Society,Pages: 1776 – 1779(2006).

[2] José Rúas-Araújo; María José Lado; Xose Antón Vila," The perception of the Hymn of Ecuador through measuring heart ratevariability (HRV)", 2016 11th Iberian Conference on Information Systems and Technologies (CISTI), Pages: 1 – 5(2016).

[3] Shahab Rezaei; Sadaf Moharreri; Ali Ghorshi,"Designing the FPGA-based system for Triangle Phase space Mapping (TPSM) of heart rate variability (HRV) signal",2015 38th International Conference on Telecommunications and Signal Processing (TSP),Pages: 1 – 4(2015).

[4] Mojtaba Jafari Tadi; Eero Lehtonen; Tero Koivisto; Mikko Pänkäälä; Ari Paasio; Mika Teräs,"Seismocardiography: Toward heart rate variability (HRV) estimation", 2015 IEEE International Symposium on Medical Measurements and Applications (MeMeA) Proceedings,Pages: 261 – 266(2015).

[5] G. Sindhu; P. Sankar,"Design of an ECG acquisition device for the nonlinear analysis of heartrate variability (HRV)", International Conference on Information Communication and Embedded Systems (ICICES2014), Pages: 1 – 6(2014).

[6] Firas Zakaria; Mohamad Khalil,"Heart rate variability (HRV) analysis using DSP for the detection of myocardial infarction", 2012 2nd International Conference on Advances in Computational Tools for Engineering Applications (ACTEA), Pages: 15 – 19(2012).

[7] M. Álvarez-González; XA Vila; MJ Lado; AJ Méndez; L. Rodríguez-Liñares,"Web site on heart rate variability: HRV-Site",2010 Computing in Cardiology,Pages: 609 – 612(2010).

[8] Wanqing Wu; Jungtae Lee,"Development of full-featured ECG system for visual stress induced heartrate variability (HRV) assessment",The 10th IEEE International Symposium on Signal Processing and Information Technology,Pages: 144 – 149(2010).

[9] W. S. Choi; C. M. Kim; S. Y. Ju,"Effects of inhaltion of anion on heart rate variability(HRV)",2010 Pan American Health Care Exchanges,Pages: 8 – 8(2010).

[10] H G Arriola-Zorrilla; M A Reyna-Carranza; M E Bravo-Zanoguera; R. López-Avitia,"Exploratory-retrospective study to measure the effects of the air pollutants over the heart rate variability (HRV) in a university community", 2010 Pan American Health Care Exchanges,Pages: 120 – 120(2010).