University of Macau

Abstract

EMBEDDED-LINK SPHYGMOGRAM ANALYZER IN E-HOME HEALTHCARE

by Fu Bin Bin

Thesis Supervisor: Prof. Dong Ming-Chui
Department of Electrical and Electronics Engineering

Cardiovascular Disease (CVD) is one of the leading causes of death in the world nowadays. Consequently, helpful to learn the health status of cardiovascular system, the corresponding monitoring schemes, which are based on the non-invasive cardiovascular monitoring, are of the urgent need to depress the intimidation from CVD. Complying with the Chinese medicine and theories of Hemodynamics, Sphygmogram owns potential to monitor the health status of cardiovascular system and is expected to complement ECG monitoring as well as enhance the traditional blood pressure monitoring which reflects limited health indices from blood circulation.

However, due to poor intelligence and lack of mobility, the conventional health monitoring apparatus based on Sphygmogram for cardiovascular system need to be greatly improved. The existing or ongoing methods have to attach to personal computers, and lack of efficient medical support. The target for this research can be summarized as towards the wearable intelligent sphygmogram analysis for e-home healthcare. It intends to provide cardiovascular health evaluation for self-monitoring with the characteristic of being easily operative, cost-effective and suitable for home healthcare. If employing ambulatory monitoring, which is generally built limited hardware resource with low computing capability, the high quality analysis result is requested. It concretely refers to intelligence for personalized health evaluation and prognosis, and plug-in triggered medical support. So the bottleneck problem becomes the conflict between the constrained resource and high computational cost.

In this thesis research, the embedded-link is proposed as a strategy to solve the aforementioned crucial problem. The embedded-link concept can be defined as two specific meanings: structure and computing. All the functions that consist of data acquisition, analysis, user interface and network developed via PC are expected to upgrade to embedded system. The computational task is separated as two parts: the embedded computing realized the automatic computerized health evaluation by adapting the hemodynamic analysis based on the morphological feature points and a medical knowledge base as the decision-making support model. Here another part of computing is to implement more reliable and personalized health evaluation grounded on the limited symptoms apart from the measured data.

On the other side of structure, the embedded system is distributed into home for daily and handy use whilst uplink to the health center while necessary. The central server maintained by the health giver is responsible for the complex computation such as machine learning technology for discovery of medical knowledge pattern based on individual's long-term medical data, and additionally communication with experts for medical support. It also manages the central data base and powerful knowledge base so as to customize the client's personalized health prognosis agent. When the embedded local knowledge base encounters insufficiency, it will be triggered by plug-in computer network mechanism to upload the history data and download the updated knowledge automatically through a novel scheme for data compression. The separation of computational task is beneficial for the more pervasive and more personalized health evaluation.

This sphygmogram analysis system implemented on the mobile platform has claimed its validity from several parts. Firstly the proposed numerical health prognosis agent has been verified by comparing with traditional string-based expert system and showed its superiority in resource saving. Secondly it is real-usable and easy to operate. Finally by validating the effect of health evaluation on the research group, the analyzer is proved with considerable processing speed, accuracy and medical support.

Key words: Embedded-Link, Sphygmogram, e-home healthcare