Demo Abstract: Body Area Network for M-Health Application

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ABSTRACT

Body area network, which has great potential in being the main front-end platform of telemedicine and mobile health systems, is currently being heavily developed to keep pace with the continuously rising demand for personalized healthcare. In our system, an entire body area network solution for M-health, including various of body sensors for collecting physiological signals, a cell phone to facilitate the joint processing of spatially and temporally collected medical data from different parts of the body for resource optimization and systematic health monitoring, a server cluster with great data storage capacity, powerful analysis capabilities to provide data storage, data mining and visualization is presented.

Categories and Subject Descriptors

J3 [**LIFE AND MEDICAL SCIENCES**]: Health –the practice of public health, supported by mobile devices

General Terms

Design

Keywords

Data server cluster, body sensor, mobile phone

1. INTRODUCION

Nowadays, the constraints in the healthcare of developing countries, including high population growth, a high burden of disease prevalence, low health care workforce, large numbers of rural inhabitants, and limited financial resources to support healthcare infrastructure and health information systems, accompanied with the improvement of potential of lowering information and transaction costs in healthcare delivery due to the explosively access of mobile phones to all segments of a country, has motivated the development of mobile health or m-health field. M-health is known as the practice of medical and public health supported by mobile devices such as mobile phones and PDAs for delivering medical and healthcare services. Thus, the popularity of m-health can be subjected to the development of wearable medical devices and wireless communication technology. In order to fully utilize wireless technology between the wearable medical devices, the concept of body area network (BAN), which is a kind of wireless sensor network around human body, was proposed in Year 2002. In a typical BAN, each sensor node collects various physiological signals in order to monitor the patient's health status and then instantly transmit all information to the medical server or the doctors. While an emergency is detected, the physicians will immediately inform the patient through the computer system by providing appropriate messages or alarms. By this way, BAN is preferred in monitoring patients in environments lack of medical doctors, such as home and workplaces.

Even though a lot of companies have been engaged in the research of M-Health system, there are a lot of key issues to be further resolved such as powerful server cluster and effective data mining solution to predict the risk factor of chronic disease. Our system will integrate cloud storage, cloud computing, mobile networks and other crucial technology, to realize the long-term monitoring, analysis, forecasting and management of health condition.

2. SYSTEM OVERVIEW

Our system is designed to realize the acquisition of physiological signals, the storage of data, and huge amount of data analysis and data visualization. As presented in Fig.1, it is comprised of four main components: body sensors for collecting physiological signals, mobile device for joint processing medical information and delivering healthcare services via mobile technology, data server cluster including the database server, data mining server and graphic server in the future, and display terminal.

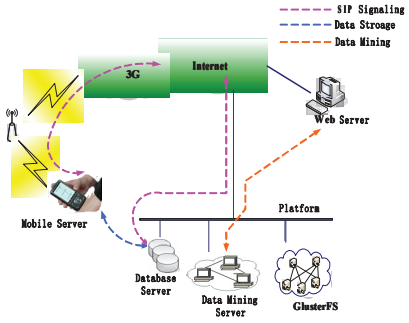

Fig.1 Schematic diagram of the system

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In the data acquisition end, vital signals such as electrocardiograph (ECG), photoplethysmograph(PPG), blood pressure (BP) and oxygen saturation (SPO2) are collected for further analysis. The collected physiological signals can be transmitted to the mobile device via Bluetooth and then to the server via Internet or 3G. By the data server cluster, the health condition can be tracked and managed by long-term health records, and thus prevent the disease, evaluate the treatment process for the users. Users can access the analysis result by a variety of interfaces such as personal computer, TV and mobile phone.

3. DEMONSTRATION SETUP

For the demonstration, we will present a prototype of our wearable medical monitoring system taking ECG monitoring for example.

3.1 Body Sensor

Fig.2 presents a typical body sensor for ECG acquisition. The body sensor can monitor the ECG signal conveniently without electrodes, and then send the data to mobile phone via Bluetooth for further analysis.

Fig. 2 Body sensor for ECG

3.2 Mobile phone

Anyone with a mobile phone, can install our software specifically for the platform such as Android or iPhone, and then get the preliminary analysis result such as Heart Rate, abnormalities of single test. The software interface is presented in Fig.3.

Fig. 3 Health mobile software interface

3.3 Data Analysis

There are some released public cloud platforms, such as Apache's Hadoop, Microsoft's Azure, Google's AppEngine and so on for data process. These systems use a proprietary cloud platform to provide a personalized service. Through the cloud data center the data mining and parallel computing of the vital signs for massive historical data through various algorithms (for ECG : RR interval analysis, analysis of instantaneous heart rate, power spectral density analysis and chaos characteristic analysis) can be carried on. According to the practical situation of users' physical health, a variety of personal services are provided to meet the demands of the different users.

Fig.4 presents the analysis result for a single test with ECG as an example. A summary report is given to remind the user of his health condition based the extracted features. The detail extracted information such as the abnormalities and features in the frequency domain are presented to provide the basis for evaluation.

In addition, the tendencies of the extracted features, which are important to evaluate one's health condition, are analyzed through long-term record. The user can clearly see the change of his indicator through the tendency image.

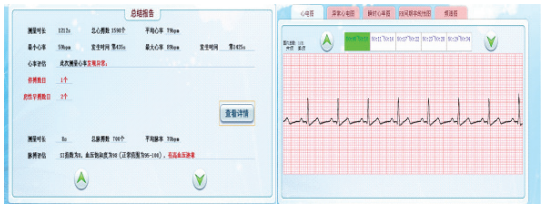

Fig.4 ECG Analysis Result

3.4 Data visualization

There are different kinds of interfaces for the user to view his historical record and the corresponding analysis results through the physiological data. For example, one can visit the health management platform, or through the TV section, as well as, he can get the analysis result and by message. The display effect on TV is shown in Fig.5.

Fig. 5 The display effect of ECG on TV

4. Conclusion

The system is incorporated into multiple technologies, such as precise and convenient data acquisition solution, high efficiency data storage and analysis method, to monitor the health condition of users at any time and any place. Through the system, one can have knowledge of his health condition, and even the risk factor of some chronic diseases. By this way, some acute attacks can be discovered without delay and some chronic diseases can be prevented before onset.

5. Acknowledgments:

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