Volume : 2 | Issue : 5 | May 2013 • ISSN No 2277 - 8160

Research Paper Engineering

Biomedical Signal Monitor System with Emergence Alarm for Remote Health Care System

Ching-Sung Wang Member, IEEE, Department of Electronic Engineering, Oriental Institute Technology, Taipei 220, Taiwan

ABSTRACT

First aid and immediate help are very important following an accident. The earlier the detection and treatment is carried out, the better the prognosis and chance of recovery of the patients. It is even more important when considering the elderly. Once the elderly have an accident, they not only physically injure their body, but also impair their mental and social ability, and may develop severe sequela. In the last few years, the continuously developed Android cell phone has been applied to many fields. Despite the nature of the GPS positioning system that the mobile phone currently uses, most applications used are SMS and file transfers. However, these biomedical measurement signals, passing through a transferring interface and uploading to the mobile, result the little really successful cases with the remote health care feasibility. This research will develop an Android cell phone which combines the functionality of an ECG, pulsimeter, SpO2, and BAD (Body Activity Detector) for real-time monitoring of the activity of a body. When an accident occurs, the signals go through Android smart phone, immediately notifying the remote ends and providing first time help.

KEYWORDS: Health care, Biomedical signal, Fall down alarm, Real-time, Android smart phone

1. INTRODUCTION

Accidents are more significant for the elderly, morbid populations, and for those who have unstable life signs. According to studies, once an elderly person falls down, they would reduce their living activity [1,2], indirectly reducing their quality of life. Due to the habit of using an Android mobile phone, we suggest a tool set that is able to monitor the user's state of health[3,4,5,6]. It operates through Bluetooth SPP (Serial Port Profile)8 to communicate with the mobile phone. When the BAD (Body Activity Device) detects an abnormal response, it will send an emergency signal to the Android mobile phone. After that, the Android mobile starts real-time biomedical signal monitoring, and efficiently transfers both the GPS and biomedical signals back to the server.

When an accident occurs, it can immediately and effectively provide relative rescue information by the mobile phone and Bluetooth, expecting that is able to improve first aid effect. In addition, it provides the senior population with an effective accident prevention guarantee, enabling them to avoid decreasing their life span because of an accident.

2. SYSTEM ARCHITECTURE

This system is categorized into three main structures, client, server, and First Aid unit. The client includes BAD, a biomedical signal monitoring device (including ECG, SpO_2 monitoring device)[7,8], and Android mobile phone with Bluetooth communication ability, When BAD detects an abnormal health response from the user, it will give the mobile a report by means of the Bluetooth. In the meantime, the operating biomedical device, in sending signals back, allows GPS coordination to take place. These messages would be sent back to server through the mobile phone's internet system. The server end is predominantly used to save the data, to analysis it, and to communicate with others. (Figure 1)

A. Client Side System

This system includes BAD, ECG, SpO_2, and Android mobile phones. They communicate with each other by means of the Bluetooth:

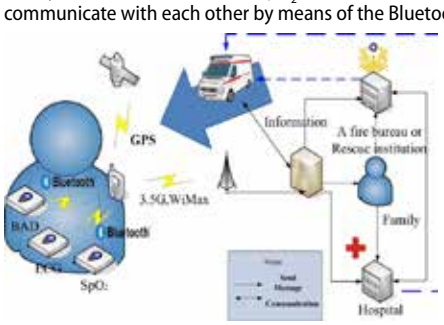


Fig. 1 System Architecture

B. Server Side System

The server end is composed of a high level server, back end processing program, emergency report system and SQL database.

C. First Aid Clients

The First Aid circuits are divided into four parts, first aid unit, medical unit, family unit, and mobile care unit.

3. HARDWARE

The whole hardware system, not only the server predominantly the user devices, includes BAD and other communicating devices:

A. BAD Device

The BAD is mainly built from a microprocessor, an accelerometer, Bluetooth transceiver and other elements. Its function is to detect the body's reaction to signals, abnormal analysis, and the control of signal transfer and receive.

B. Communication Devices

Figure 2, represents the Bluetooth composed Pico-Net. It forms communication devices by operating SPP. Figure 2 presents the system communication plot. BAD, ECG and SpO2 will shut down the system into a power save mode after Bluetooth and mobile phone pairing. When the BAD detects an emergency, it will resume normal power, and contact the mobile phone to call out ECG and SpO2 processing.

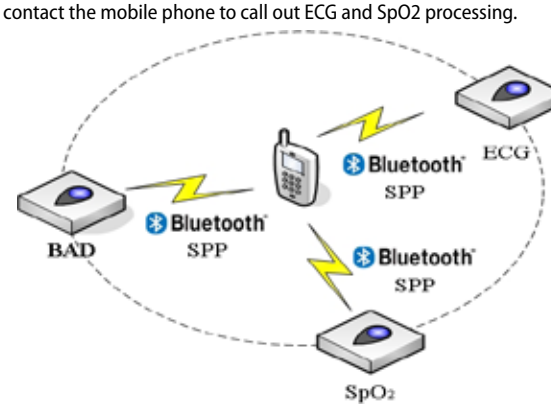


Fig.2 Bluetooth Pico-Net

4. SOFTWARE

This part of the software design includes BAD motion editing and its analysis process. When the system is told to run into the part of emergency procedure, the processing details is showing Figure 3. After the Android phone receives the signal from BAD and enters the emergency

procedure mode, the Android phone will start receiving an ECG signal. For receiving the ECG signal we used a Bluetooth class of Android mobile phone to receive the ECG data by Microchip PIC24FJ64GA004 [9] a 16 bit microchip. This chip edits two groups of 8 bits data and uses

$$\mathbf{ECG} = |(\mathbf{Data}[0] \times \mathbf{256} + \mathbf{Data}[1]) \times \mathbf{0.003223}) \times \mathbf{10000}| \div \mathbf{10000}$$

a SPP profile to transfer data. The remote and other members through the WEB interface confirm the biomedical information, the server and receives signal when simulating people falling down. At the same time, it uses GPS to confirm the client's location, for an efficient response time, and sends an ambulance to help.

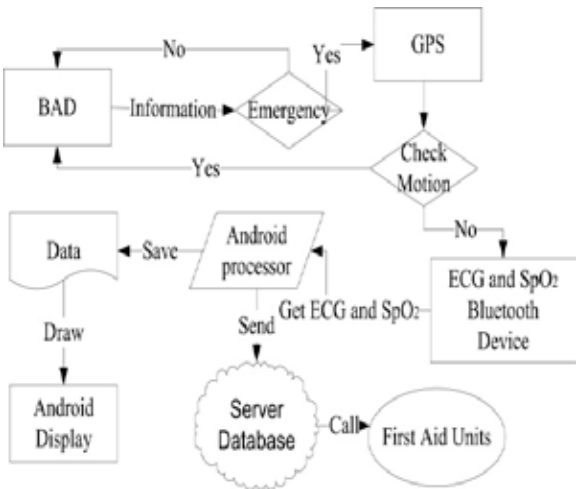


Fig. 3 Emergency Procedure

5. CONCLUSION

To develop an Android mobile phone transfer function, the proposed design with the fall down alarm and GPS functions provides a simple, practical and portable system of real-time monitoring of human body activity by BAD, ECG, pulsimeter, SpO2, or other future developed biomedical devices. These devices detects the user being in both a static and dynamic emergency by separate body stress-reaction mode and body activity detection mode, and suggests a solution with ECG, pulsimeter and SpO2, or others, in the emergency situation. In particular this is designed for the elderly and patients who are at risk, we expect that people who carried this device would have more effective care and assistance from others.

REFERENCES

[1] Albarede JL, Lemieux A, Vellas B, Groulx B. "Psychological factors in falls in elderly patients", Can J Psychiat ; 34(2):94-6,1989. | [2] S. Dagtas, G. Pekhteryev, Z. S¸ahinoglu, H. Cam, and N. Challa."Real-Time and Secure Wireless Health Monitoring", International Journal of Telemedicine and Applications, 2008. | [3] Stanford, V. "Pervasive health care applications face tough security challenges", IEEE Pervasive Computing, April-June, Vol 1, Issue: 2, pp 8-pp12, 2002. | [4] Sultan S., Mohan P., Sultan N, "Experiences from a Newe-Health Initiative for Patients with Diabetes and Cardiovascular Disease", In 1st IEEE International WoWMoM Workshop on Interdisciplinary Research on E-Health Services and Systems. Kos, Greece, June, 2009. | [5] Ren-Guey Lee, Kuei-Chien Chen, Chun-Chieh Hsiao, and Chwan-LuTseng,"A Mobile Care System With Alarm Mechanism", IEEE Transactions on Information Technology in Biomedicine, vol.11, no.5, September, 2007 | [6] Maki BE, Holliday PJ, Topper AK. Fear of falling and postural performance in the elderly J Gerontol; M123-31, 1991. | [7] Bluetooth Specification, "Serial Port Profile", Version 1.1, February,2001. | [8] Foad Dabiri, Tammara Massey, Hyduke Noshadi, Hadop Hagopian, C.K.Lin, Robert Tan, Jocob Schmidt, and Majid Sarrafzadeh,"A Telehealth Architecture for Networked Embedded Systems: A Case Study in Vivo Health Monitoring" ,IEEE Transactions on Information Technology in Biomedicine, vol. 13, no. 3, pp351-pp359, May, 2009. | [9] Microchip Technology Inc., "PIC24FJ64GA004 Series Data Guide", 10/05/2007