

Real-Time Patient Health Monitoring and Alarming Using Wireless-Sensor-Network

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Abstract—The main objective of this research is design and realization of real-time monitoring and alarming system for patient health, especially for patients suffering from diseases during their normal life. The proposed system has an embedded microcontroller connected to a set of medical sensors (related to the patient case) and a wireless communication module (Bluetooth). Each patient is considered as a node in a wireless sensor network and connected to a central node installed at the medical center through an internet connection. The embedded microcontroller checks if the patient health status is going well or not by analyzing the scanned medical signals. If the analysis results are abnormal, the embedded unit uses the patient's phone to transmit these signals directly to the medical center. In this case, the doctor will send medical advice to the patient to save his/her life. The implemented prototype has been tested and calibrated with standard devices. The experimental results confirm the effectiveness of the proposed system that is accurate in scanning, clear in monitoring, intelligent in decision making, reliable in communication, and cheap (about 100 US\$).

Keywords—Health care; Patient monitor; Remote device; Biomedical device; ECG monitoring; Outdoor patient monitoring.

I. INTRODUCTION

Advances in computer and communication technologies give electronic healthcare a great opportunity to design monitoring and alarming units that can be integrated with mobile phone[1,2]. Recently, wireless sensor networks have been adopted for real-time monitoring and alarming in healthcare applications. Therefore, it is useful to integrate medical sensors, embedded systems and smart phone to design an embedded system to provide patient, doctor and medical center with real-time health information to save time, cost and life [3-5].

Wireless communication technology is considered the best way to deal with emergency situations, especially those related to the human life, where

patient's health records such as previous medication history, identification and other information are necessary[6,7]. Most mobile phones and personal computers are integrated with wireless network, therefore, it is useful to use these devices for medical data transfer. In this case, "the amount of time the doctors need to identify the problem, trace back the medication history of the patient and consult fellow doctors will be reduced significantly"[7]. Such a system requires to update the databases for patients by real-time sensing and monitoring of their health parameters. Using computers and wireless technology in healthcare monitoring will achieve many goals, such as diagnosis time, accuracy, number of patients, amount of paper work and many others. Applications of wireless sensor technology for healthcare monitoring enable doctors to monitor their patients anywhere and at any time without any physical constraints and without the need for the patient to stay in hospital.

Real-time measurement of health parameters of critically ill patients such as heart rate, blood pressure, blood-oxygen saturation, temperature, and many other parameters have become a common feature of the healthcare monitoring system. There are many monitoring systems in medical centers used to collect and monitor patient's health. The health data are then used by doctors to generate the suitable decision. Critically ill patients require accurate monitoring and alarming system during their normal life. Therefore, it is useful to integrate the monitoring unit together with wireless sensor technology to follow up the patient's status outside the intensive-care unit (ICU) in the hospital[2,4]. In this case, the wireless monitoring system can be modified to provide the patient through his/her phone with accurate and immediate medical treatment decisions to save patient life.

Chung and his group[8] proposed WSN-based mobile healthcare monitoring system with ECG and

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