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E-Healthsense In-Home Vital Signs Monitor

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Abstract: E-HealthSense is a personalized home based remote health monitoring and notification system. It is a wearable device which monitors the health status of the wearer. It is capable of measuring vital signs like body temperature, blood pressure, heart rate. It is useful for patients who need persistent nursing and elders who are living alone. The system is low-cost, small, extremely power saving, simple in design and robust in performance. The sensors which are integrated in the wearable device are capable of reading the biological data of the patients. They are controlled by a Base Processing Unit (BPU) which is set up at patient's home. Here ZigBee mesh network is used for communication. The base station is integrated with a GSM module. If any abnormality in the patient's health is detected it alerts the caregivers by sending SMS to their mobile phones. In case of emergency the caregivers can initiate simple diagnosis via SMS. The system is intended to use at home, but could also be useful for monitoring hospital patients. It reduces the frequent visits to the doctor unnecessarily.

Key words: ZigBee · Wireless sensor · Power saving · Remote patient Monitoring

INTRODUCTION

As a result of advances in medical and health care related sciences, people are living much longer than in the past. The age people will require minimum nursing care on a regular basis. Patients are expected to manage their own conditions at home. The traditional model of patients depends on face-to-face contact with doctors is changing as patients take control of their own illnesses [1-3].

This paper proposes an electronic healh monitoring system utilizing mobile phones and ZigBee-enabled wireless sensors [4, 5].

Related Work: There are numerous monitoring systems available, ranging from basic pulse monitors and to sophisticated monitors[6]. Holter ECG monitors and (CardioMEMS) are too expensive. The Personal Health Monitor, uses a mobile phone to gather and analyze ECG data and HeartToGo, another cell-phone based wearable platform, which is capable of detecting abnormal patterns pertaining to cardiovascular disease. But these are not comfortable to wear for a long time. BioHarness from Zephyr Technology is designed for use by soldiers, firefighters, athletes, or doctors to monitor their patients. Equivital from Hidalgo Ltd offers all-pervasive functionalities. But both products use Bluetooth for wireless communications and are power consuming, To overcome the limitation in the existing technologies this paper presents a framework for a low-power wireless health monitoring system using ZigBee.

System Architecture: The proposed system is designed to be expandable and modular. It is designed in such a way to overcome the inefficiency of the existing systems. For a home health care, we can set up a small base station at home so that wearable devices only have to communicate with the home base station. Shorter distance will lead to significant amount of reduction in power consumption and simpler wireless network protocols like ZigBee can be utilized. Since GSM network is real time, supports various rich media formats and almost everybody takes along a mobile phone nowadays we use GSM to bridge the link between the home base station and caregivers.

The core of the system is a base layer which merely supports a wireless link between end devices and caregiver's mobile phone [7], the system comprises two

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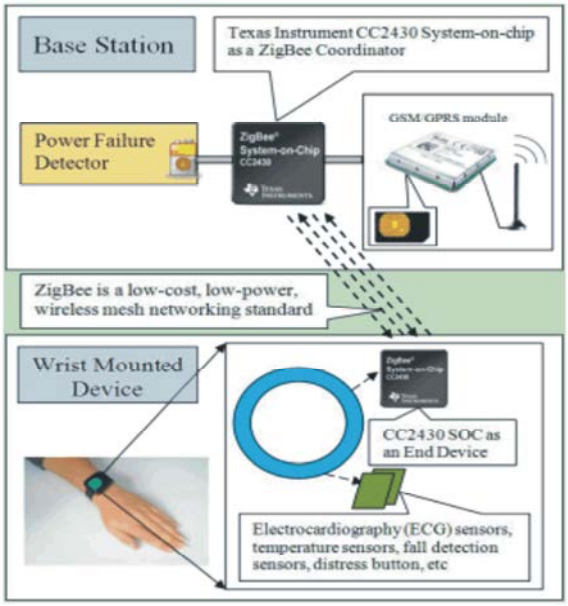

Fig. 1: Block Diagram

parts, a base station and a wearable wrist device. The base station acts as the coordinator which collects the data from the wrist mounted device. It has a ZigBee (CC2430 from Texas instrument SOC) and a GSM (GM862-QUAD-PY from Telit) modules [8], they are connected via Serial Peripheral Interface Bus. The base station ZigBee is the integration of 8051 micro-controller and a ZigBee transceiver. The base station is powered by the home electrical system and a power failure detector is connected with it.

The care takers can communicate the patients via SMS. The GSM receives the SMS commands and passes the query to the coordinator ZigBee which results in passing to the end device.

The wrist mounted device is integrated with multiple sensors and a ZigBee (CC2430 SOC) end device. It is non invasive [9], the ZigBee end device reads the sensor data, analyses to determine whether or not alert the base station. The alert is transmitted wirelessly to CC2430 coordinator. It passes to the GSM module which subsequently sends the SMS to their care givers.

The wrist mounted device is battery powered. A power failure detector is attached to trigger SMS alerts if any power failure detected.

User Interface: The user interface is very simple and easy to use. The users are only expected to press a button when they feel distress or need help without knowing how to use the system. A user friendly interface is designed for the wearers and care takers. A set of easy SMS commands are developed so that users can master it within seconds. The ZigBee mesh network can connect multiple wrist devices and other types of end devices. This feature will be useful when a family has many patients to be monitored. Since e-HealthSense is modular and expandable users can customize the system according to their needs.

CONCLUSION

The Zigbee based wireless sensor biological monitoring system sets up a wireless medical care network environment at home. When aberration is detected this proposed system can successfully send SMS to the doctor via SMS gateway. Patients can be benefited through this system by means of residing and recuperating at their house rather than staying in the hospital environment as well they can avoid visiting clinic frequently. It is flexible, simple, consumes low power and non invasive. Patient's death can be prevented by informing and providing the health care in the right time to the patient who is in need. This low cost system can be used in poverty-stricken areas, so the poor can receive the necessary medical services. The system is not only applicable to at-home solitary elderly people, but could also be useful for monitoring welfare facility residents and hospital patients, especially in outlying hospitals [10-12].

Since ZigBee is capable for video streaming at a low frame rate we can enhance this system by implementing video surveillance. So in emergency cases caregivers can know the user's exact location and condition. The data collected by the sensors can be used for assessing their health status and behavior. In future, we will carry on the further development of the system's software and hardware so that to obtain higher stability and practicality.

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