Volume 5, Issue 1, January 2015 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

Review of Patient Monitoring System with Wireless

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Abstract— To take care of critically ill patient one requires prompt & accurate decisions so that we can protect as well as save the life. Due to such requirements, ICUs have become widely established in hospitals. In most hospitals difficulty is that expert has to regularly visit the patient & asses his/her condition by measuring different parameters. These systems works when there is any emergency by using different wireless technologies. This paper is mainly based on continuous monitoring aspect of home patients. This requires a reliable, energy efficient patient monitoring system that can be able to send parameters of patient in real time. So the doctors can monitor patients parameters easily(temp, Pulse rate ,Blood Glucose).The major influence of the final proposed system is that it detects processes and sends patients data ((temp, Pulse rate, Blood Glucose))over a wireless.

Keywords: Blood Glucose, real-time, Pulse Rate, Wireless, Glucometer, Syringe pump.

I. INTRODUCTION

There is extensive interest in using wireless technologies in patient monitoring in various environments including hospitals and nursing homes. Due to wireless technology it provides better treatments to patients though they are physically not present in hospital. This system is more useful for elderly people as they are more prone to chronic dieses and need continuous health monitoring. Now a day there are different products are developed which supports the wireless health monitoring system. They provide real time current health condition of patient to doctor immediately [5].The System offers faster, reliable, effective and cost saving therapy so it becomes more popular. The system requires three key aspects: accessibility to information, convenience of use and cost effective. [6]

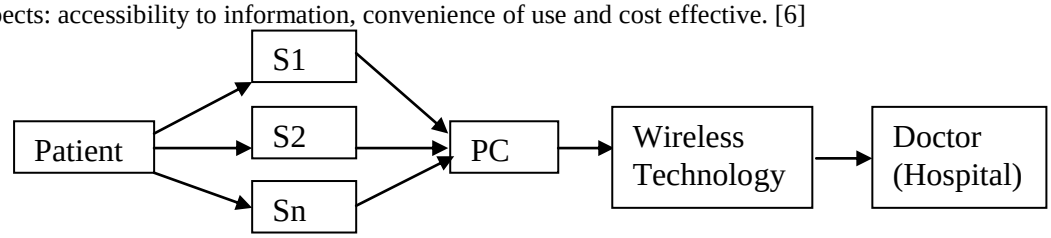

Fig. 1: Architecture of wireless health monitoring system

The general architecture of wireless health monitoring system is shown in Fig.1.Depends on applications the system may vary.S1, S2..,Sn represents different sensors or wearable medical devices. These devices are fitted on patient's body to collect body parameters like pulse rate, body temperature, blood glucose, blood pressure ECG,etc [5].From these sensors the signal is transmitted to personal computer, smart phone, microcontroller, etc.The wireless or wired transmission is used for communication between sensors and PC.The collected signals are transmitted to doctor or hospital for further analysis. And accordingly medical treatments are given to patients.

In home patient monitoring system needs to satisfy the criteria like the size and weight of the wearable devices which needs to be small and should not affect the daily activities of the patient[1].Also radiation concern should be considered. Power consumption should be low and lifetime of devices should be more. Moreover the system should support security and privacy concern. As patient's health records have sensitive data and they should be stored securely and transmitted to remote server .Also if patient moves away from home environment system should not affect the monitoring process.

II. LITERATURE SURVEY

Pandian et all [7] gives a conceptual design of a wearable physiological monitoring system based on wireless sensor network to monitor physiological parameters like ECG, EMG, EEG, SaO2, body temperature, blood pressure, respiratory rate GSR and movement of the wearer. The acquired signals are pre-processed at each node at the sensor level and transmitted to the wearable data acquisition hardware (sink node) for further processing. It is then transmitted wireless to the remote monitoring station.

Choi et all [8] describes the development of a wearable sensor platform to monitor a number of physiological correlates of mental stress. The adjustments in both system design and sensor selection to balance information content and wearability is detailed. Using experimental signals collected from the wearable sensor, a selected number of physiological features that show good correlation with mental stress is described.

Jun et all [9] also describes the architecture of a wearable ECG monitor that is patient location independent and provides continuous monitoring. The signals from the sensors are transmitted using Bluetooth to the smart phone in its area, which can in turn be send to the destination via internet.

Xin Liu et all [10] proposes a power and area efficient electrocardiogram (ECG) acquisition and signal processing application sensor node for wireless body area networks (WBAN). This sensor node can accurately record and detect the QRS peaks of ECG waveform with high-frequency noise suppression. The proposed system is implemented in 0.18-mm complementary metal–oxide–semiconductor technology with two chips: analog front end integrated circuit (IC) and digital application specific integrated circuit (ASIC). Therefore, this ECG sensor node is convenient for long-term monitoring of cardiovascular condition of patients, and is very suitable for on-body WBAN applications.

Otto, Jovanov and Milenkovic [11] in their paper describe a prototype system for continual health monitoring at home. The system consists of a modest wireless body area network (WBAN) and a home health server. The sensors of the WBAN monitor user's heart rate, mobile and locomotive activity and upload the information with time-stamp to the home server at regular intervals of time. The home server may integrate this information into the local database for the user's inspection or it may forward the information further to a medical-server.

Bachmann et all [12] describes the idea of low-power wireless sensor nodes for biomedical applications that are capable of operating autonomously or on very small batteries. Component-level power optimization for the radio and digital signal processing is described in the paper along with a short comparison between radio power consumption and on-node processing.

Abdalla et all [13] provides several solutions for improving the reliability and the power management of real-time of real-time multi-patient monitoring systems. A reliable wireless Personal Area Network based on digital signal processing has been developed using sleep strategy and other techniques like dynamic voltage and frequency scaling to achieve low power management and assisted power control. Results show that this approach has been successful in outperforming the single WPANs in terms of efficiency and reliability.

Raut and Giripunje [14] give a novel wireless data collection system for health monitoring of patients based on PIC controller and wireless sensors. The exclusive characteristics of this system such as low power, low cost, and high flexibility make them ideal for this application.

Proposed System

The Proposed system is basically two sections .1.Transmitter section i.e. patient's side and 2.Receiver section i.e.Doctor side. The modules at the patient's side are consist of Temperature sensor, Blood Glucose sensor, Pulse rate sensor, Insulin Pump, Microcontroller, LCD (Liquid crystal display), UART (Universal Asynchronous Receiver Transmitter) and RFID module.

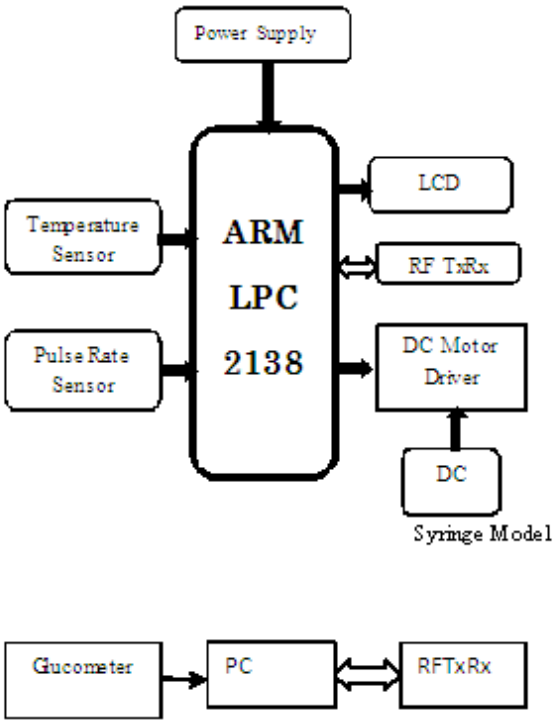

Fig. 2: block diagram of patient's section

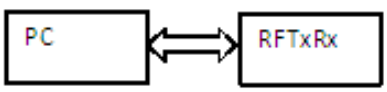

Fig. 3: block diagram of doctor's section

All sensors can connected to the patient via a very light set of cables and all sensors values are taken and give it to the microcontroller then to LCD and RFID module by using UART.The designing part includes basically three sections as follows,

- Hardware design
- Ready to use hardware modules
- Software design

A. Hardware design

1. *Power Supply circuit*
   The hardware of project requires different power supplies.
   5 v: for temperature sensor circuit, Pulse rate circuit, RS 232Connector circuit.
   3.3 v: for ARM 7 TDMI microprocessor.
2. *Temperature Sensor*
   LM35 series sensors are precision integrated –circuit temperature sensors whose output voltage is linearly propositional to the Celsius temperature.
3. *Pulse Rate Sensor*
   Pulse Rate Sensor is designed to give digital output of pulse rate when a finger is placed on it.
4. *Insulin Pump*
   Insulin Pump pumps Insulin for maintaining glucose level in blood. Pumping is done with the help of DC stepper motor.
5. *RFTxRx*
   It is the wireless non-contact use of radio-frequency electromagnetic fields to transfer data.

B. Ready to use hardware modules

Blood Glucose Sensor (Glucometer)

Jhonson and Jhonson onetouch ultra-glucometer is used to monitor the blood sugar.

In this method it provide data confidentiality along with encryption method here we use convergent key from each original information with the help of convergent key here user also produced the tag for the information that tag will be used to identify the duplicate copy [14].

C. Software design

1. For ARM 7:-Embedded c using keil software.

THE uVision IDE from KEIL combines project management, make facilities source code editing, program debugging, and complete simulation in powerful environment. The uVision development platform is easy to use and helping you quickly creates embedded programs that work. The uVision editor and debugger are integrated in a single application that provides a seamless embedded project development environment. [4]

2.For GUI: Visual Basic

For graphical user interface it uses VB 6.1.On the server side the code is developed. This code generates a GUI which includes blocks for Temp, pulse rate, blood glucose, and no. of samples.

III. CONCLUSIONS

Wireless patient monitoring system with body sensor network is an effective solution for monitoring home patients. It reduces cost as well as saves times of both doctor and patients. At a time doctor can monitor multiple patients. The different body sensors continuously collect the body parameters and immediately transfer it to the doctor. In this way quality of treatment improves. Proposed hardware is able to measure body temperature, pulse rate and blood glucose. Hardware is able to inject insulin dose in a pre-planned manner with high accuracy. Wireless communication between Glucometer and doctor's device are successfully achieved and suggestions / medication details are sends to patient's computer. History of the units can be transferred to the customized computer application in the doctor's device.

ACKNOWLEDGMENT

I am Neeta Desai would like to thank the publishers, researchers for making their resources material available. I am greatly thankful to Prof. Rashmi Mahajan for their guidance.

We also thank the college authorities, PG coordinator and Principal for providing the required infrastructure and support. Finally, we would like to extend a heartfelt gratitude to friends and family members.

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