Role of Wireless Sensor Networks in HealthCare

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ABSTRACT

In modern world the wireless sensor networks (WSN) will strive to provide effective helps to the physician as well as patients. Because in a hospital necessary to constantly monitor the patient's physiological parameters such as sound, heart rate, pressure, temperature, blood pressure and so on..The use of wireless sensor networks (WSN) in healthcare applications is growing in last few years and the system coordinator node has attached on patient body to collect all the signals from the wireless sensors and sends them to the appropriate base station (BS). The attached sensors on patient's body form a wireless body sensor network (WBSN) and they are able to sense the heart rate, blood pressure, pressure, temperature and etc. This system can find the abnormal conditions, and issue an emergency alarm to the patient and send a SMS/E-mail to the physician and hospital administration. And the wireless sensor system consists of several wireless relay node which are responsible for relaying the data sent by the coordinator node and forward them to the base station. The main advantage of this system in comparison to previous systems is to reduce the energy consumption to prolong the network for long life, speed up and extend the communication coverage to increase the freedom for enhance patient quality of life. Here we have developed this system in patient architecture for hospital healthcare and compared it with the other existing networks based on multi-hop relay node in terms of coverage, energy consumption and speeds.

Keywords : HealthCare, Base Station (BS) and Wireless Body Sensor Networks (WBSN).

I.   INTRODUCTION

The Wireless sensor network (WSN): The body systems can help patient by providing healthcare services such medical monitoring, heart rate, temperature, blood pressure, memory enhancement, medical data access, and communication with the healthcare physician in emergency situations through the SMS or GPRS. And we can Continuous health monitoring with wearable will increase detection of emergency conditions in at risk patients. Not only the patient, but also their families will benefit from these benefits. Also, these systems provide useful methods to remotely acquire and monitor the physiological signals without the need of interruption of the patient's normal life; this is improving patient quality of life.

Although the current systems allow continuous monitoring of patient and the patient vital signs, these systems require the sensors to be placed bedside of the monitors or PCs, and limit the patient to his bed. But nowadays, there is no relation between the sensors and the bedside equipment due to the wireless devices and wireless networks. These systems do not require the patient to be limited to his bed and allow him to move around but requires being within a specific distance from the bedside monitor. Out of this range, it is not possible to collect data. In different cases, health monitoring will be done by infrastructure-oriented wireless networks such as

commercial cellular or networks or wireless LANs. But, the coverage of the infrastructure-oriented networks changes with time or location. And moreover, the coverage of wireless network is not available, or the coverage is available but we cannot access to the network due to a lack of available bandwidth. So these problems continuous health monitoring is not possible and emergency signals may not be transmitted from a patient to healthcare physicians.

Patient Body Sensor Network System Architecture

The architecture of the proposed system The system consists of four parts: 1. The WBSN contains four sensors which are responsible for collecting the physiological signals from patient, 2. The WMHRN (Wireless Multi-Hop Relay Node), contain number of wireless relay node which is in charge of forwarding the health data to the base station.(BS) 3. The Base Station (BS) which is receives the relayed data and sends it to the PC's through a cable 4.The Graphical User Interface (GUI) which is responsible for storing, analyzing and presenting the received data in graphical and text format, and sending an SMS services to the healthcare physician or patient and patient family in emergency conditions through the GPRS or GSM modem

Figure 1: Architecture for proposed healthcare system in hospital.
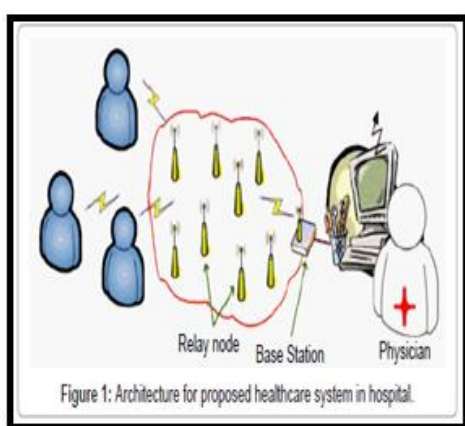
Figure 1

Sensor Note: Every node in the network has different tasks. All the sensors are wireless and sense different physiological parameters in a given duration of time and the sampling duration is determined by the

physician. For example sensors for pregnant woman can be:

1) Motion Detection Accelerometers: To calculate blood pressure, the patient should be lying or seated. So, these sensors can detect patient's position. If the patient is placed in a proper position, it will allow the other sensors to sense.
2) Blood Pressure and Heart Rate: These sensors can return heart rate and blood pressure.
3) Heart rate and Movement of the fetal: For calculate of the heart rate and the movement of the fetal used by medical practitioners to assess the health of the fetal.

Coordinator: It is a wireless node in the WBSN which in charge of collecting the sensor and the arrival signals from the other sensors as well and send to the base station (BS). This node attaches on the patient's body and it works among on battery. Each coordinator node is identified by a separate ID which is used to identify each patient in the network.

GPS: It is a Space-Based Satellite navigation system that provides location information about the patient in the hospital which is helps to hospital may find the patients in emergency conditions. It is locate where exactly patients is located in their homes

II. WBSN ARCHITECTURE

As we mentioned above to calculate blood pressure, the patient should be lying or seated. So these sensors can find the patient's position. If the patient is placed in appropriate position, the motion sensors by sending a SENSE_START packet will allow the other sensors to sense. To reduce energy consumption, in same time all the sensors wake up and wait for a specified time until they receive the SENSE_START packet. If they receive it, they will send their readings to the coordinator node and then turn off their radio. We can observe the operation state diagram of the Blood Pressure (BP) sensor in figure 2.

In case each sample of data (such as the heart beat, BP and etc.) is immediately encapsulated into a frame and transmits, the overhead will be increased and will cause excessive energy consumption. Therefore to decrease the overhead, we have used the burst transmission mechanism As we shown in figure 2 woman heart rate, woman blood pressure, fetal and fetal movement encapsulate in one frame. In this way, we achieve more energy conservation
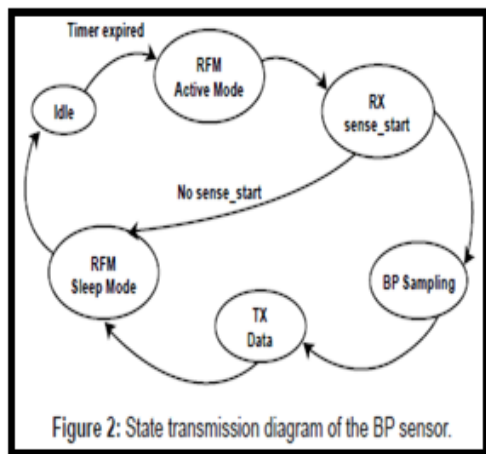

Figure 2: State transmission diagram of the BP sensor.

Figure 2

III. WMHRN WORKS

WMHRN contains several wireless nodes. Relay node has only routing capability to transfer physiological signals, such as heart beat, blood pressure, and other biomedical signals to the base station (BS) or to nearby other relay nodes As compared with the coordinator node, the power can be supplied from the battery. Since hospitals have fluorescent lights in all the rooms that are always on, it is advantages to operate these relay node by saving light energy.

This may leads result in a massive cost savings over time (this arrangement eliminates the need to monitor and re place batteries)

IV. CONCLUSION

In Wireless Sensor Networks (BSN) technology is emerging as a significant concept of next level generation people of healthcare services. In this paper we reviewed a physiological monitoring system, which is able to continuously monitor the patient's heart beat, blood pressure, temperature, sound, pressure and etc and other critical parameters in the hospital. The whole system of a coordinator node to require the patient's physiological data, the system is able to carry out a long-tem monitoring on patient's condition and is equipped with an emergency rescue mechanism using sms or e-mails.

V. REFERENCES

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