

Wireless Sensor Network Applications in Healthcare and Precision Agriculture

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In a hospital health care monitoring system it is necessary to constantly monitor the patient's physiological parameters. For example, a pregnant woman's blood pressure (BP) and heart rate, as well as the fetus heart rate and movements, are used to manage her health.

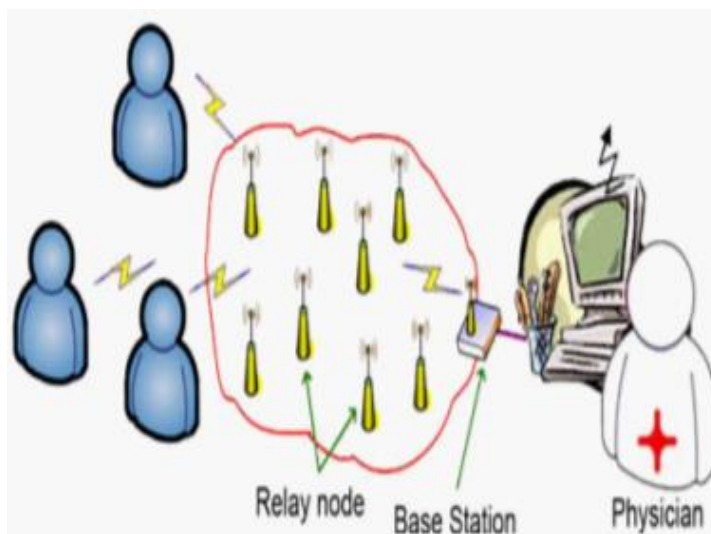
Body sensor network systems can help people by providing healthcare services such as medical monitoring, memory enhancement, medical data access, and communication with the healthcare provider in emergency situations through the SMS or GPRS. In at-risk individuals, continuous health monitoring via wearable or clothing-embedded transducers and implanted body sensor networks will improve detection of emergency circumstances. These will assist not only the sick, but also their families.

Furthermore, these technologies provide effective means for remotely acquiring and monitoring physiological signals without interfering with the patient's daily life, hence increasing life quality.

In the proposed system, a coordinator node has attached on patient body to collect all the signals from the wireless sensors and sends them to the base station. 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 and so on. This system can detect the abnormal conditions, issue an alarm to the patient and send a SMS/E-mail to the physician. Also, the proposed system consists of several wireless relay nodes 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 lifetime, speed up and extend the communication coverage to increase the freedom for enhance patient quality of life.

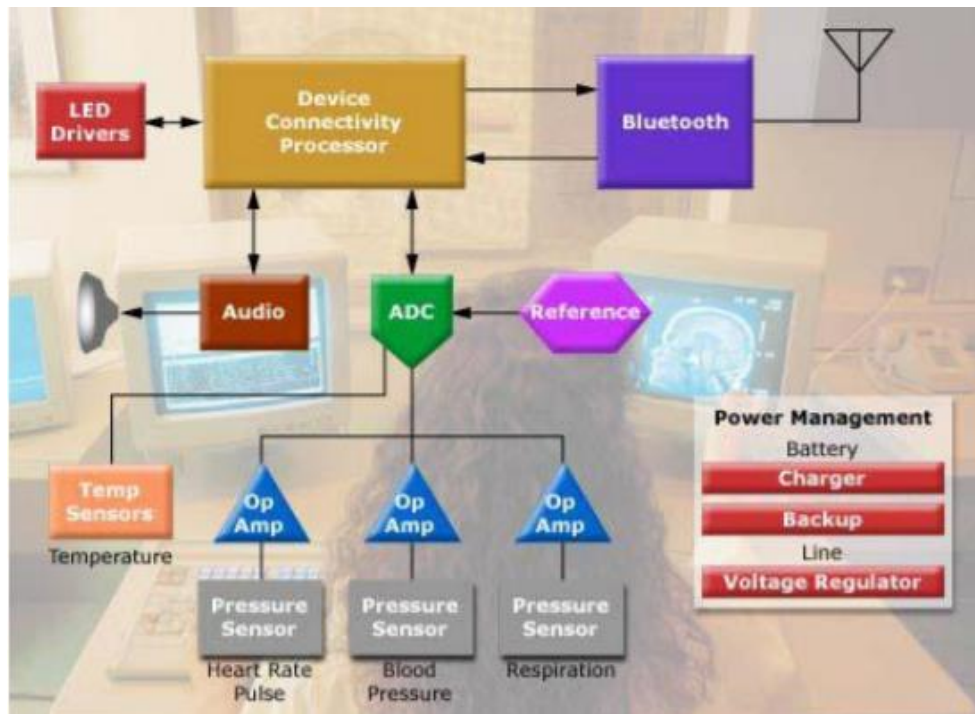
Controlling a pregnant woman is one example of how this technique could be used. The blood pressure of a pregnant woman should be the same as that of any other individual. Preeclampsia can be prevented by keeping a close eye on blood pressure during pregnancy. These women must have their blood pressure checked on a regular basis. If the patient's blood pressure rises too high, he or she may be admitted to the hospital. However, the patient is confined to her hospital bed.

Architecture for proposed healthcare system in hospital



The system is divided into four parts:

- (1) The WBSN is comprised of four sensors in charge of gathering physiological data patient's signals
- (2) The WMHRN (Wireless Multi-Hop Relay Network) Node) is made up of a number of wireless relays.nodes in charge of forwarding health information data transmission to the base station
- (3) A BS (Base Station) that receives the relayed data and transmits it to the PC via a cable
- (4) The graphical user interface (GUI), which is in charge of storing, analysing, and presenting the received data in graphical and text formats, as well as sending an SMS to the healthcare provider or patient's family in an emergency via the GPRS or GSM modem.



Coordinator and sensor nodes:

This section describes the WBSN's components and their functionality.

Coordinator Node: The coordinator node is a wireless node in the WBSN that collects and packages arrival signals from other sensors before sending them to the base station. This node is attached to the patient's body and operates on a battery.

Sensor nodes: Each node in the network performs a unique function. All of the sensors are wireless and detect a variety of physiological characteristics at regular intervals and concurrently; the sampling interval is set by the physician. Sensors for pregnant women, for example, could be:

1. Motion Detection-Accelerometers: The patient should be seated or lying down when blood pressure is measured.

As a result, these sensors are capable of detecting the patient's location. The other sensors will be able to sense if the patient is in the appropriate position.

2. Blood Pressure and Heart Rate: These sensors can provide information on blood pressure and heart rate.

3. Heart rate and Movement of the fetal: Detection of the heart rate and the movement of the fetal used by medical practitioners to assess the health of the fetal.

GPS: GPS is a space-based satellite navigation system that provides location information about patients in hospitals, assisting hospital personnel in locating patients in emergency situations. The patient always carries it. Fahim et al., for example, presented a smart house to assist elderly people in living independently in their own homes. It assists the caregiver assistant by tracking the elderly in their own homes and preventing certain accidents.