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Design and Development of Real Time Patient Monitoring System with GSM Technology

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ABSTRACT

Technology keeps evolving every second. Humans receive all the essential information with just one touch. Be it the weather forecast or ordering any grocery or communicating with one's peers, everything happens so easily and efficiently. It is undoubtedly user friendly. When the same technology associates itself with the medical equipment it becomes easier to fetch and process the patient's data in real time. It also helps to make several life-saving, spontaneous decisions for the critical care. This paper talks about the patient monitoring system. The physiological parameters of the patient are continuously monitored in real time using sensors. The data that is obtained from the sensor is then sent to an Arduino Uno microcontroller where it is analyzed. If the patient's data differs from the required threshold values, an emergency message is sent to the assigned doctor's mobile. This is done using the GSM module which is interfaced with the microcontroller. Verifying the system in software is done using Proteus.

KEYWORDS

Arduino, GSM Module, LM35, Proteus, Pulse Sensor, Sensors

1. INTRODUCTION

The collaboration of telecommunication techniques with healthcare directs a way towards "e-Health" (Ahmed, Millat, Rahman, Alam, & Zishan, 2015). This is established with the help of Wireless Sensor Network (WSN). The inclusion of WSN with the healthcare industry is definitely considered a boon which results in smart and diverse practices for monitoring one's health. WSN are sensors used to monitor physical or environmental parameters and pass the data through a network to a particular destination (Pathinarupothi, Ramesh, & Rangan, 2016). This idea helps in developing small devices that can transfer patient's vital parameters to a remote location wirelessly (Sumalan, Lupu, Arstine, & Onaca, 2015). Hence reducing the challenge faced by the doctors in monitoring multiple patients simultaneously (Mankar, Bhute, Thool, Rasnala, Handa, 2014; Purnima & Singh, 2014). Sensors are deployed in the human body which practically detects any abnormality at an early stage. The sensors are always ON and continuously gather information in real time. This assists in decision making for the treatment (Sreejith, Rahul, & Jisha, 2016) and increases the survival rate of any patient. The wireless sensors help in:

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- Gathering data in real time;
- Increasing the mobility of the patients i.e. they need not be hindered with cables (Paksuniemi, Sorvoja, Alasaarela, & Myllyla, 2006; Sokullu, & Akkaú, 2010), which in turn increase the self-confidence and provide a positive outlook for life;
- Giving the doctors a timeout as they need not be physically present to track down the vitals, respectively. The entire system is scalable, portable, user-friendly and unobtrusive.

This project aims at developing a reliable system to monitor and transfer physiological parameters of a patient wirelessly. Researchers Shin, Huh, & Pak (2007) mention Wireless WAN, Bluetooth and ZIGBEE as the emerging technologies for a wireless transmission. As quoted by Poonia & Singh (2012) VANETs integrate Wi-fi, WiMAX, Bluetooth, IRA, ZIGBEE for vehicle communications. In VANETs every vehicle behaves as a mobile node (Poonia, Bhargava & Kumar, 2015). As the communication is restricted here, this project aims at simple communication using the GSM and ZIGBEE technology. Figure 1 gives an outlook of the proposed system. The parameters considered are: temperature and heart rate. The module is designed to acquire data from various sensors. Not only is the system very economical (Liang, Barua, Chen et al., 2012), it also consumes less power and provides faster response.

An Arduino Uno microcontroller is implemented to analyze the sensor output. An algorithm is executed for the same using Arduino Ide software. The patient's parameters are sent to the doctor for further intervention. The doctor is alerted only during any adverse conditions by sending a message using the GSM module. The simulation of the system is done using the Proteus software.

The software implementation of the setup is done with the help of Proteus Design Suite. It is an Electronic Design Automation (EDA) tool which comprises of simulation, schematic capture and PCB layout modules. For the hardware purpose, an Arduino Uno microcontroller is used which is based on the ATmega328. The board has a USB connection, 6 analog inputs, 14 digital input/output pins, a 16MHz crystal oscillator, a power jack and a reset button. The power to the board of 5V can be given from the computer system with the help of the USB or with a battery or using an AC-to-DC adapter. The controller is programmed with the Arduino Ide platform.

This paper has four sections in total. Section 2 is the literature survey, followed by methodology in section 3. Section 4 defines the results and section 5 gives the conclusion and the future scope of the work respectively.

Figure 1. The idea of wireless patient monitoring system (Internet source)