An Android Based Remote Real-Time Health Monitoring System

Mr. Anurag R. Gupta **Mr.Shivam B. Navghare** **Mr. Nikhil A. Burghate** **Prof. N. S Gawai** **Prof. K. S. Hande**

Abstract **- The current method of monitoring patients in hospitals keeps patients tied to their beds and can be uncomfortable for patients. The goal of this paper is to produce a wireless patient monitoring system that could allow patients to be mobile in their environment and to automate the work of doctors and nurse. The health monitoring system with wireless sensor network is used for patient monitoring system.**

The existing modules shows the patient's vital parameters such as EMG, Heart Rate, Pulse Rate and Temperature are measured using a patient monitoring system, in that the values are entered into a database and are uploaded into a web based server manually, this data is transmited which is sensed from remote patient to the server PC by using wireless transmission technologies like Zigbee.

We intend to design a system that includes a pulse oximeter to measure blood oxygen concentration and the patient's pulse, a temperature sensor to keep track of the patient's temperature, a blood pressure sensor to check the pressure, a suger meter to check the sugar level of the patient, a respiration counter for count the breath in and out, as well as a technologic like Zigbee.

Key Words **— Health monitoring, LPC2148, ECG, temperature, heartbeat, android, ZigBee.**

I. INTRODUCTION

The modern visionary of healthcare industry is to provide better healthcare to people anytime and anywhere in the world wide in a more economic and patient friendly manner. Therefore for increasing the patient care efficiency, there arises a need to improve the patient monitoring devices and make them more mobile. The medical world today faces two basic problems when it comes to patient monitoring. Firstly, the needs of health care's provider's presence near the bedside of the patient and secondly, the patient is restricted to bed and wired to large machines. In order to achieve better quality patient care, the above cited problems have to be solved. As the bio instrumentation, computers and telecommunications technologies are advancing, it has become feasible to design more portal vital sign tele monitoring systems to acquire, record, display and to transmit the physiological signal from the human body to any location.

What we want to achieve through this paper is by some means try to convert the heart rate and temperature into a measurable entity and keep a constant check on it to see if it functions normally as well as ECG and EMG. The system should kick-start and following actions should immediately take effect. Send information about the abnormality to a family relative/doctor

II. SYSTEM ARCHITECTURE

In this paper, we intend to develop the hardware and software functions are combined to make the system as shown below.

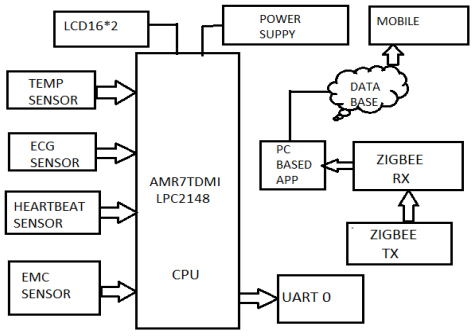

Fig:2.1 Block Diagram

1. Microcontrollers
   a) LPC2148
2. Sensors
   a) Temperature Sensor (LM35)
   b) ECG Sensor (AD-8232)
   c) Heart beat and oxygen sensor (IR sensors)
   d) EMG (INA118)
3. Zigbee Module
4. Power Supply
5. Mobile (Android App)
6. LCD Display (16*2)

This system is intended to monitor the patient health status in real time and notify relevant doctor, nurse or Family instantly if the patient is in any problem. Which is summarize as below.

STEP 1:

Connecting all the sensors to the patient and transferring that collected data through ZigBee transmitter module to the central nurse station.

STEP 2:

Once all the parameters are received by the PC based application through ZigBee receiver module, parameters are store into database system.

STEP 3:

Android application achieve these parameters for every instant change and show on the smart phone application.

The system design includes sensors, power supply, LPC2148 microcontroller, LCD, buzzer, ZigBee modules and software as follows Keil IDE, Flash Magic, Visual Studio IDE, Eclipse IDE.

III. COMPONENT AND DATASHEET

This chapter explain about the Hardware that is being used in the paper.

- **Controller Module (ARM7 LPC2148 Microcontroller)**

Over the last few years, the ARM architecture has become the most popular 32-bit architecture in the world, with wide range of ICs available from various IC manufacturers. ARM7 & Cortex series is largest success of ARM. ARM processors are embedded in products ranging from cell/mobile phones to automotive braking systems. A worldwide community of ARM partners and third-party vendors has developed among semiconductor and product design companies, including hardware engineers, system designers, and software developers. LPC2148 is the widely used IC from ARM-7 family. It is manufactured by Philips (NXP) and it is pre-loaded with many inbuilt peripherals making it more efficient and a reliable option for the beginners as well as high end application developer.

- **Temperature Sensor**

The LM35 arrangement are accuracy incorporated circuit temperature sensors, whose output voltage is linearly relative to the Celsius temperature. The LM35 does not require any external reduction to give normal correctness of ±1/4°C at room temperature and ±3/4°C, over a full - 55 to +150°C temperature range. The LM35's low impedance, linear output, and accurate characteristic brightening make interfacing to readout or control hardware particularly simple

LM35 (As shown in FIG) operates from 4 to 30 volts. Its main application is detection of heat, and hence can be used as a temperature sensor in our system.

- **LM35 Interfacing Circuit**

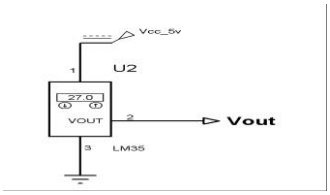

Fig of: 3.1 Interfacing Circuit

As such no more components required to assemble LM35 to ADC as the output of LM35 is linear with 10mv/degree scale. It can be directly interfaced to any 10 or 12 bit ADC. But if you are using an 8-bit ADC like ADC0808 or ADC0804 an amplifier section will be needed if you require to measure 1°C change. The output of LM35 temperature can also be provided to comparator circuit and can be used for over temperature display or by using a simple relay can be used as a temperature monitor.

- **Heart beat Sensor**

The sensor gives easy way to keep a mark left of the heart beat. This sensor judges the flow of blood through the index finger. As the heart pushes blood through the blood vessels in the finger, the amount of blood in the finger vary with time, due to which we can correctly measure the heart rate. This is a heartbeat / pulse / PSO2 sensor based on a Silicon Labs Si1143 chip. The chip wasn't exactly designed for a pulse sensor but it has all the useful ingredients. These include variable LED control for three LEDs and two photodiode detectors. The chip has a boatload commands for controlling the LED pulse width, the LED current and which LEDs are on during which exact measurement.. The board is outfitted with two infrared LEDs and one red LED, for sensing of visible red light. The two frequencies are needed for sensing and calculating the oxygen saturation in blood.

- **EMG**

Electromyography (EMG) is a diagnostic flow to assess the health of muscles and the nerve cells that ordering them (motor neurons).Motor neurons pass electrical signals that cause muscles to contract. An EMG converts these signals into graphs, sounds or numerical values that a specialist interprets. An EMG uses tiny devices called electrodes to transmit or finds electrical signals. During a needle EMG, a needle electrode inserted directly into a muscle records the electrical performance in that muscle. A nerve conduction study, another part of an EMG, uses electrodes taped to the skin (surface electrodes) to calculate the speed and strength of signals traveling between two or more points.EMG results can reveal nerve dysfunction, muscle dysfunction or problems with nerve-to-muscle signal transmission.

- **EMG Amplifier**

Applications where variable inter-electrode distance is desired, the EMG Amplifier (SX230FW) has the same

superb signal pickup of the EMG sensor (SX230). Instead of the integral electrodes of the SX230, the amplifier (SX230FW) has two flying wire leads for use with any reusable or disposable SEMG electrode incorporating a 4 mm snap. The maximum inter-electrode distance is 170 mm and the minimum distance is dependent upon the size of the electrodes used.

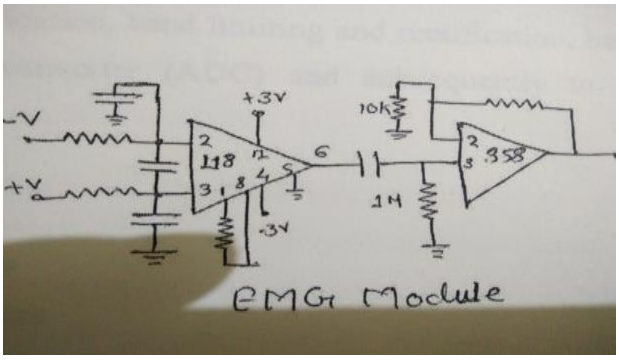

Fig of: 3.2 EMG Module

- **ECG**

It is a single lead heart rate monitoring sensor. AD8232 is a coordinated front-end for bio-electrical signs of the heart letter. This is a important parameters monitoring sensor which sense all type of application produced by low power. Basically it is an analogical us front end heart rate monitoring system. The AD8232 is an integrated signal conditioning block for ECG and other biopotential measurement applications. It is implement to extract, amplify, and filter small biopotential signals in the presence of noisy conditions, such as those created by motion or remote electrode placement. This system allows for an ultralow power analog-to-digital converter (ADC) or an embedded microcontroller to acquire the output signal easily. This filter is tightly coupled with the instrumentation architecture of the amplifier to allow both large gain and high-pass filtering in a single stage, thereby saving space and cost.

- **Zig Bee**

ZigBee is a specification for a suite Wireless Personal Area Networks (LR-WPANs). ZigBee is targeted at radio-frequency (RF) applications that require a low data rate, long battery life, and secure networking. ZigBee is a low-cost, low-power, wireless mesh networking standard. First, the low cost allows the technology to be widely deployed in wireless control and monitoring applications.

Maximum Transmission Distance – 200 mtr
Line Of Sight Range – 1200 mtr
Wireless Frequency – 2.4GHz
Working Voltage – 3.4DC

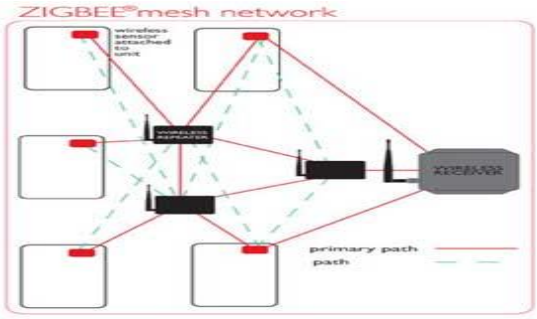

Fig of: 3.4 ZIGBEE

The **Xbee modules** work at the 2.4 GHz frequency which means smaller board and antenna size. **Xbee module** have the ability to transmit Digital, PWM, Analog or Serial RS232 signals wirelessly. To communicate over **UART** or **USART**, we just need three basic signals which are namely, RXD (receive), TXD (transmit), GND (common ground). So to **interface UART with LPC2148**, we just need the basic signals.

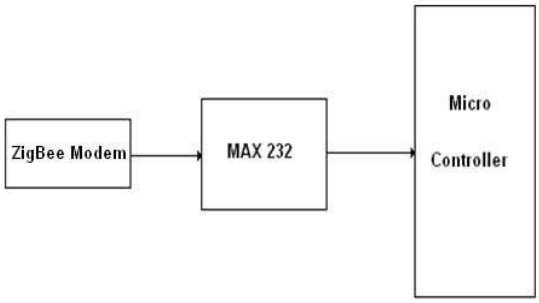

Fig of:3.3 Interfacing Zigbee to Microcontroller

- **Interfacing Zigbee with LPC2148**

We now want to interface the ZigBee module with LPC2148 Development Board.for accessing the mobiles without wires through UART0. The data communication is done in internet by using the ZigBee module through MAX232 into the SBUF register of LPC2148 Development Board**.** (refer serial interfacing with LPC2148). The serial data from the Zigbee receiver is taken by using the Serial Interrupt of the controller. +5V and ground is connected to provide power to the module. While TX and RX pin is connected for communication.

IV. CONCLUSION

This paper of Remote Patient Monitoring System is a Android application which allows doctor to view the patient's vital signs and parameters remotely and dynamically in real time. This system can be used in

hospital/clinic. We intend prepare a mobile phone based intelligent patient monitoring system with good extensibility. This system can be useful in such condition where the doctor are unable to reach to the patient. Also this system can be used to measure human parameter at home when there is the need of constant monitoring of human health.

The image can be acquired, analyzed, transmitted and analyzed remotely in a quasi real time sense. The system allows the doctor's advice to be given to the patient even if he is not present near the patient. As a summary, the presented monitoring system will be a cost effective, flexible and robust solution supporting a unique mobile based computational platform.

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