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WSN Based Healthcare Monitoring System using GSM and ARM7

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Abstract: *The research paper, presents a Wireless Sensor Network (WSN) for monitoring a patient's physiological conditions continuously using gsm. In this Project we are 4 group members are made to do test. Person A was in the age group of 1-10 years. Person B was in the age group of 11-30 years and person C was in the age group of 31-80 years. Physiological conditions of these 3 groups of persons were monitored using physiological sensor. The output of physiological sensor has to be transmitted via gsm and the same has to be sent to the remote wireless monitor for acquiring the observed patient's physiological signal. The remote wireless monitor is constructed of gsm and Personal Computer (PC). The measured signal has to be sent to the PC, which can be data collection. is basically deals with measurement of the body temperature, ECGpattern simulated BP and heartbeat rate of patients and displays the figure on LCD display. We are going to three clamped type sensors out of which two are placed on wristof the hand and one is placed on any leg. Differential voltage from sensor is in mV range which is converted into volts by instrumentation amplifier designed for gain of 1000.The amplified signal is applied to low pass filter for faithful nature of ECG whosecut-off frequency is decided to be 150Hz.*

Keywords: ARM7, GSM, LCD Display, LM35, ECG Sensor.

I. INTRODUCTION

The development of WSN was originally motivated by military application such as battlefield surveillance. GSM is gaining an exponentially increasing interest from industry and is considered as a universal solution for low-cost low-power wirelessly connected monitoring and control devices ("Electronics For You", May 2009). This interest is mainly driven by the potentially large number of emerging applications including home automation (as the current principal commercial target of the gsm Alliance), health care monitoring, industrial automation, environmental monitoring, surveillance and so on, These applications have essentiallybeen triggered by the wireless sensor network praigm, which represents the new generation of network infrastructure for large-scale distributed embedded systems conectec. To the serial communication circuit. The output of this serial communication circuit is fedinto the GSM modem device and output of this GSM device is transmitted via transmitting antenna. In the receiver side the said transmitted signal is received through the receiving antenna and fed into the GSM modem or normal mobile unit. The output of this GSM modem unit is fed into the RS-232 serial port communication interface and output of this RS-232 is fed into Personal Computer (PC) sends Global System for Mobile communication (GSM) short message to the receiver. The receivercan use the PC or Personal Digital Assistant (PDA) to observe the sensed signals in the remote place. The PIC microcontrollers are supported with a full range of hardwareand software development tools (David Gay, et al, 2003). The transmission section codes using various software. In recent years progress in the field of medical care has been rapid,especially in the field of neurology and cardiology. A major reason for this progress has been the confluence of two major disciplines viz. medicine and engineering. During the last few decades, this inter-disciplinary field in which Engineering, scienceand Technology, along with the computers are applied to medical and biological problems, has revolutionized the delivery of health care and medical procedure for diagnostic therapy, treatment and surgery

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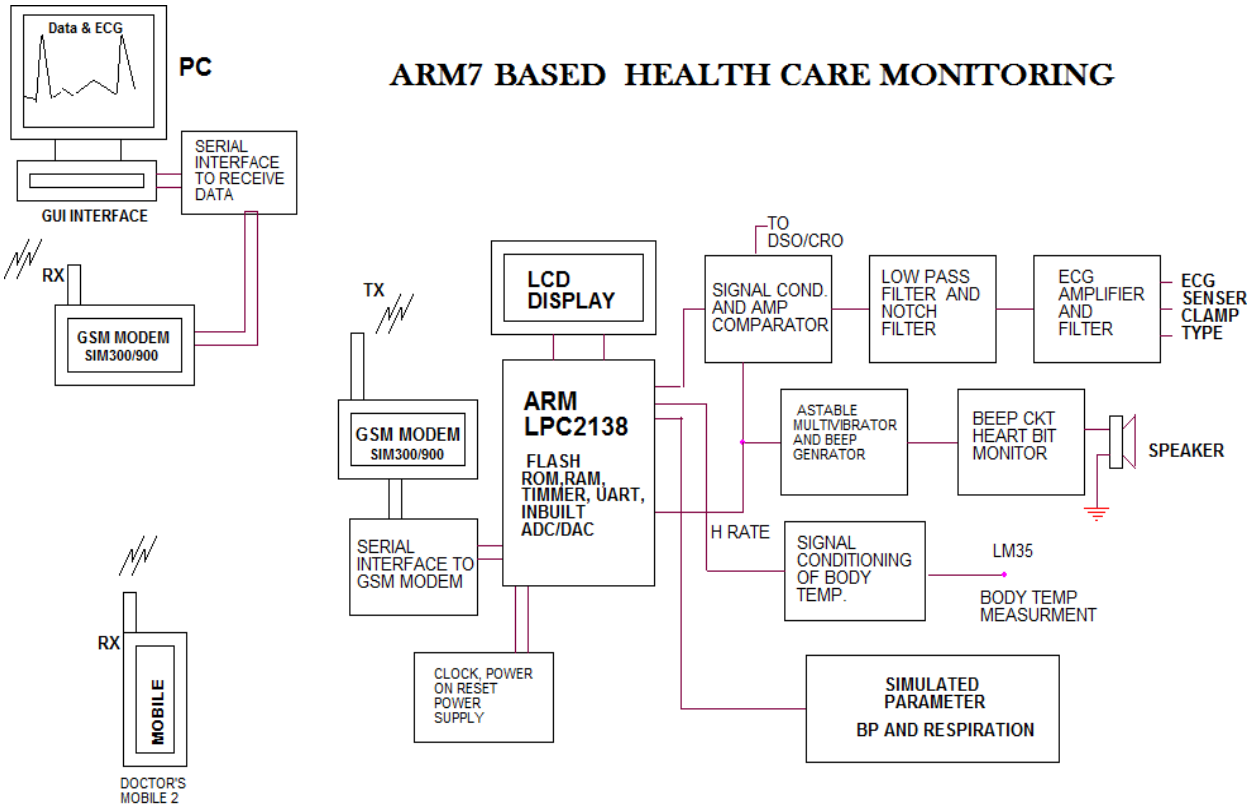
II. LITERATURE SURVEY

Health is a major issue in growing developing countries, and health monitoring system plays major role. The setup proposed through wearable sensors collects data from patients and guidance is provided by doctors to change in daily activities and patient recovery process [2]. Patients requires assistance in remembering there health parameters. Different sensors are utilized for various issue occurrences. Heartbeat [4], Air flow, ECG and LM35 sensors are utilized for determining patient's health. Different various systems for monitoring are developed which helps in monitoring patient located remotely and obtain data of health rating through GSM technology [3]. Remotely located patients adapt to wearable sensors for monitoring day to day activities. To improve diagnosis of health reliability and monitor various sensors requires android GSM [9] based smart phone application. To monitor the status of the patient, pulse rate, recognition of patient fall, status of health parameters data is collected and sent through GSM [8]. In reality health factor is very important in critical real-time systems. For health issues visiting hospitals and consulting doctors is as like spending much time and financial problem. To overcome this, a module is designed which is scalable, portable, cost effective, gives information primarily on health of person. Using this system in remote areas or in home patients health parameters like pulse rate[3], temperature of body, air flow detection[4], ECG, glucose level can be measured before approaching doctor for consultation. A LPC-2148 micro controller with effective scalable portable data information is built up to monitor health related information through various sensors. Organization of the paper is as mentioned: Section I depicts on introduction on the Health Monitoring System. Section II reviews Literature survey of the concept proposed. Section III explains on the objective and methodology of the proposed concept. Section IV explains on Hardware implementation and software implementation, section V concludes on the results snapshots and future concept of the proposed system.

III. PROPOSED SYSTEM



BLOCK DIAGRAM

Fig. 1. Block Diagram

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In this project, The different parameters of human beings are monitored from remote location by expert Dr. at remote location. Body temperature and BP. The ECG signal and heart bit rate is the main part of system. The amplified signal is applied to low pass filter for the faithful nature of ECG signal. The cutoff frequency of the low pass filter is decided to be 150Hz to pass the element of all ECG signal. The signal is thenapplied to notch filter to filter the noise of line frequency 50Hz. One more stage of amplifier is inserted and finally signal is applied to the comparator for the detection ofR wave. This signal is applied to the comparator to detect the R pulses. After detectionof the R pulses the signal is applied to monostable multivibrator. The output of monostable is the sharp spike having very low on time with respect to off time. Thesepulses are regularly generated as the ECG nature is coming from the sensor part. Theduration between two-conjugative pulses is inversely proportional to the heart beat rate. As the duration is long the heart beat rate will be low. And if the duration is low then the heart beat rate will be very high. The normal heart beat rate is varying from 70-120 bpm.

ARM7 LPC2148 Microcontroller

The LPC2131/32/34/36/38 microcontrollers are based on a 16/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combine the microcontroller with 32 kB, 64 kB, 128 kB, 256 kB and 512 kB of embedded high-speed flash memory. A 128 bit wide memory interface and unique accelerator architecture enable 32-bit code execution at maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty. Due to their tiny size and low power heir tiny size and low power consumption, these microcontrollers are ideal for applications where miniaturization isa key requirement, such as access control and point-of-sale. With a wide range of serial communications interfaces and on-chip SRAM options of 8 kB, 16 kB, and 32 kB, they are very well suited for communication gateways and protocol converters, soft modems, voice recognition and low-end imaging, providing both large buffer sizeand high processing power.

Fast GPIO ports
Dedicated result registers for ADC(s) reduce interrupt overhead
UART0/1 include fractional baud rate generator
8/16/32 kB of on-chip static RAM
32/64/128/256/512 kB of on-chip flash program
high-speed 60 MHz operation
In-System Programming/In-Application Programming (ISP/IAP) via on-chip bootloader software.
8-channel 10-bit ADCs provide a total out.
up to 16 analog inputs, with conversion times as low as 2.44 ms per channel.
10-bit DAC provides variable analog output

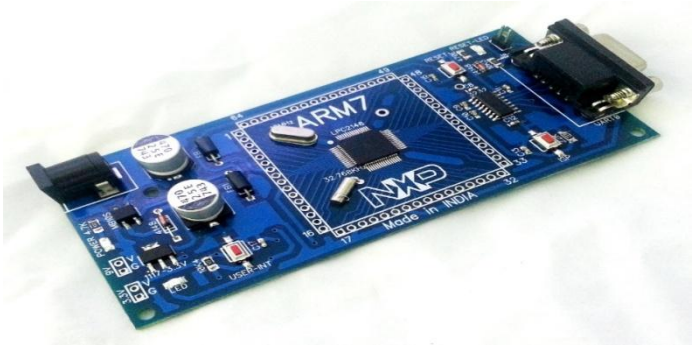

Fig. 2. Arm7 LPC2148

Temp sensor

There're many types of devices that can be employed as temperature sensors. They include integrated circuits (ICs), pyrometers, resistancetemperature detectors (RTDs), thermistors, thermocouples, electromechanical & volume (EMV). LM35 is a precision IC temperature sensor with its output proportional to the temperature (in **o**C). The sensor circuitry is sealed and therefore it is not subjected to oxidation and other processes. With LM35, temperature can be measured

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more accurately than with a thermistor. It also possesses low self-heating and does not cause more than 0.1 **O**c temperature rise in still air. The operating temperature range is from -55°C to 150°C. The output voltage varies by 10mV in response to every **o**C rise/fall in ambient temperature, *i.e.,* its scale factories 0.01V/ **o**C

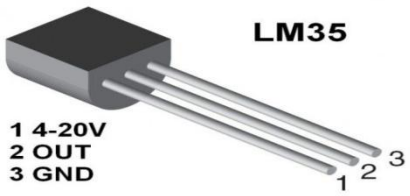

Fig. 3. Temp LM35 Sensor

GSM Module (SIM800)

This GSM modem has a SIM800A chip and RS232 interface while enables easy connection with the computer or laptop using the USB to Serial connector or to the microcontroller using the RS232 to TTL converter. Once you connect the SIM800 modem using the USB to RS232 connector, you need to find the correct COM port from the Device Manger of the USB to Serial Adapter. Then you can open Putty or any other terminal software and open an connection to that COM port at 9600 baud rate, which is the default baud rate of this modem. Once a serial connection is open through the computer or your microcontroller you can start sending the AT commands. When you send AT commands for example: "AT\r" you should receive back a reply from the SIM800 modem saying "OK" or other response depending on the command send.

Features of SIM800A

- Bands: GSM 850MHz, EGSM 900MHz, DCS 1800MHz, PCS 1900MHz
- GPRS class 2/10
- Control via AT commands (3GPP TS 27.007, 27.005 and SIMCOM enhanced AT commandset)
- Supply voltage 3.4-4.4V
- Coding schemes: CS-1, CS-2, CS-3, CS-4 Tx power: Class 4 (2W), Class 1 (1W)
- Small package: 23 * 23 * 3mm
- Low power: down to 1mA in sleep mode

Fig. 3. GSM Module

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LCD Display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD

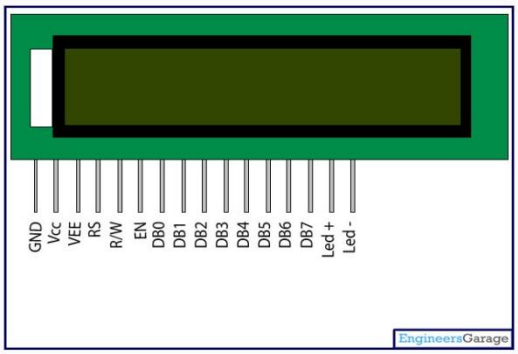

Fig. 4. LCD Display

IV. CONCLUSION

The system proposed is patient monitoring system using different sensors embedded with ARM7 LPC2148 microcontroller and GSM technology. To receive health related data before consulting doctor as information primarily this concept plays key role. LM35 sensor, air flow sensor, blood pressure, and ECG sensor signals data processed and transmitted to doctor and patient using smart phone. Through GSM technology message is received and suggestion is given further on health to patient. The system meets practical day to day life activities and promotes development of medical system wirelessly. The concept is applicable valuably in places like remote areas.

V. FUTURE SCOPE

- The interferences and noise include in the main sensed ECG signal can be minimized by the advanced signal conditioning technique like filters using AGC can be implemented.
- Diagnosis of patient can be display with prediction of heartbeat rate i.e. Low blood pressure, High blood pressure by implementing the logic for the program of microcontroller.
- The record of ECG signal, Heart bit rate can be stored using E-PROM IC's.
- PC interfacing can be done for displaying the ECG signal of patient on monitor screen.
- Selecting the proper sensors, the movement of cardiac valves (LUB-DUB and MURMUR sounds) can be amplified.
- The whole Biomedical monitoring can be done i.e. Different parameters like body temperature; blood pressure can be collectively measured and displayed.

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