

Patient E-health Monitoring System on ARM7-LPC2148 Micro Controller and GSM

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Abstract -New alternate solutions are introduced for health parameters in country like India where population and human resource health maintenance is a very big challenge. For checkup of health, advancements in technology are introduced now and then. Consulting doctor and hospital visiting is consumption of time as well financial crisis. A paper is presented which gives valuable data about human health. It is applicable in remote areas where human body checkup is done and information is sent to authorize doctor through GSM. Patient monitoring system which is effective of cost, portable, scable, and high performance can verify body temperature, heart rate, air flow, ECG before consulting doctor. Using ARM7, microcontroller LPC2148 with GSM technology and application of smart phone SMS is sent to respective person.

Keywords —ARM7, LPC2148, Sensors, E-health, Pulse rate monitor, Temperature sensor, Air flow sensor

I. INTRODUCTION

Health care engineering applications play an important role in medical achievements. Electronic sensors in the field of research are major advancements in patient monitoring [1]. Different sensors like temperature sensor, pulse rate sensor, air flow sensor, ECG sensor, and glucose level detection sensor are required to monitor health checkup of patient. The concept proposed here is used to monitor the health condition of patient in home as information containing first aid source. These days visiting hospitals and consulting doctors often is financial related and time consumption as well. To overcome this situation a module of microcontroller LPC2148 is designed for integrated monitoring system of patient's health. Heart or Pulse rate of the human is evaluated by placing finger on infrared device sensor and the measurement is read on LCD. When the parameter exceeds threshold value the device sends message [5]. The threshold value or cut-off is given while programming LPC2148. The heart beat standard range varies 20-120 pulses/min, and temperature measured through LM35 ranges 18 to 38 degree Celsius. The temperature, pulse rate, air flow information through GSM [3] is sent to the prescribed person. The concept plays a key prospect in monitoring health of patient, and provides counseling now and then. Patients can't spend much time in same place. Through various sensors data is collected from patient regularly provides information in improving health in day to day activities. Patient is monitored and helps doctor for recovery process of patient. Analysis and computation of data is done through sensors. The various

sensors like LM35, Pulse rate, ECG, Air flow sensor along with GSM technology [8] enables collection health related parameters and SMS sent to authorize person.

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 cost

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. OBJECTIVES AND METHODOLOGY

A. Objectives and Methodology

The Electronic sensors are playing a major role in health care units. In research field the patient monitoring through electronic sensors is one of the major advancements. High performance and advanced integrated patient monitoring system is designed. Micro controller LPC2148 designed with different sensors like pulse rate [3], air flow, temperature, and ECG sensor to monitor the health of patient accordingly. The integration of system is done with different sensors to capture information and check patient health. Every information is displayed on LCD when each sensor detects through integrated system. In case of threshold expedition the data is notified to doctor through GSM.

B. Block Diagram and Working principle

The given concept of the proposed system contains patient monitoring sensors of health related parameters. Proposed concept depicts diagram containing various sensors, LPC-2148, power supply, LCD module and GSM Modem.

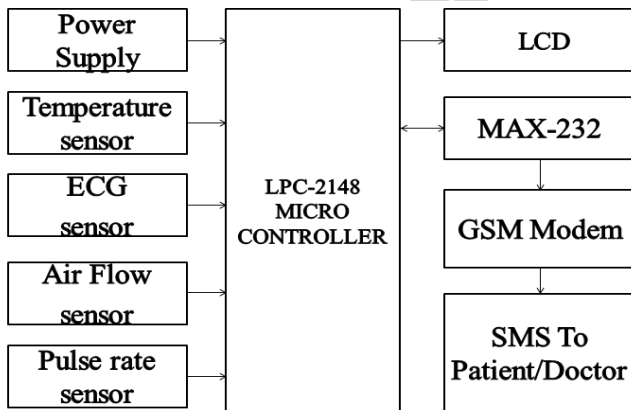


Fig.1: Proposed concept Block Diagram

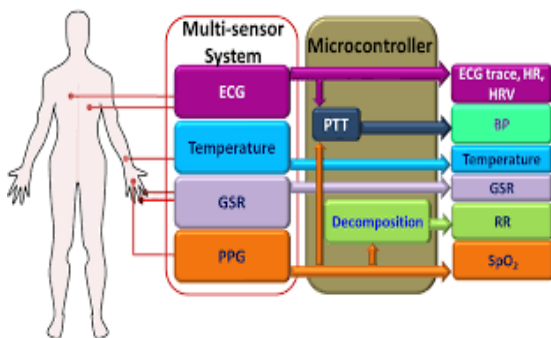


Fig.2. Multi-sensor System Application

To ARM processor input power of 12v supply is given. 3.3v input is used and different sensors utilize 5v. LM-35 sensor measures temperature output in centigrade form displayed in LCD. Heart beat sensor detects the blood transmission on finger insertion in the detection level, the reading is displayed on LCD. ECG rate is detected by ECG sensor and displayed on LCD. Air Flow sensor detects the air flow range, detects bad air and reading is displayed on LCD [4]. Through GSM technology authorized person receives message if the value of the threshold is exceeded by the sensors.

C. Hardware Specifications

i) ARM7:

- ARM (Advanced Risk Machine), is a family of CPU based on RISC architecture.
- It is a 32-bit Microprocessor.
- ALU is of 32-bit.
- Data bus of 32-bit.
- 32-bit Instruction set(RISC)
- 32-bit data in 1cycle, Von-Neumann architecture.
- 32-bit address bus. N-bit – 2ⁿ bits.
- 3-stage pipelining. - Fetching, Decoding, Executing. It has Load and Store mode.
- It operates on 3 parameters - Byte, Half word and Word.

ii) LPC2148:

- 32 bit Micro Controller.
- 16-bit Thumb mode instruction set.
- RISC instruction set.
- Performance Oriented processor.
- 45 fast GPIO Pins.
- Von-Neumann architecture.
- Low Power Consumption.
- 37 register of 32 bits.
- 32kb to 512kb Flash Memory.
- 4kb to 16kb S-RAM.

iii) Pulse rate sensor:

- AD8232 Pulse rate sensor adopts op-amp, uses 3-pole LPF eliminate noises.
- -40 to 85 degree is the operating temperature.
- Photo plethysmography principle is adopted.
- It works on the measure of changes in blood volume.

iv) LM35 Sensor:

- Temperature Sensor LM35 is a thermistor type small in size detects based on touch or conditions ambient in surrounding atmosphere.

- Calibration is done directly in Celsius.
- Linear in +10mV per degree Celsius Scale Factor.
- Range rated for -55 degree to 150 degree Celsius.
- Applicable for Remote appliances.
- Established in room temperature signal line ADC.

v) Air Flow sensor:

- It identifies the air flow in room, detects the bad air and buzzer.
- Its operating voltage is 5v.

vi) Electrocardiogram (ECG):

- The heartbeat muscular and electric functions are measured through ECG.
- The Heart Rate Monitor AD8232 provides attachment to sensors through pins Right Leg (RL), Left Arm (LA), Right Arm (RA).
- Operating voltage of ECG is 3.3V, pins operational essentially are provided with various developmental kits.
- The pulse rate adjusts higher cutoff filter after signal abrupt change amplifier leads condition nil. Readings taken after connecting to electrodes manifests AD8232 recover instantly.
- AD8232 is specified for performance from 0 to 70 degree Celsius range, operational at -40degree Celsius to +85degree Celsius. Available in a 20 lead package.

v) UART:

- User Asynchronous Receiver Transmitter
- The UART a serial communication.
- Data is shared between two controllers, required in embedded system applications.
- Other modes of communication like MASTER SLAVE, JTAG are available, here RS232 is chosen.

vi) LCD (Liquid Crystal Display):

- Liquid Crystal Display allows thinner display than cathode ray tube technology.
- LCD technology is used to display as like LED and gas plasma technologies, works on the basis of display light rather than emitting it.
- To produce a visible image LCD uses liquid crystal an electronic display module.
- The LCD display of 16x2 is widely utilized in circuits which translate 2 in lines characters 16 per line. Character is in 5x7 pixel matrix displayed and 8 data pins are utilized from D0 to D7.

vii) GSM Modem:

- The modem works on 900/1800MHz frequencies. It is built with Dual Band GSM engine SIM900A.
- Baud rate AT command is 9600-115200 configured.

- To connect via GPRS internet stack TCP/IP is enabled.
- Data, voice, SMS in M2M interface is suitable.
- On board Regulated power supply allows wide range connection.
- The modem provides facilities like SMS, audio calls, incoming calls, and internet through AT commands available.

viii) ADC:

- Analog to Digital Conversion .Two in LPC2148, approximation of 10 bit ADC.
- ADC0 and ADC1 multiplexing input are 6 or 8 pins.
- 0V to VREF, typically 3V measurements range.
- Applicable to mode of Power down.
- Conversion mode of single or multiple burst inputs. Conversion time lapse is 10bit >= 2.44microseconds.
- Conversion on transition optional. Timer Match signal or input pin.
- In LPC2148 only, start command globally for both converters.

IV. IMPLEMENTATION

Basic initial stages I/O hardware addressing is considered. For easy implementation microcontroller registers declaration and files containing special functions are declared. Embedded C to specify the registers addressing mentioned, facilitate the methodology of programming as C.

Source files are unlimited in number. Programming assembled and C language mixed. It is compatible with various MPLAB, IDE and most development tools which run on multiple platforms such as UNIX, Linux, Windows, and Mac OS.

A. Proposed System Flow Chart

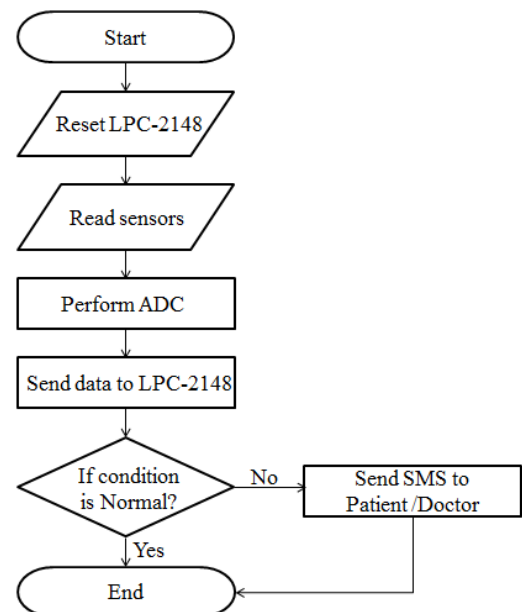


Fig.3. Proposed concept flow chart

B. Software specifications

Embedded C:

C is primarily used for programming system, includes operating system implementation. System applications embedded to various characteristics applications like efficiency, code portability, ability for specific hardware addresses. Run type, match data access imposed externally, requirements and runtime on system resources demand low. One of the consequences is of efficiency and acceptance. It is used to implement end-user applications, shifted widely to other higher level languages. The libraries, interpreters and compilers are implemented often in Embedded C Keil Software.

Coding done in this language to integrate various sensors with LPC2148 microcontroller, message send to authorized phone number person through GSM technology. The reading is displayed on LCD. By standards in C, Embedded C is one of the set of extension languages. Additional features are introduced in Embedded C.

V. EXPERIMENTAL RESULTS

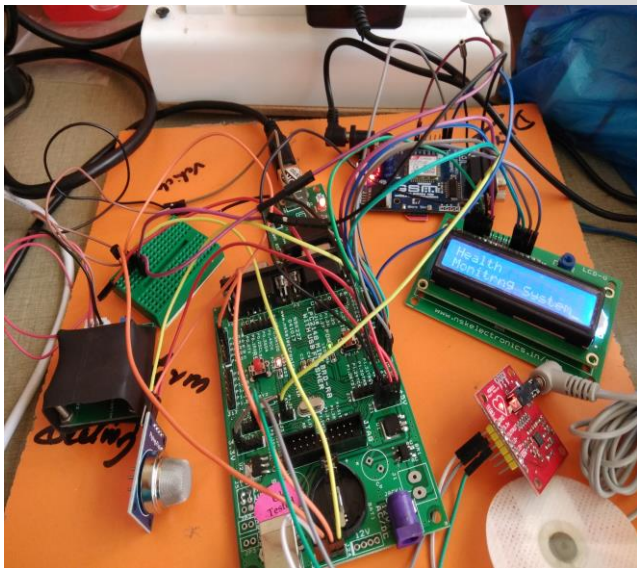


Fig.4 Proposed Concept Hardware Setup

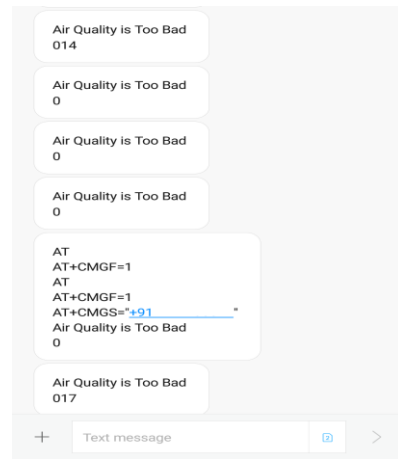


Fig.6 GSM commands information

- Power initialization for supply and system resetting of the controller. The patient is monitored by different sensors.
- Data is read from input sensors and ADC takes place. Data collected is sent to microcontroller LPC2148 as shown in fig. 4.
- The normal condition information data of the patient is displayed on LCD.
- The abnormality of patient condition result through GSM technology is sent to person authorised/Doctor.
- Pulse rate sensor is connected to finger in the hardware setup and values are displayed in LCD.
- Temperature varying verification is done by LM35, air flow detection and bad air flow is sensed through sensor and buzzer is turned on.
- Message is sent to person authorised or doctor .The data of message sent is displayed in fig. 5 and fig. 6.
- Message reads abnormality of data detected of air flow, temperature, and heartbeat is displayed. Information is sent to authorised personnel.

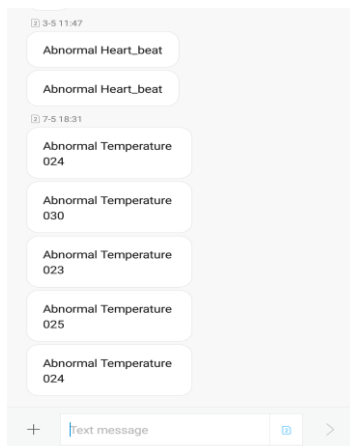


Fig.5. GSM sends information on abnormality conditions

VI. CONCLUSION

The system proposed is patient monitoring system using different sensors embedded with 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.

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