Wireless Remote Healthcare System

Ambika R, Kiran Jose, Priyadharshini. K, Priyanga S Kumar, Ramyashree

Abstract: Health monitoring is one of the main application areas for ubiquitous computing. The potential for ubiquitous computing is evident in almost every aspect of our lives including the hospital, emergency and critical situations. The use of this technology in the field of health and wellness is known as pervasive health care. The proposed project, Wireless Remote Healthcare System, is a smart and personalized means by which a patient can get medical health feedback and helps in saving Valuable Time, Ensures remote monitoring of vital statistics such as Pressure, Temperature and Pulse Rate and helps in Lowering the cost of Long term medical Care. It introduces the concept of tele-care – Allowing doctor patient interaction at a distance and not in the conventional setting of the hospital. The proposed WRHS integrate a set of interacting portable devices, while preserving mobility and independence and providing medical support in certain critical situations.

Keywords: ARM 7 microprocessor, GSM modem, KEILµVision, LCD, Power supply, Sensors

I INTRODUCTION

Technology has been part of our life and it is one of the key ingredients for the survival of mankind to living in a fast-phase environment.By all means, the most imperative impact of advancement in technology is in health and care sector, which has profited mankind the most. A health system is the organization of people, institutions, and resources to deliver health care services to meet the health needs of target populations. A healthcare system thus has the necessary amalgamation of technology and people to provide necessary services for patients. Wireless Remote Healthcare System (WRHS) aims to create new health and wellness dimensions with a holistic approach to life. Modern medicine, being the most prevalent and widely practiced is restricted only to primary, secondary and tertiary preventions only. However, WRHS aims to detect symptoms before they could even surface and hence helps in identifying abnormalities before they develop into full-fledged problems and metamorphosing into chronic ailments.

- *Kiran Jose is currently pursuing bachelor degree program in electronic and communications engineering in BMSIT E-mail: kijo456@gmail.com*
- *Priyadharshini K is currently pursuing bachelor degree program in electronic and communications engineering in BMSIT E-mail: priya.krishnamurthy91@gmail.com*
- *Priyanga S Kumar is currently pursuing bachelor degree program in electronic and communications engineering in BMSIT E-mail: priyanga.sk90@gmail.com*
- *Ramyashree V is currently pursuing bachelor degree program in electronic and communications engineering in BMSIT E-mail: srunique92@gmail.com*
- *Under the guidance of Associate Professor Ambika . R , BMSIT E-mail : ambika2810@gmail.com*

Recent advancements in wireless sensor networks have resulted in a plethora of opportunities in wireless remote healthcare systems. The future will see the integration of the abundance of existing specialized medical technology with ubiquitous, wireless networks. At their core, all models of ubiquitous computing share a vision of small, inexpensive, robust networked processing devices, distributed at all scales throughout everyday life and generally turned to distinctly common-place ends. They are designed to operate in harmony with pre-installed infrastructure, augmenting data collection and real-time response. Today's hospitals are understaffed and there is no relief in sight. The demand for qualified professionals far exceeds the number of students in programs in medical schools. This problem will probably not be resolved any time soon, and with more and more baby boomers entering the hospital and healthcare systems, the need has become critical. So in all these perception, an intelligent wireless healthcare system which monitors the in-home patient's vital physiological signs via and thus enabling easy contact with the doctor is designed in this project.

II DESIGNING

The designing part includes basically two sections as follows:

1. Hardware design
2. Software design

A Hardware Design

It includes power supply design, Temperature sensor (LM35), pressure sensor (NPC1210), heart beat sensor (LM358), LCD, ARM 7 processor and GSM SIM 300 modem.

Power Supply Circuit

The hardware requires different power supplies as follows:

1. 5V-temperature sensor, pressure sensor, heart beat sensor,LCD.
2. 12V-GSM SIM 300 modem,
3. 3.3V-ARM 7 processor

Arm 7 Processor

The LPC2148 microcontrollers are based on a 32 bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combines the microcontroller with embedded high speed flash memory ranging from 32 kB to

512 kB. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reducescode by more than 30 % with minimal performance penalty. Due to their tiny size and low power consumption, LPC2148 are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale. A blend of serial communications interfaces ranging from a USB 2.0 Full Speed device, multiple UARTS, SPI, SSP to I2Cs and on-chip SRAM of 8 kobo up to 40 kB, make these devices very well suited for communication gateways and protocol converters, soft modems, voice recognition and low end imaging, providing both large buffer size and high processing power. Various 32-bit timers, single or dual 10-bit ADC(s), 10-bit DAC, PWM channels and 45 fast GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers particularly suitable for industrial control and medical systems.

Pressure Sensor -NPC1210

With piezo resistive measurement, an elastic diaphragm of single-crystal silicon is deflected under pressure. A Wheatstone bridge made of semiconducting resistor elements are diffused into the diaphragm. As this bridge is unbalanced in proportion to the pressure applied, it produces a voltage that is also proportional to this pressure. This voltage is finally used as the actual measuring signal and for visualization of the measured pressure. . Compensation resistors are an integral part of the sensor package; no additional external resistors are required. Pins 7 and 8 must be kept open. The NPC-1220 is interchangeable only when used with the current set resistor shown in the schematic diagram. Superior Sensitivity and Natural Frequency Integrated circuit technology allows extremely small resistor networks and active elements to be integrated on the silicon chip, which can be designed to act as a pressure diaphragm as well. The main advantages of this technology over thin-film sensors or conventional metal strain gages are high sensitivity, compactness and a high natural frequency.

Heartbeat Sensor-LM358

The sensor unit consists of an infrared light emitting diode (IR LED) and a photo diode, placed side by side. The fingertip is placed over the sensor. The LED transmits an IR light into the fingertip, a part of which is reflected back from the blood inside the finger arteries. The photo diode senses the portion of light that is reflected back. The intensity of reflected light depends upon the blood volume inside the finger tip. So every time the heart beats the amount of reflected infrared light changes which can be detected by photodiode. With a high gain amplifier change in amplitude of reflected light can be converted into a pulse. The detectors photo current (AC part) is converted to voltage and amplified by an inexpensive op-amp LM358. Amplification is combined with 2nd order analog filtering. The pulses can be later counted by the microcontroller to determine the heart rate.

Temperature Sensor-Lm35

Lm35 uses solid state technique to determine the temperature. As temperature increases, voltage across a diode increases at a known rate i.e, voltage drop between base and emitter of a transistor. By precisely amplifying the voltage change, it is easy to generate the analog signal that is diectly propotional to measured temperature.The output is linearly scalable to the measured temperature which is 10mV/°C. This output voltage can be directly fed as an input to signal conditioning circuit or a series of ADC.

GSM

Global System for Mobile Communications or GSM is the world's most popular standard for mobile telephone systems. It is a hardware component that allows the capability to send and receive SMS to and from the system. The communication with the system takes place via RS232 serial port. Cell phone can be attached at the place of GSM hardware but it limits the hardware functionality such as sending or receiving of SMS. GSM services include telephony, asynchronous and synchronous data services (2.4/4.8/9.6 Kbps); value added features (SMS, fax) and more. Speech is digitally encoded and transmitted as digital stream standards GSM users can send and receive data, at rates up to 9,600bps. The dominant mobile phone network in the world today is GSM. It is a digital mobile communication network, which developed, rapidly in recent years. This network has coverage in most urban areas and offer. It provides the industry standard serial RS232 interface for easy connection to computers and other devices and provides serial TTL interface for easy and direct interface to microcontrollers. Controlled through standard AT commandsGsm comes with an onboard wire antenna for better reception.GSM board provides an option for adding an external antenna through an SMA connector.The SIM300 allows an adjustable serial baud rate from 1200 to 115200 bps (9600 default). Operating Voltage for this modem is 7 – 15V AC or DC (board has onboard rectifier).

B Software Design

Keil µVision

This includes the coding of ARM 7 processor and coding for downloading of data and for GUI (Graphical User Interface) on server side.The µVision2 IDE is Windows-based software development platforms that combines a robust editor, project manager, and make facility. µVision2 integrates all tools including the C compiler, macro assembler, linker/locator, and HEX file generator.

HJ Tag

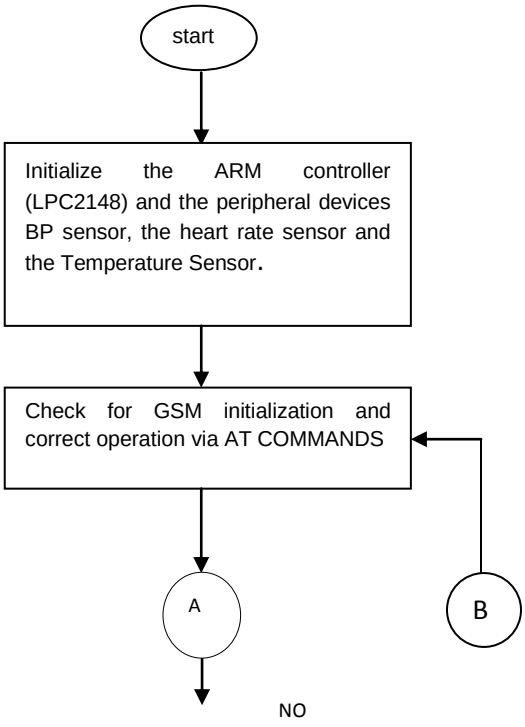
HJ TAG is used to dump the code on to the chip. H-JTAG USB emulator is a high-performance in circuit emulator, which provides 10K~15M Hz JTAG clock. The maximum download speed is up to 800KB/S and the maximum upload speed is up to 550KB/S. Used with H-JTAG Server and H-Flasher, high-speed debugging and flash programming can be achieved easily.

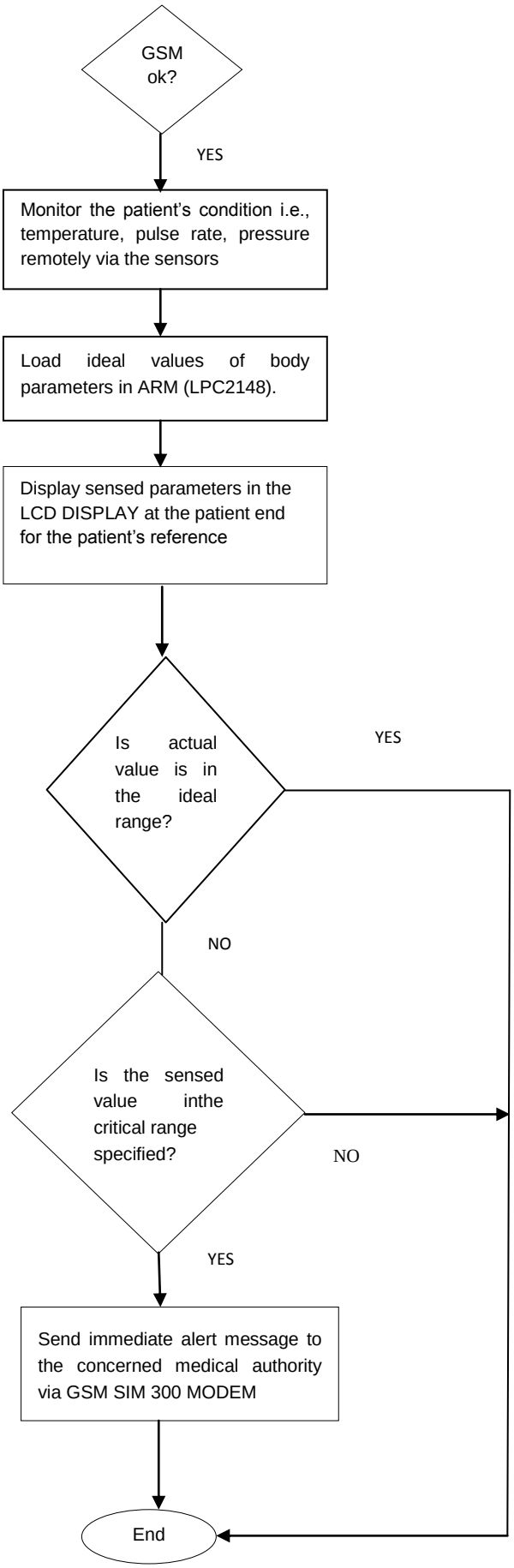
III WORKING

A Generic real time monitoring system has been developed for long time patient monitoring**.** The heart of our system is ARM CORTEX microcontroller, here we are using Philip's LPC2148 microcontroller to control all the functions of the system. The primary function of the system is to monitor the

temperature, pressure, and heart rate of the patient. The data collected is sent to the microcontroller on the transmitting end. The processor then compares the sensed data with a predetermined reference range and if there is any deviation sends a message to the concerned authority through the GSM MODEM. The GSM modem also has the GPRS feature which allows us to continuously update the sensed data into the patient database.

Flowchart





IV CONCLUSIONS

The primary objective of this project is to develop a reliable, efficient and easily deployable remote patient monitoring system that can play a vital role in providing basic health services to the remote population and elderly patients. This project enables transmission of the system body parameters which is sensed from remote patient to the server PC by using wireless transmission technology - GSM. Using GSM, the doctor is notified and he will receive SMS on his mobile phone in case any parameter goes beyond the normal specified range.

V FUTURE ENHANCEMENTS

Advances in remote patient monitoring include new peripherals, real-time audio and video for "face-to-face" interaction between clinicians and patients, and devices that are expected to transmit data to a physician's EMR system or will add the feature during the upfront years.The system can also be extended to provide GPRS features to allow continuous updation of patient database in emergency situations. In addition there are a number of devices of devices that monitor multiple vital signs—for example ECG, Pulseoximetry and Galvanic-Skin Resistance Amenia.

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