Review Paper on Designing of Telemedicine Application using ARM

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***Abstract* - The people in rural and remote areas, often face difficulties in receiving proper medical treatment. The world is categorized by densely populated communities spread over distances and there is a lack of expert physicians in certain sectors of the health service. Telemedicine originally emerged to serve rural populations or anyone who is geographically dispersed, where time and cost of travel make it difficult to receive the best medical care. Nowadays, telemedicine is forming a new structure in health-care services. By using information and communication technologies, the healthcare professionals in specialized fields, such as cardiology, urology, oncology, psychiatry, surgery and many others, can access or exchange information for diagnosis, treatment and prevention of diseases. This new age concept also provides solutions for continuous education and research among health-care providers to improve the health of individuals and their communities. Thus, telemedicine facilitates the delivery of the right medical advice at the right place at the right time using new computer-based communication technologies for medical purposes.**

This paper is based on ARM-7 processor which establishes an embedded telemedicine platform ground on LPC2148 and realizes some very popular embedded application technologies such as USB communication, embedded Internet communication, infrared communication, etc. The volume of the hardware is smaller; power consumption is lower; the functions are mightier and the expansibility is stronger. The whole running system is more stable and the program maintenance and update is more convenient. The telemedicine system based on this technology has been tested to be stable and efficient, and has obtained the results as expected.

I. INTRODUCTION

Telemedicine is the transfer of electronic medical data (i.e. high resolution images, sounds, sometimes video briefings, records of specific operations and patient records) from remote areas to centers where experts or well-equipped hospitals are available. Taking advantage of telecommunication, medical electronics and information technologies, telemedicine acts as a potential source to reduce health-care expense, improve health-care services in remote areas and support modern home health care and so on. Telemedicine can deliver health-care services to places where distance is the critical factor. Recent works in communication technologies have inspired the development of telemedicine to a large extent. There are many different disciplines in telemedicine such as teleradiology, telepathology, telecardiology and so on.

The common problem faced during the development of a telemedicine system is how to integrate the existing techniques to meet requirements for telemedicine applications. The series of ARM7 processors are 32bit RISC processors with low power consumption, which suit to those products that are exigent to the price and power consumption. The characters of ARM7 are shown as below:

- The exceptionally low power consumption;
- Offer third grade pipeline architecture of 0.9MIPS/MHz(fetching instruction, decoding and running);
- The maximum master frequency adds up to 130MIPS;
- The high coding density and supporting 16bit Thumb instruction set;
- Supporting OS that includes Windows CE, Linux, Palm OS and so on.

In this paper a novel system using micro electro mechanical systems (MEMS), ECG, GPS, and GSM is presented. MEMS are used to measure temperature, blood pressure of the person. ECG is used to measure the heart beat rate of the person. GPS gives location in the form of latitude and longitude. Once the controller gets the information from these devices it sends the information to the specialist as well as family members using GSM and internet. This system is designed by using ARM 32-bit microprocessor. The main advantage of this system is it reduces unnecessary wastage of memory storage as well as it saves power. At the receiving end, an android mobile is used to receive all the data of the patient. The information is continuously shown on the LCD & is transferred using GSM .Through GSM continuously the updated information is given to the concerned person.

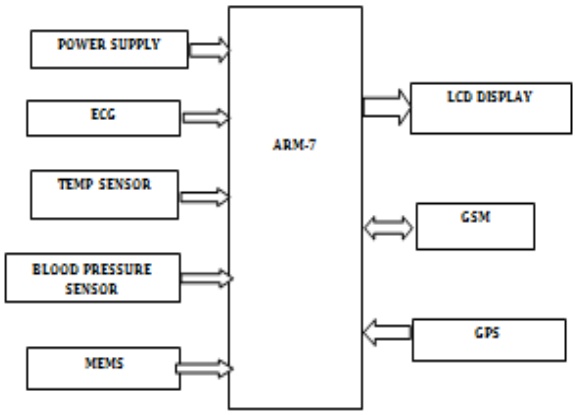

Fig.1 Block diagram of proposed system

II. THE INTRODUCTION TO ARM-7 CONTROLLERS LPC2148

The LPC2129/48 are ARM Cortex-M3 based microcontrollers for embedded applications featuring a high level of integration and low power consumption. The ARM Cortex-M3 is a next generation core that offers system enhancements such as enhanced debug features and a higher level of support block integration. The LPC1768/67/66/65/64/63 operates at CPU frequencies of up to 100 MHz. The LPC1769 operates at CPU frequencies of up to 120 MHz. The ARM Cortex-M3 CPU incorporates a 3-stage pipeline and uses Harvard architecture with separate local instruction and data buses as well as a third bus for peripherals. The ARM Cortex-M3 features and benefits are

- ARM Cortex-M3 processor, running at frequencies of up to 100 MHz (LPC2129/48) or of up to 120 MHz (LPC2129/48). A Memory Protection Unit (MPU) supporting eight regions is included.
- ARM Cortex-M3 built-in Nested Vectored Interrupt Controller (NVIC).
- Up to 512 kB on-chip flash programming memory. Enhanced flash memory accelerator enables high-speed 120MHz operation with zero wait states.
- In-System Programming (ISP) and In-Application Programming (IAP) via on-chip bootloader software.
- On-chip SRAM includes:
    - 32/16kB of SRAM on the CPU with local code/data bus for high-performance CPU access.
    - Two/one 16kB SRAM blocks with separate access paths for higher throughput. These SRAM blocks may be used for Ethernet, USB, and DMA memory, as well as for general purpose CPU instruction and data storage.
- Eight channel General Purpose DMA controller (GPDMA) on the AHB multilayer matrix that can be used with SSP, I2S-bus, UART, Analog-to-Digital and Digital-to-Analog converter peripherals, timer match signals, and for memory-to-memory transfers.
- Multilayer AHB matrix interconnect provides a separate bus for each AHB master. AHB masters include the CPU, General Purpose DMA controller, Ethernet MAC, and the USB interface. This interconnect provides communication with no arbitration delays.
- Split APB bus allows high throughput with few stalls between the CPU and DMA.

III. TELEMEDICINE SYSTEM HARDWARE DESIGN

The system adopts framework design thought of modularization, which divides the equipment into main module and other function modules. There is a uniform or special interface form between the main module and other modules.

The user can select different function modules according to their own needs.

Different kinds of data can be transmitted synchronously. Other functional modules can be expanded depending on the market demand, for example the photo electricity communication module, fetal heart rate monitoring etc. The design structure is convenient not only to use but also to update. The main control module is mainly up to human computer interaction, communication with functional modules, data storage, data transmission, etc. Through controlling the main functional module, the user may operate the functional module as well as other system functions and the data will be saved in the main control module. Then the main control module can send data to the server.

IV. FUTURE SCOPE

The pre-processing of the signal can be done by programming in MySQL while storing the data in database. We can set the alarm, if doctor does not respond in particular range of time. Many more features can be added on android side. The home based health monitoring application is presented which allows doctor to view his patient's medical parameter remotely and dynamically in a Web page in real time and does not need to have any special requirement on his PC or mobile; all he needs is an internet access. In future we can create and save the database of the patient, if patient could come after 1, 2 years then doctor can treat the patient very well.

CONCLUSION

Having worked on a Multi-Parameter Monitor System, the proposed idea is to design Telemedicine using ARM based on patient monitoring system for hospitals with features of storing the data in web database is viable. Android based patient monitoring system may be a better solution for a doctor to work from offline in case of emergency. With this system multiple parameters of the body can be detected, such as ECG, heart rate, blood pressure, temperature sensor. The advantages of this system are the system is

portable, mobile, compact, consumes low power , stores the data in database and is a very simple application. In this study, the frame work for implementation of Multi-Parameter monitor is reported. This system can be a powerful tool for doctors and nurses.

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