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REMOTE PATIENT HEALTH CARE MONITORING OVER INTERNET

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Abstract: ***We have developed an Android based mobile data acquisition (DAQ) solution, which collects personalized health information of the end-user, store analyze and visualize it on the smart device and optionally sends it towards to the datacenter for further processing. The smart mobile device is capable to collect information from a large set of various wirelesses (Bluetooth, and GPRS). Embedded sensors of the mobile device provide additional useful status information (such as: user heart rate, acceleration, ECG. temperature, etc.). The user interface of our software solution is suitable for different skilled users, highly configurable and provides diary functionality with information. The software enables correlation analysis between the various sensor data sets. The developed system is tested successfully within our Living Lab facility. Sensor data acquisition on the personal mobile device enables both endusers and care givers to provide better and more effective health monitoring and facilitate prevention. The paper describes the internal architecture of the software solution and its main functionalities.***

Keywords: Microcontroller, ECG sensor, Internet, Pulse sensor, Mems sensor, RFID reader, Bluetooth.

I. INTRODUCTION

The aging population of industrialized countries grows and this increases also among other things the health care costs. Transparently embedded remote health care can become a new cost effective paradigm, which can solve most of the problems primarily centralized Health Care system's have. Currently, there is a large number of enabling technologies to measure the patient's physiological signals remotely. With handheld and PC devices used as data acquisition (DAQ) systems we are able to collect vital information about the (elderly and demented) patients remotely. Due to the different - in most cases proprietary and incompatible- sensor technologies and solutions, it is a hard task to create generic, user friendly DAQ systems. There are already remote patient monitoring solutions available such as the Android based MyFitnessCompanion, which is able to support the following therapy fields: Fitness, Diabetes, Asthma, Obesity, Hypertension, CHD, or the iCare[which provides medical guidance, emergency alarm functionality and collects personal health information. Other example is the Microsoft HealthVault which supports care of elderly persons (e.g.: neurodegenerative diseases, stroke etc.), additionally it provides online web interface to manage (process and share) health information.

II. HARDWARE SYSTEM

Microcontroller: This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

ARM7TDMI: ARM is the abbreviation of Advanced RISC Machines, it is the name of a class of processors, and is the name of a kind technology too. The RISC instruction set, and related decode mechanism are much simpler than those of Complex Instruction Set Computer(CISC) designs.

Liquid-crystal display (LCD) is a flat panel display, electronic visual display that uses the light modulation properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

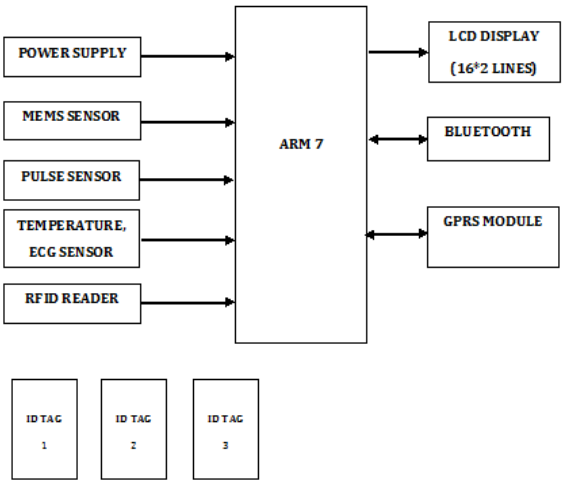


Fig 1: Block diagram

In this proposed system, the sensors are connected to microcontroller in this process. The GPRS module is connected through UART of the microcontroller providing serial data to microcontroller. The pulse sensor provides the Pulse readings to the controller. Similar to other sensor connected to the patient. These values are displayed on the LCD by the microcontroller. If the PULSE values exceed

their threshold values an alert is given. The data collected by controller is placed on the server by using GSM/GPRS SIM900 Modem. The data placed in the web page can be accessed anywhere by the doctor and nurse.

III. METHODOLOGY

The communication protocol has been mostly used to connect personal computers so far, but shortly all kinds of appliances with embedded computers will exchange information over the wireless network. In this project the main purpose is to provide a single control point which provides access to all building services with low cost reduction factors. A remote monitoring allows the quick detection of failing devices without needing long searches and wasting personal time. Android based My Fitness Companion, which is able to support the following therapy fields: Fitness, Diabetes, Asthma, Obesity, Hypertension, CHD, or the I Care [which provides medical guidance, emergency alarm functionality and collects personal health information. The system uses a compact circuitry built around LPC2148 (ARM7) microcontroller Programs are developed in Embedded C. Flash magic is used for loading programs into Microcontroller.

Fig 2: System Design Architecture

Temperature sensor: A thermistor is a type of resistor whose resistance is dependent on temperature. Thermistors are widely used as inrush current limiter, temperature sensors (NTC type typically), self-resetting over current protectors, and self-regulating heating elements. The TMP103 is a digital output temperature sensor in a four-ball wafer chip-scale package (WCSP). The TMP103 is capable of reading temperatures to a resolution of 1°C.

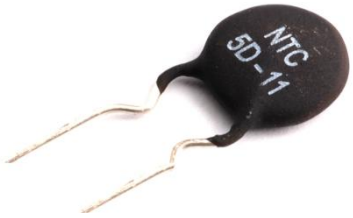


Fig 3: Temperature Sensor

MEMS: Micro-Electro Mechanical Systems (MEMS) is the integration of mechanical elements, sensors, actuators, and electronics on a common silicon substrate through micro fabrication technology. While the electronics are fabricated using integrated circuit (IC) process sequences (e.g., CMOS, Bipolar, or BICMOS processes), the micromechanical components are fabricated using compatible "micromachining" processes that selectively etch away parts of the silicon wafer or add new structural layers to form the mechanical and electromechanical devices. MEMS promises to revolutionize nearly every product category by bringing together silicon-based microelectronics with micromachining technology, making possible the realization of complete systems-on-a-chip. Microelectronic integrated circuits can be thought of as the "brains" of a system and MEMS augments this decision-making capability with "eyes" and "arms", to allow micro systems to sense and control the environment. Sensors gather information from the environment through measuring mechanical, thermal, biological, chemical, optical, and magnetic phenomena. The electronics then process the information derived from the sensors and through some decision making capability direct the actuators to respond by moving, positioning, regulating, pumping, thereby controlling the environment for some desired outcome.

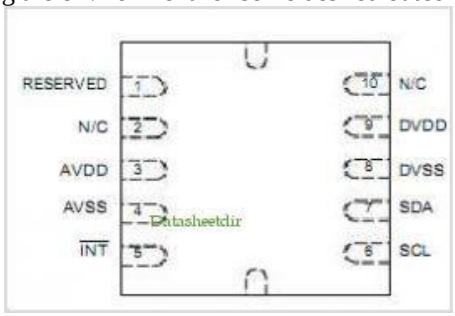


Fig: 4. MEMS IC

PULSE SENSOR: Pulse sensor is also called as Heart Beat Sensor. This heart beat sensor is designed to give digital output of heat beat when a finger is placed inside it. When the heart detector is working, the top-most LED flashes in unison with each heart beat. This digital output can be connected to microcontroller directly to measure the Beats Per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse.

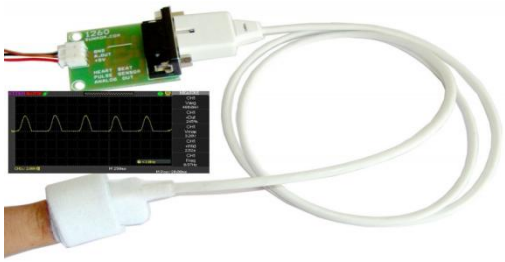


Fig.5. Pulse Sensor

ECG Sensor: The electrocardiogram (ECG or EKG) is a diagnostic tool that is routinely used to assess the electrical and muscular functions of the heart. The electrocardiogram (ECG) has grown to be one of the most commonly used medical tests in modern medicine. Its utility in the diagnosis of a myriad of cardiac pathologies ranging from myocardial ischemia and infarction to syncope and palpitations has been invaluable to clinicians for decades.

Fig 6: ECG Sensor

GPRS: GPRS (general packet radio service) is a packet-based data bearer service for wireless communication services that is delivered as a network overlay for GSM, CDMA and TDMA (ANSI-I36) networks. GPRS applies a packet radio principle to transfer user data packets in an efficient way between GSM mobile stations and external packet data networks. Packet switching is where data is split into packets that are transmitted separately and then reassembled at the receiving end. GPRS supports the world's leading packet-based Internet communication protocols, Internet protocol (IP) and X.25, a protocol that is used mainly in Europe. GPRS enables any existing IP or X.25 application to operate over a GSM cellular connection. Cellular networks with GPRS capabilities are wireless extensions of the Internet and X.25 networks.

Fig 7: GPRS module

RFID: Radio Frequency Identification (RFID) is a silicon chip-based transponder that communicates via radio waves. Radio Frequency Identification is a technology which uses tags as a component in an integrated supply chain solution set that will evolve over the next several years. RFID tags contain a chip which holds an electronic product code (EPC) number that points to additional data detailing the contents of the package. Readers identify the EPC numbers at a distance, without line-of-sight scanning or involving physical contact. Middleware can perform initial filtering on data from the readers. Applications are evolving to comply with shipping products to automatically processing transactions based on RFID technology RFID Reader Module, are also called as interrogators. They convert radio waves returned from the RFID tag into a form that can be passed on to Controllers, which can make use of it. RFID tags and readers have to be tuned to the same frequency in order to communicate. RFID systems use many different frequencies, but the most common and widely used & supported by our Reader is 125 KHz.

Fig 8: RFID Reader

Tags are classified into two types based on operating power supply fed to it.

- Active Tags
- Passive Tags

Active Tags: These tags have integrated batteries for powering the chip. Active Tags are powered by batteries and either have to be recharged, have their batteries replaced or be disposed of when the batteries fail.

Passive Tags: Passive tags are the tags that do not have batteries and have indefinite life expectancies.

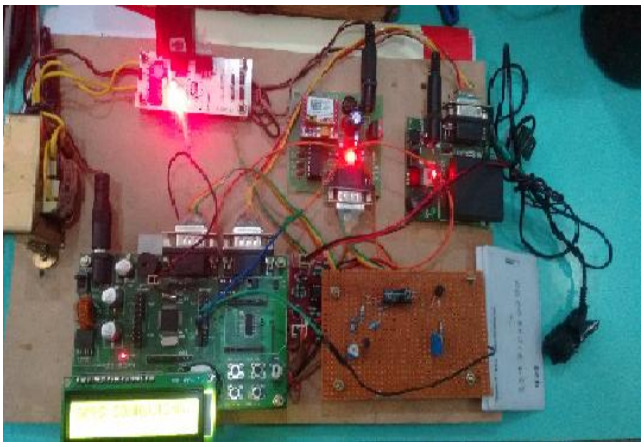
Fig 9: Different types of tags

BLUETOOTH: Bluetooth was selected as our way of communicating PDA/Mobile with a central system. The reason Bluetooth was selected over Wi-Fi for various reasons. First of all, Bluetooth security is less complex and more stable than that of Wi-Fi. Bluetooth manages a security measure of only permitting certain selected devices to interact with them; Wi-Fi in the other hand establishes a WEP key that has been known to be cracked. Another reason that Bluetooth was selected over Wi-Fi is that Bluetooth has a shorter range of signal emission than Wi-Fi. This is a pro because the shorter the range the less the amount intruders that will try to infiltrate your home system

Fig 10: Bluetooth Module

AUBTM-22 is a Bluetooth v1.2 module with SPP profiles. The module is intended to be integrated into another HOST system which requires Bluetooth functions. The HOST system could send commands to AUBTM-22 through a UART. AUBTM-22 will parse the commands and execute proper functions, e.g. set the maximum transmit power, change the name of the module. And next the module can transmit the data receive from the uart with SPP profiles.

IV. RESULT



V. CONCLUSION

This current designed system provides low complexity, low power consumptions and highly portable for health care monitoring of patient's and it can eliminates the need of utilization of expensive facilities. The doctor can easily access the patient's information at anywhere with the help of android web server.

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