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Wireless Sensor Network Based Patient Health Care Parameters Monitoring System

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Abstract: **- Patient monitoring systems are gaining their importance as the fast-growing global elderly population increases demands for caretaking. These systems use wireless technologies to transmit vital signs for medical evaluation. A patient monitor may not only alert caregivers to potentially life-threatening events; many also provide physiologic input data used to control directly connected life support devices. The aim of the project is to provide a better health care system to people from house, in more economic and pertinent friendly manner. The need of home-based health monitoring system is increased now days because health care cost is increasing exponentially in last few decades. In the proposed home-based health monitoring system using android smart phone includes the aspects of acquisition of medical parameters like Body temperature, Pulse rate and ECG. Processing of a collected data using ARM7 (LPC2148) microcontroller and processed data is then displayed on doctors or relative's android mobile phones. Also, the data can be displayed on personal computer. The system is utilizing a low-cost component to transmit data like ECG to physician for monitoring; diagnosis and patients care at significantly low cost, regardless of patient's location.**

Keywords**: Bluetooth, Wireless sensor network, ARM7TDMI.**

I. INTRODUCTION

In intensive care units, there are provisions for continuously monitoring patients. Their heart rates, temperatures, ECG etc. are continuously monitored. But in many cases, patients get well and come back to home from hospital. But the disease may return, he may get infected with a new Disease, there may be a sudden attack that may cause his death. In many cases, patients are released from hospital but still they are strongly advised to be under rest and observation for some period of time (from several days to several months). In these cases, our system can be quite handy. Patient's data (temperature, heart rate, ECG etc.) will be frequently measured and sent to server. Period of sending (say every 3 min) can be set. Heat rates can be sent every minute and temperatures can be sent after half an hour etc. But these can be parameterized to ensure that when a patient is normal, not many readings will be sent so that sensors have a longer life-time. But when the patient is ill, readings will be taken frequently and sent to server. Monitoring person learns patient specific threshold. Say the regular body temperature of a patient is 37□c whereas one person feels feverish if his body temperature is 37.0□c. By employing an averaging technique over a relatively long time, Observer can learn these thresholds for patients. Using android application, one can view his medical history date wise, event wise etc. android application can perform data mining on a particular patient data to discover important facts. Suppose a person has medium high temperature that starts at evening and lasts till midnight. If this phenomenon continues for several days, observer can detect this fact and inform to doctors saying "You frequently have short-period fever that may be a symptom of a bad disease. Consult patient immediately". This system can transmit continuously data. Suppose a patient has come back home after cardiac surgery. If the patient as cardiac problems like arrhythmia, then there will be irregular variation of heart signal. This may occur only once or twice a day. But if system transmits continuous data, such variations will be immediately detected and alerts will be issued. Early detection and diagnosis of potentially fatal physiological conditions such as heart attack require continuous monitoring of patient's health following transfer from hospital to home. Studies have shown that 30% of patients with a discharge diagnosis of heart failure are readmitted at least once within 90 days with readmission rates ranging from 25 to 54% within 3 – 6 months. In response to these types of needs, home based health monitoring systems are being proposed as a low-cost solution. Such a system consists of physiological data that stores, process and communicate through a local manner such as smart phones, personal computers. Such systems should satisfy strict safety, security, reliability, and long term real-time operation requirements.

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II. LITERATURE SURVEY

In the previous existing method PC devices used as data acquisition (DAQ) systems we are able to collect vital information about the elderly patients remotely. Existed system which monitors temperature & pulse rate of different patients and immediate action is taken using Bluetooth technology. The Mobile Hub has many attractive features cheaper price, portable, location awareness, inbuilt touch screen , however on the other side it has also significant limitations compared to a full PC hardware like limited CPU power, memory, storage size and external interface connection support, The Mobile Hub is targeting different functionalities compared to the Home Hub solution due to the smaller screen size and fewer hardware interfaces, and it can extend the usability with additional special features, such as mobility, location awareness and small size. Mobile Hub software is capable to run almost all Bluetooth enabled and Android based Smartphone. In a sudden panic situation an alarm can be activated manually (by the patient) or automatically (by e.g. the accelerometer) with the mobile device. When an alarm signal initiated the central dispatcher is able to acquire location information (based on GSM/GPRS cell information) immediately.

III. PROPOSED SYSTEM OVERVIEW

BLOCK DIAGRAM:

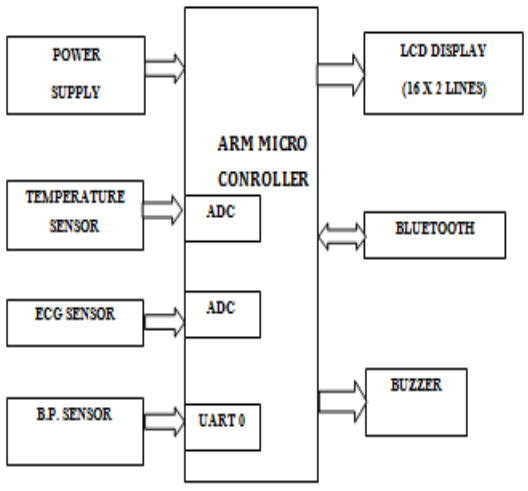

Fig1: Block diagram for Patient Monitoring

HARDWARE

Micro controller:

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)

It 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.

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 overcurrent 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: 2: Temperature sensor

Buzzer:

A buzzer or beeper is a signaling device, usually electronic, typically used in automobiles, household appliances such as a microwave oven, & game shows. The word "buzzer" comes from the rasping noise that buzzers made when they were electromechanical devices, operated from stepped-down AC line voltage at 50 or 60 cycles. Other sounds commonly used to indicate that a button has been pressed are a ring or a beep. The "Piezoelectric sound components" introduced herein operate on an innovative principle utilizing natural oscillation of piezoelectric ceramics. These buzzers are offered in lightweight compact sizes from the smallest diameter of 12mm to large Piezo electric sounders. Today, piezoelectric sound components are used in many ways such as home appliances, OA equipment, audio equipment telephones, etc. And they are applied widely,

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for example, in alarms, speakers, telephone ringers, receivers, transmitters, beep sounds, etc.

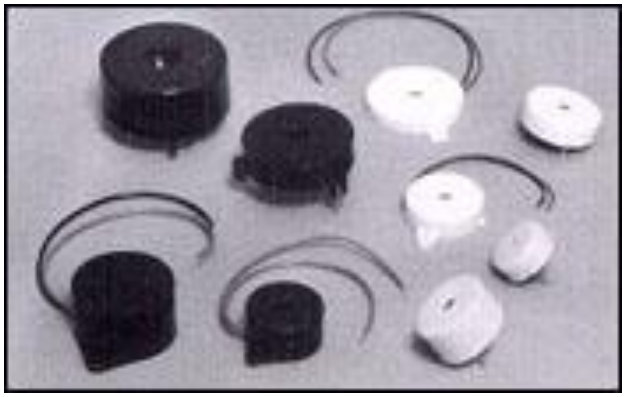

Fig: 3: Types of Buzzers

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: 4: ECG Sensor

Bluetooth:

Bluetooth is a wireless technology used to transfer data between different electronic devices. The distance of data transmission is small in comparison to other modes of wireless communication. This technology eradicates the use of cords, cables, adapters and permits the electronic devices to communicate wirelessly among each other.

The key features of Bluetooth technology:

· Less complication
· Less power consumption
· Available at cheaper rates
· Robustness

Bluetooth technology was discovered to have wireless protocols to connect several electronic devices and as a solution to synchronize the data. The Bluetooth standard is maintained by the Bluetooth Special Interest Group.

At the physical layer, the Bluetooth RF transceiver is positioned. At around 79 Bluetooth channels are placed with a space of 1MHz. Transmission of data and voice are achievable at short distances and thereby creating Wireless PANs.

A Bluetooth device is comprised of an adapter. A Bluetooth adapter can be available in the form of a card to connect the device or integrated into an electronic device. Link Management Protocol (LMP) is responsible for peer – to – peer message exchange when the electronic devices interfere in each other's radio range. This layer creates the link and negotiation of packet size. If required this layer can perform the segmentation and reassembling of the packets. The Bluetooth device enabled by the Service delivery protocol joins the piconet and enquires with all the services available. A piconet has a star topology with one master and seven slaves. The concept of Master and Slave is used in the Bluetooth technology. Only after the master takes the initial action, the devices can begin to talk. Bluetooth Global lD is exchanged among the electronic devices and a connection is build up after the profiles are matched. Get in-depth of Bluetooth Protocol Stack here. Frequency hopping is used in the Bluetooth technology to avoid interfering with other signals. After the packet is transmitted or received, the Bluetooth signal hops to a new frequency. Each packet can cover five time slots. The Bluetooth technology supports asynchronous data channel, or 3 simultaneous synchronous voice channels, or a channel which supports asynchronous data and synchronous voice.

Fig .5: Bluetooth Module

BLOOD PRESSURE SENSOR:

Features

- Intelligent automatic compression and decompression
- Easy to operate, switching button to start measuring
- 60 store groups memory measurements

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- Can read single or all measures
- 3 minutes automatic power saving device
- Intelligent device debugging, automatic power to detect
- Local tests for : wrist circumference as 135-195mm
- Large-scale digital liquid crystal display screen, Easy to Read Display
- Fully Automatic, Clinical Accuracy, High-accuracy
- Power by External +5V DC
- Serial output data for external circuit processing or display.
- Specification
- Working Voltage: +5V, 200mA regulated
- Output Format: Serial Data at 9600 baud rate (8 bits data, No parity, 1 stop bits). Outputs three parameters in ASCII.
- Sensing unit wire length is 2 meters

Fig .6: B.P. Sensor

PLATFORM DEVELOPMENT

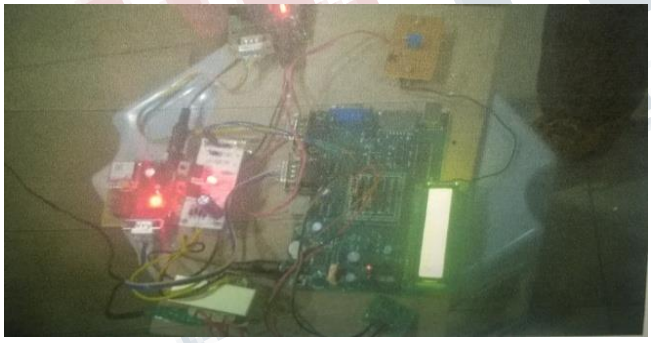

Fig .7: Project Output Execution

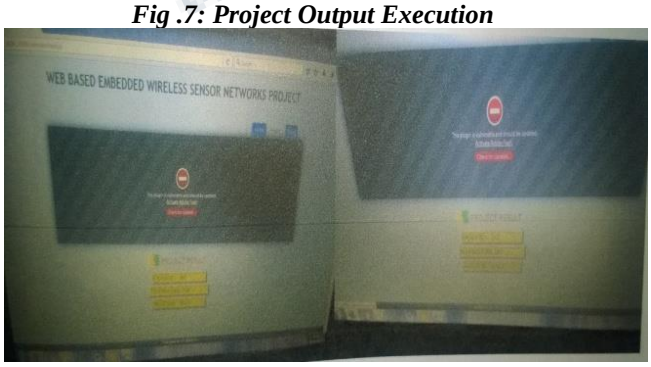

Fig 8. Different individual patients Body temperature details in URL

Fig 9. GPRS Modem Connecting shown in display

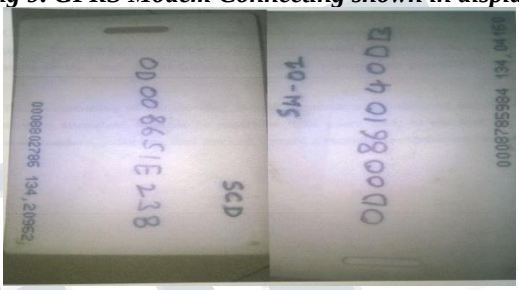

Fig. 10. RFID Tags

IV. CONCLUSION

This system reduces costs by enabling in home monitoring of patients, eliminating the need for utilization of expensive facilities, and reducing the need for transportation of patients to physicians and Medical centers.

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AUTHOR'S PROFILE

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