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GSM Based Health Monitoring System

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Abstract:

Wireless, remote patient monitoring system and control using feedback and GSM technology is used to monitor the different parameters of an ICU patient remotely and also control over medicine dosage is provided. Measurement of vital parameters can be done remotely and under risk developing situation can be conveyed to the physician with alarm triggering systems in order to initiate the proper control actions.

In the implemented system a reliable and efficient real time remote patient monitoring system that can play a vital role in providing better patient care is developed. This system enables expert doctors to monitor vital parameters viz body temperature, blood pressure and heart rate of patients in remote areas of hospital as well as he can monitor the patient when he is out of the premises. The system in addition also provides a feedback to control the dosage of medicine to the patient as guided by the doctor remotely, in response to the health condition message received by the doctor. Mobile phones transfer measured parameters via SMS to clinicians for further analysis or diagnosis and also send as a transfer measured parameters via short message service (SMS) with Bluetooth using android phone. The timely manner of conveying the real time monitored parameter to the doctor and control action taken by him is given high priority which is very much needed and which is the uniqueness of the developed system. The system even facilitates the doctor to monitor the patient's previous history from the data in memory inbuilt in the monitoring device. Also data can be sent to several doctors incase a doctor fails to respond urgently

This proposed research work would be implemented using embedded system design methodology, which includes embedded hardware and firmware design modules. This project would be carried out with Low cost 32 bit LPC2148 Micro controller, PCB Design Software Tools and industry driven Embedded EDA Tool kit and Embedded 'C' Programming Language.

1. INTRODUCTION

Patient Monitoring System is a process where a surgeon can continuously monitor more than one patient, for more than one parameter at a time in a remote place. The technical brilliance and development in different fields has led to a drastic change in our lives, one among them is embedded systems and telecommunications. Telecommunications has the potential to provide a solution to medical services to improve quality and access to health care regardless of geography. The advances in information and communication technologies enable technically, the continuous monitoring of health related parameters with wireless sensors, wherever the user happens to be. They provide valuable real time information enabling

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the physicians to monitor and analyze a patient's current and previous state of health. Now days there are several efforts towards the development of systems that carry out remote monitoring of patients. Although many wireless standards can be used, there are important considerations such as range, throughput, security, ease of implementation and cost. The patient monitoring involves handling of sensitive data. These data should be transmitted securely without any intrusion.

2. EXISTING SYSTEM:

In the existing work, the medical world today faces two basic problems when it comes to patient monitoring, firstly the need of health care providers present bedside the patient and secondly the patient is restricted to bed and wired to large machines. In order to achieve better quality patient care, the above cited problems have to be solved. As the technologies are advancing it has become feasible to design to home based vital sign monitoring system to display, record and transmit signals from human body to any other location.

3. PROPOSED MECHANISM:

The proposed project will overcome the drawbacks of the devices observed and therefore following modifications are done by replacing the devices. In the previous cases the sensors used were PPG sensor for temperature and blood pressure measurement and also electrodes were used for measuring the pulses and BP. The block diagram and the mechanism used will be improvised by some of the replaced methods from the recently implemented methods in order to make it more feasible and cost effective. The microcontroller atmega32 is replaced with ARM7 which has larger benefits from the previous implemented methods.

Hence designing the signal conditioning interface based on the different type of sensors such as MEMS and temperature sensor, Blood pressure module, humidity sensor and saline levels. The design will be useful for the patient health monitoring systems which use microcontroller for interpret ate through mobile phone network assisted by GSM/GPRS modem.

4. System Architecture

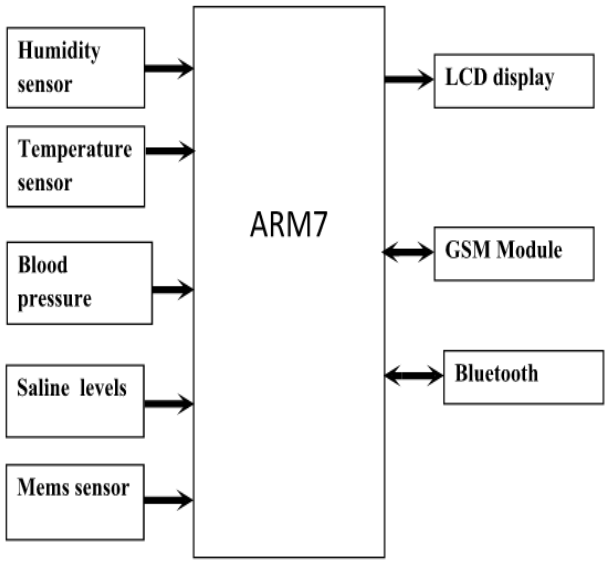

Figure:1 System Architecture

4.1 ARM (LPC 2148)

ARM stands for Advanced RISC Machine developed by ARM Ltd which is most widely used in number of embedded systems. Today ARM family accounts for approximately 75% of all embedded CPUs making it one of the leading architecture in the world. Previous designs used 8 bit/16 bit devices, but the designers are looking for highly integrated high performance ARM based 32-bit microcontroller. Heart of the design is ARM 32 bit RISC processor, hence brief description was given about its specifications below.

The basic block diagram of the system is as shown in fig 1, the signal conditioning interface based on the type of sensor such as MEMS and temperature sensor, Blood pressure module, humidity sensor and saline levels. The design will be useful for the patient health monitoring systems which use microcontroller for interpretation before sending them to the doctor through mobile phone network assisted by GSM/GPRS modem.

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Figure:2 Arm7 LPC2148 Board

The LPC2148 board consists of ARM7TDMI as its core and it is designed by NSK. ARM7TDMI family has good performance in situations where the energy consumption is critical design goal. LPC2148 has ARM7TDMI as its core is called CPU core. The modules inside are connected by the CPU high performance bus called Advance High performance bus (AHB) and the peripherals are connected by VLSI peripheral bus (VPB).

4.2 LCD DISPLAY:

A liquid-crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are used in a wide range of applications including computer monitors, televisions, instrument panels, aircraft cockpit displays, and signage.

Figure:3 LCD Display

They are common in consumer devices such as DVD players, gaming devices, clocks, watches, calculators, and telephones, and have replaced cathode ray tube (CRT) displays in most applications. They are available in a wider range of screen sizes than CRT and plasma displays, and since they do not use phosphors, they do not suffer image burn-in. LCDs are, however, susceptible to image persistence. The LCD screen is more energy efficient and can be disposed of more safely than a CRT. Its low electrical power consumption enables it to be used in battery-powered electronic equipment. It is an electronically modulated optical device made up of any number of segments filled with liquid crystals and arrayed in front of a light source (backlight) or reflector to produce images in colour or monochrome. Liquid crystals were first discovered in 1888.[2] By 2008, annual sales of televisions with LCD screens exceeded sales of CRT units worldwide, and the CRT became obsolete for most purposes.

4.3 Temperature sensor:

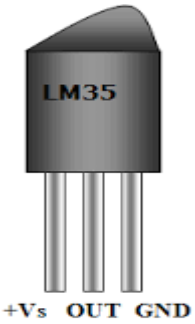

Figure:4 Temperature sensor

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1⁄4°C at room temperature and ±3⁄4°C over a full −55 to +150°C temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to

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readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies.

4.4 GSM Module

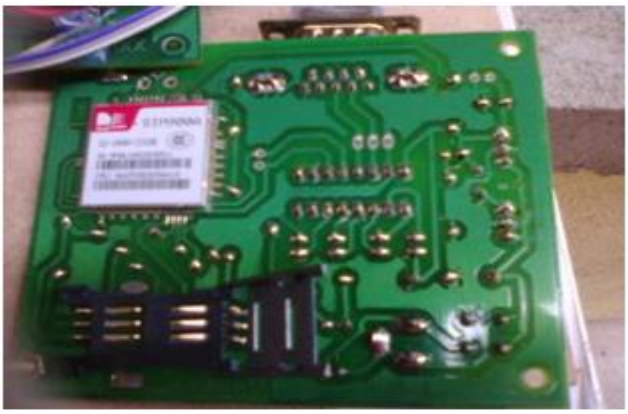

Figure:5 GSM Modem

GSM supports voice calls and data transfer speeds of up to 9.6 kbit/s, together with the transmission of SMS (Short Message Service). GSM operates in the 900MHz and 1.8GHz bands in Europe and the 1.9GHz and 850MHz bands in the US. The 850MHz band is also used for GSM and 3G in Australia, Canada and many South American countries. By having harmonized spectrum across most of the globe, GSM's international roaming capability allows users to access the same services when travelling abroad as at home. This gives consumers seamless and same number connectivity in more than 218 countries. Terrestrial GSM networks now cover more than 80% of the world's population. GSM satellite roaming has also extended service access to areas where terrestrial coverage is not available.

4.5 HC-05

Figure:6 HC-05 Bluetooth

The Bluetooth serial module named even number is compatible with each other; The salve module is also compatible with each other. In other word, the function of HC-04 and HC-06, HC-03 and HC-05 are mutually compatible with each other. HC-04 and HC-06 are former version that user can't reset the work mode (master or slave). And only a few AT commands and functions can be used, like reset the name of Bluetooth (only the slaver), reset the password, reset the baud rate and check the version number. The command set of HC-03 and HC-05 are more flexible than HC-04 and HC-06's. Generally, the Bluetooth of HC-03/HC-05 is recommended for the user.

4.6 Humidity sensor (HR 201)

Our highly advanced technology of Humidity Sensors is presented by us with the efficient functionality and less maintenance features. These sensors are useful for determining the humidity content or relative humidity of air. Further, due to their optimum temperature, these converts relative humidity to output voltage without any hassle. Our valued clients acclaimed the range for their easy operations and installations.

Figure:7 Humidity sensor

4.7 Heart Beat Sensor

Figure:8 Heart Beat Transducer

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A simple heart -beat transducer can be made from an infrared LED and an infrared phototransistor. It works because skin acts as a reflective surface for infrared light. The IR reflectivity of one's skin depends on the density of blood in it. Blood density rises and falls with the pumping action of the heart. So the intensity of infrared reflected by the skin (and thus transmitted to the phototransistor) rises and falls with each heartbeat.

4.8 MEMS

An accelerometer is a device that measures the physical acceleration. The physical parameters are temperature, pressure, force, light etc. it measures the weight per unit mass. By contrast, accelerometers in free fall or at rest in outer space will measure zero. Another term for the type of acceleration that accelerometers can measure is g-force.

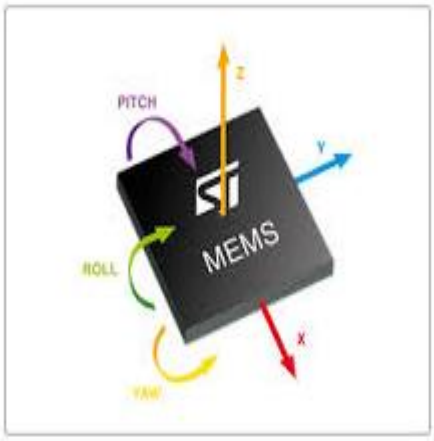

Figure: 9 MEMS Sensor

5. EXPERIMENTAL RESULTS:

These are the results obtained when the patient parameters changed. The parameters are like temperature, Humidity, Blood Pressure, Saline level and finally the patient motion i.e he is moving or not.

The system being a complete hardware design the data available on cell phone and LCD display have been captured. The system's prototype is successfully implemented and can be demonstrated. A few test results of the system are put down below, which show successful implementation of the system. Figure10 shows the actual implemented system. The operation the system is following like when we switched on the power we can obtained as show in the following figure11.Before initiating the system we need to fix a SIM card in the GSM modem and we need to recharge it with the SMS balance. After that we need send a mobile as followed by the star (*) Example:*8959370208.Then the inserted mobile number will save the sent mobile number.

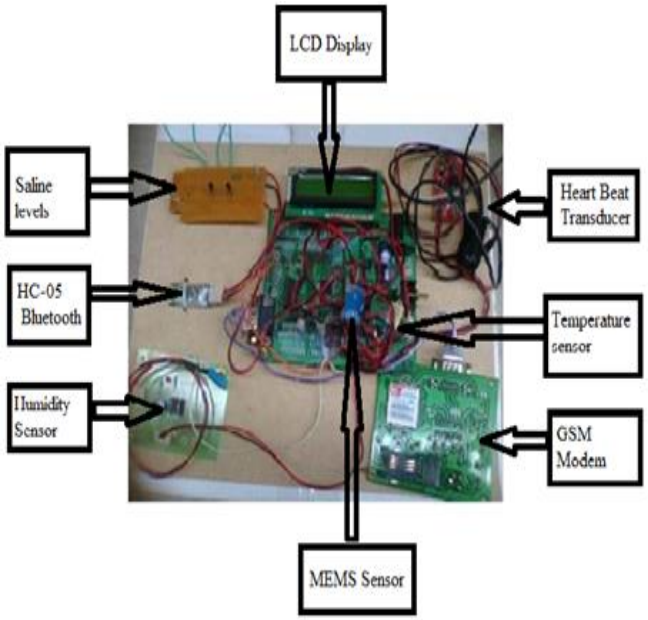

Figure:10 GSM patient health monitoring system(Main circuit)

This the figure obtained when we switched on the Power supply and after that we can reset the system we can get the response like figure12.

Figure:11 Initial response of the circuit

After getting the response like in the below figure we can send the mobile number like *8959370208 then it will receive the number and will save it.

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Figure:12 circuit is ready to save the mobile number

After saved the number it will display the parameters what we mentioned in the system as following Temperature, Humidity, Blood pressure, saline levels and finally the patient motion .These are the parameters we can set as normal values in the program. If any changes can be obtained that means if the parameters are exceed the normal values then we can get the SMS to the saved mobile number/s.

The following figures shows the results when the parameters changes. During the execution of the system some of the snapshots of the display were taken. The following figure13 shows temperature changes, Figure14 shows patient moments and finally figure 15 shows saline levels

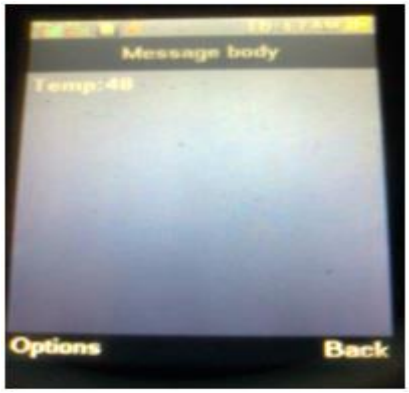

Figure:13 When temperature changes

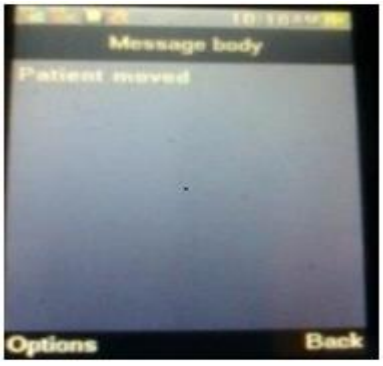

Figure:14 when patient moved

Figure:15 when saline in medium level

6. CONCLUSION:

The remote patient monitoring system is one of the major improvements in the hospitality because of its advanced technology. A wireless patient monitoring system to measure heartbeat, body temperature and blood pressure by using embedded technology is discussed. An embedded technology is used instead of DSP technology to develop this system so that it is easy to operate and available at an affordable cost.

This is a convenient process to monitor the patient's health conditions from any distance. Since we are using GSM technology, this makes the user to communicate for longer distances. This work provides real-time update of the patient's health to the doctor along with necessary preliminary action taken by physician in case of his absence. It reduces the frequent visits of the doctors to the patient in person and assistance to the patient in case of biomedical parameter change.

7. FUTURE SCOPE:

Future work would include implementing the pulse detection in real time with the ability of the mobile phone to identify incorrect holding of the phone and instruct a proper way. We also plan to implement a real-time filtering of audio heart sounds capable of detecting beats. The accuracy results were obtained by using an off-the-shelf blood pressure meter. However, the data from them are not accurate either. Hence, we plan on using more reliable source of measurement for our accuracy calculations.

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A Peer Reviewed Open Access International Journal

8. References:

[1] Arun E,Marimuthu V,Pradeep E and Karthikeyan M on"Remote Patient Monitoring-An implementation in ICU Ward", International Conference on Information and Network Techonology IPCSIT,Vol 4, 2011 pages 260-264..

[2] Pedro Girao,Fernando Santiago,Pena A ,"Enabling Telecare assessment with pervasive sensing and Android OS smartphone",IEEE 2011,page289-293.

[3] Sukanesh R,Rajan S.P ,Vijayprasath S.S Prabhu ," GSM based tele alert system", IEEE 2010,pages 1-5.

[4] Kamel M, Fawzy S.,"Secure remote patient monitoring system" IEEE Feb 2011, pages 339-432.

[5] C. Scully, J. Lee, J. Meyer, A. Gorbach, D. Granquist, Fraser, Y. Mendelson, and K. Chon, "Physiological parameter monitoring from optical recordings with a mobile phone," IEEE Trans. Biomed. Eng., vol. 99, no. 5, pp. 749–898, 2011.

[6] J. E and L. Martin, "Investigating a smartphone imaging unit for photoplethysmography," Physiol. Meas., vol. 31, no. 11, pp. N79–N83, 2010.

[7] S. Lv, Y. Lu, and Y. Ji, "An enhanced IEEE 1588 time synchronization for asymmetric communication link in packet transport network," Commun. Lett., vol. 14, no. 8, pp. 764–766, 2010.

[8] K. Banitsas, P. Pelegris, T. Orbach, D. Cavouras, K. Sidiropoulos, and S. Kostopoulos, "A simple algorithm to monitor hr for real time treatment applications," in Proc. Int. Conf. Inf. Technol. Appl. Biomed., Nov. 2009, pp. 1–5.

[9] G. K. Palshikar, "Simple algorithms for peak detection in time-series," in Proc. 1st Int. Conf. Adv. Data Anal., Business Anal. Intell., 2009.

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