RELIABLE TRANSMISSION PROTOCAL FOR GSM AND HTTP BASED ON WIRELESS PATIENT MONITORING

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Abstract: *The main focus of the paper is to implement a prototype model for the real time patient monitoring system. The proposed is used to measure the physical parameters like body temperature, heartbeat, ECG, blood sugar, and oxygen level monitoring with the help of biosensors. Conventionally there are number of techniques available for the ICU patient's health monitoring system with wired communication technology. In the novel system the patient health is continuously monitored and the acquired data is transmitted to an ARM server using zigbee wireless sensor networks. Embedded processor supports for analyzing the input from the patient and the results of all the parameters are stored in the database. If any abnormality felt by the patient automatic alarm sound will arrive and the message will send to the doctor mobile automatically by using GSM module. The implementation of the system is achieved by the advanced processor and simulation results are obtained by Keil c software.*

Keywords: ARM Processor, sensors, Zigbee, GSM, Qt linux

I. INTRODUCTION

Recently wireless sensors and sensor networks plays a vital role in the research, technological community. But there are different from traditional wireless networks as well as computer networks, today the progress in science and technology offers miniature, speed, intelligence, sophistication, and new materials at lower cost, resulting in the development of various high-performance smart sensing system. Many new research is focused at improving quality of human life in terms of health by designing and fabricating sensors which are either in direct contact with the human body (invasive) or indirectly (noninvasive). In the

current proposed system the patient health is continuously monitored by the patient monitoring system and the acquired data is transmitted to a centralized ARM server using Wireless Sensor Networks. A Zigbee node is connected to every patient monitor system that consumes very low power and is extremely small in size. This paper builds an independent system that automatically logs vital parameters of patients for easy access. The data is accessible to doctors through mobile device for convenience. the wrist, finger and the ARM unit connected via ribbon Data of all patients is stored in a common database. A system to monitor the overall health of welfare facility, which needs constant care, has been reported. The host computer stores the data, which can be used to analyze the patient's overall health condition. When the patient is in an emergency situation, such as falling or in an inactive state for more that the allotted time, the host computer automatically alerts the situation to the care staff by an alarm sound and also the message has been send to doctor through GSM module. These facts show an increasing demand for long-term health monitoring which is affordable, continuous, and unobtrusive, which will result in considerable impact on annual medical costs and health management. Wearable systems for continuous health monitoring are a key technology in helping the transition to more practical and affordable healthcare. It not only allows the user to closely monitor changes in her or his aimed to provide emergency assistance to senior citizens, rehabilitation patients, and medically physiological parameters but also provides feedback to help maintain an optimal health status. The fundamental problem with this system is that when medical emergencies happen to the user, they are often unconscious and unable to press an "emergency alert button."
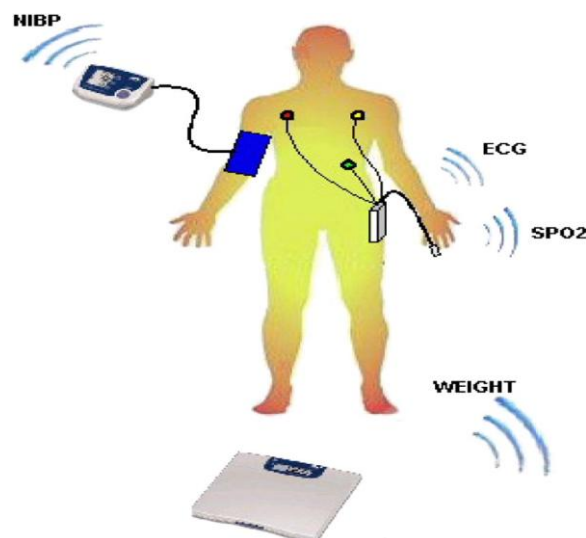
Fig:1Sensor Monitoring

There is no product on the market which does not require manual activation of the alarm and monitors a user's vital signs smartly, though research is currently undergoing.This is the novel design goal of the work presented in this paper. The reported device consists of a wrist strap and a finger ring (circuitry). This allows the sensors to be mounted around cable.

II.   LITERATURE SURVEY

Karandeep Malhi et al develop Zigbee smart noninvasive wearable physiological parameters monitoring device has been developed and reported in this paper. The system can be used to monitor physiological parameters, such as temperature and heart rate, of a human subject. The system consists of an electronic device which is worn on the wrist and finger, by an at risk person. Using several sensors to measure different vital signs, the person is wirelessly monitored within his own home. An impact sensor has been used to detect falls. The device detects if a person is medically distressed and sends an alarm to a receiver unit that is connected to a computer. This sets off an alarm, allowing help to be provided to the user. Rubina.a.shaikh, et al Design a module to monitoring of remote patients, after he is discharged from hospital. I have designed and developed a reliable, energy efficient remote patient monitoring system. It is ableto send parameters of patient in real time. It enables the doctors to monitor patient's parameters (temp, heartbeat, ECG) in real time. Here the parameters of patient are measured continuously (temp, heartbeat, ECG) and wirelessly transmitted using Zigbee.

B. sirisha et al describes a solution for enhancing the reliability, flexibility by improving the performance and power management of the real-time multi-patient monitoring system (MPMS). In the current proposed system the patient health is continuously monitored by the MPMS and the acquired data is transmitted to a centralized ARM server using Wireless Sensor Networks. A Zigbee node is connected to every patient monitor system which will send the patient's vital information .Upon system boot up, the mobile patient monitor system will continuously monitor the patients vital parameters like Heart Beat, body temperature etc and will periodically send those parameters to a centralized server using Zigbee node configured as co-coordinator. If a particular patient's health parameter falls below the threshold value, a buzzer alert is triggered by the ARM server. Along with a buzzer an automated SMS is posted to the pre-configured Doctors mobile number using a standard GSM module interfaced to the ARM server.

III.   EXISTING SYSTEM

There are some shortcomings present in existing system. The patient is monitored in ICU and the data transferred to the PC is wired. Such systems become difficult where the distance between System and PC is more. The available systems are huge in size. Regular monitoring of patient is not possible once he/she is discharged from hospitals. These systems cannot be used at individual level. The other problem with these systems is that it is not capable of transmitting data continuously also range limitations of different wireless technologies used in the systems. So to overcome these limitations of systems we proposed a new system. O medium. Due to which we would be able attend the patient immediately. Therefore by developing a system that can constantly measure the important parameters of patient's body and which can alert the closed ones and the doctor on any time when the patient's condition gets bad, this can really provide quick service and be beneficial in saving a lot of lives.

IV.   PROPOSED SYSTEM DESCRIPTION

Our Embedded Project connects the temperature sensor, LDR and ECG to the patient. All the outputs are connected to micro controller. The controller processes this information and transmits through Zigbee. Our Embedded project uses ARM micro controller which is 32-bit controller. The specialist staying at a distance can monitor the patient condition through remote controlled PC so that he can save the life of the patient.We are using the Embedded Technology, so that we can monitor the patient condition easily.

Your system is able to transmit the parameters of patient continuously and over long distance in wireless
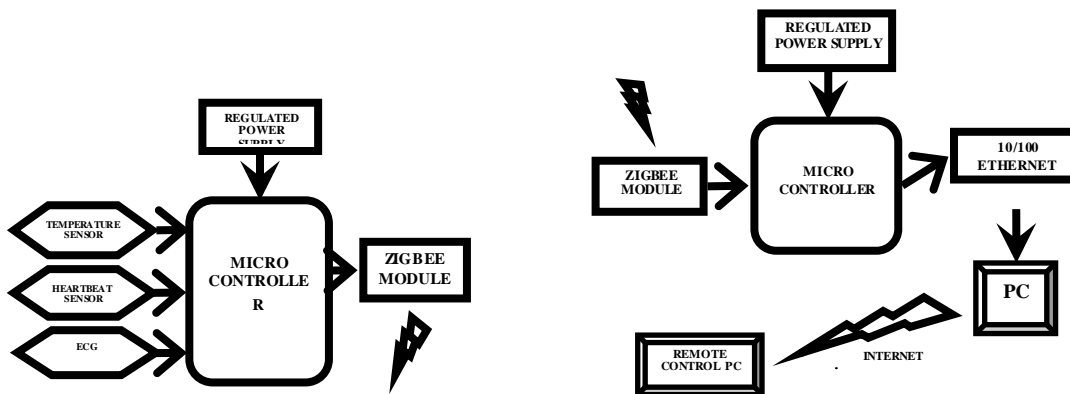
Fig:2 at patient   *Fig:3 reciver*

 The proposed system is designed for monitor the patient is in any place. The system would constantly monitor important physical parameters like temperature, heartbeat, ECG, blood sugar, and would compare it against a predetermined value set and if these values cross a particular limit it would automatically alert the alarm and doctor via a SMS. This system provides a continuous health monitoring service.

The data processed are transmitted by Zigbee wireless. Finally the received data is sent to the PC. The graphical user interface programs on the PC are coded using keil C software, Using GSM modem message is transmitted to the doctor mobile number when the measured temperature exceeds the allowable value or if the pulse measured is abnormal.

V.   HARDWARE DESCRIPTION

It includes various sensors like Temperature sensor, Heart beat sensor, ECG sensor, Blood sugar sensor, ARM processor, display, buzzer, and Zigbee connector circuit. Wireless sensors nodes with a single accessing from one AP (access point) to another have addressed the usefulness of these sensors in sending and retrieving data. The proposed circuit has the ability to determine the patient's temperature in real-time status inside the hospital.

Heart beat sensor is designed to give digital output of heart beat when a finger is placed inside the clip. This digital output can be connected to Zigbee and transmitted to ARM directly to measure the Beats per Minute (BPM) rate. The ECG (Electrocardiogram) records the pathway of electrical impulses through the heart muscle, and can be recorded on resting and ambulatory subjects, or during exercise to provide information on the heart's response to physical exertion**.** Zigbee is 'Wireless Networking Technology' and is an established set of specifications for wireless personal area networking (WPAN), i.e., digital radio connections between computers and related devices. This kind of network eliminates use of physical data buses like USB and Ethernet cables. Zigbee indoors can usually reach 400 m range. The ARM TDMI-S is a special ARM purpose 32-bit microprocessor, offers high   performance and very low power consumption. ARM architecture is based on RISC principles, instruction set and related decode mechanism are simpler than CISC Pipeline techniques employed ARM Processor supports both 32-bit and 16-bit instructions via the ARM and Thumb instruction sets. The 5 parameters to be monitored are sensed using respective sensor and data is feed to ARM processor. ARM is a 32-bit RISC processor architecture developed by the ARM corporation. ARM processors possess a unique combination of features that makes ARM the most popular embedded architecture today. First, ARM cores are very simple compared to most other general-purpose processors, which means that they can be manufactured using a comparatively small number of transistors, leaving plenty of space on the chip for application specific macro cells. A typical ARM chip can contain several peripheral controllers, a digital signal processor, and some amount of on-chip memory, along with an ARM core. Second, both ARM ISA and pipeline design are aimed at minimising energy

198

consumption — a critical requirement in mobile embedded systems. Third, the ARM architecture is highly modular: the only mandatory component of an ARM processor is the integer pipeline; all other components, including caches, MMU, floating point and other co-processors are optional, which gives a lot of flexibility in building application-specific ARM-based processors. Finally, while being small and low-power, ARM processors provide high performance for embedded applications.

For example, the PXA255 XScale processor running at 400MHz provides performance comparable to Pentium 2 at 300MHz, while using fifty times less energy.

ARM vs RISC:

In most respects, ARM is a RISC architecture. Like all RISC architectures, the ARM ISA is a load-store one, that is, instructions that process data operate only on registers and are separate from instructions that access memory. All ARM instructions are 32-bit long and most of them have a regular three-operand encoding. Finally, the ARM architecture features a large register file with 16 general-purpose registers. All of the above features facilitate pipelining of the ARM architecture. However, the ARM architecture deviated from the RISC architecture in some respects to improve its performance. The ARM did not include register windows that were used by original RISC architectures to reduce complexity. The ARM architecture introduced an auto-indexing addressing mode, where the value of an index register is incremented or decremented while a load or store is in progress. ARM supports multiple register- transfer instructions that allow loading or storing up to 16 registers at once.

Thumb instruction set extension

The Thumb instruction set was introduced in the fourth version of the ARM architecture in order to achieve higher code density for embedded applications. Thumb provides a subset of the most commonly used 32-bit ARM instructions which have been compressed into 16-bit wide opcodes. On execution, these 16-bit instructions can be either decompressed to full 32- bit ARM instructions or executed directly using a dedicated Thumb decoding unit. Although Thumb code uses 40% more instructions than equivalent 32-bit ARM code, it typically requires 30% less space. Thumb code is 40% slower than ARM code; therefore Thumb is usually used only in non-performance-critical routines in order to reduce memory and power consumption of the system.
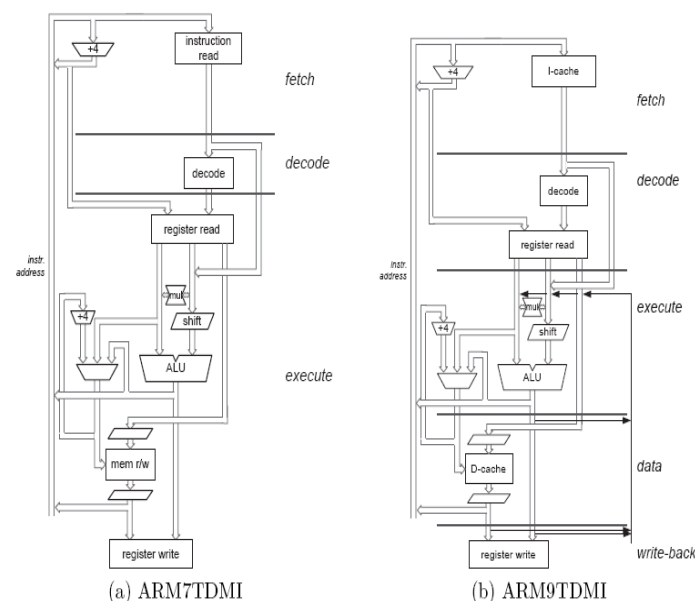
Pipeline Design in ARM

Fig:4 Pipeline architecture in ARM7 and ARM9cores

The 3-stage pipeline

It is a classical fetch-decode-execute pipeline, which, in the absence of pipeline hazards and memory accesses, completes one instruction per cycle. The first pipeline stage reads an instruction from memory and increments the value of the instruction address register, which stores the value of the next instruction to be fetched. This value is also stored in the PC register. The next stage decodes the instruction and prepares control signals required to execute it on. The third stage does all the actual work: it reads operands from the register file, performs ALU operations, reads or writes memory, if necessary, and finally writes back modified register values. In case the instruction being executed is a data processing instruction, the result generated by the ALU is written directly to the register file and the execution stage completes in

one cycle. If it is a load or store instruction, the memory address computed by the ALU is placed on the address bus and the actual memory access is performed during the second cycle of the execute stage. This pipeline remained unchanged from the first ARM processor to the ARM7TDMI core.

The 5 stage pipeline

The 3-stage pipeline has the problem of pipeline stall when a memory read or write operation is going on, and the next instruction is to be fetched. The solution to this problem was to use a separate instruction and data cache. First, to make the pipeline more balanced, ARM9TDMI moved the register read step to the decode stage, since instruction decode stage was much shorter than the execute stage. Second, the execute stage was split into 3 stages. The first stage performs arithmetic computations, the second stage performs memory accesses (this stage remains idle when executing data processing instructions) and the third stage writes the results back to the register file. This results in a much better balanced pipeline, which can run at faster clock rate, but there is one new complication — the need to forward data among pipeline stages to resolve data dependencies between stages without stalling the pipeline. The ARM10 and ARM11 came up with the 6-stage and the 8-stage pipeline.

VI.   SOFTWARE DESCRIPTION

A.   *Mini2440 Development Board*

Fig5. Mini2440 Development board

The ARM9 processor is ideal for many real-time embedded applications with demanding sizeconstraints and cost-sensitive considerations. The enhanced DSP extensions in the ARM9 processor remove the need for a separate DSP in the SoC design, resulting in additional savings in chip complexity, power consumption, and time-to-market. Today, the ARM family accounts for approximately 75% of all embedded 32-bit RISC CPU are, making it the most widely used 32-bit architecture. ARM CPUs are found in most corners of consumer electronics, from portable devices (PDAs, mobile phones, iPods and other digital media and music players, handheld gaming units, and calculators) to computer periphe as IEEE 802.3rals (hard drives, desktop routers). ARM does not manufacture the CPU itself, but licenses it to other manufacturers to integrate them into their own system.

B.   *Ethernet LAN:*

Ethernet is a family of computer networking technologies for local area networks (LANs). Ethernet was commercially introduced in 1980 and standardized in 1983. Ethernet has largely replaced competing wired LAN technologies such as token ring, FDDI, and ARCNET.The Ethernet standards comprise several wiring and signaling variants of the OSI physical layer in use with Ethernet. Data rates were periodically increased from the original 10 megabits per second to 100 gigabits per second.

C. *Temperature Sensor:*

LM35 is a precision IC temperature sensor with its output proportional to the temperature (in ^{o}C). With LM35, temperature can be measured more accurately than with a the rmistor.severaltemperature sensingtechniquescurrentlyinwidespreadusage.themostcommonoftheseareRTDs.thermocouples,thermistors,and sensor ICs.The right one for your application depends on the requied temperature range,linearity,accuracy,cost,features,and ease of designing the necessary support circuitry.

200

Fig.6: Temperature Sensor

D .Heart beat sensor:

Heart beat sensor is designed to give digital out put of heart beat when a finger is placed on it.when the heart beat detector is working,the beat LED flashes in unison with each heart beat.this digitalout put can be connected to microller 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.however this sensor is of high cost,hence in this project we are using a transducer to demonstrate the measure of heart beat rate.we are just showing a prototype and demonstrating how we can measure heart beat rate and send to remote doctor.

C. ECG:

Electrocardiograph (ECG) is a transthoracic interpretation of the electrical activity of the heart over time captured and externally recorded by skin electrodes. It is a noninvasive recording produced by an electrocardiographic device. The ECG works mostly by detecting and amplifying the tiny electrical changes on the skin that are caused when the heart muscle "depolarizes" during each heart beat. At rest, each heart muscle cell has a charge across its outer wall, or cell membrane reducing this charge towards zero is called de-polarization, which activates the mechanisms in the cell that cause it to contract. During each heartbeat a healthy heart will have an orderly progression of a wave of depolarization that is triggered by the cells in the sinoatrial node, spreads out through the atrium, passes through "intrinsic conduction pathways" and then spreads all over the ventricles. This is detected as tiny rises and falls in the voltage between two electrodes placed either side of the heart which is displayed as a wavy line either on a screen or on paper..

F. ZIGBEE:

Zigbee is a low power spin off of WiFi. It is a specification for small, low power radios based on IEEE 802.15.4 – 2003 Wireless Personal Area Networks standard.

Fig:7 zig-bee module

Zigbee Alliance is a group of more than 300 companies including industry majors like Philips, Mitsubishi Electric, Epson, Atmel, Texas Instruments etc.

G. GSM:

GSM is a cellular network, which means that mobile phones connect to it by searching for cells in the immediate vicinity. There are five different cell sizes in a GSM network—macro, micro, pico, femto and umbrella cells. The coverage area of each cell varies according to the implementation environment. Macro cells can be regarded as cells where the base station antenna is installed on a mast or a building above average roof top level. Micro cells are cells whose antenna height is under average roof top level; they are typically used in urban areas. Picocells are small cells whose coverage diameter is a few dozen metres; they are mainly used indoors. Femtocells are cells designed for use in residential or small business environments and connect to the service provider's network via a broadband internet connection. Umbrella cells are used to cover shadowed regions of smaller cells and fill in gaps in coverage between those cells.

VII.   SOFTWARE REQUIREMENTS

A. Linux Operating System:

Linux or GNU/Linux is a free and open source software operating system for computers. The operating system is a collection of the basic instructions that tell the electronic parts of the computer what to do and how to work. Free and open source software (FOSS) means that everyone has the freedom to use it, see how it wo the software will put any license restrictions on users. This is one of the reasons why many
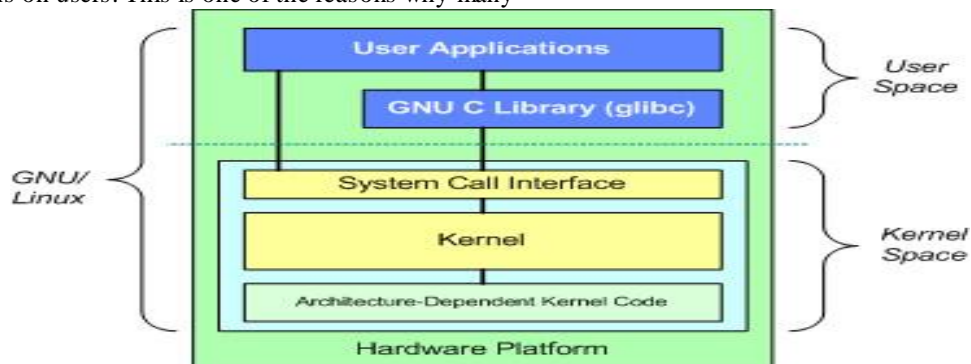

Fig8. Architecture of Linux Operating System

A Linux-based system is a modular unix-likeoperating system. It derives much of its basic design from principles established in UNIX during the 1970s and 1980s. Such a system uses a monolithic kernel the linux kernel which handles process control, networking, and peripheral and file system access.device drivers are either integrated directly with the kernel or   added as modules loaded while the system is running.

B .Qt for Embedded linux:

Qt is a cross-platform application framework that is widely used for developing application software with a graphical user interface (GUI) (in which cases Qt is classified as awidget toolkit), and also used for developing non-GUI programs such ascommand-line tools and consoles for servers. Qt uses standard C++ but makes extensive use of a special code generator (called the Meta Object Compiler, or moc) together with several macros to enrich the language. Qt can also be used in several other programming languages via language bindings. It runs on the major desktop platforms and some of the mobile platforms. Non-GUI features include SQL database access, XML parsing, thread management, network support,   and   a   unified   cross-platform application   programing   interface   for   file   handling.It   has extensive internationalization support.

C. Hyper Text Transfer Protocol (HTTP)

HTTP is an asymmetric request-response client-server protocol as illustrated. An HTTP client sends a request message to an HTTP server. The server, in turn, returns a response message. In other words, HTTP is a pull protocol; the client pulls information from the server.
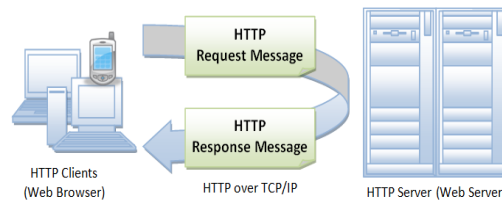
- HTTP is a stateless protocol. In other words, the current request does not know what has been done in the previous requests.
- HTTP permits negotiating of data type and representation, so as to allow systems to be built independently of the data being transferred.
- Quoting from the RFC2616: "The Hypertext Transfer Protocol (HTTP) is an application-level protocol for distributed, collaborative, hypermedia information systems. It is a generic, stateless, protocol which can be used for many tasks beyond its use for hypertext, such as name servers and distributed object management systems, throextension of its request methods, error codes and headers."

VIII.   RESULT
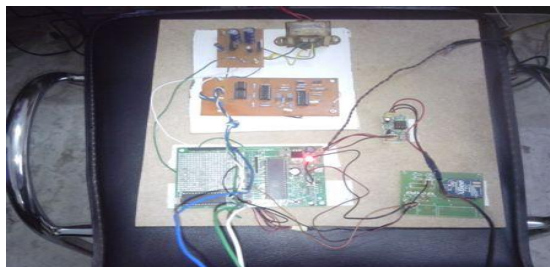
IX.   CONCLUSION

In this proposed model of monitoring physiological parameters such as temperature, heartbeat, ECG, blood sugar, are more powerful than currently available system. Currently available systems for monitoring physiological signals suffer from technical limitations. The proposed system is an enormous improvement over existing commercial methods, the present system can support up to twenty patients with real-time, low-power, low-cost, long-distance, and dual-mode monitoring, from the above designed project. The keil C software is used for implementing the process and results were discussed. In future we can expand this system by using RFID technology; through this technology we can monitor the multiple numbers of patients. It may be a future work to develop another patient monitoring application code in that direction.

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