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# Embedded Based Real-time Patient Monitoring System

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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, keil C.*

## [1] 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)[5],. 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. 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 [8],. 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." 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 [3]. 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 the wrist, finger and the ARM unit connected via ribbon cable.

## 2. LITERATURE SURVEY

Karandeep Malhi et al [1] 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 [2] 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 able

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http://ijves.com
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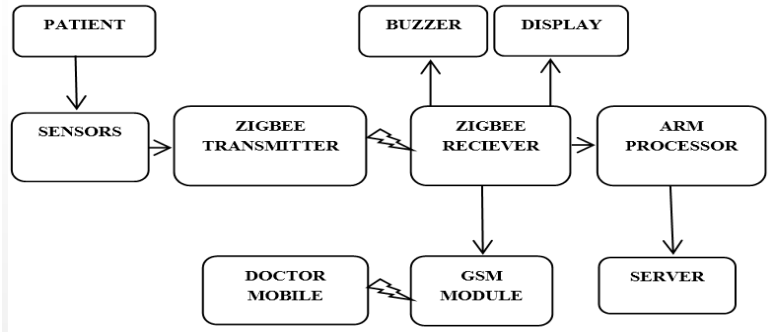
to send parameters of patient in real time. It enables the doctors to monitor patient's parameters (temp, heartbeat, ECG) in real time. Here the parameters of patient are measured continuously (temp, heartbeat, ECG) and wirelessly transmitted using Zigbee.
B. sirisha et al [3] describes a solution for 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.

## 3. 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. Our system is able to transmit the parameters of patient continuously and over long distance in wireless 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.

## 4. PROPOSED SYSTEM DESCRIPTION

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.




**Block diagram of the Proposed Systems**

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.

## 5. 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.

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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.

## 6. SOFTWARE DESCRIPTION

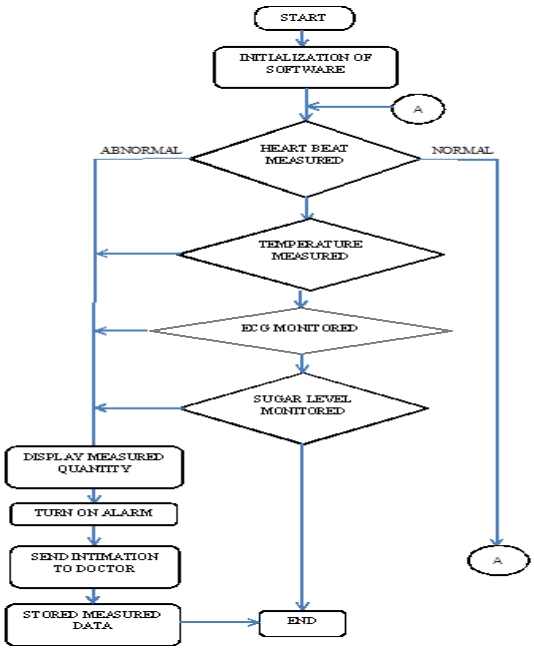
### 6.1 Keil C µVISION 4

The µVision IDE from KEIL combines project management, make facilities source code editing, program debugging, and complete simulation in powerful environment. The µVision development platform is easy to use and helping you quickly creates embedded programs that work. The Keil C development tools for the ARM processor family support every level of developer from the professional applications engineer to the student just learning about embedded software development. The industry-standard Keil C Compilers, Macro Assemblers, Debuggers, Real-time Kernels, and Single-board Computers support all ARM processor compatible derivatives and help you get your projects completed on schedule. With the Keil tools, we can generate embedded applications for virtually every ARM derivative. The Keil Software ARM development tools are designed for the professional software developer; any level of programmer can use them to get the most output of the ARM processor architecture. Keil C µ Vision 4 help provides the various simulation output.

## 7. ALGORITHM

| | | |
|---|---|---|
| Step 1 | : | Start the program |
| Step 2 | : | Enter the mode of operation. |
| Step 3 | : | Evaluate mode of operation with switch case |
| Step 4 | : | Heart Beat Measured |
| Step 5 | : | Temperature Measured |
| Step 6 | : | ECG Monitored |
| Step 7 | : | Sugar Level Monitored |
| Step 8 | : | Data base saved successfully |
| Step 9 | : | Intimation to Doctor |

## 8. FLOWCHART




## 9. SIMULATION RESULTS

In our research we use the ARM processor board for porting our ideas. Since after the debugging, we get the results in UART window.

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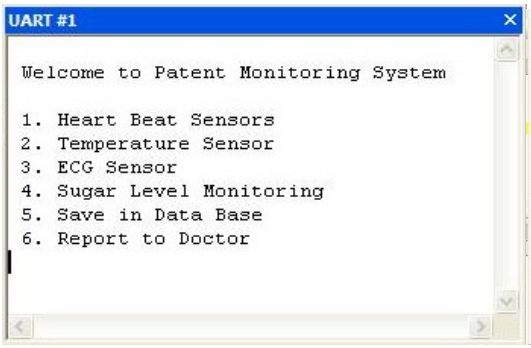



*Output of Mode 1* *Output of Mode 2*

The UART show the ARM microprocessor was displays the mode of operation and waits for input in fig.7 MODE 2 was operated for Patient monitoring system, UART display the output as ****


*Output of Mode 3*

MODE 3 was operated for Patient monitoring system, UART display the output as @@@

## CONCLUSIONS

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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Vol 05, Article 02231; March 2014
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