



Real Time Health Care Monitoring System Using Android Mobile

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ABSTRACT:In today's era, IoT is playing an important role in health care systems, which is not only for monitoring but also to communicate, store and display. The prime aim of the project is to design and implement effective health care monitoring dashboard. The proposed system monitor the vital parameters like ECG, Temperature, BP, Heart rate etc. and transmit wirelessly through ZigBee technology. The transmitted data is displayed in the PC based application called the central nurse station where PC with the receive ZigBee acts as hub. This data gets updated into database continuously. From the database the android application fetches all the updated data and displays it. This enables the doctor to receive the current status of the patient in real time. If any parameter of a particular patient goes beyond a pre-assigned threshold value, an automated notification will pop up in doctor android mobile application. Android application can also generate call option if the doctor won't notice notification. Additionally system is also able to generate alarm to notify nurse around for emergency treatment. The system mainly consists of hardware like sensors, microcontroller (LPC2148) ZigBee, LCD display etc. and software's like keil u vision 3, flash magic, visual studio, eclipse etc.

KEYWORDS: Health monitoring, LPC2148, ECG, temperature, heartbeat, android, ZigBee.

I. INTRODUCTION

Many patients in rural area die untreated because of travelling long distance to consult doctors. This telemedicine removed this barrier using this advanced IoT technology. Telemedicine is completely reliant on IOT, this IoT innovation give a stage to advancement and change of tele social insurance and telemedicine. IoT technology is nothing but millions of objects around us are interconnected and interact between each other, these objects can sense data by communicating to relevant objects and share that in between them. IoT concept was basically coined by the RFID development community in the year of 1999. Recently this technology is becoming more popular due to plenty of usage of mobile devices, embedded system communication and database cloud computing etc. IoT technology has great future in upcoming days.

Telehealth can be defined as device which delivers health care and clinical data of the patients to the remote desired locations. Telehealth is approved by FDA. Telehealth has various platforms which connect patients to doctors 24*7 interactively using internet, IoT technology, video conferences, smart mobiles and database cloud computing. Telehealth is a great solution for improvement in health administration in the 21st century. Telehealth forms an umbrella which includes several services, which are listed below:

- **Telemedicine:** Telemedicine is the combination of the telecommunication and medical information technology which provides clinical consultation in any remote location or any emergency treatment. It is successes in handling 78% emergency cases efficiently.
- **Telemonitoring:** Using IoT technology acquiring patient health parameters like temperature, heartbeat, BP, ECG, SPO2 etc and sending that collected data to hospitals for remote analysis and treatment. Telemonitoring service also facilitates that alert system that sense information of patient's body parameters to relevant doctor/nurse, if any fluctuation of parameters go beyond threshold.
- **Patient Telemonitoring Using Android concept:** Patient telemonitoring framework utilizing Java empowered 3G cellular smart phone empowers specialists to screen the crucial vital parameters like ECG, Respiration rate,

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(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 5, May 2016

heart rate SpO₂, temperature etc. of patients in ICU utilizing the ongoing waveform and information checking capacity of introduced Java construct application in light of the smart phone.

II. RELATED WORK

There are a few weaknesses present in existing framework. The patient is checked in ICU and the information exchanged to the PC is wired. Such frameworks get to be troublesome where the separation amongst System and PC is more. The accessible frameworks are tremendous in size. Standard observing of patient is unrealistic once he/she is released from doctor's facilities. These frameworks can't be utilized at individual level. The other issue with these frameworks is that it is not fit for transmitting information constantly additionally run restrictions of various remote advancements utilized as a part of the frameworks. So to conquer these constraints of frameworks we proposed another framework. Our framework can transmit the parameters of patient ceaselessly and over long separation in remote medium. Because of which we would be capable go to the patient instantly. Along these lines by building up a framework that can always gauge the essential parameters of patient's body and which can caution the shut ones and the specialist on whenever when the patient's condition gets terrible, this can truly give speedy administration and be advantageous in sparing a great deal of lives.

III. PROPOSED METHODOLOGY

The proposed system main object is to monitor the patient health status in real time and notify relevant doctor or nurse instantly if the patient is in risk. The complete project methodology is explained below in steps

STEP 1: Connecting all the sensors to the patient and transferring that collected data through ZigBee transmitter to the central nurse station.

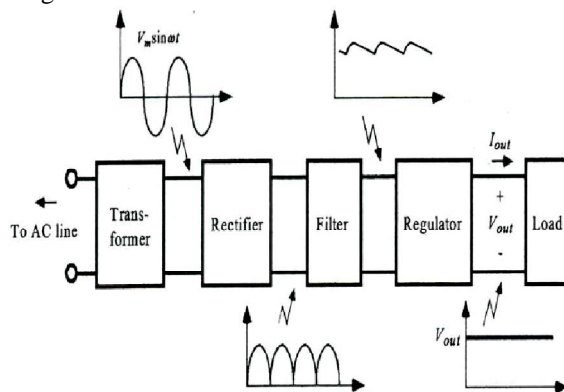
STEP 2: Once all the parameters are received by the PC based application through ZigBee receiver, parameters are updated into database

STEP 3: Android application fetches these parameters for every change and display on the smart phone application.

The proposed system includes few of the hardware and software equipment's. The basic hardware requirements are sensors, power supply, LPC2148 microcontroller, LCD, buzzer, ZigBee modules and software as follows Keil IDE, Flash Magic, Visual Studio IDE, Eclipse IDE.

A. HARDWARE COMPONENTS:

POWER SUPPLY: The power supplies are intended to change over high voltage AC mains power to a reasonable low voltage supply for electronic circuits and different gadgets. A power supply can be separated into a progression of obstructs, each of which performs a specific functionality. A DC power supply which keeps up the yield voltage steady regardless of AC mains changes or load varieties is known as "Controlled D.C Power Supply" For case a 5V directed power supply system shown in Fig. 1.



Components of a typical linear power supply

Fig. 1 Power Supply Circuitry



International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 5, May 2016

ARM7 LPC2148 MICROCONTROLLER: The LPC2148 microcontroller depends on a 16/32-bit ARM7TDMI-S CPU that join the microcontroller with 32 kb, 64 kb, 128 kb, 256 kb and 512 kb of flash memory of high speed. A128-bit wide memory interface and special architectures enables 32-bit code execution at most extreme clock rate.

LIQUID-CRYSTAL DISPLAY (LCD): Liquid crystal display is a level board show, electronic visual presentation that uses the light balance properties of liquid. Liquid crystals don't radiate light specifically. LCDs are accessible to show discretionary pictures or settled pictures which can be shown or covered up, for example words, digits, and 7-segment displaying unit as in a digitalized clock. They utilize the same essential innovation, with the exception of that discretionary pictures are comprised of a substantial number of little pixels, while different displays have bigger components.

ZIGBEE: ZigBee remote system innovation is propelled and made by ZigBee Alliance. The collusion, established in August 2001, is a quickly developing association. ZigBee is a straightforward parcel information correspondence convention for lightweight remote systems. It chiefly concentrates on unwavering quality, effortlessness, low power and minimal effort. The ZigBee module is utilized to exchange data from the patient segment to the server area. With ZigBee, correspondence between the individual in the hospital ward and the inaccessible checking room,(about 50-100m away)becomes simple under the control of the specialist responsible for that ward. The handled data is transmitted utilizing the transmitting ZigBee and the data is gotten utilizing the getting ZigBee lastly got information is sent to the PC.

TEMPERATURE SENSOR (LM35): The LM35 arrangement are accuracy incorporated circuit temperature sensors, whose yield voltage is linearly relative to the Celsius (Centigrade) temperature. The LM35 does not require any external trimming to give normal correctness of $\pm 1/4^{\circ}\text{C}$ at room temperature and $\pm 3/4^{\circ}\text{C}$, over a full - 55 to $+150^{\circ}\text{C}$ temperature range. The LM35's low impedance, linear output, and exact characteristic alignment make interfacing to readout or control hardware particularly simple. It can be utilized with single power supplies, or with more or less supplies. As it draws just 60 μA from its input supply, it has low self-warming, under 0.1°C in still air.

HEARTBEAT SENSOR: The new form utilizes the TCRT1000 intelligent optical sensor for photoplethysmography. The utilization of TCRT100 improves the construct procedure of the sensor part of the work as both the infrared light emitter diode and the detector are organized one next to the other in a leaded bundle which would block the ambient light present around; else is affect the performance of the sensor. It produces the digital output which is synchronous with the heartbeat. The output heartbeat can be nourished to either an ADC channel or an advanced info pin of a microcontroller for further preparing and recovering the heart rate in beats per minute (BPM).

ECG SENSOR: It is a single lead heart rate monitoring sensor. AD8232 is a coordinated front-end for bio-electrical signs of the heart letter. This is a vital parameters monitoring sensor which sense all type of application produced by low power. Basically it is ananalogous front end heart rate monitoring system.

B. SOFTWARE TOOLS:

KEIL IDE:Integrated development environment for embedded C programming which enables us to code the microcontroller as per desired functionality. It is flexible and user friendly platform for programmers. μVision underpins numerous screens and permits you to make singular window formats anyplace on the visual surface. The μVision Debugger gives a standalone environment in which testing, verification and optimization can be done on application code. The debugger incorporates conventional components like basic and complex breakpoints, watches windows, and execution control and gives fully visible to gadget peripherals.

FLASH MAGIC:flash Magic is an application created by Embedded Systems Academy to permit you to effortlessly get to the components of a microcontroller. With this program you can clear blocks or the whole flash memory of the microcontroller.Using Flash Magic, you can perform distinctive operations to a microcontroller, operations like deleting, programming and perusing the flash memory, adjusting the Boot Vector, performing an unlimited free pass on an area of the Flash memory and numerous others. Only hex files are dumped on the controller so generating hex file is mandatory.

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 5, May 2016

VISUAL STUDIO: Visual Studio is an integrated development environment (IDE) developed by the Microsoft. It is utilized to create PC programs for Microsoft Windows, and in addition sites, web applications etc. Visual Studio can be used in distinctive programming languages and permits the programmer and debugger to support (to fluctuating degrees) almost any programming languages like C, C++, .NET, #C, Python, and Java etc.

ECLIPSE IDE: The Eclipse Platform is an open source platform and toolbox for developing IDE's .Eclipse itself comprises of core innovations. A core Java Development Toolkit, and what is known as the Plug-in Development Kit. You can assemble "modules" in either Java or different advances which can communicate with each other through standard, distributed Extension Points. In this we are using eclipse to develop android application using java based android language.

IV. IMPLEMENTATION

The overall block diagram of the proposed system is shown below in Fig. 2. Microcontroller LPC2148 is the heart of the complete system which monitors and controls all the signals coming and going out of the controller. Microcontroller LPC2148 is coded using the keil software and code is dumped using flash magic tool.

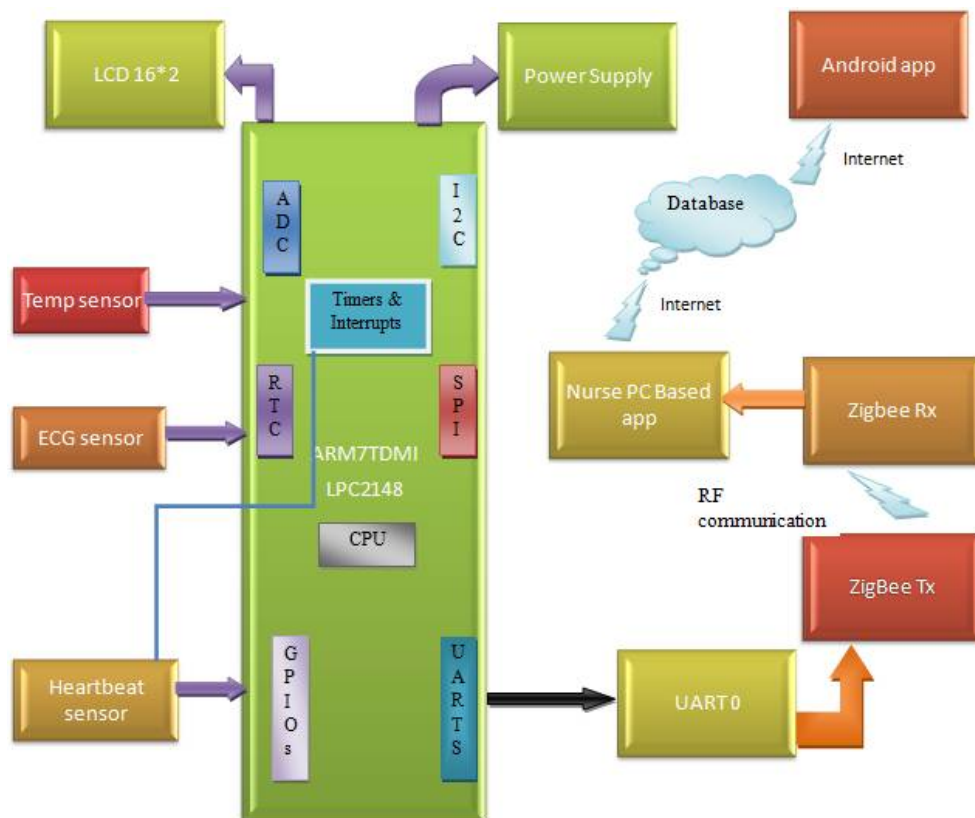


Fig. 2 Block diagram of proposed system

ALGORITHM OF PROPOSED SYSTEM:

- I. Temperature sensor, ECG sensor and heartbeat sensor are interfaced with the microcontroller. Since the temperature and ECG sensors produce analog output, the output pins of these sensors are assigned to the ADC pins of the controller. And these sensors don't need any delay to measure the parameters of the patient, but heartbeat sensor need minimum of 15sec to measure. Therefore timers and interrupts are introduced in heartbeats sensor. Once all the data is ready microcontroller read the data, process it and send serially to the

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 5, May 2016

- next level. With the parameter of the patient, bed ID is also sent. So that ZigBee can differentiate the data coming from different patients.
- II. Processed parameters are displayed on the LCD as well as given to the ZigBee transmitter through UART0.
 - III. The ZigBee receives the parameters from by the devices which are ON, the PC based application segregates the parameters coming from different patients and display on the specific table. This application used different ID to segregate the data. If the value goes beyond the threshold value it display red color indicating danger.
 - IV. Once the data is put in different table and displayed it is updated into the database to the specific patient column.
 - V. Android will be monitoring continuously all the columns, any changes will update into the android application. If any value goes beyond threshold the doctor will get popup message. If unnoticed call is be generated to the doctor.

V. RESULTS AND DISCUSSIONS

The implemented system is shown in the Fig. 3. This project involves two nodes i.e. two patients are monitored simultaneously at a time. Output of each module is explained step by step.

Step1: Once power is supplied to the hardware, LCD displays “WELCOME TO IOT BASED HEALTH CARE MONITORING SYSTEM”.

Step2: Next the controller fetches data from sensors which are attached to the patient body and display on the LCD shown in Fig.5.

Step3: Simultaneously this data is transmitted to the central nurse station through ZigBee technology shown in Fig. 4. The received data may be from different patient which are segregated depending upon the patient bed ID and then it displayed on the PC based application GUI. PC based application GUI is shown in the Fig. 6.

Step4: PC based application uploads the data from PC to global database which can be fetched from authorised people from anywhere and anytime. Uploaded data with database table is shown in Fig. 7.

Step5: The android application is also developed in order to display the patient status, the patient parameters android app is shown in the Fig. 8.

Step6: During emergency or critical condition of the patient, doctor get notification message and call option is also included.

The detailed explanation of each step is done below.

In 1st step, all the sensors are attached to the patients and system is turned ON. In this project, we designed two set of modules which can measure two patients parameters which is shown in Fig. 3. Once the parameters are measured these are sent to the nurse station using ZigBee wireless protocol.



Fig. 3 Proposed system prototype

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 5, May 2016

In this step, the parameters sent by the different patients are received and segregated. This module consists of ZigBee receiver and PC based application. Depending upon the bed ID of patient which is predefined, data is segregated and put in relevant blocks. Result is shown in Fig. 4.

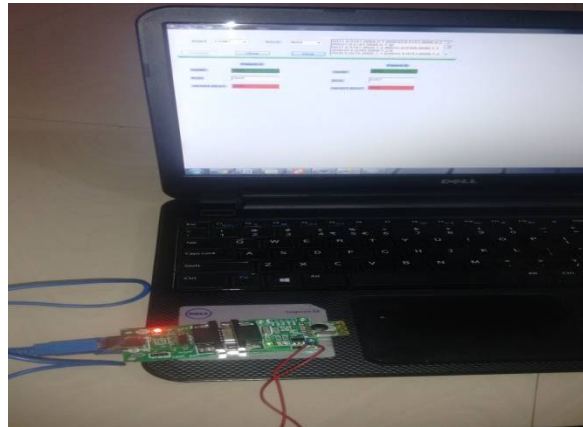


Fig. 4 ZigBee receiver with PC based app(nurse station)

Simultaneously the measured parameters are displayed on the LCD which is shown in the below Fig. 5. The parameters like temperature, ECG and Heart rate is displayed.

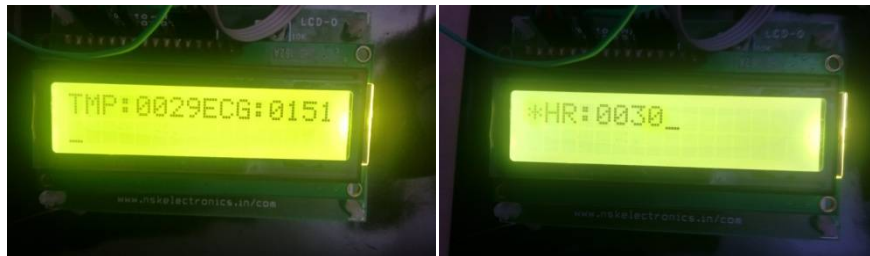


Fig. 5 Patient parameter display on LCD

The PC based application tab is shown in the Fig. 6 which is currently displaying 2 patient's parameters. The tab has PORT number, BAUDRATE, CONNECT, CLOSE, CLEAR buttons. This application is developed using .NET in Visual studio software.



Fig. 6 PC based application GUI



International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 5, May 2016

Database is used to store individual patient data, which may be suitable to decide about current or future health issue. Data is updated into the database table from PC based application. PC based application is connected to php page through mysql driver, where sql query is executing to insert the data into the table that is shown in Fig. 7.

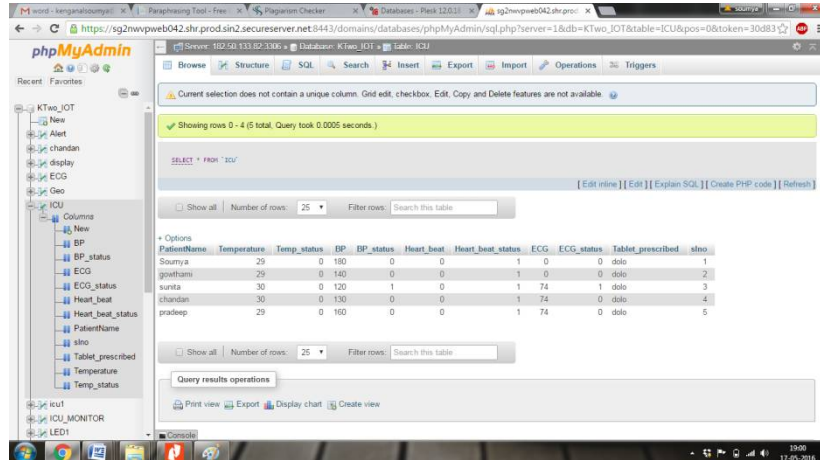


Fig. 7 Database for storing patient data

Android application is used to track individual patient health detail by doctor and technician. Once a Doctor/Technician login into the application, they can see a pie chart representing total number of doctor, technician and patient is shown in the 1st window of the Fig.8. A Doctor/Technician can see list of their patient, technician and doctor in 2nd window. Once a Doctor/Technician select a patient from the list, they can see patient detail like patient name, temperature, heart beat and ECG in 3rd window. A doctor/Technician can give call to Doctor or Technician by selecting them from the list.

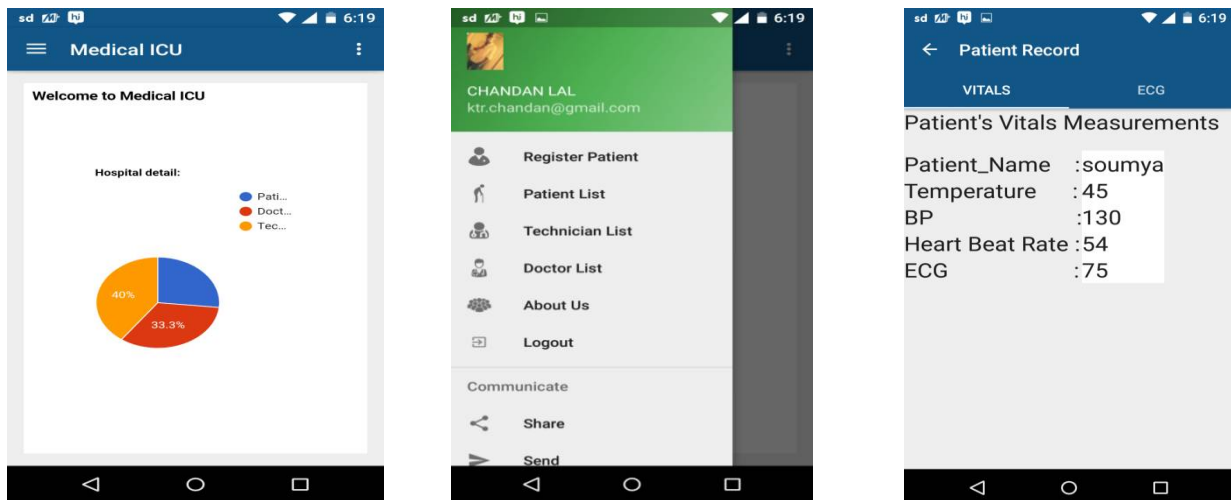


Fig. 8 Android application

VI. CONCLUSION

21st century is the era of internet, this motivated us to design and implement a health monitoring framework using IoT concept. Internet of things is evaluated to acquire the world in numerous fields but Telehealth care reaches to the top. Hence this work presenting a newer concept entitled “real time health care monitoring system using android mobile”. The project is designed and implemented as stated and it’s working successfully fine. The proposed system updates the



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patient parameters in real time in both the PC and android GUI. Android GUI is the noticeable enhancement in this work. Depending upon the ZigBee module capability number of patients can be increased, for demo purpose we implemented two patients and can be increased. It's one time investment system but an effective one. Android application enables authorized doctor to know the status of patient anytime, anywhere across the world.

VII. FUTURE WORK

The future work of this module is design the system still more advanced. Enhancement could be measuring all some more parameters of the patients and also increasing the number of patients for monitoring simultaneously. Data uploading can be done using WIFI8266 module that may result faster uploading of data into the database and also enhancing the android application functionality.

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