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IOT Based Health Care Monitoring System with SMS Alert

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ABSTRACT:

This project describes the design of a simple, low-cost controller based patient health monitoring system. Heart rate of the subject is measured from the thumb finger using IRD (Infra Red Device sensors and the rate is then averaged as message). The Blood Pressure will also be monitored and displayed on LCD interfaced. A glass tube and simple less weight plastic ball is placed inside that for a patient and then that patient will be asked to inhale near the tube arranged so that to check the respiratory i.e., breath rate. A temperature sensor has been used here to test the patient temperature. In this project we are monitoring few things those are heart rate, blood pressure, temperature and lungs condition of a patient. Heart beat sensor instrument employs a simple Opto electronic sensor, conveniently strapped on the finger, to give continuous indication of the pulse digits. The Pulse monitor works both on battery or mains supply. It is ideal for continuous monitoring in operation theatres, I.C. units, biomedical/human engineering studies and sports medicine. Here we are using LPC2148 as our controller. The patient condition will be analyzed and made available in the web using IOT module interfaced to the controller. Here we are also giving an SMS alert for heart beat, blood pressure and temperature monitoring using GSM modem interfaced to the controller. This project uses regulated 3.3V, 500mA power supply. 7805 three terminal voltage regulator is used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac output of secondary of 230/12V step down transformer.

Keywords:

Arm7 Processor , Blood Pressure Sensor, Heart Beat Sensor, Heart Beat Circuit Drive, Temperature Sensor, Respiratory Kit, IR Sensors, IOT Module, Android Application, Smartphone, GSM SIM900 modem and Buzzer.

1. INTRODUCTION:

The patient monitoring systems is one of the major improvements in the hospitality because of its advanced technology. This project is designed for convenience of patient using embedded technology. In this project simultaneously monitor the patient's condition. It is operated and available at an affordable cost.

Existing Method:

In this method, zigbee protocol technology usage is done. By which patient's condition is sent from various transmitter sections to receiver section. i.e The transmitter sections are arranged at each and every patient. At the receiver PC need to be monitored continuously by a doctor/staff in the hospital.

Draw Backs

- Limit range
- Requires a computer system
- Low efficiency

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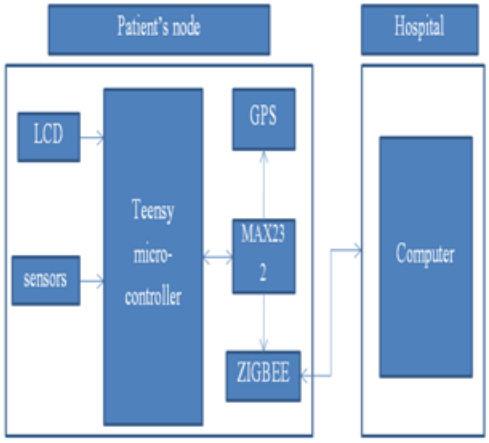
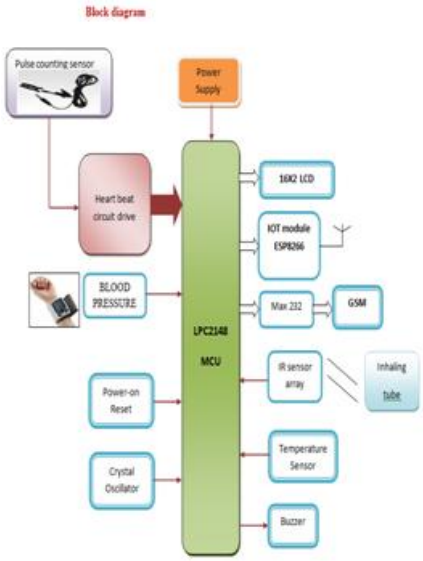
Block diagram:



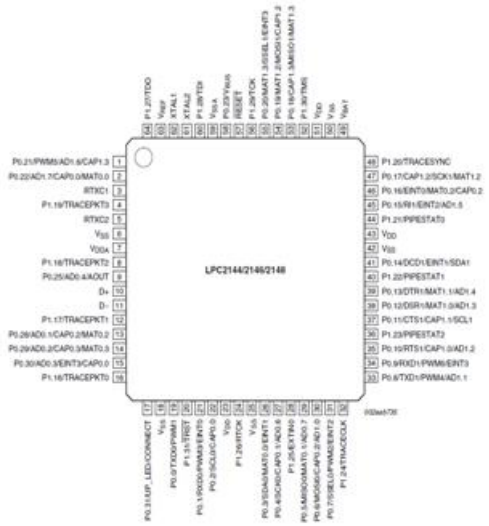
Proposed Method:

This project describes the design of a simple, low-cost controller based patient health monitoring system. Here we are monitoring the vitals of a patient in Two Modes. In Mode1 we are monitoring the blood Pressure, Heart Beat and Temperature. In Mode2 Respiratory (Breath Rate) of a patient. Heart rate of the subject is measured from the thumb finger using IRD (Infra Red Device sensors and the rate is then averaged as message). The Blood Pressure will also be monitored and displayed on LCD interfaced. Here we are having the simple glass tube with a light weight plastic ball residing in it. One IR sensor is placed in front of the glass tube for reading the number of obstacles. Tat obstacles will be count up to one minute. Those values are nothing but respiratory (breath rate) of a patient. A temperature sensor has been used here to test the patient temperature. In this project we are monitoring few things those are heart rate, blood pressure, temperature and respiratory (breath rate) of a patient. Heart beat sensor instrument employs a simple Opto electronic sensor, conveniently strapped on the finger, to give continuous indication of the pulse digits. It is ideal for continuous monitoring in operation theatres, I.C. units, biomedical/human engineering studies and sports medicine. Here we are using LPC2148 as our controller. The patient condition will be analyzed and made available in the web using IoT module interfaced to the controller. SMS is also sent in case of abnormal situation using GSM modem interfaced to the controller.



2. HARDWARE MODULES USED IN THIS PROJECT

LPC2148



ARM7TDMI Processor Core

- Current low-end ARM core for applications like digital mobile phones
- TDMI
  - T: Thumb, 16-bit compressed instruction set
  - D: on-chip Debug support, enabling the processor to halt in response to a debug request
  - M: enhanced Multiplier, yield a full 64-bit result, high performance
  - I: Embedded ICE hardware

Von Neumann architecture

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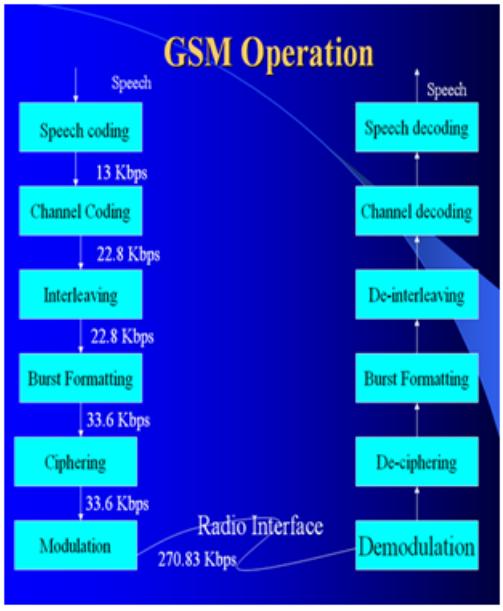
Global System for Mobile (GSM) Communication Definition:

GSM, which stands for Global System for Mobile communications, reigns (important) as the world's most widely used cell phone technology. Cell phones use a cell phone service carrier's GSM network by searching for cell phone towers in the nearby area. Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication. GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900 MHz It is estimated that many countries outside of Europe will join the GSM partnership.



BLOOD PRESSURE METER:

A sphygmomanometer (blood pressure meter, or blood pressure gauge (also referred to as a sphygmometer) is a device used to measure blood pressure, composed of an inflatable cuff to restrict blood flow, and a mercury or mechanical manometer to measure the pressure. It is always used in conjunction with a means to determine at what pressure blood flow is just starting, and at what pressure it is unimpeded. Manual sphygmomanometers are used in conjunction with a stethoscope. Normal blood pressure of a healthy person is 120/80 maximum up to 140/90.

PULSE COUNTING SENSOR

Heart rate is the speed of people's emotional state, exercise intensity and objective indicator of cardiac function. But most people are very difficult to accurately measure the time and his heart rate values. If the heart rate monitor with me, heart ECG electrodes will be detected by monitoring the signal processing device, the user can at any time that your heart rate changes, changes in heart rate, self-monitoring status.

Heart rate monitor for heart rate range (60 ~ 90) / min. Circuit by adjusting the relevant components, in the (60 ~ 90) / min within the audible alarm can change the heart rate range. This heart rate range the width of the design center values ± 20% range. If central values such as emphasis on the 100 / exceptionally, the heart rate signal range (80 ~ 120) / min, if the heart rate exceeds this range, the lower limit, the instrument does not sound, if the heart rate in the range of the instrument ECG is the sound issue.

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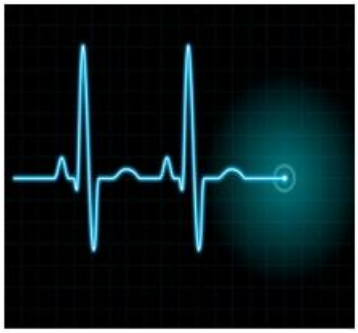


LM35

FEATURES DESCRIPTION

• Calibrated Directly in ° Celsius (Centigrade)
• Linear + 10 mV/°C Scale Factor • 0.5°C Ensured Accuracy (at +25°C) • Rated for Full −55°C to +150°C Range
• Suitable for Remote Applications
• Low Cost Due to Wafer-Level Trimming
• Operates from 4 to 30 V
• Less than 60-µA Current Drain
• Low Self-Heating, 0.08°C in Still Air
• Nonlinearity Only ±¼°C Typical
• Low Impedance Output, 0.1 Ω for 1 mA Load

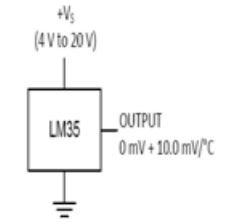


Figure 1. Basic Centigrade Temperature Sensor (+2°C to +150°C)

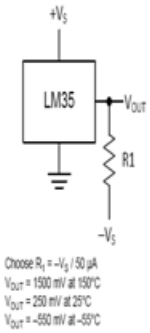


Figure 2. Full-Range Centigrade Temperature Sensor

Normal temperature of the human body is 98.6 degrees Fahrenheit or 37.0 degrees Celsius.

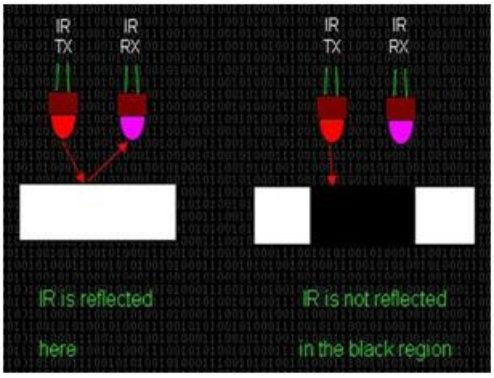
RESPIRATORY (BREATH RATE)

The number of breaths per minute or, more formally, the number of movements indicative of inspiration and expiration per unit time.

In practice, the respiratory rate is usually determined by counting the number of times the chest rises or falls per minute. This phenomenon is also referred as Breath Rate. The respiration rate is the number of breaths a person takes per minute. The rate is usually measured when a person is at rest and simply involves counting the number of breaths for one minute by counting how many times the chest rises. Respiration rates may increase with fever, illness, and with other medical conditions. When checking respiration, it is important to also note whether a person has any difficulty breathing. Normal respiration rates for an adult person at rest range from 12 to 18 breaths per minute maximum up to 30.

IR SENSOR:

IR reflectance sensors contain a matched infrared transmitter and infrared receiver pair. These devices work by measuring the amount of light that is reflected into the receiver. Because the receiver also responds to ambient light, the device works best when well shielded from abient light, and when the distance between the sensor and the reflective surface is small(less than 5mm).



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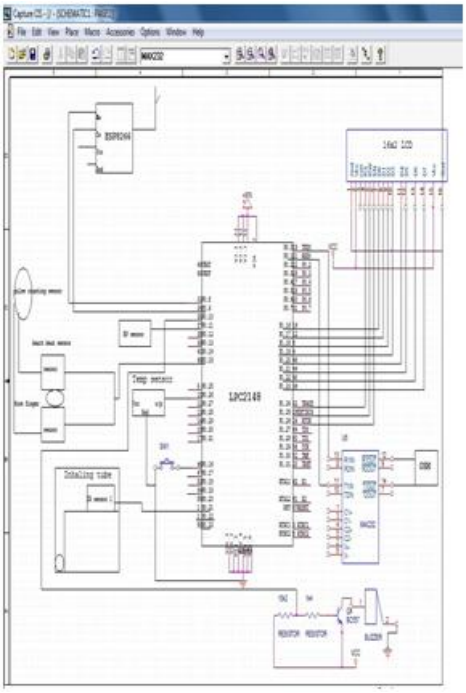
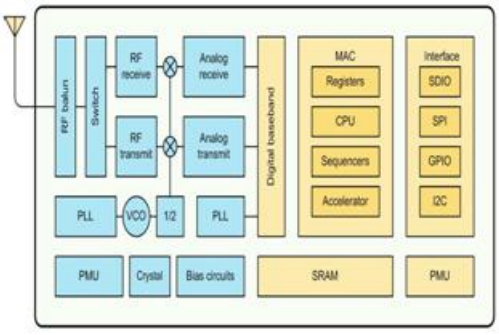
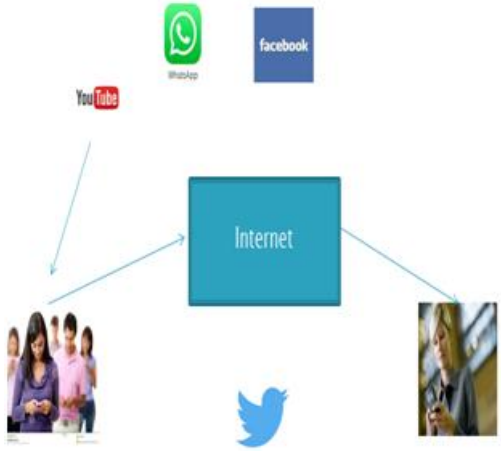
Circuit diagram:



INTERNET OF THINGS (IOT):

Internet is helping people to communicate each other using different applications





Internet of things helps the things to communicate each other using IOT module

ESP8266EX:

- The Internet of Things (IOT) is the network of physical objects or "things" embedded with electronics,
- Software, sensors, and network connectivity, which enables these objects to collect and exchange data.

Different things:

- ESP8266(ESPRESSIF)
- ESP8089
- ESP6203

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Advantages:

- Ease of operation
- Low maintenance cost
- Fit and forget system
- No wastage of time
- Durability
- Accuracy

Applications:

- Hospitals
- Remote heart rate monitoring applications
- Body temperature Monitoring
- Local monitoring applications
- Designed for Home and Clinical Applications

3. WORKING:

This process is carried out in 2 modes. The circuit is connected to power supply, hold on the number enrolment button until wait for a call text is displayed on the LCD screen. Make a call to the SIM which is inserted in GSM module SIM slot. Internal ROM will stores that corresponding number. All the alerts regarding monitored patient will be sent to that particular number. The number which is stored in ROM can be replaced with another new number by pressing reset & number enrolment switches. In mode 1 we can check 3 vitals i.e., blood pressure, heart beat and temperature. And in mode 2 we can check the respiratory i.e., breath rate. Initially we are checking the 3 vitals in mode 1 i.e., blood pressure, heart beat and temperature. As we are discussing above after the number enrolment, display will shows the default values of blood pressure. The blood pressure values are taken by the blood pressure kit i.e., sphygmomanometer which is displayed on the screen. After that pulse rate is monitored with the help of heart beat circuit. By placing the temperature sensor belt to the patient's wrist we can get the body temperature of the patient. In mode 2 we monitoring the respiratory i.e., breath rate of the patient. Here we are having the simple glass tube with a light weight plastic ball residing in it. One IR sensor is placed in front of the glass tube for reading the number of obstacles.

Here one pipe is attached connected to for inhaling and exhaling. When the patient is made to inhale and exhale air into the pipe the ball in the tube will bounce in such a way that it will interrupt the IR rays, these interruptions are calculated ARM7 LPC2148. These values are nothing but the breath rate of the patient. All the readings will sent to web server using one WI-FI chip (ESP8266) i.e., IOT. These readings can be monitored by the doctor who is residing far away. And by using android application graphical representation of monitored values can see in Smartphone. In case of any abnormal conditions SMS alerts will be sent to the enrolled number. Reference values of normal healthy person was taking based on the consulted physician prescription attached in references.

4. EXPERIMENTAL RESULTS:

Checking the Vitals (Blood Pressure, Heartbeat, Temperature & Respiratory) of our Respected Project Guide

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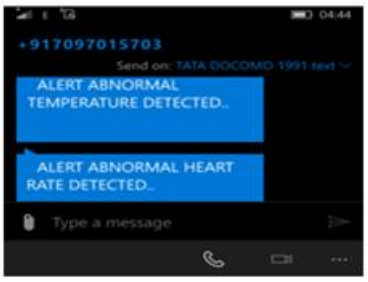
Initializing the Vital values

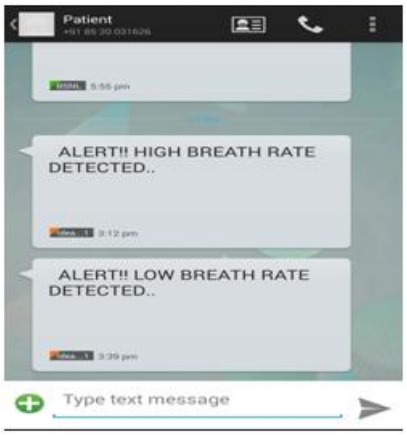
Showing the monitored values of Blood Pressure, Heart Beat and Temperature

If any Abnormal Vitals occur warning text will display on LCD



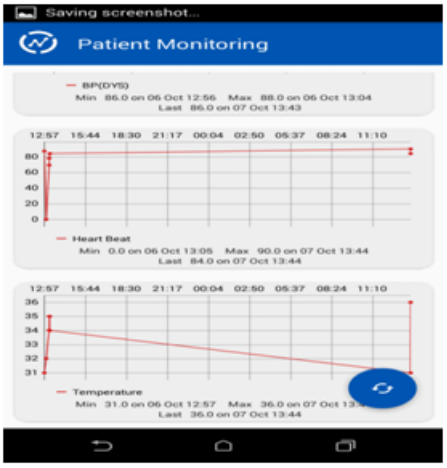
Abnormal Vitals i.e., Temperature and Heart Beat SMS Alerts

Low Breath Rate Alert text will be displayed on Screen



Abnormal Respiratory (Breath Rates) i.e., High & Low SMS Alerts

Monitored values of Breath Rate & BP (Systole) shown graphically in Smartphone using Android Application



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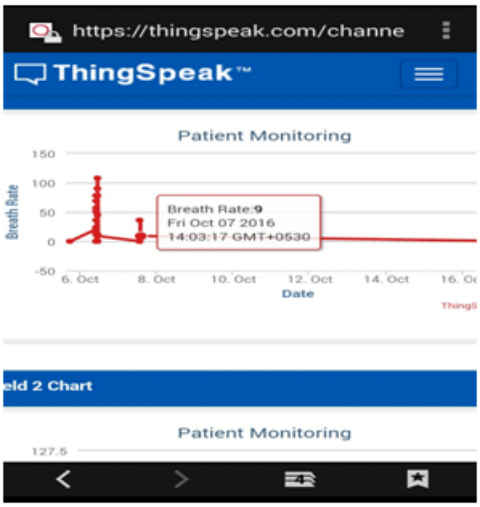
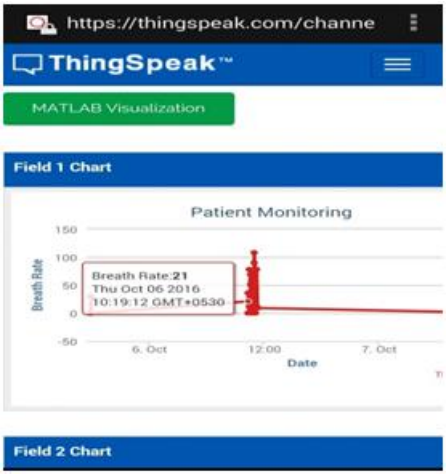
Monitored values of BP (Diastole), Heart Beat & Temperature showing graphically in Smartphone using Android Application



Monitored Respiratory (Breath Rate) values shown in Web Server



Monitored Respiratory (Breath Rate) values shown in Web Server

5. FUTURE SCOPE:

In the present project we have developed it for single patient vitals monitoring. So it will also develop for multiple patients and also complexity will get more. And SPO2 (Saturation of Peripheral Oxygen or Pulse Oximeter Oxygen Saturation) also known as Spot Oxygen Saturation is a Saturation of Hemoglobin with Oxygen As Measured by Pulse Oximetry will be developed by using this project in real time.

Physicians are used it for the real time purpose and that to it is a separate embedded system based device, we cannot dump this with vital monitoring applications. This becomes complexity and more expensive. But we can overcome this problem and will be developed in future

Video monitoring could be used for monitoring patients

6. CONCLUSION:

Here we have designed a simple, low-cost controller based wireless electrocardiogram detection (heart beat), blood pressure and body temperature for personal health monitoring. This is an easier way to check the vitals of patients in emergency situations. Corresponding physician need not to present nearby patient. At any point of time patient can be monitored by his Vital values can be shown by the physician with the help of web server and android smart phone at anywhere and at any point of time. With the help of this project we can save the life of a patient in emergency situations in hospitals when corresponding physician or persons not available right there.

7. REFERENCES:

Here we have consulted a physician to know the accuracy vitals reference ranges of a normal healthy person. Based on physician prescription we developed project code for normal ranges and abnormal ranges to get SMS alerts. Consulted physician prescription is also attached showing in figure below.

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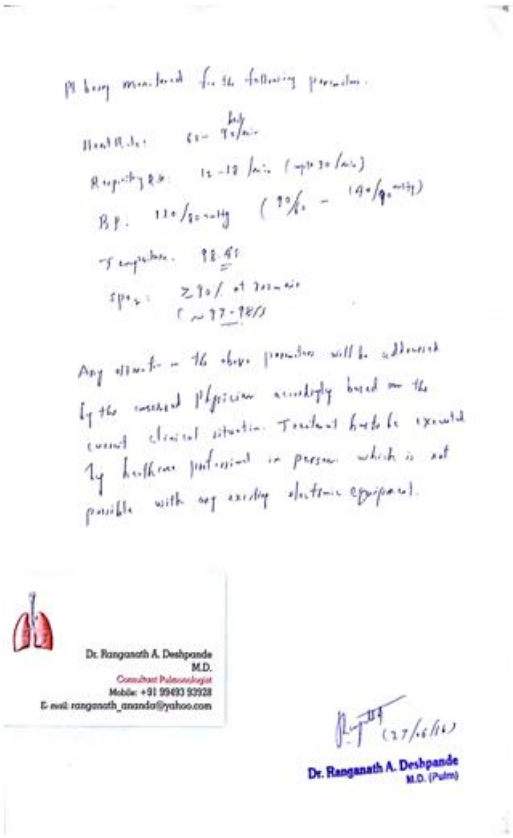

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