

Design and Implementation of Wireless Durable Medical Equipment for Continuous Health Monitoring of Patients during Natural Disaster



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ABSTRACT:

The patient monitoring systems is one of the major improvements in the hospitality because of its advanced technology, but during natural disaster or in any un even conditions continuous monitoring of patient is not possible. The current paper which is developed will avoid all those problems which was occurred previously .This project is designed to measure heart beat (pulse count) and temperature of the patient by using embedded technology. In this project simultaneously we can measure and monitor the patient's condition. It is to operate and available at an affordable cost.

This project describes the design of a simple, low-cost controller based wireless Patient monitoring system. Heart rate of the patient is measured from the thumb finger using IRD (Infra Red Device sensors) and temperature of the patient is measured using LM35 sensor. A panic switch is also interfaced to the controller that is to send a signal by the patient if anything is wrong or else if the patient needs some attention then they can press the switch. Heart rate values, temperature values and the signal through the panic switch is sent the remote place using GSM module interfaced to the controller. A GPS module is also interfaced to get the location value of the patient. The main purpose of the project is to work without power supply .This project uses 12v/1.3APH rechargeable battery.

Keywords: Durable medical equipment, Zigbee, GSM, GPS, IRD

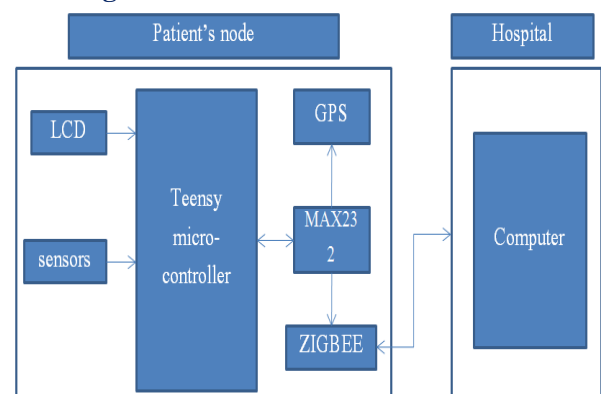
Introduction

The patient monitoring systems is one of the major improvements in the hospitals because of its advanced technology. This project is designed for convenience of patient using embedded technology. In this project simultaneous monitoring of patient's condition is being done. 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.

Block diagram



Draw backs

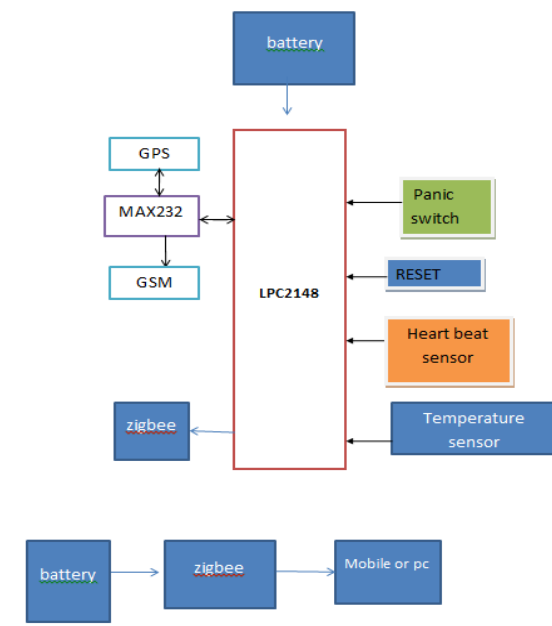
- Limit range
- Requires a computer system
- Low efficiency

Proposed method:

This project describes the design of a simple, low-cost controller based wireless Patient monitoring system. Heart rate of the patient is measured from the thumb finger using IRD (Infra Red Device sensors).

A panic switch is also interfaced to the controller that is to send a signal by the patient if anything is wrong or else if the patient needs some attention then they can press the switch. Heart rate values and the signal through the panic switch is sent the remote place using GSM module interfaced to the controller. A GPS module is also interfaced to get the location value of the patient.

Block diagram



Modules used in this project

ARM7TDMI Processor Core

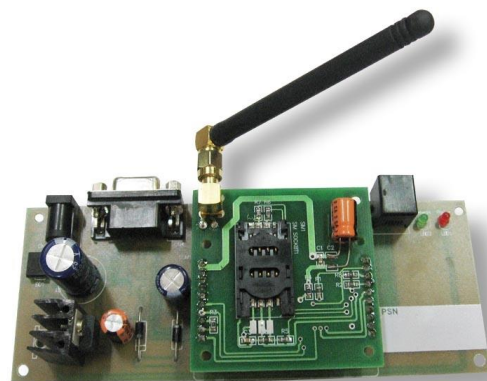
- Current low-end ARM core for applications like digital mobile phones
- TDMI
 - T: Thumb, 16-bit compressed instruction set
 - D: on-chip Debug support, enabling the processor to halt in response to a debug request

- M: enhanced Multiplier, yield a full 64-bit result, high performance
- I: Embedded ICE hardware
- Von Neumann architecture

GSM

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.



Global Positioning System

The **Global Positioning System (GPS)** is a U.S. space-based global navigation satellite system. It provides reliable positioning, navigation, and timing services to worldwide users on a continuous basis in all weather, day and night, anywhere on or near the Earth which has an unobstructed view of four or more GPS satellites.



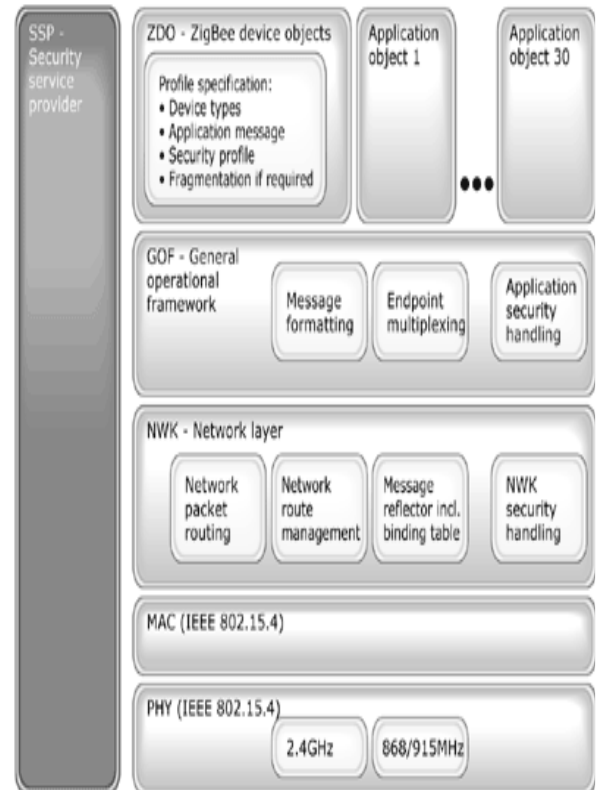
ZIGBEE



Zigbee module. The €1 coin, shown for size reference, is about 23 mm (0.9 inch) in diameter. Zigbee is a specification for a suite of high level communication protocols using small, low-power digital radios based on the IEEE 802.15.4-2003 standard for wireless personal area networks (WPANs), such as wireless headphones connecting with cell phones via short-range radio.

The technology defined by the ZigBee specification is intended to be simpler and less expensive than other WPANs, such as Bluetooth. Zigbee is targeted at radio-frequency (RF) applications that require a low data rate, long battery life, and secure networking. The Zigbee Alliance is a group of companies that maintain and publish the Zigbee standard.

Architecture:



Blood pressure meter

A **sphygmomanometer (blood pressure meter, or blood pressure gauge)** (also referred to as a **sphygmomanometer**) 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.

A sphygmomanometer consists of an inflatable cuff, a measuring unit (the mercury manometer, or aneroid gauge), and a mechanism for inflation which may be a manually operated bulb and valve or a pump operated electrically.

The usual unit of measurement of blood pressure is millimeters of mercury (mmHg) as measured directly by a manual sphygmomanometer.



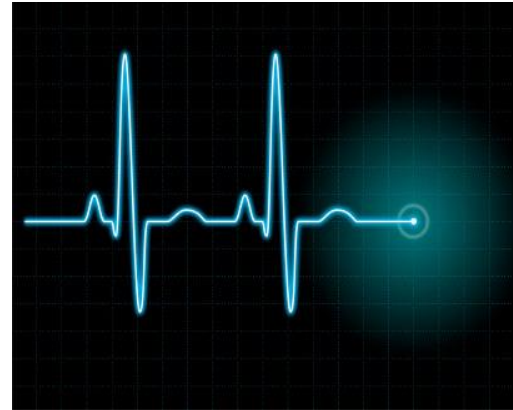
Pulse counting sensor

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 ~ 160) / min. Circuit by adjusting the relevant components, in the (60 ~ 160) / min within the audible alarm can change the heart rate range. This heart rate ranges the width of the design center values $\pm 20\%$ 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.



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- μ A Current Drain
- Low Self-Heating, 0.08°C in Still Air
- Nonlinearity Only $\pm 1/4^\circ$ C Typical
- Low Impedance Output, 0.1 Ω for 1 mA Load

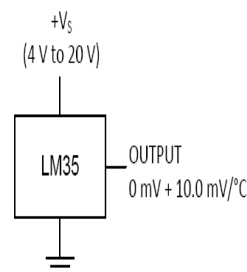
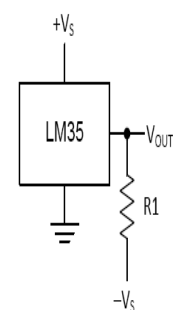


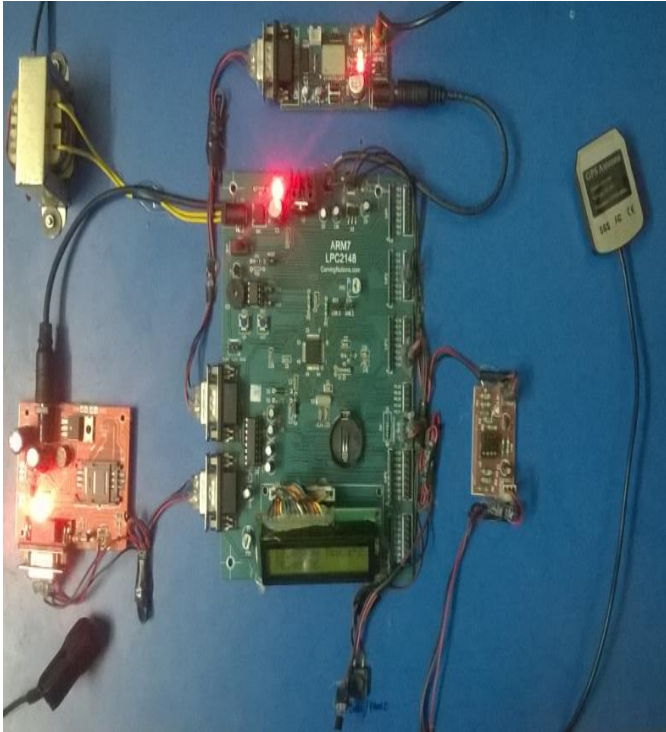
Figure 1. Basic Centigrade Temperature Sensor (+2°C to +150°C)



Choose $R_1 = -V_S / 50 \mu A$
 $V_{OUT} = 1500 \text{ mV at } 150^\circ C$
 $V_{OUT} = 250 \text{ mV at } 25^\circ C$
 $V_{OUT} = -550 \text{ mV at } -55^\circ C$

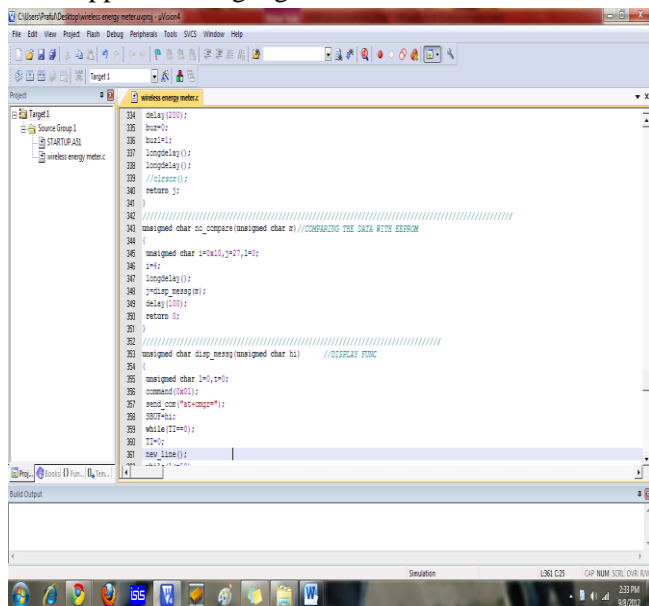
Figure 2. Full-Range Centigrade Temperature Sensor

Modules interfaced to ARM7



Software tools

Keil compiler is software used where the machine language code is written and compiled. After compilation, the machine source code is converted into hex code which is to be dumped into the microcontroller for further processing. Keil compiler also supports C language code.



Flash Magic

Flash Magic is a tool which is used to program hex code in EEPROM of micro-controller. It is a freeware tool. It only supports the micro-controller of Philips and NXP. It can burn a hex code into that controller which supports ISP (in system programming) feature. Flash magic supports several chips like **ARM Cortex M0, M3, M4, ARM7 and 8051**.



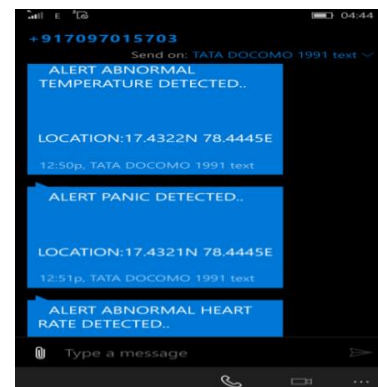
Advantages:

- 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

Project Result shown in mobile with location details



Future scope

Video monitoring could be used for monitoring patients

Conclusion

Here we have designed a simple, low-cost controller based A Wireless Tracking System for At-home Medical Equipment during Natural Disasters

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