An Enhanced Fall Detection System for Elderly Person Monitoring using Consumer Home Networks

LakshmiPriyankaDevi.M[1], T. Ravi kumar[2], Girish Kumar PVR[3]
[1]*PG Scholar, Dr.K.V.Subba Reddy College of Engineering for Women's, Kurnool, Andhra Pradesh, India*
[2]*Assistant Professor, Dr.K.V.Subba Reddy College of Engineering for Women's, Kurnool, A.P, India.*
[3]*Assistant Professor, Geethanjali College of Engineering & Technology, R.R.Dist, Telangana, India.*

Abstract:

This project describes Various fall-detection solutions have been previously proposed to create a reliable surveillance system for elderly people with high requirements on accuracy, sensitivity and specificity. In this project, an enhanced fall detection system is proposed for elderly person monitoring that is based on smart sensors worn on the body and operating through consumer home networks the design of a simple, low-cost controller based wireless fetal heart beat 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 and displayed on a text based LCD).The device LCD displaying the heart beat rat and0 counting values through sending pulses from the sensor. This 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. This project uses as ARM 7 (LPC2148) its controller. By reading pulse values continuously from pulse count sensor these values are displayed wirelessly using GSM technology.

Keywords: *Arm 7 (Lpc2148), Mems Sensor, Panic Switch, Temp Sensor, Heart Beat Sensor, GSM*

I. INTRODUCTION

In this method we are using total three sensors one is MEMS sensor and other heart beat sensor, temperature sensor. Whenever the elderly person is going to fall immediately the MEMS sensor will be activated and the message transmitted to the authorized person. Even though if the person requires anything immediately the person will press the panic switch and the message will be transmitted with the help of GSM modem.

This project describes the design of a simple, low-cost controller based wireless fetal heart beat 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 and displayed on a text based LCD).The device LCD displaying the heart beat rat and0 counting values through sending pulses from the sensor.

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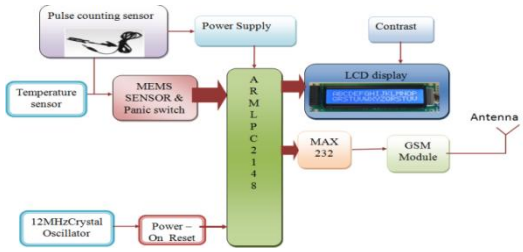


Fig 1 (a)

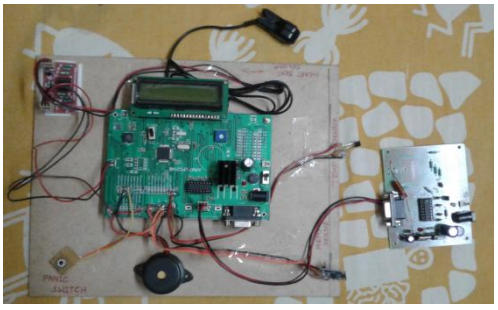


Fig 1 (b)

Figure 1 (a) & (b) Block Diagram of Fall Detection System & Circuit Board

Power Supply

This project uses regulated 5V,9V 500mA power supply.7805 three terminal voltage regulator is used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac out put of secondary of 230/18V step down transformer

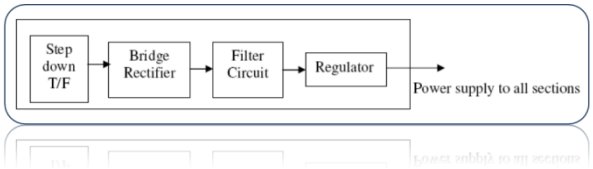


Figure 2. Block Diagram at the Receiver Section

II. LPC2148 CONTROLLER

ARM7TDMI is an advanced version of microprocessors and forms the heart of the system. The LPC2148 are based on a 16/32 bit with real-time emulation and embedded trace support, together with 512 kilobytes of embedded high speed flash memory. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at maximum clock rate.

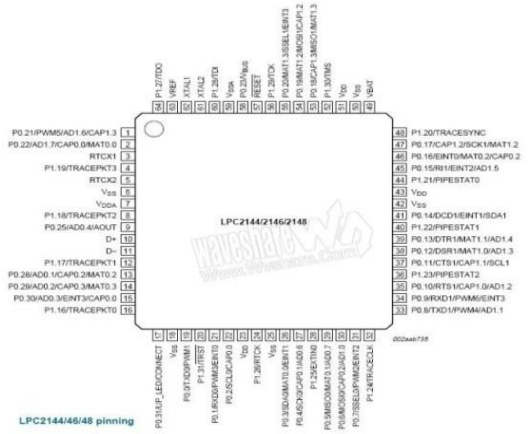


Figure 3. Pin Diagram of LPC2148 Microcontroller

For critical code size applications, the alternative 16-bit Thumb Mode reduces code by more than 30% with minimal performance penalty. With their compact 64 pin package, low power consumption, various 32-bit timers, 4- channel 10-bit ADC, USB PORT,PWM channels and 46 GPIO lines. these microcontrollers are particularly suitable for industrial control, medical systems, access control and point-of-sale.

With a wide range of serial communications interfaces, they are also very well suited for communication gateways, protocol converters and embedded soft modems as well as many other general-purpose applications.

A. Board Technical Specifications:

Processor : LPC2148
Clock speed : 11.0592 MHz / 22.1184 MHz
Clock Divisors : 6 (or) 12
Real time Clock : DS1307 on i2c Bus /w Battery
Data Memory : 24LCxx on i2c Bus
LCD : 16x2 Backlight
LED indicators : Power
RS-232 : +9V -9V levels
Power : 7-15V AC/DC @ 500 mA
Voltage Regulator : 5V Onboard LM7805

B. Specifications of Board:

- Use 16/32 Bit ARM7TDMI-S MCU No.LPC2148 from Philips (NXP)
- Has 512KB Flash Memory and 40KB Static RAM internal MCU
- Use 12.00MHz Crystal, so MCU can process data with the maximum high speed at 60MHz when using it with Phase-Locked Loop (PLL) internal MCU.
- Has RTC Circuit (Real Time Clock) with 32.768 KHz XTAL and Battery Backup.
- Support In-System Programming (ISP) and In-Application Programming (IAP) through On-Chip Boot-Loader Software via Port UART-0 (RS232)
- Has circuit to connect with standard 20 Pin JTAG ARM for Real Time Debugging
- 7-12V AC/DC Power Supply.
- Has standard 2.0 USB as Full Speed inside (USB Function has 32 End Point)
- Has Circuit to connect with Dot-Matrix LCD with circuit to adjust its contrast by using 16 PIN Connector.
- Has RS232 Communication Circuit by using 2 Channel.
- Has SD/MMC card connector circuit by using SSP.
- Has EEPROM interface using I2C.
- Has PS2 keyboard interface.
- All port pins are extracted externally for further interface s.

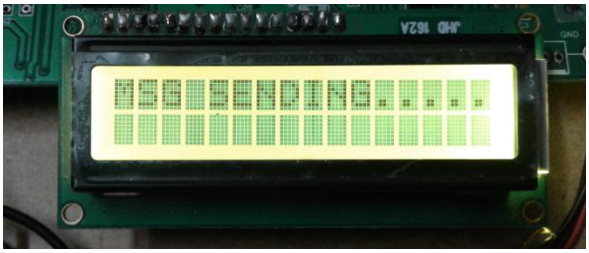
C. GSM Technology

- Global System for Mobile (GSM) is a second generation cellular standard developed to cater voice services and data delivery using digital modulation.
- Characteristics of GSM Standard
- Fully digital system using 900,1800 MHz frequency band.
- TDMA over radio carriers(200 KHz carrier spacing.
- 8 full rate or 16 half rate TDMA channels per carrier.
- User/terminal authentication for fraud control.
- Encryption of speech and data transmission over the radio path.

1) Advantages of GSM over Analog System

- Capacity increases
- Reduced RF transmission power and longer battery life.
- International roaming capability.

- Better security against fraud (through terminal validation and user authentication).
- Encryption capability for information security and privacy.
- Compatibility with ISDN,leading to wider range of services



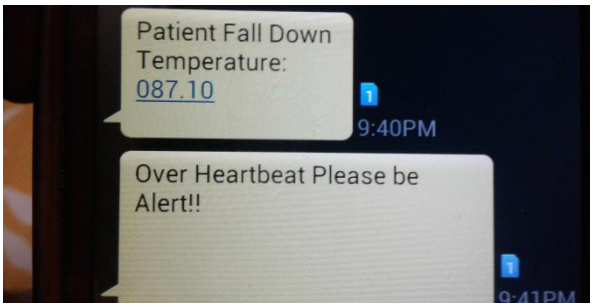


Fig 4 Sending SMS to Mobile

D. Max-232

The MAX232 is an integrated circuit that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits. The MAX232 is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals.

E. Pulse Counting Sensor

Heart rate is the speed of people's emotional state, exercise intensity and objective indicator of cardiac function.

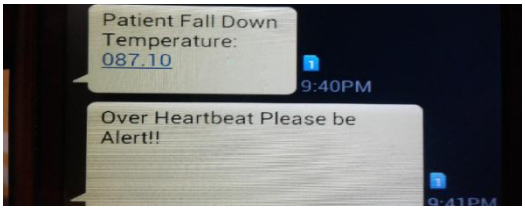
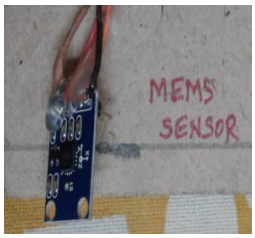


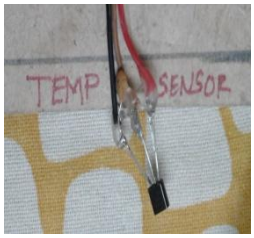
Fig 5 Heart Beat Sensor & Heart Beat Display

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.

F. Micro Electro Mechanical Systems Sensor

Micro-Electro-Mechanical Systems, or MEMS, is a technology that in its most general form can be defined as miniaturized mechanical and electro-mechanical elements (i.e., devices and structures) that are made using the techniques of microfabrication. The critical physical dimensions of MEMS devices can vary from well below one micron on the lower end of the dimensional spectrum, all the way to several millimetres.





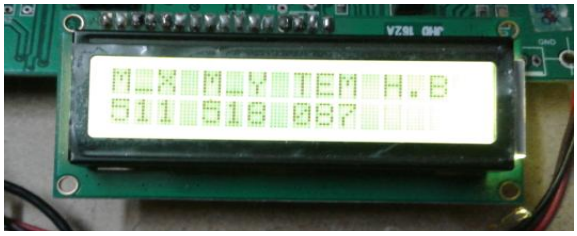


Fig 6 MEMS Sensor & Temp Sensor

G. Liquid Crystal Display

A liquid crystal display (LCD) is a thin, flat panel used for electronically displaying information such as text, images, and moving pictures.

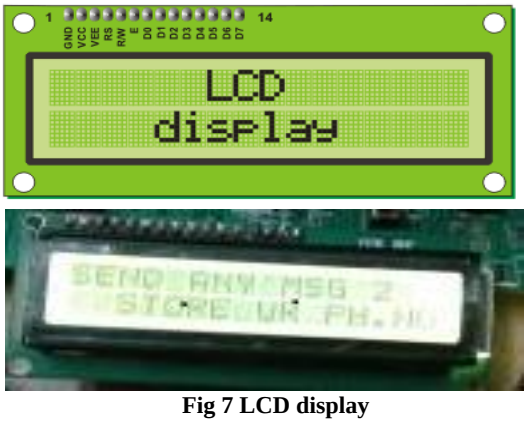


Fig 7 LCD display

Liquid crystal display is very important device in embedded system. It offers high flexibility to user as he can display the required data on it. But due to lack of proper approach to LCD interfacing many of them fail. Many people consider LCD interfacing a complex job but according to me LCD interfacing is very easy task, you just need to have a logical approach. This page is to help the enthusiast who wants to interface LCD with through understanding.RS232+5VPowered, Multichannel RS-232 Drivers/Receivers.

III. CONCLUSION

Here we have designed a simple, low-cost controller based wireless fetal heart beat monitoring system Using Wireless GSM Technology. In this paper, we are using total three sensors one is MEMS sensor and panic switch Temperature sensor and Heartbeat sensor. Whenever the elderly person is going to fall immediately the MEMS sensor will be activated and the message transmitted to the authorized person. Even though if the person requires anything immediately the person will press the panic switch and the message will be transmitted with the help of GSM modem. Whenever the patient body temperatures fluctuate beyond its minimum and maximum level immediately the message will send to the doctors or authorised persons.

From the dataset of 30 participants, it is found that the proposed fall detection system achieved a high accuracy of 97.5%, and the sensitivity and specificity are 96.8% and 98.1% respectfully. The proposed system is ready to be implemented in a consumer device.

A. Advantages

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

B. Applications

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

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