ZigBee based Patient Monitoring System

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ABSTRACT

Statistics reveal that every minute a human is losing his/her life across the globe. More close in India , everyday many lives are affected by heart attacks and more importantly because the patients did not get timely and proper help . There are many emergency response services striving hard to save the lives of people during emergencies, though they are successful at few times. But sometimes they fail to race against time to reach the victim. All over the globe , emergency response service is the need of the hour.

India has the highest incidence of heart related diseases in the world and the number of those affected is likely to double in the coming years. If no initiative is taken to check the disease, the most predictable and also preventable among all chronic diseases, India will have 62 million patients with heart disease. So in the future what if due to lack of urgent service we are not able to save the patient?

The answer to such a problem is that the patient needs to be "monitored constantly"[1]. 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 when he is not along with them, this can really provide quick

1. INTRODUCTION

Now-a-days many people are looking forward to have a healthy life. These days due to pollutions and highly competitive aspects in field of living, number of people falling pray for heart related diseases are seen often arises due to increase of stress level. These days maintaining a healthy life is tough. It is vital to keep track on body by regular check-up. Patient monitoring refers to the continuous observation of repeating events of physiologic function to guide therapy or to monitor the effectiveness of interventions and is used primarily in the intensive care unit and operating room.

At least in India there is no system which continuously monitors the patient when patient is on move. And this motivated us to work in this area.

2. BACKGROUND OVERVIEW

2.1 Existing System

Currently the system used for patient monitoring is the fixed monitoring system which can be used only when the patient is on bed. The available systems are huge in size and only available in the hospitals in ICU.

Figure 2.1 Existing System.

2.2 Drawbacks of Existing System

In existing system patient need to hospitalise shown in fig.1. Regular monitoring of patient is not possible once he/she is discharged from hospitals. These systems cannot be used at individual level.

3. THE PROPOSED SYSTEM

The system which we propose to develop would not only help in monitoring the patient when he is in the bed but also when he is out of his bed i.e.like in Fig.2 when he is mobile.[2] Such a system would constantly monitor important body parameters like temperature , heartbeat and would compare it against a predetermined value set and if these values cross a particular limit it would automatically alert the doctor and relatives of the patient via a SMS. In such case the patient will get a very quick medical help and also would save time and energy of the relatives who neither would have to be with them all the time.

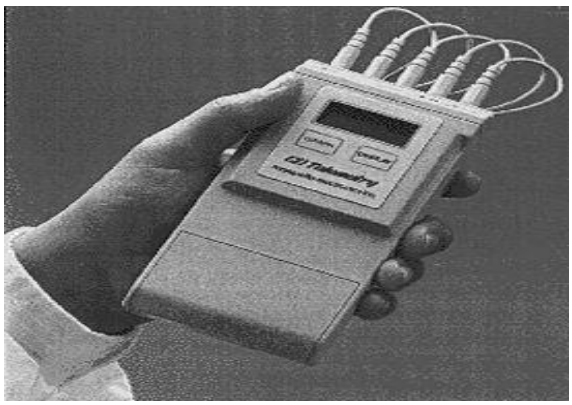

Figure 3 System for mobile patient.

3.1 System Overview

The above proposed system will be divided into the following sub modules or sections…

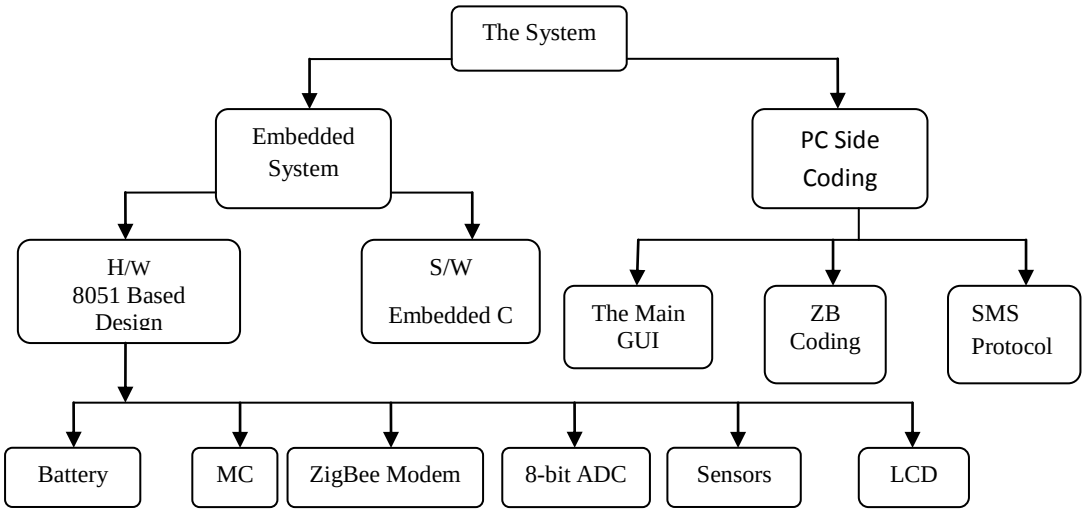

Figure 3.1Hardware / Software Overview

3.2 Block Diagram

The Block Diagram of the system is given below

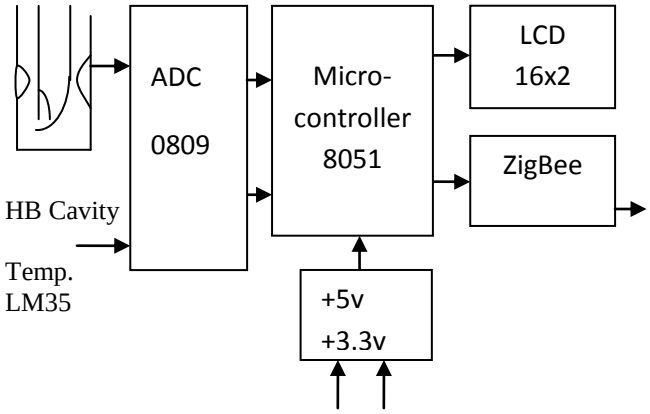

Figure 3.2 Hardware.

3.2.1Explanations of Blocks

The following are the brief explanations of the working principle of the various major blocks or sections used in the system…

3.2.1.1Power Supply

This unit will supply the various voltage requirements of each unit.[6]

3.2.1.2Microcontroller

This unit is the heart of the complete system. It is actually responsible for all the process being executed. It will monitor & control all the peripheral devices or components connected in the system. In short we can say that the complete intelligence of the project resides in the software code embedded in the Microcontroller.

The controller here user will be of 8051 family.[3] The code will be written in Embedded C and will be burned or programmed into the code memory using a programmer.[4]
This unit requires +5VDC for it proper operation.

3.2.1.3 LCD 16x2

It is called Liquid Crystal Display. We are going to use 16x2 character LCD. This will be connected to microcontroller. The job of LCD will be to display all the system generated messages coming from the controller. LCD will provide interactive user interface.
This unit requires +5VDC for it proper operation

3.2.1.4 ADC 8-bit

This unit is one of most important unit in embedded system as microcontroller uses this to understand this unit requires +3.3VDC for it proper operation various analog parameter incoming from transducers. The job of this section is to convert analog input signals (voltages) into its equivalent digital (decimal) value. Here we are using 8-bit ADC that means its digital range is 0-255. Also the same ADC will be used for multiple sensors as it has 8 channels.

This unit will be connected with microcontroller with 8-bit Data lines,3-bit Address lines and some control lines. Also it requires clock pulses for its internal operation which will be given by 555 timer section.
This unit requires +5VDC for it proper operation.

3.2.1.5 555 Timer

The 555 monolithic timing circuit is a highly stable controller capable of producing accurate time delays, or oscillation. Here we are using it in Astable Multivibrator mode for generating clock pulses. The frequency depends upon the external register connected to the IC.[7]
This unit requires +5VDC for it proper operation.

3.2.1.6 ZigBee Modem

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

Table1. Comparison between current wireless standards

Standard	Bandwidth	Power Consumption	Stack Size	Strongholds	Applications
Wi-Fi	up to 54 Mbps	400+mA TX,	100 KB	High Data Rate	High data rate networking, file transfers
Bluetooth	1 Mbps	40mA TX, Standby 0.2mA	~100 KB	Interoperability, cable replacement	Wireless USB, headsets, handsets
ZigBee	250 Kbps	30mA TX, standby 3µA	<32 KB	Long battery life, low cost	Remote control Battery-operated Products, sensors

headphones connecting with cell phones via short-range radio[1].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.

3.2.1.7 Temperature Sensor LM35

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 does not require any external calibration or trimming to provide typical accuracies. This is 3 leg IC that directly gives analog output.
This unit requires +5VDC for it proper operation.

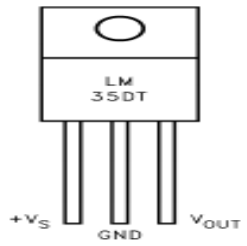

Figure 3.2.1.7 Temperature sensor LM35

3.2.1.8 Heart Beat Sensor

Here we will be making a cavity having one bright red LED & one LDR just opposite to it. By placing the finger in between a LED and LDR, we can detect the pulses of heart, the analog voltages are further processed with an operational amplifier LM 358, this chip has two built in OPAMPs.[2] One will act as amplifiers and another will be used as comparator. The output of comparator will be fed to the microcontroller.
This unit requires +5VDC for it proper operation.

4. FEATURES

The Following are the prominent features of the above discussed system…

- Real time monitoring of patient.
- Automatic Alert SMS to family or doctor,
- Flexibility of changing trigger limits,
- Handy device can be kept in pocket.

5. TECHNOLOGY AND PROGRAMMING LANGUAGES

As microcontrollers are the core of these days digital circuit design in industry, this system uses it for the centralized operation and digital processing. The technology used here is embedded technology which is the future of today's modern electronics.

The followings are the various Programming Languages & Technologies that are going to be used in the proposed system...

For Embedded System…

- Embedded Technology,
- 8051 Family Based Controller,
- Embedded C - Keil Compiler,[4]
- Eagle Software for PCB Designing,

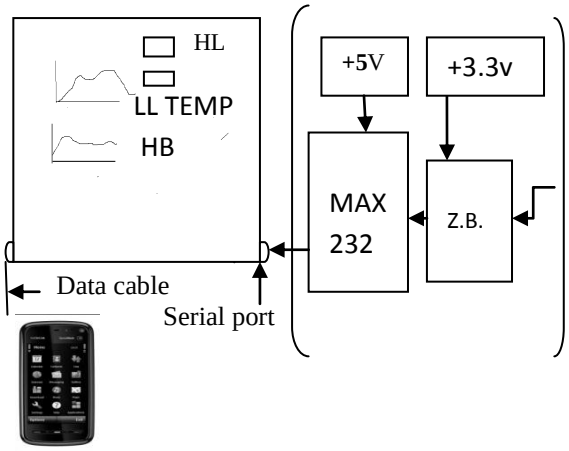

Figure 5.1 PC Side PC/VB net/S2L/Access

6. PROJECT DEVELOPMENT METHODOLOGY OR STEPS

The following will be development steps so as to achieve the working Prototype Model of the above proposed system…

- Defining the Problem,
- Understanding the Need & Usability in industry and society (Market Analysis),
- Developing Block Diagram,
- Designing Circuits of individual blocks,
- Testing circuits in LAB & Finalizing,
- Developing PCB on PC,
- Getting the PCB printed from market,
- Soldering the components,
- Performing various Basic Experiments to test the PCBs,
- Developing Flowchart for the entire process,
- Writing actual Software Program,
- Compilation & Burning,
- Testing and Debugging
- Finally Running the system and, Documentation

7. SCOPE AND APPLICATION

Only the imagination can limit the applications of the above proposed system.

Though the following are some examples…

- Cure can be provided at an early stage.
- Notification to the doctor is provided in case of critical conditions even though the patient is unable to provide any details.

8. CONCLUSION

Thus the microcontroller based wireless Heartbeat and body temperature monitoring system is designed and implemented, in which both the signals directly measured from the human body and both the parameter values displayed on LCD on the transmitter side. This data is transmitted to the receiver wirelessly through ZigBee. The received signal compared with normal heartbeat and body temperature signals based on normal range in the receiver side. If an abnormality is detected, the SMS is send to the doctor. The distance between the transmitter and receiver is less in the range of about 10m.

The distance range can be extended in future.

By the realization of the above proposed system one can learn many aspects of a digital electronics circuit. This will give the complete knowledge of designing microcontroller based system and developing embedded software.

We will also learn the software development strategies and various programming techniques for PC based applications.

9. ENHANCEMENTS

9.1. Limitations

As generally all systems have some limitation, here are some listed for the proposed system

- Developing Data Flow Diagram,
- Writing actual code.
- System can monitor only temperature and heartbeat
- Patient need to carry the hardware all the time,

9.2. Drawbacks

This system has certain drawbacks also as listed…

- SMS will not be send if patient is out of range,
- Every SMS will attract some cost,
- System will not work if mobile phone is switched off,

9.3. Future Modifications

There is always chance to improve the any system as research & development is an endless process. Our system is no exception to this phenomenon. The following improvements can be done…

- ECG Blood pressure,
- Pulse oximetry,
- Galvanic- Skin Resistance,
- Nearest hospital will be informed automatically with the help of GPS and ambulance will be sent to the patient,
- Automatic calling to the doctor in case of emergency,

10. REFERENCES

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