

## A REAL TIME MONITORING SYSTEM FOR PHYSIOLOGICAL SIGNALS USING WIRELESS SENSOR NETWORK

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### Abstract:-

In recent years, the world is facing a common problem that the number of elderly people is increasing. Hence, the problem of home-care for elderly people is very important. In recently, wireless sensor networks are used to structure home-care system in many researches. Wireless sensor networks application for physiological signals communication transmission has many technologies. Such as the Infrared, Bluetooth and ZigBee, etc. Because the angle limit problem of the infrared transmission, and the infrared have not be used for Physiological signal transmission.

Although Bluetooth is better than ZigBee for transmission rate, but ZigBee has lower power consumption. Hence, ZigBee is generally used for 24 hours monitor of communication transmission systems. The first procedure of the system that we use the sensors to measure temperature, heart rate and blood pressure from human body, Using Zigbee the measured signal sends to the PC via the RS-232 serial port communication interface. We can send the signal to remote PC or PDA. In particular, when measured signals over the standard value, the personal computer will send GSM short message to absent manager's mobile phone.

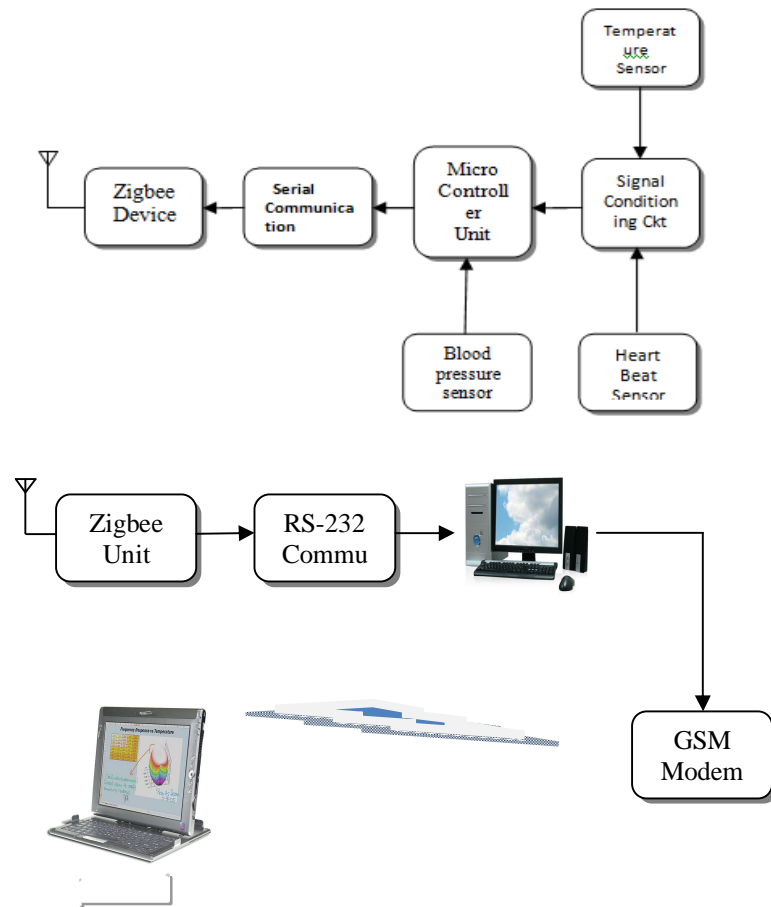


Fig A: Module Wise Block Diagram

## 1. INTRODUCTION

### A. Overview of the System

In this paper, we presented the wireless sensor networks (WSN) to observe the human physiological signals by ZigBee, which is provided with lower power consumption, small volume, high expansion, stylization and two-way transmission, etc. ZigBee is generally used for home care, digital home control, and industrial and security control. This paper developed a suite of home care sensor network system by ZigBee's characteristic, which is embedded sensors, such as the biosensor for observe heart rate and blood pressure. The biosensor transmits measured signals via ZigBee, and then sends to the remote wireless monitor for acquiring the observed human physiological signals. The remote wireless monitor is constructed of ZigBee and personal computer (PC). The measured signals send to the PC, which can be data collection. When the measured signals over the standard value, the personal computer sends Global System for Mobile Communication (GSM) short message to the manager. The manager can use the PC or personal digital assistant (PDA) to observe the observed human physiological signals in the remote place.

### B. Temperature sensor

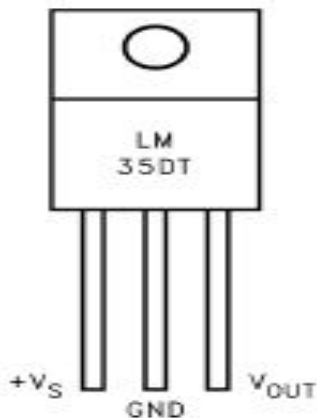


Fig 2 Temperature sensor

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies 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. Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only

$60\mu\text{A}$  from its supply, it has very low self-heating, less than  $0.1^\circ\text{C}$  in still air.

The LM35 is rated to operate over a  $-55^\circ$  to  $+150^\circ\text{C}$  temperature range, while the LM35C is rated for a  $-40^\circ$  to  $+110^\circ\text{C}$  range ( $-10^\circ$  with improved accuracy). The LM35 series is available packaged in hermetic TO-46 transistor packages, while the LM35C, LM35CA, and LM35D are also available in the plastic TO-92 transistor package. The LM35D is also available in an 8-lead surface mount small outline package and a plastic TO-220 package.

### C. Heart beat sensors

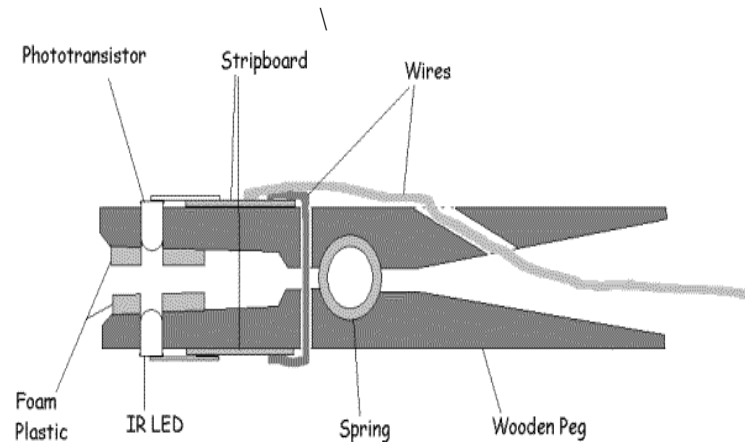


Fig 3 Heart beat sensors

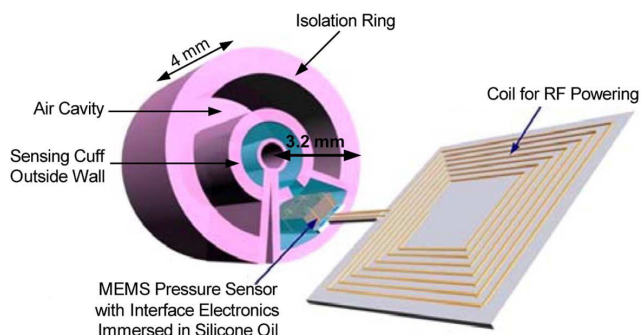
The sensor consists of a light source and photo detector; light is shone through the tissues and variation in blood volume alters the amount of light falling on the detector. The source and detector can be mounted side by side to look at changes in reflected light or on either side of a finger or earlobe to detect changes in transmitted light. The particular arrangement here uses a wooden clothes peg to hold an infra red light emitting diode and a matched phototransistor. The infra red filter of the phototransistor reduces interference from fluorescent lights, which have a large AC component in their output

The skin may be illuminated with visible (red) or infrared LEDs using transmitted or reflected light for detection. The very small changes in reflectivity or in transmittance caused by the varying blood content of human tissue are almost invisible. Various noise sources may produce disturbance signals with amplitudes equal or even higher than the amplitude of the pulse signal. Valid pulse measurement therefore requires extensive preprocessing of the raw signal.

The setup described here uses a red LED for transmitted light illumination and a pin Photodiode as detector. With only slight changes in the preamplifier circuit the same hard- and software could be used with other illumination and detection concepts. The detectors photo current (AC Part) is converted to voltage and amplified by an inexpensive operational amplifier (LM358). A LPC2148 microcontroller converts

the analog signal with 10 bits resolution to a digital signal. An average is calculated from 250 readings taken over a 20 milliseconds period (This equals one period of the European power line frequency of 50 Hz).

#### D. Blood pressure



To miniaturize the large-model prototype design presented in pervious section, a miniature implantable blood pressure monitoring cuff is designed and fabricated. Fig. 6 shows a detailed 3-D configuration of the implantable blood pressure monitoring cuff with a sensor, interface electronics and RF powering coil. As illustrated in the figure, a silicone rigid isolation ring is used to decouple the sensing cuff, which is located at the structural center, from environmental variations in animal body. Because of the soft nature of the sensing cuff outside wall, the pressure inside the sensing cuff is susceptible to environmental variations, such as animal muscle and tissue movement, without the isolation ring. The sensing cuff outside wall can be made more rigid to decrease this effect, however, at the same time the blood vessel restraint will be increased, thus leading to a tradeoff between blood pressure baseline drift and the vessel restraint. However, it is difficult to quantify this tradeoff due to limited research data currently available regarding the long-term influence of laboratory animals with different amount of vessel restraint. Therefore, a rigid isolation ring is employed to suppress low-frequency baseline drift.

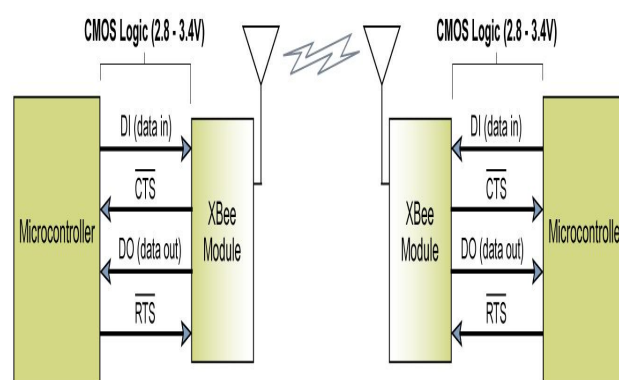
#### E. Zigbee module

The XBee/XBee-PRO RF Modules are designed to operate within the ZigBee protocol and support the unique needs of low-cost, low-power wireless sensor networks. The modules require minimal power and provide reliable delivery of data between remote devices. The modules operate within the ISM 2.4 GHz frequency band and are compatible with the following:

- XBee RS-232 Adapter
- XBee RS-232 PH (Power Harvester) Adapter
- XBee RS-485 Adapter
- XBee Analog I/O Adapter
- XBee Digital I/O Adapter

- XBee Sensor Adapter
- XBee USB Adapter
- XStick
- Connect Port X Gateways
- XBee Wall Router.

The XBee/XBee-PRO ZB firmware release can be installed on XBee modules. This firmware is compatible with the ZigBee 2007 specification, while the ZNet 2.5 firmware is based on Ember's proprietary "designed for ZigBee" mesh stack (EmberZNet 2.5). ZB and ZNet 2.5 firmware are similar in nature, but not over-the-air compatible. Devices running ZNet 2.5 firmware cannot talk to devices running the ZB firmware.



#### F. GSM communication

A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves.

A GSM modem can be an external device or a PC Card / PCMCIA Card. Typically, an external GSM modem is connected to a computer through a serial cable or a USB cable. A GSM modem in the form of a PC Card / PCMCIA Card is designed for use with a laptop computer. It should be inserted into one of the PC Card / PCMCIA Card slots of a laptop computer. Like a GSM mobile phone, a GSM modem requires a SIM card from a wireless carrier in order to operate.

As mentioned in earlier sections of this SMS tutorial, computers use AT commands to control modems. Both GSM modems and dial-up modems support a common set of standard AT commands. You can use a GSM modem just like a dial-up modem.

In addition to the standard AT commands, GSM modems support an extended set of AT commands. These extended AT commands are defined in the GSM standards. With the extended AT commands, you can do things like:

- Reading, writing and deleting SMS messages.
- Sending SMS messages.
- Monitoring the signal strength.
- Monitoring the charging status and charge level of the battery.
- Reading, writing and searching phone book entries.

The number of SMS messages that can be processed by a GSM modem per minute is very low -- only about six to ten SMS messages per minute.

### G.Experimental Results:

The below figures consists of various people's Temperature, heartbeat and blood pressure taken at different conditions. These conditions are normal stage and after exercise

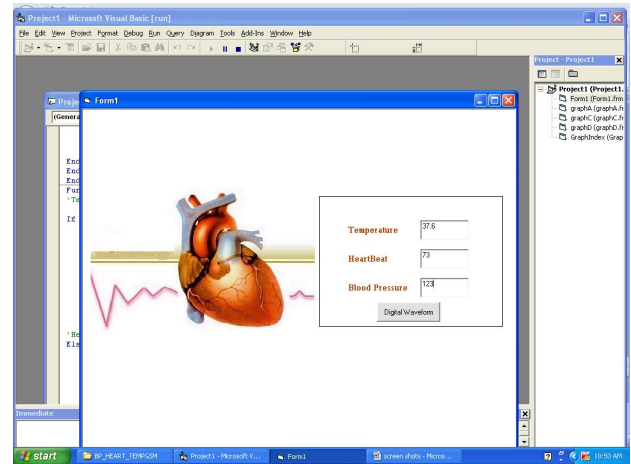


Fig3:Person3 at normal stage

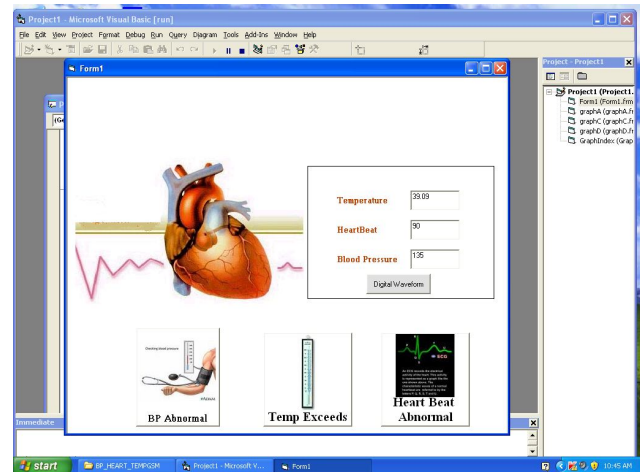


Fig4:Person1 after exercise

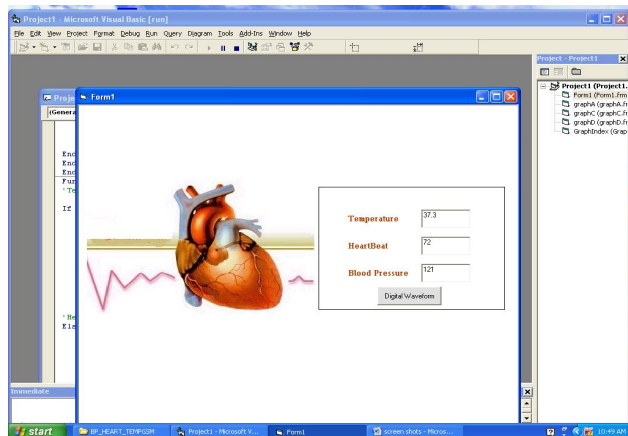


Fig1:Person 1 at normal stage

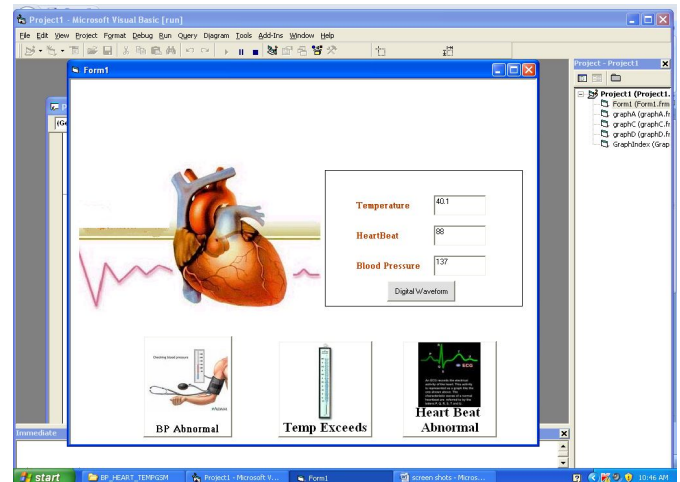


Fig5:Person2 after exercise

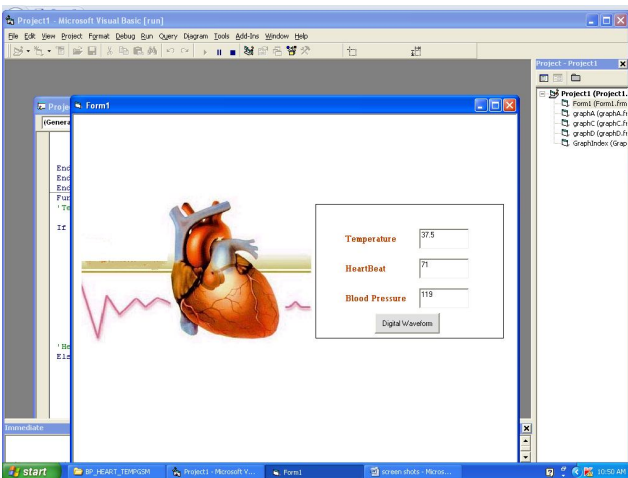


Fig2:person2 at normal stage

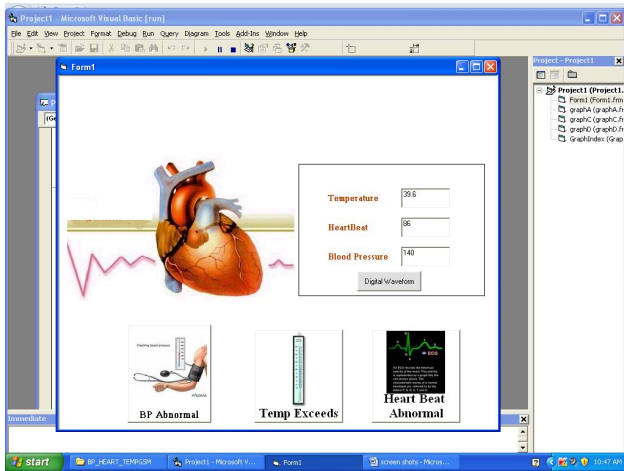
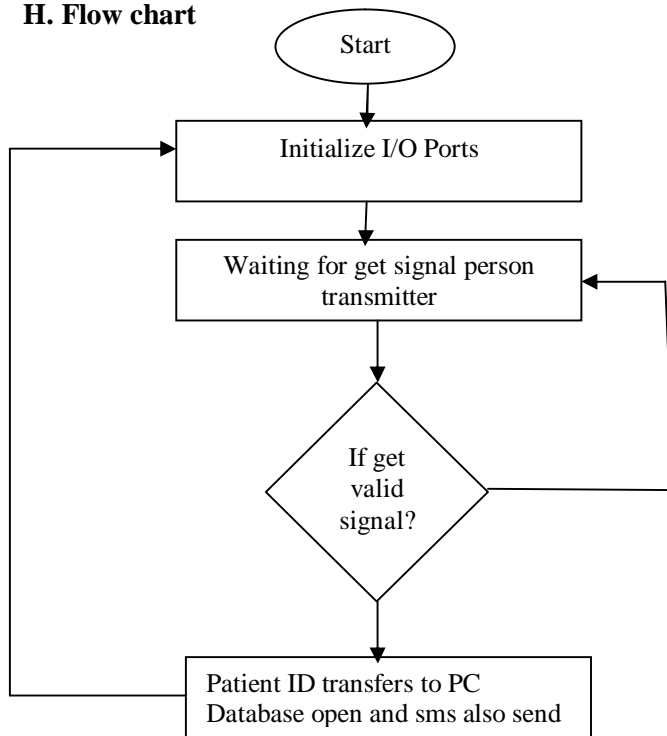


Fig6:Person3 after exercise

**H. Flow chart**



**2. CONCLUSION**

In this time, model biotelemetry system is being implemented into working solution. Nevertheless, there is space for improvements in both concept and implementation details of this system. Model biotelemetry system is currently designed for indoor use by one patient only. More nearby instances of inner part of model biotelemetric system managed by single outer part of system are possible, but there exists one to one mapping

between patient and ZigBee network. Future improvements may include support for outdoor operation with communication implemented using 3G mobile technology and patient's tracking by GPS system. With advancements in low-power high-density FPGA solutions, FPGA programmable system on chip technology seems to be promising for purpose of this biotelemetric system.

**3. REFERENCES**

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