"WIRELESS HEALTH MONITORING SYSTEM USING ARM AND ZIGBEE"

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ABSTRACT

This paper creates Portable device implementation of wireless technology to monitor human health. The health information acquired on the portable side transmits to the server wirelessly. Human parameter can be analyzed by monitoring with pc. This project provides a low prize, easy access human health monitor solution bridging gap between patient and doctor.

The wireless system was designed to comprise of integrated biomedical sensors which were developed into a robust human-technology interface. The human factors Evaluation was accomplished through the design and Implementation of a usability study, which focused on the relationship between the human subject user and the home healthcare provide. In the present time the embedded systems forge an integral part of our everyday lives. Comparatively in the near future embedded systems will ward over our lives and health. It enables both reductions of costs for patient in the hospital and increasing the level of the health care in such a way that the critical states of patients just for hospitalization will be found out more quickly. The future of embedded health maintenance systems fully depend on development of specific sensors, data transmission, also on embedded systems improvements that take up modern role of our personal guards.

Keywords: LPC2138,Zigbee,PT100

I. INTRODUCTION

In this paper, we are going to design "Wireless Health Monitoring System" which will sense human body parameters such as respiration rate, temperature and heart beat using various biomedical sensors. These parameters are displayed on LCD at transmitter side and we can transmit these parameters wirelessly using ZIGBEE module having range nearly 100m.

At receiver side, those parameters can be analyzed by physician. As we approach a new millennium, an emerging trend in medical devices is home healthcare technology. Wireless physiological monitoring technology is currently among the most nascent of the developments, and is one that has great applications for care of patients with chronic conditions.

The effectiveness and efficiency of such home healthcare monitoring devices needs to be assessed in order to gather data which will enable us to improve system performance, increase safety, improve cost savings, increase user satisfaction, and increase health care provider satisfaction. Advances in wireless sensor networking have opened up new opportunities in healthcare systems.

The future will see the integration of the abundance of existing specialized medical technology with pervasive, wireless networks. They will co-exist with the installed infrastructure, augmenting data collection and real-time response. An example of area in which future medical systems can benefit the most from wireless sensor networks is in-home assistance. In-home pervasive networks may assist residents by providing memory enhancement, control of home appliances, medical data lookup, and emergency communication.

II. SYSTEM BLOCK DIAGRAM

This paper give the idea about the techniques used for the wireless health monitoring system,The way and algorithms that are run on the different platform to achieve the goal of the final result.

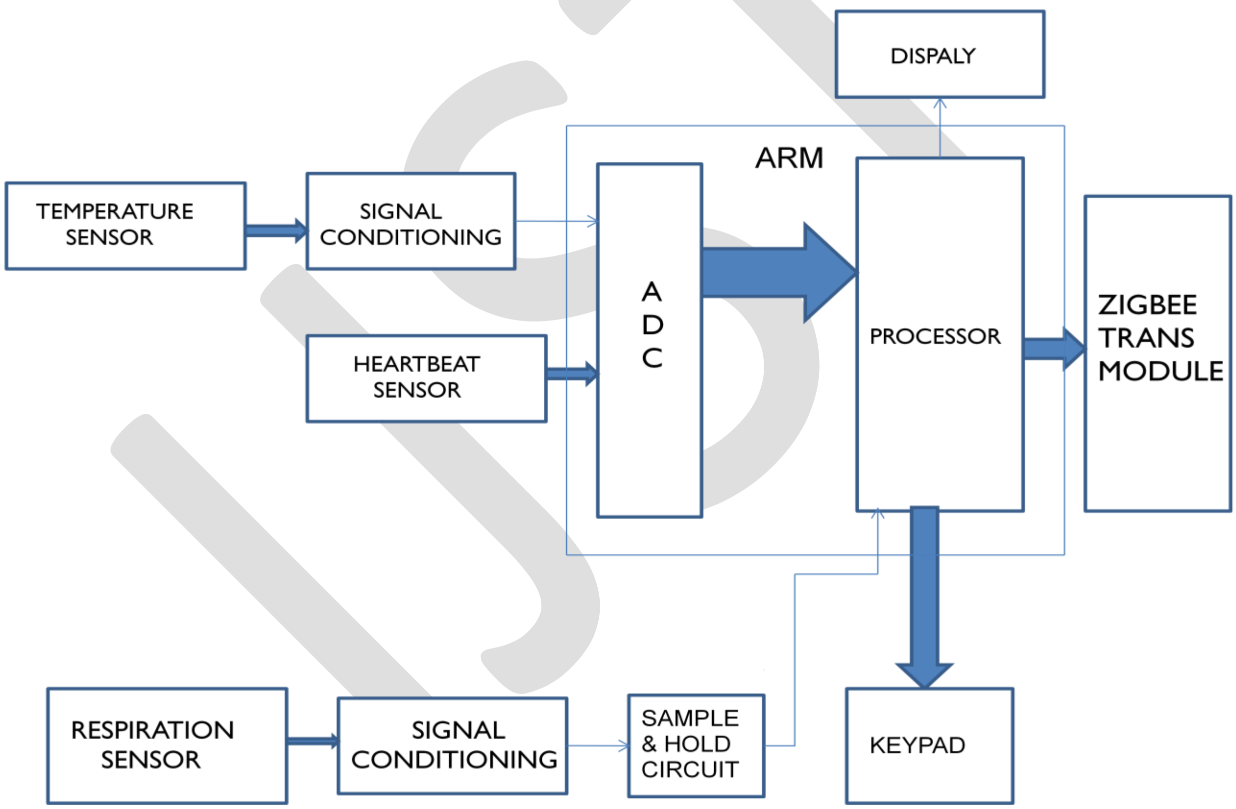


Figure.1 Block diagram of design

Block diagram consists of following main blocks

1. Sensor.
2. Signal conditioner
3. Arm Processor
4. Display

5. Keypad
6. ZIG-BEE Module

1. SENSOR

There are three sensors used in this design that are temperature sensor, heart beat sensor and respiration sensor. To measure body temperature we have used PT 100 temperature sensor and for measurement of heartbeat rate we have used finger chip sensor.

2. SIGNAL CONDITIONING

The change in resistance of RTD with respect to temperature (PT100) is detected using Whetstone's bridge where PT100 serves as one of the four arms. The resistance of RTD varies from 100ohm to 139 ohm for temperature range of 0c to 100c. As output of RTD is very weak, it should be amplified by using instrumentation amplifier which converts 0 to 100 degree centigrade temperature into standard 0 to 5 volts. Gain of signal conditioner is adjusted such that for lower temperature 0 c the output is 0V & for maximum temperature 100 c we get 5V. In this circuit LM358 is used to build instrumentation amplifier.

The output of heartbeat sensor is given to transistorized switch to give voltage between 0-5 V.

3. ARM

To display digital outputs on LCD, output of signal conditioning and heartbeat sensor is given to ADC. The LPC2138 contain two ADCs. These converters are single 10-bit successive approximation ADCs with eight multiplexed channels.

Features of ADC

- Measurement range of 0 V to 3.3 V.
- Each converter capable of performing more than 400000 10-bit samples per second.
- Burst conversion mode for single or multiple inputs.
- Optional conversion on transition on input pin or Timer Match signal.
- Global Start command for both converters.

4. DISPLAY

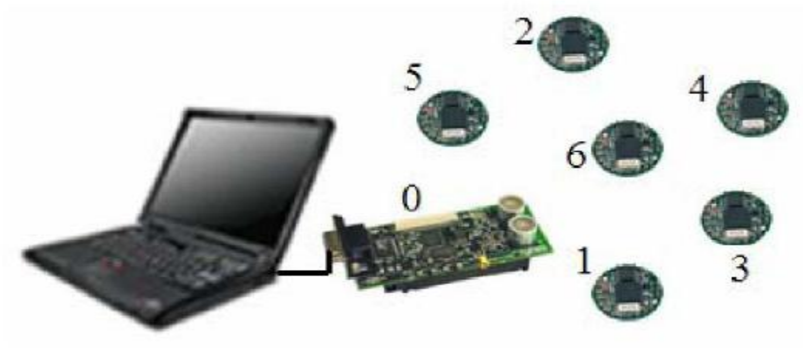
This is 16×2 matrix LCD display. At transmitter side the digital values of body temperature and heartbeat rate will be displayed on LCD.

5. KEYPAD

Keypad is used for deciding the data is transmitted to zigbee transmitter and receiver for further processing.

6. ZIGBEE TRANSMITTER MODULE

Health parameters body temperature and heartbeat rate are transmitted wirelessly using ZIGBEE module.



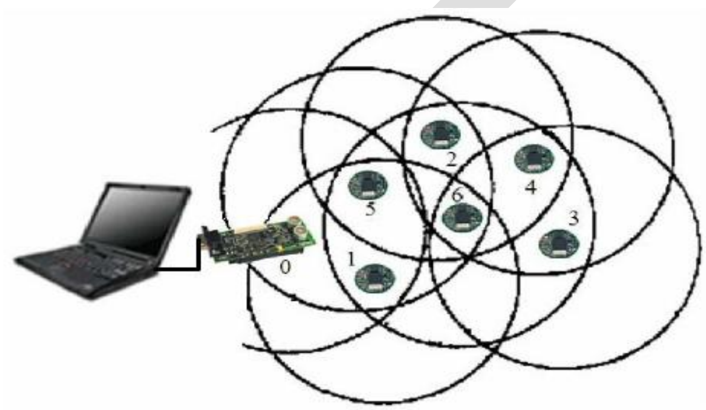


Figure 2. Zigbee Transmitter Module

III. SYSTEM HARDWARE DESIGN SCHEME

In this section we focus on the hardware configuration of the project, the detailed information regarding to the each and every component that are used for the implementation various sections of the project.

A) ARM LPC2138

1. Introduction
2. LPC2138 features
3. Pin out diagram
4. Hardware connections

1. INTRODUCTION

The LPC2131/32/34/36/38 microcontrollers are based on a 16/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combine the microcontroller with 32 kB, 64 kB, 128 kB, 256 kB and 512 kB of embedded high-speed flash memory. A 128-bit wide memory interface and a unique accelerator architecture enable 32-bit code execution at maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty. Due to their tiny size and low power consumption, these microcontrollers are ideal for applications where miniaturization is a key requirement, such as access control and Point-of-sale. With a wide range of serial communications interfaces and on-chip SRAM options of 8 kB, 16 kB, and 32 kB, they are very well suited for communication gateways and protocol converters, soft modems, voice recognition and low-end imaging, providing both large buffer size and high processing power. Various 32-bit timers, single or dual 10-bit 8-channel ADC(s), 10-bit DAC, PWM channels and 47 GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers particularly suitable for industrial control and medical systems.

2.FEATURES

1. 16/32-bit ARM7TDMI-S microcontroller in a tiny LQFP64 or HVQFN package.
2. 8/16/32 kB of on-chip static RAM and 32/64/128/256/512 kB of on-chip flash program memory. 128-bit wide interface/accelerator enables high-speed 60 MHz operation.
3. In-System Programming/In-Application Programming (ISP/IAP) via on chip boot loader software. Single flash sector or full chip erase in 400 ms and programming of 256 B in1 ms.
4. Embedded ICE RT and Embedded Trace interfaces offer real-time debugging with the on-chip Real Monitor software and high-speed tracing of instruction execution.
5. Two 8-channel 10-bit ADCs provide a total of up to 16 analog inputs, with conversion times as low as 2.44 ms per channel.
6. Single 10-bit DAC provides variable analog output.
7. Two 32-bit timers/external event counters (with four capture and four compare Channels each), PWM unit (six outputs) and watchdog.
8. Low power Real-time clock with independent power and dedicated 32 kHz clock input.
9. Up to nine edge or level sensitive external interrupt pins available.
10. 60 MHz maximum CPU clock available from programmable on-chip PLL with settling time of 100 ms.

3. PIN OUT DIAGRAM

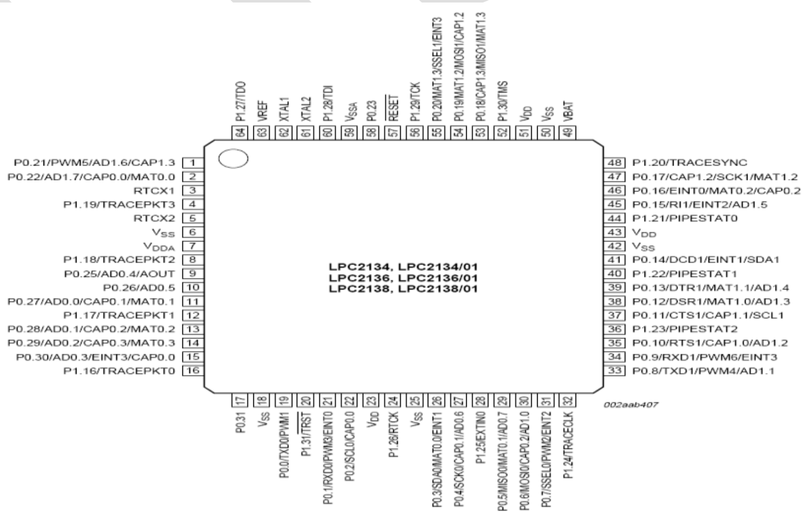


Figure.3 Pinout of LPC2138

4. HARDWARE CONNECTIONS

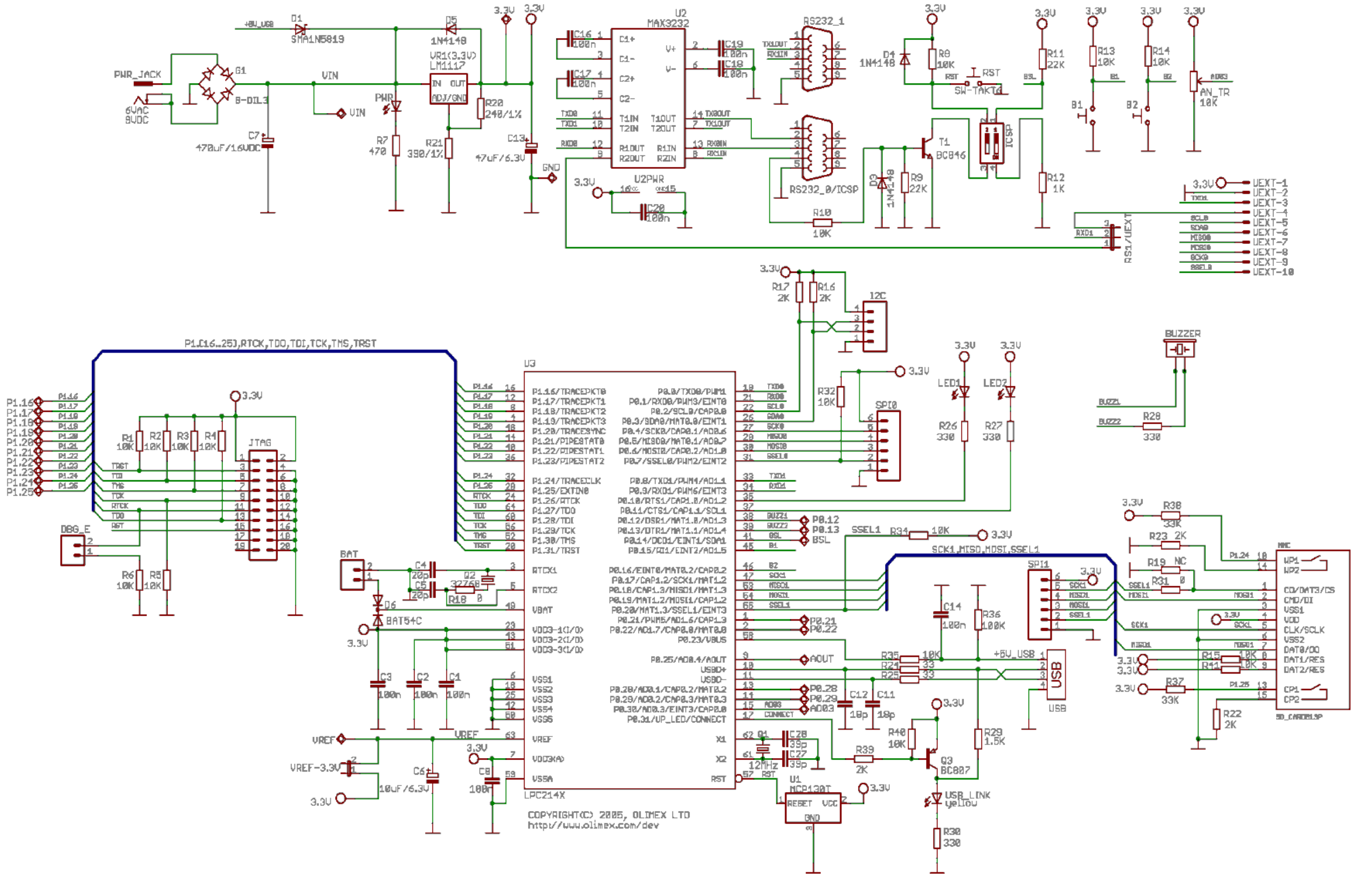


Figure.4 Hardware Connection

B) ZIGBEE MODULE

1. Introduction
2. ZIGBEE module feature
3. Hardware connection

1. INTRODUCTION

The ZIGBEE Modules were engineered to meet IEEE 802.15.4 standards 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 devices. The modules operate within the ISM 2.4 GHz frequency band and are pin-for-pin compatible with each other.

2. FEATURE

Long Range Data Integrity ZIGBEE

- Indoor/Urban: up to 100’ (30 m)
- Outdoor line-of-sight: up to 300’ (100 m)
- Transmit Power: 1 mW (0 dBm)
- Receiver Sensitivity: -92 dBm

Operations Low Power ZIGBEE

- TX Current: 45 mA (@3.3 V)
- RX Current: 50 mA (@3.3 V)
- Power-down Current: < 10 Ma

3. ZIGBEE CHIP

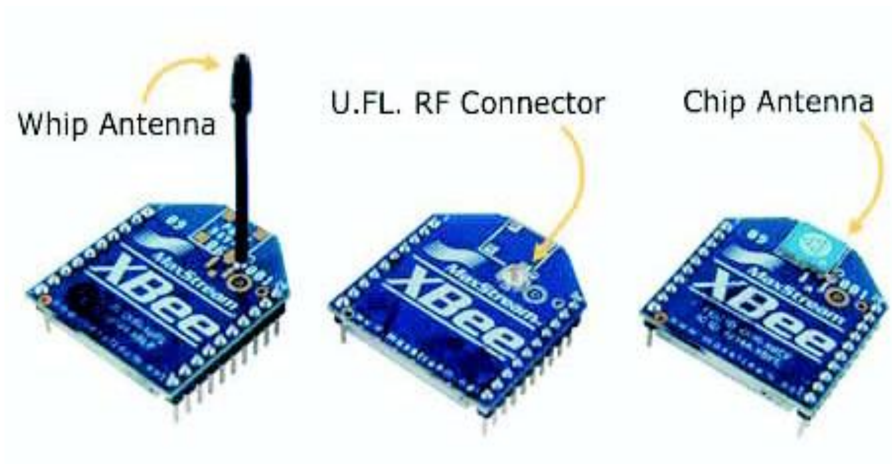


Figure.5 Zigbee Chip

4. HEART BEAT SENSOR

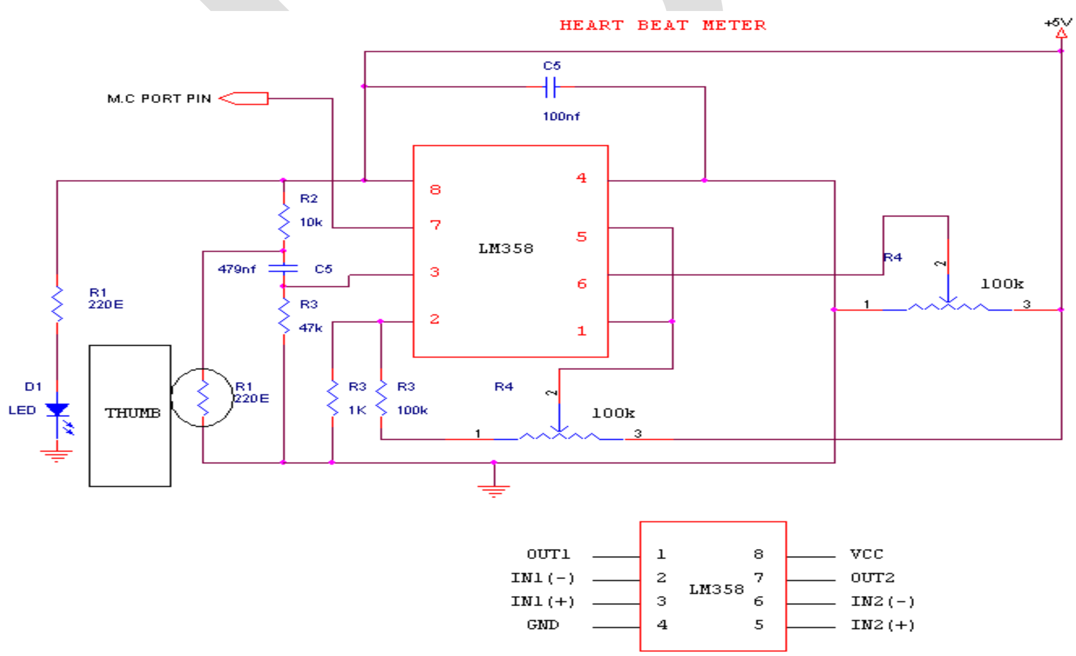


Figure.6 Heart beat sensor connection

- Heart beat sensor amplifier

The sensor consists of a super bright red LED and light detector. when the heart pumps a pulse of blood through the blood vessels, the finger becomes slightly more opaque and so less light reached the detector.With each heart pulse the detector signal varies. This variation is converted to electrical pulse. This signal is amplified and triggered through an amplifier which outputs +5V logic level signal.

IV. SYSTEM SOFTWARE DESIGN

1. VISUAL BASIC 6.0

Visual basic is high level programming language which evolved from the earlier dos version called BASIC.BASIC means beginners' All-purpose Symbolic Instruction Code.however, in VB ,we just need to drag and drop any graphical object anywhere on the form, and you can change its color any time using the properties windows.

In VB 6.0 we can create any program depending on our objective.for example, if we are a college or university lecture, we can create educational programs to teach business, economic, computer science, accountancy, finacial management, information system.

In our project Using VB 6.0 we creat database for health monitoring.

2. VISUAL BASIC 6.0 FEATURES

1) VB 6.0 is object-based and event driven.
2) Developed by Microsoft.
3) A programmer can put together an application using components provided with basic itself.

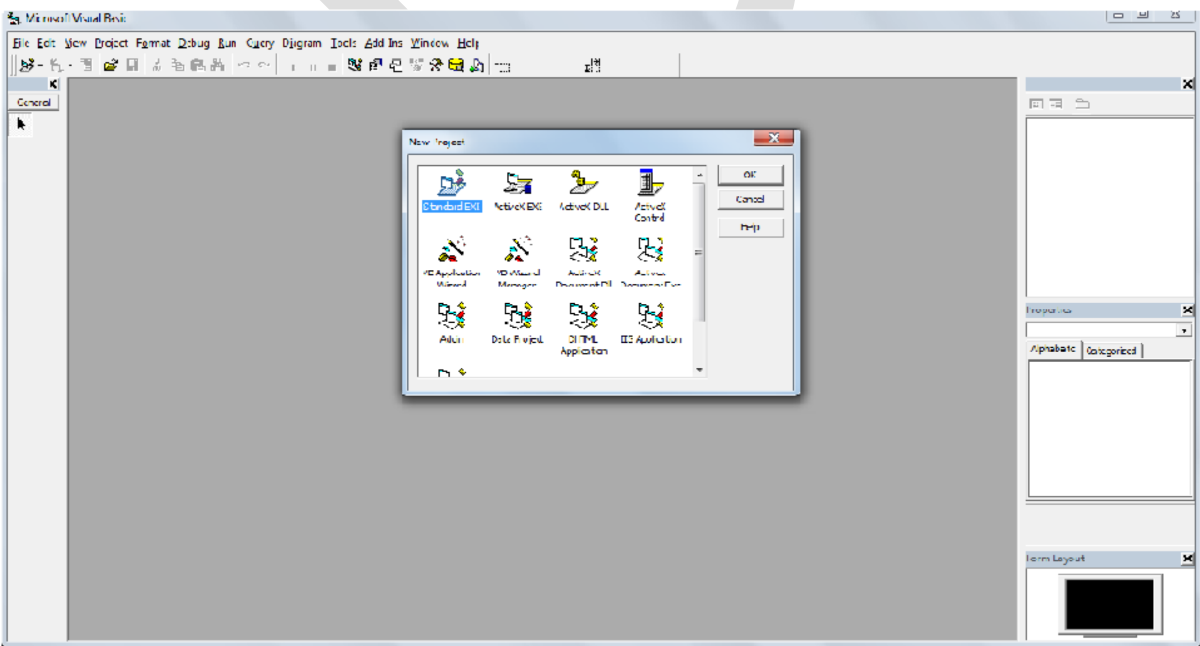


Figure.7 software development

3. Keilc51

Keil vision IDE (Integrated Development Environment) which helps to write ,compile and debug the embaded program.The main features of this compiler are as under,

- It contains the information about more than 400 supported microcontrollers.
- It provides complete simulation for CPU and on chip peripherals of most embaded Devices.
- Even though it have variety of applicatiions it suffer from the some drawbacks such as It supports the files that are 2kbs or smaller than that.

V. EXPERIMENTAL RESULT

Initial part of this section shows the snap shots of the hardware components and the images that are aquired for the further analysis in the process of the health monitoring system.While parameters are taken and after the analysis on it transmit it.the parameters that we obtained from sensors are shown in this section.

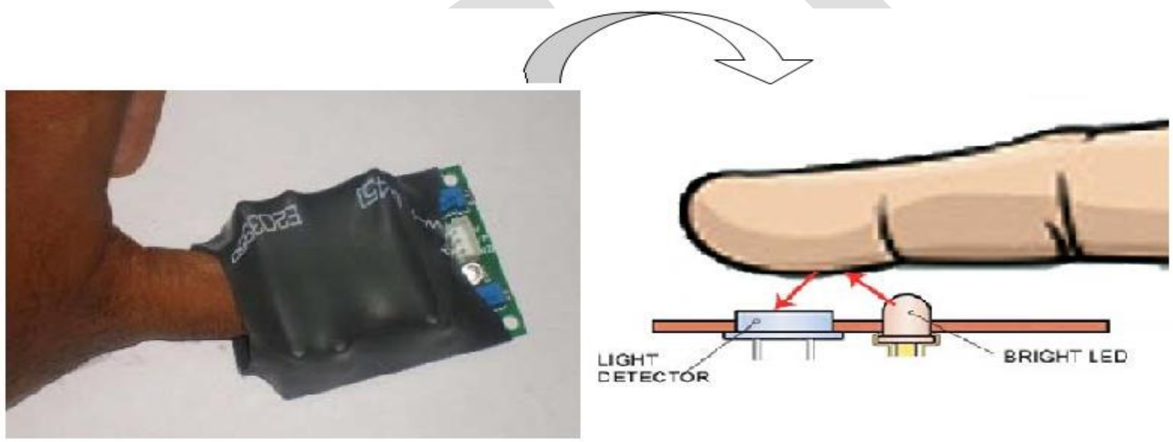


Figure.8 Heart Beat sensor

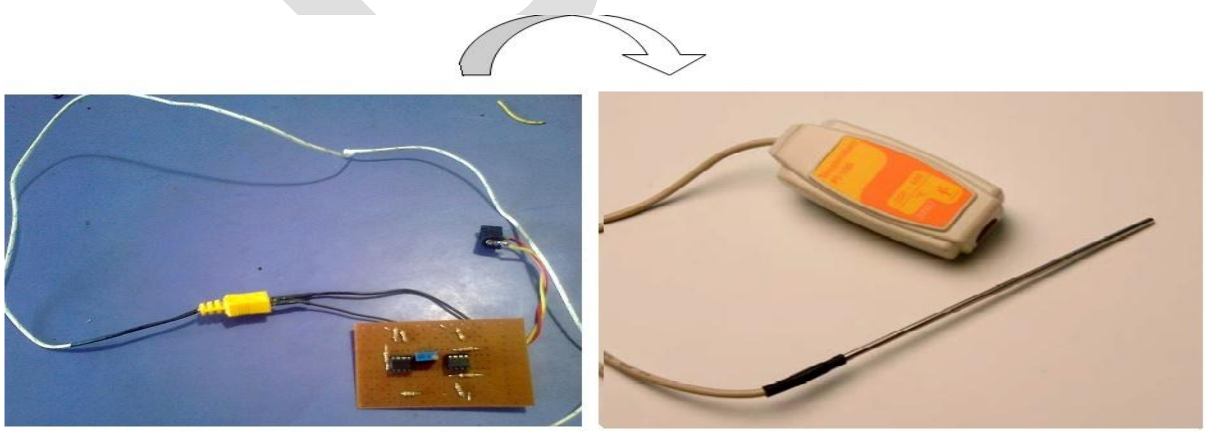


Figure.9 Temperature sensor PT100

1) Temperature sensor PT100 will sense Human body Temperature and will give following results, Resistance of PT100 at 0 °C=100Ω and at 100°C=139Ω. The bridge converts the change in resistance of the sensor into change in voltage. This voltage is in range of milivolt. This weak signal is to be amplified to drive the ADC. Here LM 358 is used,Voltage of amplifier at 0 °C = 0V and 100°C =5V.Result that we noted.

Temperature in °C	Output of amplifier in Volts.
10	0.9V
28	1.8V
40	2.7V
80	4V

Table 1. Temperature Vs Output of Amplifier

2) **Heart rate** is the number of heartbeat per unit of time, typically expressed as *beats per minute* (bpm). Heart rate can vary as the body's need to absorb oxygen and excrete carbon dioxide changes, such as during exercise, sleep, illness, or as a result of ingesting drugs. According to the National Health Service, UK, the following are ideal normal pulse rates at rest, in bpm (beats per minute):

- Newborn baby - 120 to 160
- Baby aged from 1 to 12 months - 80 to 140
- Baby/toddler aged from 1 to 2 years - 80 to 130
- Toddler/young child aged 2 to 6 years - 75 to 120
- Child aged 7 to 12 years - 75 to 110
- Adult aged 18+ years - 60 to 100
- Adult athlete - 40 to 60

Output of heart beat sensor is given to transistorized switch so that we get output in the form of 0 or 5 V. Analog 5v output is given to the one of the channel of the ADC. It will convert the analog output to the digital output in LPC2148. At 5 V maximum the pulse will sense and the LED on sensor will glow each time, we will count the no of pulses in 1 minute it should be However, heart rates from 60 to 100 bpm are common among healthy people. We noted reading of three different peoples as follow,

Time in per minute	Heartbeat in bpm
1 min for adult 1	70 bpm
1 min for child 15 year	72 bpm
1 min for adult 2	69 bpm

Table 2: Time and Heartbeats

VI. CONCLUSION

We believe the future of this system lies in its application as a tele-healthcare Technology. Using our tele-homecare system, physiological measurements can be taken and stored in the hospital and then forwarded to a remote location where a health care provider is stationed. This will enable a nurse or rehabilitation specialist to both view and assess a patient with chronic conditions in the home. Further usability testing needs to be conducted to truly understand the use of the healthcare wireless physiological monitoring device in its relation between users, which include elderly and disabled patients, and health care professionals in the environment.

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