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MONITORING THE PATIENT'S HEALTH USING ZIGBEE APPLICATIONS

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ABSTRACT

The aim of this paper is to monitoring the patient's health using Wireless ECG Acquisitions. In the proposed system, we are implemented two nodes. One node is the data acquisition node and another node is monitoring node. In the data acquisition node, the patient's heart beat; ECG value is taken and sends to the monitoring node. If there is any abnormality in the values then the shock circuit will get on. The values of the two sensors are displayed in LCD. The parameters are monitored in the PC and uploaded in the server. The ZIGBEE protocol is adopted for wireless communication to achieve high integration, applicability, and portability. A fully integrated CMOS RF front end containing a quadrature voltage-controlled oscillator and a 2.4-GHz low-IF transmitter is employed to transmit ECG signals through wireless communication.

I.Introduction

Even though we have developed a lot in industrial and economic needs, we are not able to tackle the health issues caused by them. These diseases include infectious diseases, cardiovascular diseases, etc..The main disease is cardiovascular disease and there are many products developed to diagnose it and some of them are BioSenseTek, etc.. IMEC has demonstrated an integrated ECG monitoring system with RF and digital signal processing capability . All the products are targeted on medical-grade ECG signal acquisition and processing capability. But in SoC (System on Chip)the

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mixed mode signals and RF components are integrated into a single piece of silicon. Hence it is of very small size and also lower cost and power consumption is also low. The SoC developed for the body sensor network (BSN) aims to bring healthcare closer to the patients, allowing bio signal monitoring to be conducted daily and there is no need to go to hospital often. BSN is predicted as the next homecare platform because of its significant potential as a low-cost high-patient safety medical device. The SoC features the programmable gain and bandwidth for ECG detection, containing a three-stage front-end circuit, an 8-bit successive-approximation-register analog-to-digital converter (SAR-ADC), and a digital core. The SoC includes a two-channel ECG front-end with an 8-bit SAR-ADC, a simple microcontroller and a SRAM, and a medical implantation communication service band RF-transceiver with binary frequency-shift keying and on–off keying (OOK) modulation for uplink and downlink transmissions, respectively. However, this paper presents a standard-based wireless solution (ZigBee) which has low-power consumption, low cost, high-node density, simple protocol, and long-distance communication.

II. System Architecture In Personal Health Monitoring

IIHMS-An interactive intelligent healthcare and monitoring system is proposed to enhance the portability of home telecare system which includes a BSN and a local sensor network where the BSN is the medium of communication between the acquisition auxiliaries and the wearable device (e.g., watch) and the LSN is the inter-mediate medium between the wearable device and the portable facility.

III. Existing System

In the existing system, the SoC developed for the body sensor network (BSN) intends to bring healthcare closer from the hospital to the patients, allowing bio signal monitoring to be conducted daily than limiting it within the clinical environment. In recent years, some wireless technologies are adopted for BSN application, such as the low-power radio frequency identification (RFID) technology. Disadvantage of Existing System

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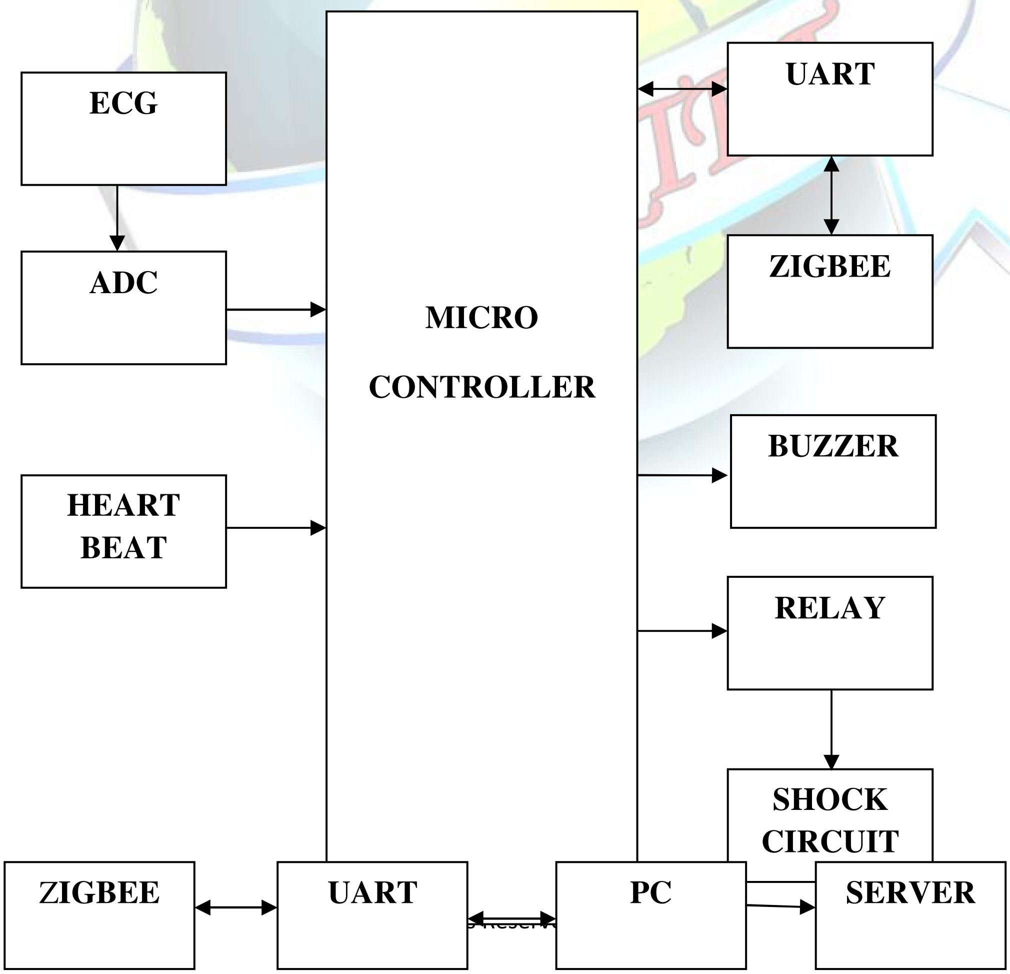
- Cannot be used for long distance communication
- Lower efficiency
- Less timing integrity

IV.proposed system

In the proposed system, we are going to implement two nodes. One node is the data acquisition node and another node is monitoring node. In the data acquisition node, the patient's heart beat; ECG value is taken and sends to the monitoring node. If there is any abnormality in the values then the shock circuit will get on. The values of the two sensors are displayed in LCD. The parameters are monitored in the PC and uploaded in the server. Advantages of Proposed Systems

- For long distance communication
- Low power consumption
- High timing integrity

V.Block Diagram



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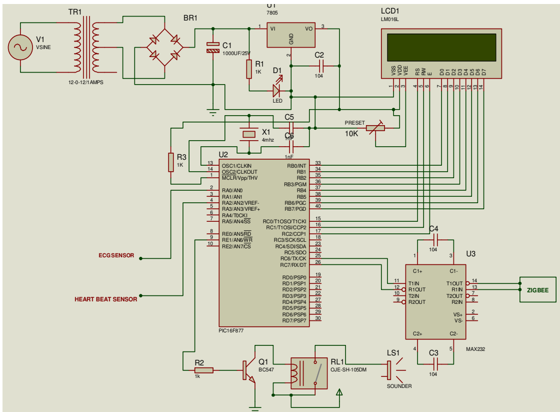
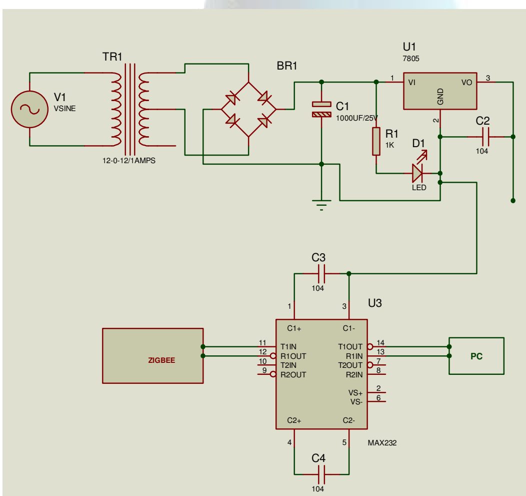
CIRCUIT DIAGRAM





VI. Sensors

The Heart Beat Sensor provides a simple way to study the heart's function. This sensor monitors the flow of blood through Finger. As the heart forces blood through the blood vessels in the Finger, the amount of blood in the Finger changes

with time. The sensor shines a light lobe (small High Bright LED) through the ear

and measures the light that is transmitted to LDR. The signal is amplified, inverted

and filtered, in the Circuit .By graphing this signal, the heart rate can be determined, and some details of the pumping action of the heart can be seen on the graph which is shown below.Newer versions include a microprocessor which is continuously monitoringthe heartbeat rate and calculating the heart rate, and other parameters. These mayInclude accelerometers which can detect

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speed and distance eliminating the needfor foot worn devices

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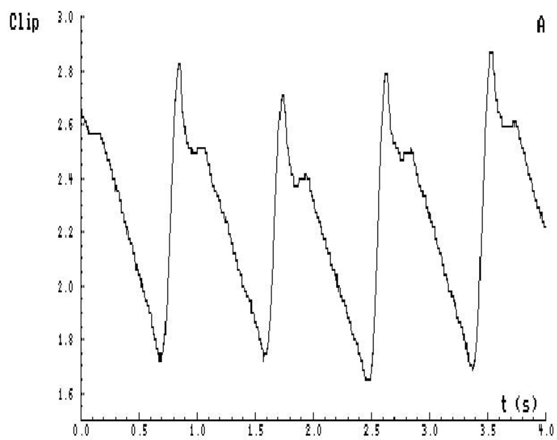

FIG:Bloodfiowing through the Finger Rises

The above figure shows that the blood flowing through the Finger rises at the start of the heartbeat. This is caused by the contraction of the ventricles forcing blood into the arteries. Soon after the first peak a second, smaller peak is observed. This is caused by the shutting of the heart valve, at the end of the active phase, which raises the pressure in the arteries and the earlobe.There are a wide number of receiver designs, with various features. These include average heart rate over exercise period, time in a specific heart rate zone, calories burned, breathing rate, built-in speed and distance, and detailed logging that can be downloaded to a computer.

VII. Resonance modes

A quartz crystal provides both series and parallel resonance. The series resonance is a few kilohertz lower than the parallel one. Crystals below 30 MHz are generally operated between series and parallel resonance, which means that the crystal appears as an inductive reactance in operation, this inductance forming a parallel resonant circuit with externally connected parallel capacitance. Any small additional capacitance in parallel with the crystal will thus pull the frequency downwards. Moreover,

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the effective inductive reactance of the crystal can be reduced by adding a capacitor in series with the crystal. For a crystal to operate at its specified frequency, the electronic circuit has to be exactly that specified by the crystal manufacturer. Christo Ananth et al. [1] discussed about an eye blinking sensor. Nowadays heart attack patients are increasing day by day."Though it is tough to save the heart attack patients, we can increase the statistics of saving the life of patients & the life of others whom they are responsible for. The main design of this project is to track the heart attack of patients who are suffering from any attacks during driving and send them a medical need & thereby to stop the vehicle to ensure that the persons along them are safe from accident. Here, an eye blinking sensor is used to sense the blinking of the eye. spO2 sensor checks the pulse rate of the patient. Both are connected to micro controller. If eye blinking gets stopped then the signal is sent to the controller to make an alarm through the buffer. If spO2 sensor senses a variation in pulse or low oxygen content in blood, it may results in heart failure and therefore the controller stops the motor of the vehicle. Then Tarang F4 transmitter is used to send the vehicle number & the mobile number of the patient to a nearest medical station within 25 km for medical aid. The pulse rate monitored via LCD .The Tarang F4 receiver receives the signal and passes through controller and the number gets displayed in the LCD screen and an alarm is produced through a buzzer as soon the signal is received.

Operation

When a crystal of quartz is properly cut and mounted, it can be made to

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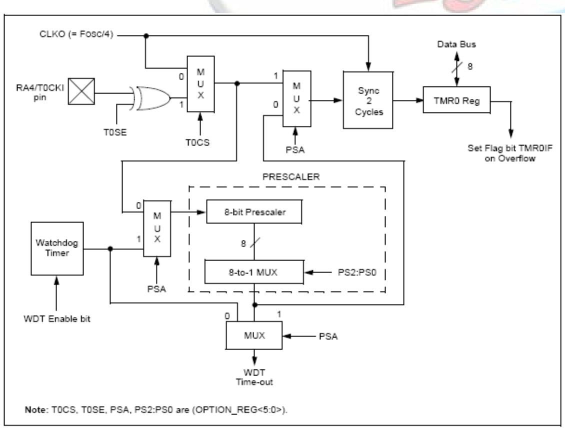
distort in an electric field by applying a voltage to an electrode near or on the crystal. This property is known as electrostriction or inverse piezoelectricity. When the field is removed, the quartz will generate an electric field as it returns to its previous shape, and this can generate a voltage. The result is that a quartz crystal behaves like a circuit composed of an inductor, capacitor and resistor, with a

precise resonant frequency.

VIII. Timer 0 Blockdiagram



Timer 1 Module

The Timer1 module is a 16-bit timer/counter consisting of two 8-bit registers (TMR1H and TMR1L) which are readable and writable. The TMR1 register pair (TMR1H:TMR1L) increments from 0000h to FFFFh and rolls over to 0000h. The TMR1 interrupt, if enabled, is generated on overflow which is latched in interrupt flag bit, TMR1IF (PIR1<0>). This interrupt can be enabled/disabled by setting/clearing TMR1 interrupt enable bit, TMR1IE (PIE1<0>). Timer1 can operate in one of two modes:

- As a Timer
- As a Counter

The operating mode is determined by the clock select bit, TMR1CS (T1CON<1>). In Timer mode,

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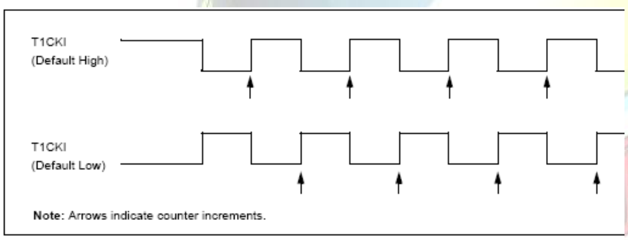
Timer1 increments every instruction cycle.In Counter mode, it increments on every rising edge of the external clock input. Timer1 can be enabled/disabled by setting/clearing control bit, TMR1ON (T1CON<0>). Timer1 also has an internal "Reset input". This Reset can be generated by either of the two CCP modules (Section 8.0 "Capture/Compare/PWM Modules").



Timer2 Module

Timer2 is an 8-bit timer with a prescaler and a postscaler. It can be used as the PWM time base for the PWM mode of the CCP module(s). The TMR2 register is readable and writable and is cleared on any device Reset. The input clock (FOSC/4) has a prescale option of 1:1, 1:4 or 1:16, selected by control bits T2CKPS1:T2CKPS0 (T2CON<1:0>). The Timer2 module has an 8-bit period register, PR2. Timer2 increments from 00h until it matches PR2 and then resets to 00h on the next increment cycle. PR2 is a readable and writable register. The PR2 register is initialized to FFh upon Reset. The match output of TMR2 goes through a 4-bit postscaler (which gives a 1:1 to 1:16 scaling inclusive) to generate a TMR2 interrupt (latched in flag bit, TMR2IF (PIR1<1>)).

Timer2 can be shut-off by clearing control bit, TMR2ON (T2CON<2>), to minimize power consumption.

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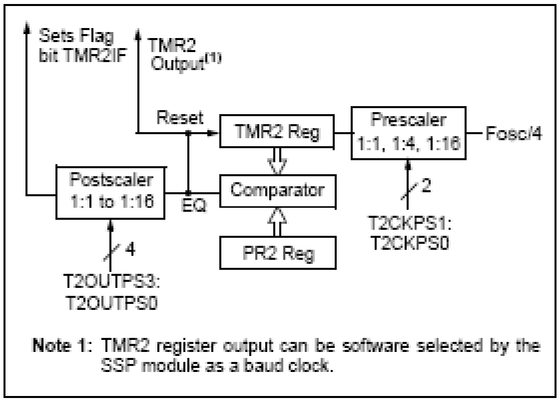

IX. Instruction Set Summary

The PIC16 instruction set is highly orthogonal and is comprised of three basic categories:

- **Byte-oriented** operations
- **Bit-oriented** operations
- **Literal and control** operations

Each PIC16 instruction is a 14-bit word divided into an **opcode**which specifies the instruction type and one or more **operands** which further specify the operation of the instruction. For **byte-oriented** instructions, 'f' represents a file register designator and 'd' represents a destination designator. The file register designator specifies which file register is to be used by the instruction.

The destination designator specifies where the result of the operation is to be placed. If 'd' is zero, the result is placed in the W register. If 'd' is one, the result is placed in the file register specified in the instruction.

For **bit-oriented** instructions, 'b' represents a bit field designator which selects the bit affected by the operation, while 'f' represents the address of the file in which the bit is located.

For **literal and control** operations, 'k' represents an eight or eleven-bit constant or literal value One instruction cycle consists of four oscillator periods; for an oscillator

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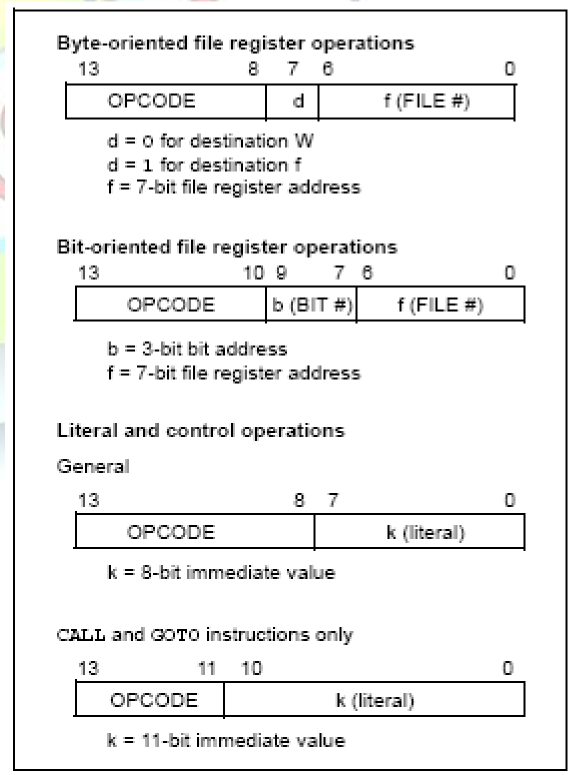
frequency of 4 MHz, this gives a normal instruction execution time of 1and 0s. All instructions are executed within a single instruction cycle, unless a conditional test is true, or the program counter is changed as a result of an instruction. When this occurs, the execution takes two instruction cycles with the second cycle executed as a NOP. Any instruction that specifies a file register as part of the instruction performs a Read-Modify-Write (R-M-W) operation. The register is read, the data is modified, and the result is stored according to either the instruction or the destination designator'd'. A read operation is performed on a register even if the instruction writes to that register.

Field	Description
f	Register file address (0x00 to 0x7F)
W	Working register (accumulator)
b	Bit address within an 8-bit file register
k	Literal field, constant data or label
x	Don't care location (= 0 or 1). The assembler will generate code with x = 0. It is the recommended form of use for compatibility with all Microchip software tools.
d	Destination select; d = 0: store result in W, d = 1: store result in file register f. Default is d = 1.
PC	Program Counter
TO	Time-out bit
PD	Power-down bit

GENERAL FORMAT FOR INSTRUCTIONS



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X. PCB Design And Fabrication

Designing of a PCB is a major slip in the production of PCBs. It forms a distinct factor n electronic performance and reliability. The productivity of a PCB with assembly and serviceability also depends on design.

STEPS INVOLVED

1. Prepare the required circuit diagram
2. List out the components, their sizes etc.
3. Draft it onto a graph sheet
4. Place all pads and finish thin tracks
5. Put it on the mylor sheet and then on the graph sheet
6. Place parts including screw holes with the help of knife.
7. Fix all the tracks.
8. Keep one component as the key.

CONVERSION OF CIRCUIT DIAGRAM

1. Cutting lines, mounting lines are done
2. List all the components their length diameter thickness code names etc.
3. Keep one component as key component
4. Keep key component first and their supporting tools
5. All tracks are straight lines
6. In between ICs no signal lines should be passed
7. Mark the pin number of IC on the lay out for avoiding dislocations
8. The length of the conductor should be as low as possible

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9. Place all the components, resistors, diodes etc. parallel to each other

XI. Software Tools

1. MPLAB

MPLAB IDE is an integrated development environment that provides development engineers with the flexibility to develop and debug firmware for various Microchip devices

MPLAB IDE is a Windows-based Integrated Development Environment for the Microchip Technology Incorporated PICmicrocontroller (MCU) and dsPIC digital signal controller (DSC) families. In the MPLAB IDE, you can:

- Create source code using the built-in editor.
- Assemble, compile and link source code using various language tools. An assembler, linker and librarian come with MPLAB IDE. C compilers are available from Microchip and other third party vendors.
- Debug the executable logic by watching program flow with a simulator, such as MPLAB SIM, or in real time with an emulator, such as MPLAB ICE. Third party emulators that work with MPLAB IDE are also available.
- Make timing measurements.
- View variables in Watch windows.
- Program firmware into devices with programmers such as PICSTART Plus or PRO MATE II.

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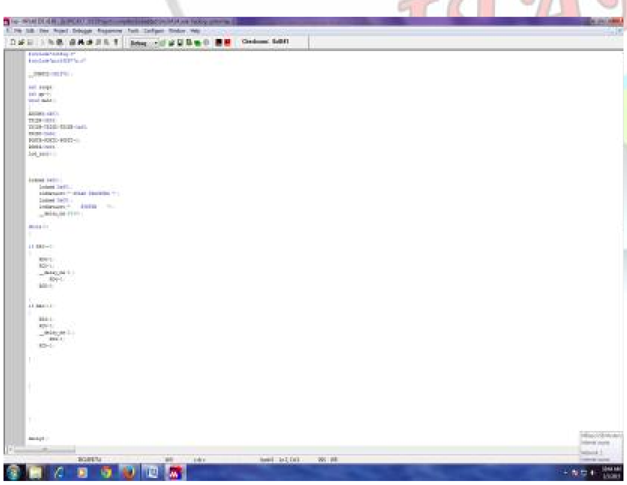
- Find quick answers to questions from the MPLAB IDE on-line Help.

2. MPLAB SIMULATOR

MPLAB SIM is a discrete-event simulator for the PIC microcontroller (MCU) families. It is integrated into MPLAB IDE integrated development environment. The MPLAB SIM debugging tool is designed to model operation of Microchip Technology's PIC microcontrollers to assist users in debugging software for these devices



4. COMPILER-HIGH TECH C

A program written in the high level language called C; which will be converted into PICmicro MCU machine code by a compiler. Machine code is suitable for use by a PICmicro MCU or Microchip development system product like MPLAB IDE.

5. PIC START PLUS PROGRAMMER:

The PIC start plus development system from microchip technology provides the product development engineer with a highly flexible low cost microcontroller design tool set for all microchip PIC micro devices. The **pic** start plus development system includes PIC start plus development programmer and MPLAB IDE.

The PIC start plus programmer gives the product developer ability to

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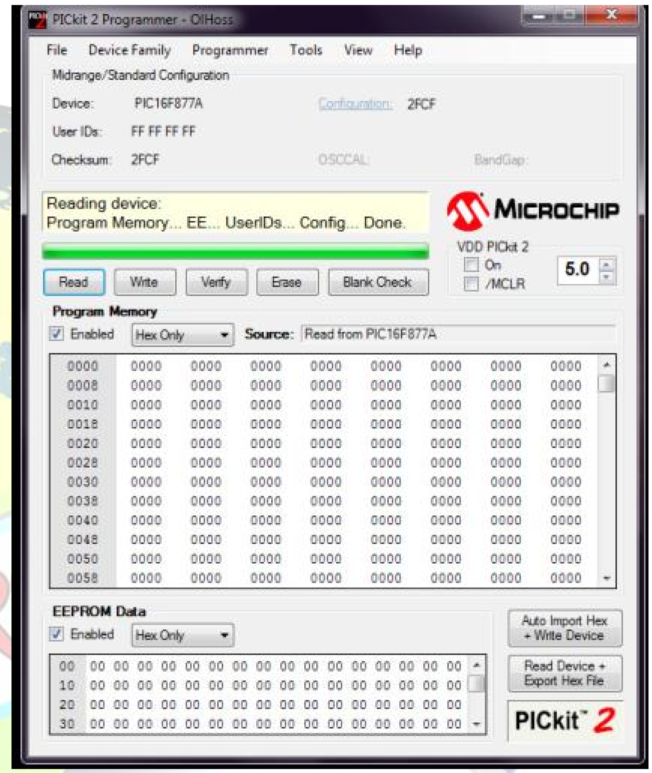
program user software in to any of the supported microcontrollers. The PIC start plus software running under MPLAB provides for full interactive control over the programmer.The PICKIT 2 is a low-cost in-circuit debugger (ICD) and in-circuit serial programmer (ICSP). PICKIT 2 is intended to be used as an evaluation, debugging and programming aid in a laboratory environment. The PICKIT 2 offers these features: Real-time and single-step code execution

Breakpoints, Register and Variable Watch/Modify

- In-circuit debugging
- Target VDD monitor
- Diagnostic LEDs
- MPLAB IDE user interface
- USB interface to a host PC / USB POWERED

- 40 Pin Target Board With FRC Cable
- ICSP FRC connecter Easy to interface to all our boards



Visual basic 6.0

Visual basic is a programming language and integrated development environment. VB 6.0 learning consists of all necessary tools required to build main stream windows application.

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Professional of this software includes advanced features such as tools to develop active and internet controls in personal and workstation computers. A programmer can create an application using the components provided by the visual basic itself.

Advantages

- Very simple and executable code
- Easy to develop GUI
- It provides a comprehensive interactive and context-sensitive online environment.
- It consists of readily available components to design
- Logical and bitwise operators are unified
- Integers are automatically promoted to reals in expressions.

XII. Conclusion

This paper presents an effective methodology of monitoring ECG of a patient using BSN and LSN. The human-body ECG signals are acquired by the adoption of WBSA-SoC with the help of ZigBee network communication (IEEE 802.15.4). The TSMC CMOS process of 0.18-µm standard is implemented with the help of various components such as WBSA-SoC, ECG acquisition node, ZigBee protocol supported transmitter-baseband processor, RF transmitter and MM interface. Wireless ECG communication is demonstrated with the help of a ADC, O-QPSK digital demodulation and an RF receiver and a PIC-based display which combinedly forms the receiver side. The resistance to noise can be can be enhanced in wireless communication by improving the RF circuit's data transmission which promises to increase the performance of the entire system.

XIII. Future Enhancements

Some enhancements that can be done in future- 1) a Zigbee transmitter can be used to transfer the patient record to doctor's PC as it covers a larger distance and highly efficient. 2)using a Blueterm app, the patient can get his own updated medical information in his mobile phone with the help of Bluetooth Standards.

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