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ROLE OF PUBLIC HEALTH INFORMATICS IN ENHANCING PUBLIC HEALTH SURVEILLANCE

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ABSTRACT: Health monitoring system using coin is used to monitor the different parameters of patients remotely and simultaneously. In this system the doctor can monitor different parameters of patients sitting in his room & even when he is away from the patient.

Suppose on the way if a person is moving on a street he feels that he is not feeling well than he just has to insert a rupee coin inside a machine. When that person puts his finger on the machine than machine will sense flow of blood inside the body with the help of finger and calculates the pulse rate, blood pressure and heart beat .If heart beat rate goes beyond the normal value then an emergency number will be called on automatically. Through the tracker an emergency number will be called on and a person will go to the toll booth and receive that particular person.

INTRODUCTION

Public health surveillance has benefitted from, and has often pioneered, informatics analyses and solutions. However, the field of informatics also serves other facets of public health including emergency response, environmental health, nursing, and administration. Public health informatics has been defined as the systematic application of information and computer science and technology to public health practice, research, and learning (*1*). It is an interdisciplinary profession that applies mathematics, engineering, information science, and related social sciences (e.g., decision analysis) to important public health problems and processes. Public health informatics is a sub domain of the larger field known as biomedical or health informatics. Health informatics is not synonymous with the term health information technology (IT). Although the concept of health IT encompasses the use of technology in the field of health care, one can think of health informatics as defining the science, the how and why, behind health IT. For example, health IT professionals should be able to resolve infrastructure problems with a network connection, whereas trained public health information's should be able to support public health decisions by facilitating the availability of timely, relevant, and high-quality information. In other words, they should always be able to provide advice on methods for achieving a public health goal faster, better, or at a lower cost by leveraging computer science, information science, or technology.

SYSTEM DESIGN

The **"Wireless patient monitoring system"** is divided into two parts - Hardware & Software. The hardware unit is further split into two units - Transmitter & Receiver. The transmitter unit consists of the following components-:

- PIC 16F877A
- Resister
- Capacitor
- Diodes
- Crystal

- Buzzer

- GSM modem
- GPS modem
- LCD

PIC 16 F877A-PIC16F877 belongs to a class of 8-bit microcontrollers of RISC architecture. It has 8kb flash memory for storing a written program. Since memory made in FLASH technology can be programmed and cleared more than once, it makes this microcontroller suitable for device development. IT has data memory that needs to be saved when there is no supply. It is usually used for storing important data that must not be lost if power supply suddenly stops. For instance, one such data is an assigned temperature in temperature regulators. If during a loss of power supply this data was lost, we would have to make the adjustment once again upon return of supply.

- **RISC architecture**
  - Only 35 instructions to learn
  - All single-cycle instructions except branches
- **Operating frequency 0-20 MHz**
- **Precision internal oscillator**
  - Factory calibrated
  - Software selectable frequency range of 8MHz to 31KHz
- **Power supply voltage 2.0-5.5V**
  - Consumption: 220uA (2.0V, 4MHz), 11uA (2.0 V, 32 KHz) 50nA (stand-by mode)
- **Power-Saving Sleep Mode**
- **Brown-out Reset (BOR) with software control option**
- **35 input/output pins**
  - High current source/sink for direct LED drive
  - software and individually programmable *pull-up* resistor
  - Interrupt-on-Change pin
- **8K ROM memory in FLASH technology**
  - Chip can be reprogrammed up to 100.000 times
- ***In-Circuit Serial Programming* Option**
  - Chip can be programmed even embedded in the target device

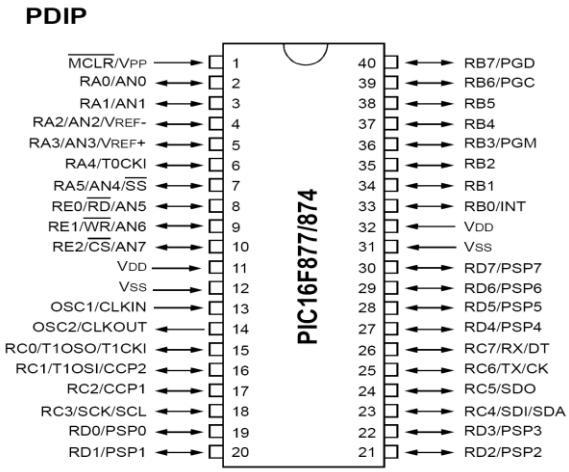
  256 bytes EEPROM memory
  - Data can be written more than 1.000.000 times
- **368 bytes RAM memory**
- **A/D converter:**
  - 14-channels
  - 10-bit resolution
- **3 independent timers/counters**
- **Watch-dog timer**
- **Analogue comparator module with**
  - Two analogue comparators
  - Fixed voltage reference (0.6V)
  - Programmable on-chip voltage reference
- **PWM output steering control**
- **Eight level deep hardware stack**
- **Power-on Reset (POR)**
- **Power-up Timer (PWRT) and**

PIN DIGRAM

Here in this microcontroller most pins are multi-functional. For example, designator RA3/AN3/Vref+/C1IN+ for the fifth pin specifies the following functions:

- RA3 Port A third digital input/output
- AN3 Third analog input
- V ref+ Positive voltage reference
- C1IN+ Comparator C1positive input

This small trick is often used because it makes the microcontroller package more compact without affecting its functionality. These various pin functions cannot be used simultaneously, but can be changed at any point during operation.



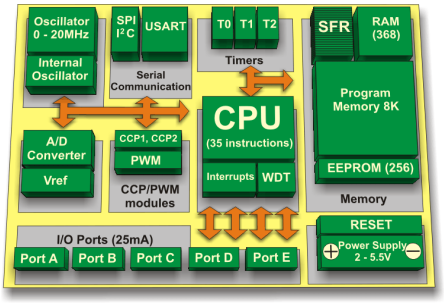
BLOCK DIAGRAM

The Block Diagram of this microcontroller consists of the following parts

- CPU
- 256 bytes of EEPROM
- 2 Comparators
- Timers:

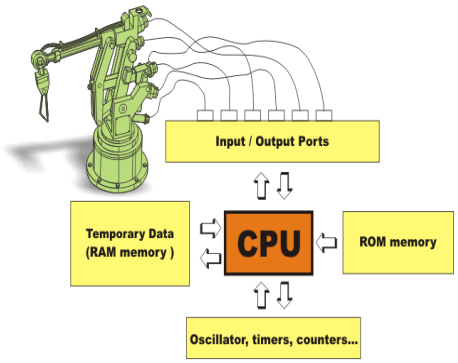
TMR0: 8-bit timer/counter with 8-bit prescaler
TMR1 enhanced: 16-bit timer/counter with prescaler, External Gate Input mode and dedicated low-power 32 kHz oscillator
TMR2: 8-bit timer/counter with 8-bit period register, prescaler and post scaler

- Oscillator(0-20Mhz)
- Ports(A-E)
- Ram(containing general purpose and special function register)
- A/D converter
- EEPROM Memory



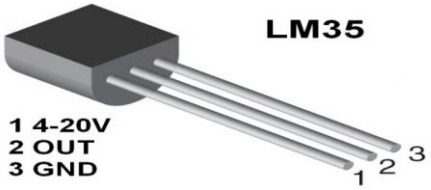
CPU

The CPU can recognize only 35 simple instructions (In order to program some other microcontrollers it is necessary to know more than 200 instructions by heart). The execution time is the same for all instructions except two and lasts 4 clock cycles (oscillator frequency is stabilized by a quartz crystal). The Jump and Branch instructions execution time is 2 clock cycles. It means that if the microcontroller's operating speed is 20MHz, execution time of each instruction will be 200nS, i.e. the program will be executed at the speed of 5 million instructions per second.



TEMPERATURE SENSOR (LM35)

LM35 is used as a sensor to measure temperature. It produces voltage Propional to centigrade temperature. Its Operating Range-is 55C to 110 C. The scale factor is .01V/^{o}C The LM35 does not require any external calibration or trimming and maintains an accuracy of +/-0.4 ^{o}C at room temperature and +/- 0.8 ^{o}C over a range of 0 ^{o}C to +100 ^{o}C



GSM MODULE

GSM is a mobile communication modem; it is stands for global system for mobile communication (GSM). The idea of GSM was developed at Bell Laboratories in 1970. It is widely used mobile communication system in the world. Whenever a person feels that he is not feeling well than immediately he can go to the public booth machine and test his condition. If the condition of the patient is beyond the normal rate then then public booth machine will immediately send the message to the nearest patient and someone from the hospital would come to receive the patient.

GPS MODULE

GPS stands for the Global Positioning System. Whenever the patient does not feel well then he goes to the public booth machine to check his blood pressure, temperature and heart beat. If either of the parameters are beyond the normal value then through the GSM

The message will be transmitted to the doctor and doctor will trace the longitude and latitudinal directions of the patient and send one of the persons to pick up that particular patient.

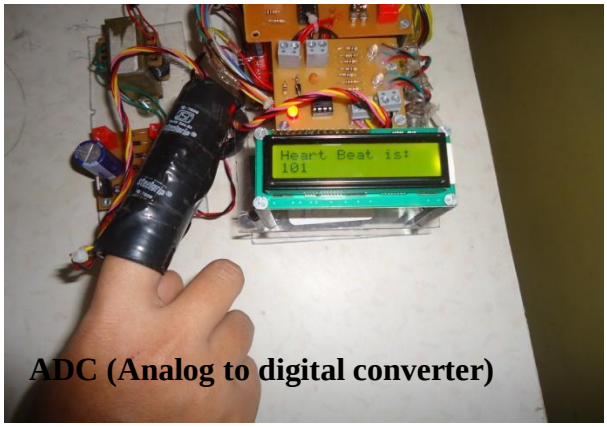
PIEZO BUZZER

A buzzer or beeper is an audio signaling device, which may be mechanical,, or piezoelectric. Typical uses of buzzers and beepers include alarms, timers and confirmation of user input such as a mouse click or keystroke. A piezoelectric element may be driven by an oscillating electronic circuit or other audio signal source, driven with a piezo audio amplifier. Sounds commonly used to indicate that a button has been pressed are a click, a ring or a beep.

It most commonly consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound. Initially this device was based on an electromechanical system which was identical to an electric bell without the metal gong (which makes the ringing noise). Often these units were anchored to a wall or ceiling and used the ceiling or wall as a sounding board. Another implementation with some AC-connected devices was to implement a circuit to make the AC current into a noise loud enough to drive a loudspeaker and hook this circuit up to a cheap 8-ohm speaker. Nowadays, it is more popular to use a ceramic-based piezoelectric sounder like a Son alert which makes a high-pitched tone. Usually these were hooked up to "driver" circuits which varied the pitch of the sound or pulsed the sound on and off.

HEART BEAT MEASUREMENT

As shown in figure 5.2 there is a cavity for measurement of the heartbeat, which consists of a arrangement of LED and LDR. By placing your 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, and this chip has two built in OPAMPs. Result is displayed on the LCD. This collected data is transmitted using GSM module. This data is received at the receiver section.



ADC (Analog to digital converter)

ADC stands for analog to digital conversion. Micro controller sends the address of port to the ADC. For example 000 for channel 0. µc gives high pulse to ALE (Address Latch Enable) to latch the address into the ADC. It sends SOC (Start of Conversion) pulse, so that ADC starts performing successive appreciation for digital conversion on the selective channel. ADC starts processing the input channel for equivalent digital data. When the data is available on the port, it sends EOC (End of Conversion) pulse to the µc. µc continuously monitors the EOC pulse. When it goes low, it takes the data from ADC. LM 555 is connected externally to the ADC in a stable mode to give clock pulse.[6][7]

RECEIVER SECTION

The embedded based software will display the data (Voltage values) of all channels in real time & will store them into database for future reference.[9].The graphical and many more analysis on the stored data can be performed later on interactively. The Software is also designed to monitor the values of those physical parameters so as they are always in the range of predefined limits i.e. Lower Limit & Upper Limit. This can be achieved by monitoring the incoming data of each channel and by comparing it with both the limits. If the value does not reside within the range then the software will give command to pc & message is sent on mobile connected to the parallel port. That will alert the doctor so that he can immediately take the necessary action to normalize the patient.

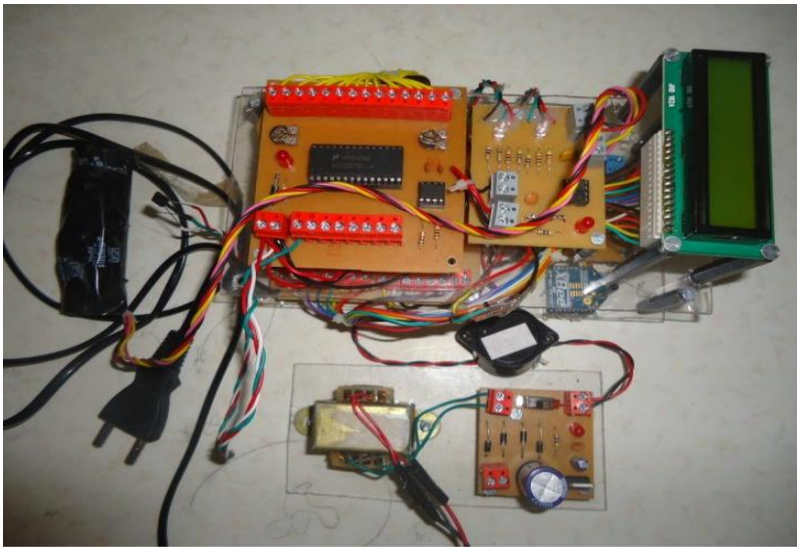
LCD DISPLAY

LCD stands for the Liquefied Crystal Display. A very popular standard exists which allows us to communicate with the vast majority of LCDs regardless of their manufacturer. The standard is referred to as HD44780U, which refers to the controller chip which receives data from an external source (in this case, the 8051) and communicates directly with the LCD.

LCD UNIT

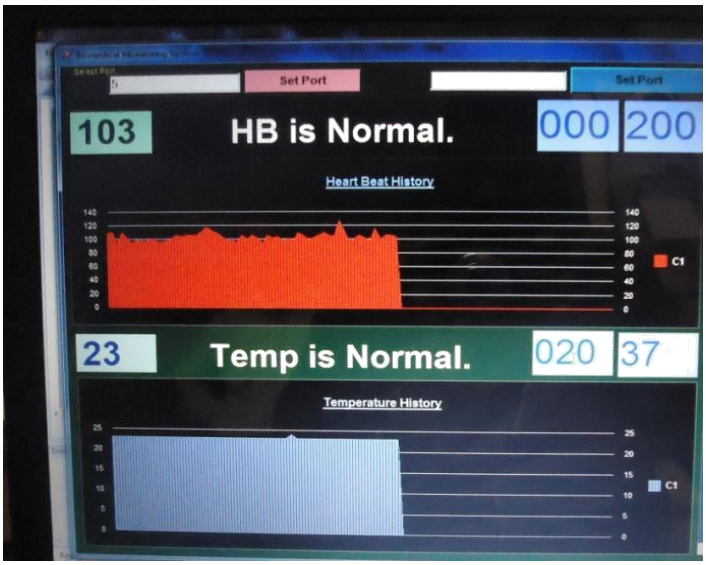
CIRCUIT IMPLEMENTATION

Initially, there is a development of the block diagram of system. Then developed circuits of individual blocks. All circuits are tested in lab and finalized. Next step is to develop PCB on pc. Printed circuit boards, or PCBs, form the core of electronic equipment domestic and industrial. Some of the areas where PCBs are intensively used are computers, process control, telecommunications and instrumentation.



GRAPHICAL REPRESENTATION OF TEMP AND HB

The embedded system based software is used for programming. The programming of microcontroller is done in embedded C. The Figure 5.4 shows graphical representation of Heart beat and temperature. Doctor can set the lower and upper limits of both the parameter in run condition. If values of both the parameters are within the range then messages like “HB is normal” and “Temperature is normal “is displayed on the screen. Otherwise it will display the message like “ HB is high” or “ HB is Low” and message is send to the doctor mobile or any family member depends on the entered no



CONCLUSION

I have analyzed the wireless patient health monitoring system of temperature and heartbeat of humans using the microcontroller, GSM, GPS, and SMS. Any abnormalities in health conditions are informed via SMS to the indicated mobile number through GSM. The hardware is implemented and the output is studied. Also in this module the location of the person is being tracked and is informed to the doctor.

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