INTELLIGENT MEDICINE BOX FOR EMERGENCY MANAGEMENT

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ABSTRACT

Technological evolution in wearable sensors accounts for major growth and transformation in a multitude of industries, ranging from healthcare to computing and informatics to communication and biomedical sciences. A modern healthcare with an intelligent medicine box along with sensors for health monitoring and diagnosis is proposed here. An intelligent home based medicine box with wireless connectivity along with sensors helps patients more close communication. The proposed model has an intelligent medicine box that gives alerts to patients for their medication at right time. It is connected to global system communication modem to make whether abnormal situation occurs and updates to concerned doctor for patients. The system automatically gives alarm to the patient, if there is any changes in vital signs that would be occur any time, calls and SMS alerts are given to predefined guardian.

1. INTRODUCTION

At-home first aid kits are typically just a bunch of bandages, gauzes, and other products stuffed into a little box. Yet, without knowing how to properly use these tools, the first aid kits may end up providing little help in emergency situations. We may soon see a smart aid kit hit the market from a company called 19Labs, based in Menlo Park, California. The GALE first aid kit features a number of compartments that organize the medical supplies, and a touchscreen display on the inside cover is used to access instructions on how to perform different procedures. These include cuts, burns, concussions, fractures, and a bunch of other common situations that can strike anyone at home.

1.1 Software

The embedded controller and a personal computer is that the embedded controller is dedicated to one specific task or set of tasks. A personal computer is designed to run many different types of programs and to connect too many different external devices. An embedded controller has a single program and, as a result, can be made cheaply to include just enough computing power and hardware to perform that dedicated task.

1.2 Microprocessor Lab

MPLAB X IDE is a software program that is used to develop applications for Microchip microcontrollers and digital signal controllers. This development tool is called an Integrated Development Environment, or IDE, because it provides a single integrated "environment" to develop code for embedded microcontrollers. MPLAB X is the latest edition of MPLAB, and is developed on the Net Beans platform.

1.3 Peripheral Interface Controller Kit

PIC kit is a family of programmers for PIC microcontrollers made by Microchip Technology. They are used to program and debug microcontrollers, as well as program EEPROM. Some models also feature logic analyser and serial communications (UART) tool. The people who develop open-source software for the PIC kit use a mailing list for collaboration. PIC kit was a rudimentary USB programmer for PIC microcontrollers, produced by Microchip Technology, the manufacturers of the PIC series of 28 microcontrollers. It was integrated into a demo board featuring 8 LEDs, a switch, and a potentiometer. Its default program (explained in the documentation) rotates the LEDs in series.

1.4 Hardware

PIC was first designed in 1975 by General Instruments. This chip called PIC1650 was meant for totally different purposes. About ten years later, by adding EEPROM memory, this circuit was transformed into a real PIC microcontroller. Nowadays, Microchip Technology announces a manufacturing of the 5 billionth sample.

PIC is a family of Harvard architecture microcontrollers made by Microchip Technology, derived from the PIC1640 originally developed by General Instrument's Microelectronics Division. The name PIC initially referred to Peripheral Interface Controller. PICs are popular with developers and hobbyists alike due to their low cost, wide availability, large user base, extensive collection of application notes, availability of low cost or free development tools, and serial programming capability.

1.5 Architecture of PIC16F887

It is a 40 pin and 8 bit CMOS PIC microcontroller that comes with Nano watt technology The PIC16F887 incorporates 256 bytes of EEPROM data memory, 368 bytes of RAM, and program memory of 8K.Apart from self-programming capability, it also contains 2 Comparators, 10-bit Analog-to-Digital (A/D) converter with 14 channels, and capture, compare and PWM functions.it is widely used in many electronic applications. Some pins in the controller are capable of doing more than one functions that allow us to use the pin according to the needs and demands of the project. Architecture of peripheral interface controller has consist of various function are shown in figure 1.

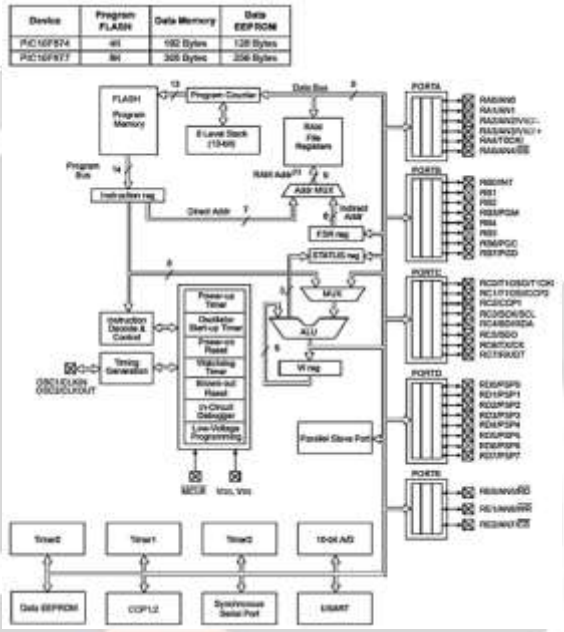

Fig -1 Architecture of PIC

1.6 Data Memory

PIC16F887 have a set of registers that function as general purpose RAM. Special purpose control registers for on-chip hardware resources are also mapped into the data space.

1.7 Program Memory

PIC16F887 has a feature of Harvard architecture, so the code space and the data space are separate. PIC code space is generally implemented as EPROM, ROM, or flash ROM. In general, external code memory is not directly addressable due to the lack of an external memory interface.

1.8 Word Size

The word size of PICs can be a source of confusion. All PICs handle (and address) data in 8-bit chunks, so they should be called 8-bit microcontrollers. However, the unit of addressability of the code space is not generally the same as the data space.

1.9 Stacks

PICs have a hardware call stack, which is used to save return addresses. The hardware stack is not software accessible on earlier devices, but this changed with the 18 series devices.

1.10 Instruction Set

A PIC's instructions vary from about 35 instructions for the low-end PICs to over 80 instructions for the high-end PICs. The instruction set includes instructions to perform a variety of operations on registers

directly, the accumulator and a literal constant or the accumulator and a register, as well as for conditional execution, and program branching.

1.11 Buzzer

A buzzer or beeper is a signalling device, usually electronic, typically used in automobiles, household appliances such as a microwave oven. 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 present 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.

2. PROPOSED SYSTEM

Most of devices monitor the person health by using pedometer with the help of mobile device. By using this type of device we continuously monitor the person health and daily activities. These are used for healthy person who want build the better future. But it is not a doctor and patient communication device. In now a day most of the people got blood pressure and diabetics. They have to take medicine for a while to control their blood pressure and diabetic level on better. For this existing system they have to visit doctor more often.

Our system includes a featured medicine box which is wirelessly connected patient body. Through this system, patients could view and get notifications regarding medicine intake. Medicine box is provided with different compartments. In this system, a controller is used for the appropriate time of action .the patient block diagram are shown in figure 2

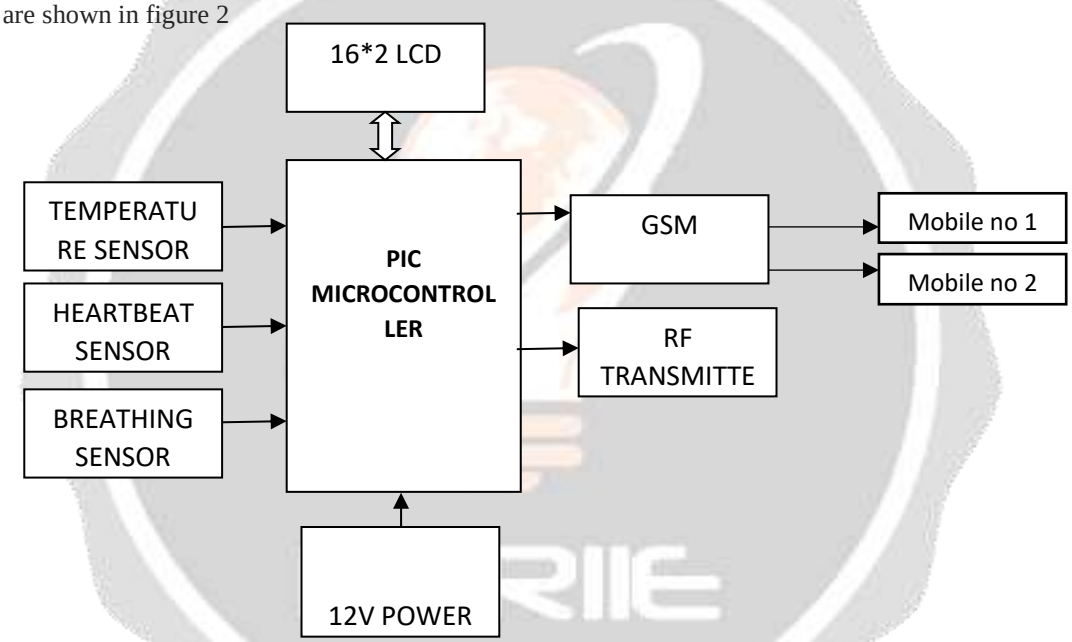

Figure 2 Block Diagram (Patient)

2.1 LM35 Sensor

The LM35 thus has an advantage over linear temperature sensors calibrated in degree Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. For each degree Celsius change in temperature, the sensor output changesby10mV. The sensor can measure temperature in the range of 0 to 100°C, i.e., the output of the sensor varies from 0 to 1000 mV. The LM35 operates over the temperature range of -55° to +150°C, while the LM35C is rated for a -40°C to +110°C range. The centigrade temperature sensor are shown in figure 3.

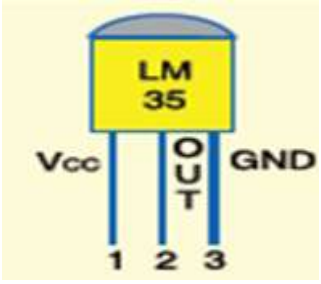

Figure 3 LM35 sensor

Pin layout of the sensor is as follows,

1. Pin 1-V_{DD}
2. Pin 2-Output of the sensor
3. Pin 3-V_{SS}

2.2 PIC Micro Controller

Microcontroller is a general purpose device, which integrates a number of the components of a microprocessor system on to single chip. It has inbuilt CPU, memory and peripherals to make it as a mini computer. A microcontroller combines on to the same microchip:

- The CPU core
- Memory(both ROM and RAM)
- Some parallel digital i/o

2.3 Introduction to PIC Microcontroller

The microcontroller that has been used for this project is from PIC series. PIC microcontroller is the first RISC based microcontroller fabricated in the CMOS (complementary metal oxide semiconductor) that uses separate bus for instruction and data allowing simultaneous access of program and data memory. The main advantage of CMOS and RISC combination is low power consumption resulting in a very small chip size with a small pin count. The main advantage of CMOS is that it has immunity to noise than other fabrication techniques.

2.4 Special Features of PIC Microcontroller

The pin diagram of PIC microcontroller are shown in figure 3.4, the Pic Microcontroller delivers various different improvements over its predecessors which includes the following,

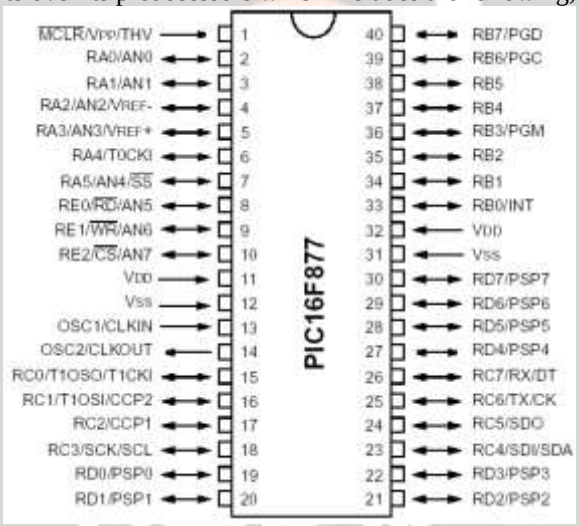

Figure 4 Pin Diagram of PIC16F877

2.5 I/O Ports

Some pins for these I/O ports are multiplexed with an alternate function for the peripheral features on the device. In general, when a peripheral is enabled, that pin may not be used as a general purpose I/O pin. It consist of various flash and data memory specification and it refer the different data memories are indicated and these are the specifications are shown in table 1.

Table 1 Specification

DEVICE	PROGRAM FLASH	DATA MEMORY	DATA EEPROM
PIC 16F877	8K	368 Bytes	256 Bytes

2.6 Memory Organisation

There are three memory blocks in each of the PIC16F877 MUC's. The program memory and Data Memory have separate buses so that concurrent access can occur.

2.7 Program Memory Organisation

The PIC16f877 devices have a 13-bit program counter capable of addressing 8K *14 words of FLASH program memory. Accessing a location above the physically implemented address will cause a wrap around. The RESET vector is at 0000h and the interrupt vector is at 0004h.

2.8 Respiration

The intake of oxygen and releasing carbon dioxide is probably the most basic but a pivotal respiratory system function. The process, as we all know, is called respiration. Although it seems very simple from its basic definition, the process can reflect the state of human body. The respiratory rate is one such parameter of this process which can reveal many facts about overall working of the body. It is considered very important to maintain a normal respiratory rate. Respiratory rate, also known as breathing rate, is defined as the number of breaths (inhalation and exhalation) a living being takes per unit time, generally in a minute.

It is calculated by counting the number of times a person's chest expands and contracts in one minute. The unit of respiratory rate is breaths per minute. This rate can range from a low of 12 breaths per minute in resting adults to a high of 75 breaths per minute in case of athletes while doing extremely strenuous work. But, these are not called normal as this rate is recorded in special conditions.This circuit is designed to measure the respiration. In this circuit two thermistor is used for the respiration measurement which are connected in the resistor bridge network. The bridge terminals are connected with inverting and non-inverting input terminals of the differential amplifier. The diff eventual amplifier is constructed by the LM 741 operational amplifier. Here one thermistor is used for the respiration measurement. Another thermistor is used as reference which measures the room temperature. The schemotic diagram of respiratory are shown in figure 3.7 . The differential amplifier provides the error voltage at its output. Then the error voltage is filtered by the next stage of the op-amp. The output voltage is converted to +12v to -12v square wave pulse through the comparator. Then the square wave pulse is converted to 5v to 0v TTL pulse through the transistor (BC 547).

2.9 Heart Beat Measurement

The pulse rate is a measurement of the heart rate, or the number of times the heart beats per minute. As the heart pushes blood through the arteries, the arteries expand and contract with the flow of the blood. Taking a pulse not only measures the heart rate, but also can indicate the following

- Heart rhythm
- Strength of the pulse

The normal pulse for healthy adults ranges from 60 to 100 beats per minute. The pulse rate may fluctuate and increase with exercise, illness, injury, and emotions. Females ages 12 and older, in general, tend to have faster heart rates than do males. Athletes, such as runners, who do a lot of cardiovascular conditioning, may have heart rates near 40 beats per minute and experience no problems.

Heart rate is a term used to describe the frequency of the cardiac cycle. It is considered one of the four vital signs. Usually it is calculated as the number of contractions (heart beats) of the heart in one minute and expressed as "beats per minute" (bpm). See "Heart" for information on Embryofetal heart rates. The heart beats up to 120 times per minute in childhood. When resting, the adult human heart beats at about 70 bpm (males) and 75 bpm (females), but this rate varies among people. However, the reference range is normally between 60 bpm (if less termed bradycardia) and 100 bpm (if greater, termed tachycardia). Resting heart rates can be significantly lower in athletes. The infant/neonatal rate of heartbeat is around 130-150 bpm, the toddler's about 100–130 bpm, the older child's about 90–110 bpm, and the adolescent's about 80–100 bpm. The heart measurement are shown in figure 3.8.

3. OUTPUT

3.1 Initial View

Proteus 8 professional is used to give the digital display and working of the kit in the monitor figure 5.1 shows the general view of the kit in the monitor.it consists of LCD, respiratory, heartbeat, temperature measurement units

3.2 GSM Check

Then gsm checking process will start which is indicated in the LCD .this is done to ensure the correct working of the gsm .once completed the kit will be ready for the further measurements. The gsm are

For the purpose of testing the kit automatically sends a test message to the doctor and the patient’s family member immediately. Figure 5 shows the format of the message.

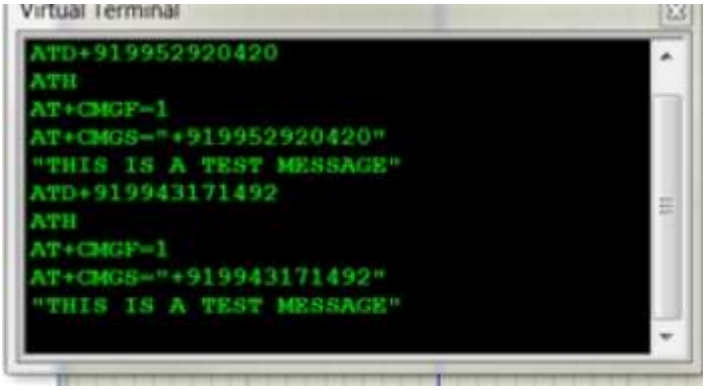

Figure 5 Message Sent Process

3.4 Temperature Breath Rate and Seconds

Liquid crystal display displays the temperature value, breath rate value, the time in seconds. This helps the patient to correctly recognize the value of all measurements.

3.5 Temperature Measurement

Normal temperature value is below 40°C. To make the kit function the temperature value is increase to 42°C manually. Abnormality in temperature is detected and displayed in the LCD. Temperature abnormality is indicted in the liquid crystal display to make the patient know about the condition so as to take immediate medical treat this is shown in the figure 5.6 . Temperature abnormality message will be sent to the doctor and he will be insisted to check the patient immediately, simultaneously the family member will also be insisted about the condition. The temperature message format are shown in figure 6.

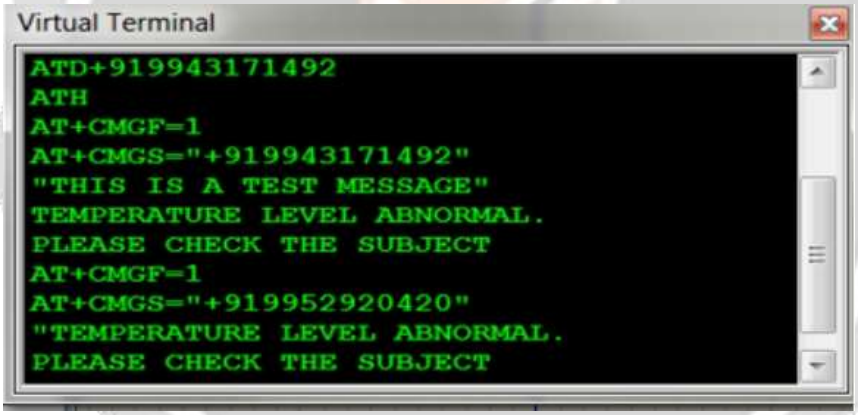

Fig 6 Temperature Message Format

3.6 Heart Beat Measurement

Heart beat fall is indicted in the liquid crystal display to make the patient know about the condition so that he can take immediate medical help .Then amplified signal is given to inverting input terminal of c amplifier. The amplifier is constructed by the A4 amplifier in which the offset voltage is given to non-inverting input terminal. The offset voltage is generated by the A3 amplifier. Then the amplifier amplifies the signal and delivered its output. Then the signal is given to base of the BC 557(PNP) and BC547 (NPN) switching transistors in order to convert the TTL voltage 0 to 5v level. Finally the TTL output is given to 74C04 inverter to invert the pulse in digital form. Then the final square wave signal is given to microcontroller or other interfacing circuit in order to monitor the heart rate. The heart level drop will be sent to the doctor and he will be insisted to check the patient immediately via gsm, simultaneously the patient family member will also be insisted about the condition.

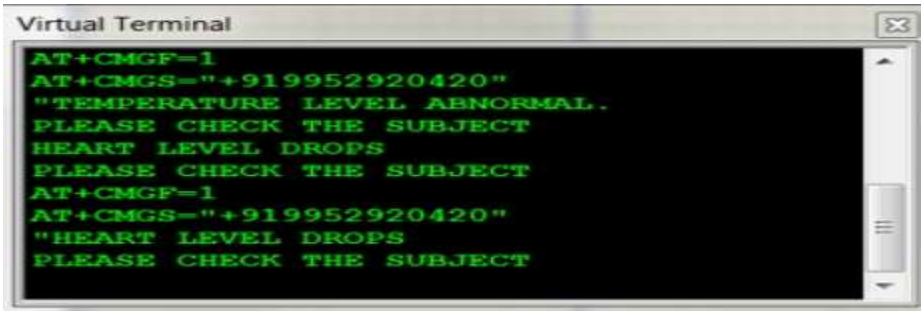

Fig 7 Heart Beat Message Format

3.7 BPM Display

The respiratory switch is switched on to make a abnormality and this is done to show a working abnormal condition in the kit and the proper functioning of the kit. The respiratory switch are shown in the figure 5.11.

Beats per minute I displayed in the LCD. Buzzer will ring for bpm<15.if bpm>15 there will be no action. Once the measurement is taken the value is shown in the liquid crystal display. The Bpm are shown in the figure 5.12.

Here one thermistor is used for the respiration measurement. Another thermistor is used as reference which measures the room temperature. The comparator provides the error voltage at its output. Then the error voltage is amplified by the next stage of the amplifier. The amplified voltage is converted to +12v to -12v square wave pulse through the comparator. Then the square wave pulse is converted to 5v to 0v TTL pulse through the transistor Q1 (BC 547). Then the final TTL pulse is given to microcontroller in order to monitor the respiration rate. Low oxygen limit is indicted in the liquid crystal display to make the patient know about the condition so that he can take immediate medical help, this is shown in the figure 5.13 .

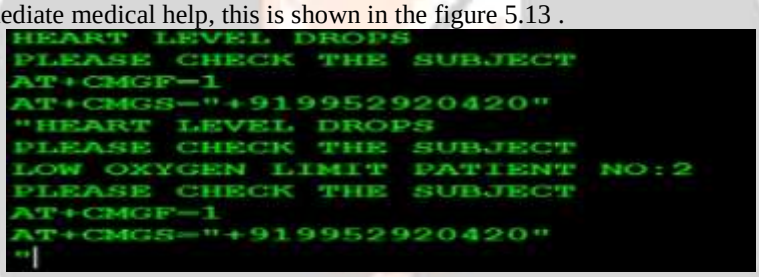

Fig 8 Respiratory Abnormality Message Format

The low oxygen limit is sent to the doctor and he is insisted to check the patient immediately, simultaneously the family member will also be insisted about the condition. Oxygen limit process are shown in figure 8.

4 CONCLUSION

An attempt has been made to make Smart Medicine Box with very high efficiency and low cost. The designed smart medicine box would significantly release nurses or users burden, by reminding about the medicines to be taken at appropriate times. It is also helpful to old age people who take medicines regularly and vitamin supplements. The smart medicine box can be connected to a system interface, so that it can be placed in a nursing station and the nurse will enter the pill details of different patients through the system.

5 Reference

(1). Jacob Milman, Christos Halkias and Chetan D Parikth 2001,' Milman's Integrated Electronics', Tata McGraw-Hill Publishing Company, Edition-2.McGraw-Hill Companies.

(2). Pang,Tian and chen 2014,'Intelligent packaging and Intelligent medication management towards the IoT', 16th International conference on advanced communication technology, pyeongchang.

(3). Srinivas, Durgapradarao and Raj 2018, 'Intelligent medicine box for medication management using IoT, 2nd international conference on inventive system and control (ICISC), coimbatore.

(4). Yang 2014, 'A Health-IoT platform bed on the integration of Intelligent of packaging, Unobtrusive Bio-sensor and Intelligent medicine', in IEEE Transaction on industrial informatics.