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Smart Medicine Box using ARM 7 Micro controller

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Abstract – *Most of the people, from young age to the old age forget to take medicines on time. The elder people also forget which medicine to take at particular time. There should be a means to always remind such people to take medicines on time. This paper presents a Smart Medicine box[1] to users who regularly take drugs or vitamin supplements, or nurses who take care of the older or patients. Our medicine box is programmable that reminds the nurses and users which specific pill to take at particular times of day and serves at those times each day. It contains three separate boxes. Therefore, nurses or users can set information for three different pills. When the pill quantity and time have been set by making use of the keys provided, the medicine box will remind users or patients to take pills using sound and light. The specific box from which the pill needs to be taken will be displayed by an led placed on the corresponding box.*

Key Words: Microcontroller, ARM 7[2], LED(Light Emitting Diode).

1. INTRODUCTION

With the tremendous growth in medical technology, there is cure for many dreadful diseases through the intake of several new medicines. The number of medicines to be taken by each person has increased. It has become hard for us to remind ourselves to take the medicines at particular time. This Smart Medicine Box helps us in reminding us of the medicine that we should take at that particular time.

1.1 Components used in Smart Medicine Box

ARM7 LPC2148 Micro controller:

The ARM LPC2148 is a 32-bit microcontroller with real-time emulation and embedded trace support, that combines it with embedded high speed flash memory ranging from 32 kB to 512 kB. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the 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, LPC2148 are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale. Serial communications interfaces ranging from a USB 2.0 Full-speed device, multiple UARTs, SPI, SSP to I2C-bus and on-chip SRAM of 8 kB up to 40 kB, make these devices 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 ADC(s), 10-bit DAC, PWM channels and 45 fast GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers suitable for industrial control and medical systems. It also includes an in-built Real Time Clock (RTC) which plays the key role in our present application.

Keys:

Keys are used for the user or nurse to enter the information of time when the smart box would send "reminder" (displaying numbers and playing synthesized voice). It is also used for the user to enter a number to command a specific pill box to open on a specific time. (say, open No.1 pill box), and user can also enter the frequency information to take pills for each day. Keys contain four buttons. Alarm, enter, increment, decrement.

Liquid Crystal Display(LCD):

The 2 line, 16 characters LCD screen is used to display the instruction information, that the pills need to be taken now, and the current time and date.

Speaker Module:

The speaker module is used to play the synthesized sound to remind the user to take pill.

Pill boxes: We used a pillbox system containing 3 separate small pillboxes. Each box has an led display placed on the box. For our pill system, the user can store up to three different types of pills, which can be stored in those three small separate boxes. He or she can also specify the different combinations of pill boxes to be open for each day. Microcontroller: ARM LPC2148 is used to execute all the commands mentioned above.

Real time clock[3] in ARM7:

ARM LPC2148 has an Real Time Clock Built into it. The real time clock running in our system is implemented by using MCU 16-bits timer to generate 1-second base. Firstly, we will open the compare match interrupt service routine, and set the compare value to 249. Also, we scale the running frequency of timer1 to 1/64. Then, the interval time between each interrupt routine is 0.001 second. We have a volatile variable to run the clock function every 1000 interrupt routines. Then, in the clock function, it will run like a clock. We have separated variable for two digits of seconds, minutes and one variable for hours. We do not store the year information because we think it is unnecessary.

1.2 Working

As we switch on our device, the current time and date that is stored in the RTC is displayed on LCD. The device initially asks the user to set the alarm timings using the keys. A speaker module is connected to the ARM7 microcontroller .The playback voice should be initially recorded in it through the microphone in it. The alarm time is compared to the current time by the microcontroller and when they match, an interrupt is generated. Then the LED on the pillbox glows and a voice play back is also generated indicating which pill should be taken.

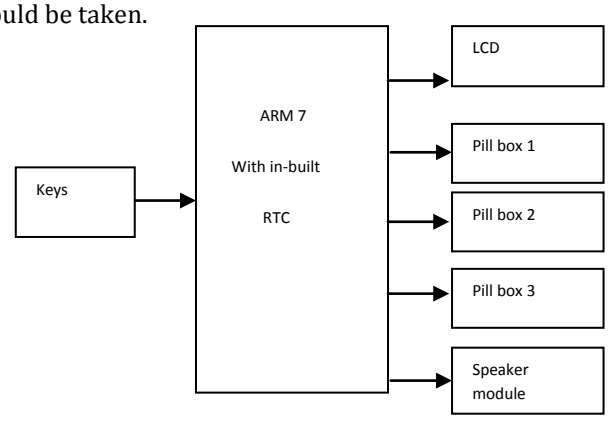

Fig-1 : Block Diagram of Smart Medicine Box

2. SOFTWARE IMPLEMENTATION

Firmware implementation deals in programming the microcontroller so that it can control the operation of the IC's used in the implementation.

In the present work, we have used the OrCAD(Oregon Computer Aided Design) design software for Printed Circuit Board(PCB) circuit design, the Keil µv4 software development tool to write and compile the source code, which has been written in the C language. The Flash magic programmer has been used to write this compile code into the microcontroller.

2.1 Software Tools Required

- OrCAD
- Keil µVision4
- Flash Magic

OrCAD is used for drawing the schematic diagram. Keilµv4, Flash magic are the two software tools used to program microcontroller. The working of each software tool is explained below in detail.

2.2 Programming code description

A compiler for a high level language helps to reduce production time. To program the LPC2148 microcontroller the Keil µv4 is used. The programming is done in the embedded C language or Assembly language. Keil µv4 is a suite of executable, open source software development tools for the microcontrollers hosted on the Windows platform.

One of the difficulties of programming microcontrollers is the limited amount of resources the programmer has to deal with. In personal computers resources such as RAM and processing speed are basically limitless when compared to microcontrollers. In contrast, the code on microcontrollers should be as low on resources as possible.

2.3 Keil Compiler

Keil compiler is software used where the machine language code is written and compiled. After compilation, the machine source code is converted into hex code which is to be dumped into the microcontroller for further processing. Keil compiler also supports C language code. The compilation of the C program converts it into machine language file (.hex). This is the only language the microcontroller will understand, because it contains the original program code converted into a hexadecimal format. During this step there

are some warnings about eventual errors in the program. If there are no errors and warnings then run the program, the system performs all the required tasks and behaves as expected the software developed. If not, the whole procedure will have to be repeated again.

2.4 Flash magic

Flash Magic is a PC tool for programming flash based microcontrollers from NXP using a serial or Ethernet protocol while in the target hardware. The baud rate is selected for the microcontroller and the registers erased before the device is programmed.

If dumping process of the hex file is completed, then the controller will work as per our requirement.

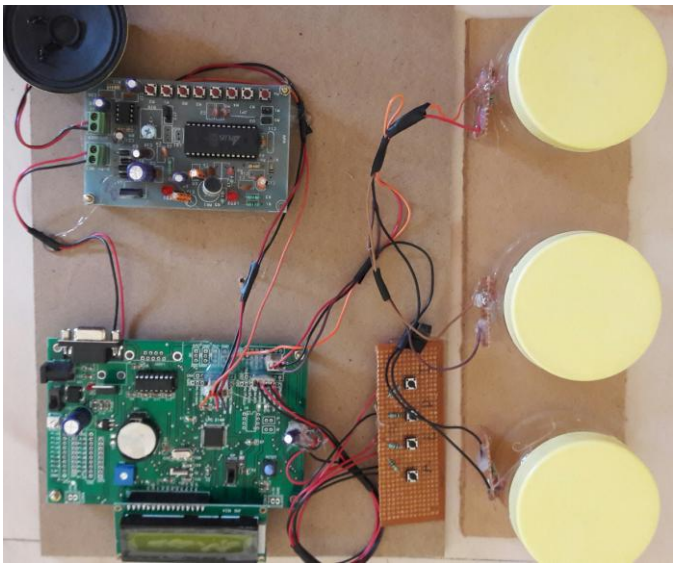

Fig -1: Our project

3. FUTURE SCOPE

There are several aspects we need to work on our device in the future to meet the user needs. Firstly, we should develop strategies and modify the device based on the user's evaluation results. This includes creating a user manual, choosing a large LCD display, using the metal or plastic box cover the entire circuitry placing switch and LCD display on the surface of the box and using the pill boxes.

We can also use this sort of implementation, not only in medical applications, but also in industrial and automotive applications where time management is critical.

4. CONCLUSION

There is a great need for timely intake of medicines which is often skipped by many people. Our Smart Medicine Box helps to remind us to take medicines regularly and also which medicine to take. Thus this implementation, though small and simple, will be a very great and useful step in the field of medicine.

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