On the Study of Telephone Based Home Monitoring System

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ABSTRACT

We can monitor home from any remote location using our existing telephone line. We have already some technologies to perform these types of application such as: Bluetooth, IR. But these are used in a limited area which we can easily come over in our system. Our propose system has two sections one is Remote Section (RS) where the client will place the request and another is Local Section (LS) where the telephone line is connected with an Input Interfacing Circuit (IIC). Input Interfacing Circuit (IIC) receives the frequency and converts frequency to machine language. Output Interfacing Circuit (OIC) sends voice signal to the client as acknowledgement through modem then the client proceeds for the next steps. This system can be used in commercial or industrial purposes such as controlling computer from remote locations, home monitoring system instead of man or any kind of switching.

1. Introduction

Controlling devices using switches are common. From a few decades controlling devices using remote control switches like infrared remote control switch, wireless remote control switches, light activated switches are becoming popular. But these technologies have their own limitations. Laser beams are harmful to mankind. Some technologies like IR remote control are used for short distance applications [6]. In such case if we have system which does not require any radiations or which is not harmful, long remote control switch!! Yes here is the solution. Here we are introducing such a system which does not require any radiations, any laser beam which has no limitation of range, we mean it can be used from any distance from meters to thousand kilometers using a simple telephone line or mobile phone.

2. Dual tone multiple frequency (DTMF)

The DTMF (Dual Tone Multiple Frequency) application is associated with digital telephony [9], and provides two selected output frequencies (one high band, one low band) for a duration of 100 ms. This DTMF subroutine takes 110 bytes of COP820C/840C code, consisting of 78 bytes of program code and 32 bytes of ROM table. The timings in this DTMF subroutine are based on a 20 MHz COP820C/840C clock, giving an instruction cycle time of 1 ms [6].

The matrix for selecting the high and low band frequencies associated with each key is shown in Figure 1. Each key is uniquely referenced by selecting one of the four low band frequencies associated with the matrix rows, coupled with selecting one of the four high band frequencies associated with the matrix columns [8]. The low band frequencies are 697, 770, 852, and 941 Hz, while the high band frequencies are 1209, 1336, 1477, and 1633 Hz. The DTMF subroutine assumes that the key decoding is supplied as a low order hex digit in the accumulator. The COP820C/840C DTMF subroutine will then generate the selected high band and low band frequencies on port G output pins G3 and G2 respectively for a duration of 100 ms. The COP820C/840C each contain only one timer. The problem is that three different times must be generated to satisfy the DTMF application. These three times are the periods of the two selected frequencies and the 100 ms duration period. Obviously the single timer can be used to generate any one (or possibly two) of the required times, with the program having to generate the other two (or one) times.

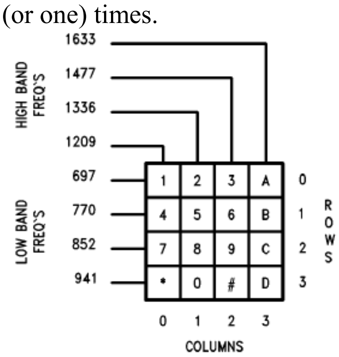

Figure 1: DTMF Keyboard Matrix

The solution to the DTMF problem lies in dividing the 100 ms time duration by the half periods (rounded to the nearest micro second) for each of the eight frequencies, and then examining the respective high band and low band quotients and remainders. The low band frequency quotients range from 139 to 188, while the high band quotients range from 241 to 326. The observation that only the low band quotients will each fit in a single byte dictates that the high band frequency be produced by the 16 bit (2 byte) COP820C/840C timer running in PWM (Pulse Width Modulation) Mode.

3. Description of IC MT8870

IC MT8870 serves as DTMF decoder [5]. This IC takes DTMF signal coming via telephone line and converts that signal into respective BCD number.

It uses same oscillator frequency used in the remote section so same crystal oscillator with frequency of 3.85M Hz is used in this IC.

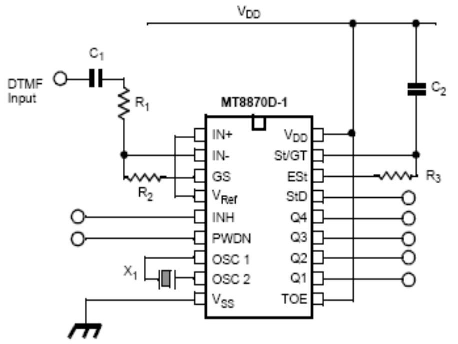

Figure 2: Frequency to Binary Conversion IC MT8870

NOTES:
R1 = 102KW ± 1%
R2 = 71.5KW ± 1%
R3 = 390KW ±1 %
C1,C2 = 100 nF ± 5%
X1 = 3.579545 MHz ± 0.1%
VDD = 5.0V ± 5%

The MT8870D/MT8870D-1 (Figure 2) is a complete DTMF receiver integrating both the band split filter and digital decoder functions. The filter section uses switched capacitor techniques for high and low group filters; the decoder uses digital counting techniques to detect and decode all 16 DTMF tone-pairs into a 4-bit code [6]. External component count is minimized by on chip provision of a differential input amplifier, clock oscillator and latched three-state bus interface[5][7].

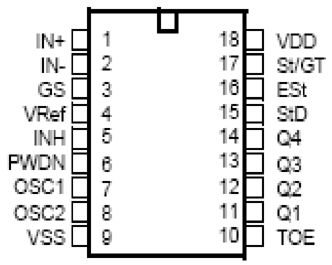

Figure 3: Block Diagram of MT8870

4. Parallel port

A PC parallel port is an inexpensive and yet powerful platform for implementing projects dealing with the control of real world peripherals. The parallel port provides eight TTL outputs, five inputs and four bidirectional leads and it provides a very simple means to use the PC interrupt structure [1].

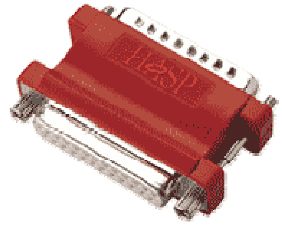

Figure 4: Parallel Port Device

The Data Control and status lines are connected to there corresponding registers inside the computer. So by manipulating these registers in program , one can easily read or write to parallel port with programming languages like 'C' and Visual Basic [4]. The registers found in standard parallel port are, I. Data register ii. Status register and iii. Control register

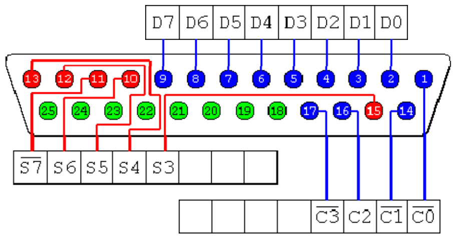

Figure 5: Register with Port Sequence

A larger manual which deals with such topics as driver circuits, opt-isolators, control of DC and stepping motors, infrared and radio remote control, digital and analog multiplexing, D/A and A/D is available.

TABLE 1: PARALLEL PORT CONFIGURATIONS

Pin No	Signal name	Direction	Register bit	Inverted
1	nStrobe	Out	Control-0	Yes
2	Data0	In/Out	Data-0	No
3	Data1	In/Out	Data-1	No
4	Data2	In/Out	Data-2	No
5	Data3	In/Out	Data-3	No
6	Data4	In/Out	Data-4	No
7	Data5	In/Out	Data-5	No
8	Data6	In/Out	Data-6	No
9	Data7	In/Out	Data-7	No
10	nAck	In	Status-6	No
11	Busy	In	Status-7	Yes
12	Paper-Out	In	Status-5	No
13	Select	In	Status-4	No
14	Linefeed	Out	Control-1	Yes
15	nError	In	Status-3	No
16	nInitialize	Out	Control-2	No
17	nSelect-Printer	Out	Control-3	Yes
18 -25	Ground	-	-	-

The original IBM-PC's Parallel Port had a total of 12 digital outputs and 5 digital inputs accessed via 3 consecutive 8-bit ports in the processor's I/O space [3].

1. 8 output pins accessed via the DATA Port
2. 5 input pins (one inverted) accessed via the STATUS Port
3. 4 output pins (three inverted) accessed via the CONTROL Port
4. The remaining 8 pins are grounded

We implemented some codes to know the status of parallel port as follows:

A. For Data Port

There is no any inverted pin [3]. We use this port just to send data in output port. The code of the Data port which is written in C++ is as follows:

```
void main()
{     int i, v:
      for (i=0; i<=8; i++)
      {          v= pow(2,i);
                 outportb(0x378,v);
                 printf("%d\n",v);
                 delay(500);  }   }
```

B. For Control Port

There are three inverted pins (C3, C1, C0) in Control port [3] so for the input value '0', Parallel port receives '11'. The code of the control port is as follows which is written in C++:

```
void main()
{     v = inportb(0x37A);
      printf("Input Received: %d",v);  }
```

5. Implementation procedure

A. Requirements

This system uses Dual Tone Multi Frequency (DTMF) technology of our telephone set. Every telephone set will have this facility. We have two type of dialing facilities in our telephone system (i) Pulse dialing mode (ii) Tone dialing mode. Here this system works on tone dialing mode. The DTMF mode is shortly called as tone dialing mode. This system is divided into two sections as follows:

i. Remote Section (RS): It is nothing but remote telephone set which is present in the remote place. This may be your workspace (office / school) phone or mobile phone or a phone in PCO. Signals are sent through this telephone.

ii. Local Section (LS): This is a control system through which we can control our appliances. This contains one telephone line with an Input Interfacing Circuit (IIC) and Output Interfacing Circuit (OIC). The appliances to be controlled must be connected to telephone line through an IIC.

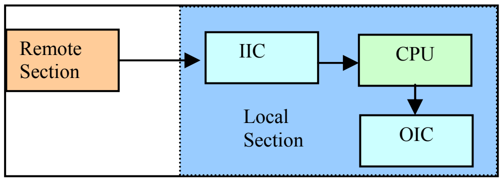

Figure 6: Remote and Local Section

B. How it works

Step 1: Now if the client presses "1" from RS then a frequency will be generated as follows:

Step 2: In our IIC decodes this frequency and find out corresponding BCD value

Step 3: These BCD values are sent to processing unit through parallel port then the processing unit finds out corresponding task. Then the software in processing unit executes the corresponding BCD code.

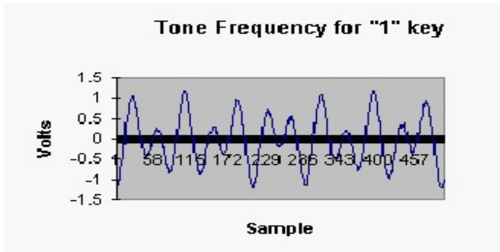

Figure 7: Generated frequency for key pressing

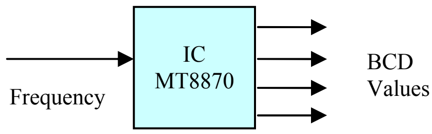

Figure 8: converting BCD values from frequency

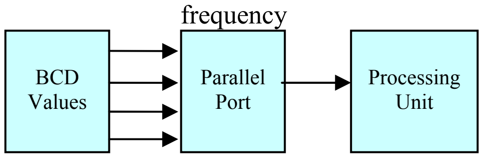

Figure 8: Processing Unit processes BCD values

6. Application

From the remote location we can control our devices through telephone. We can decode frequency to BCD number and this BCD number is connected with parallel port. We can read BCD number through status and control port. Now there will have some fixed keys for fixed services. Suppose 1 for fan turn on, 2 for light turn on, etc. We read the request from control port and send it to data port. There is an OIC with some devices (Opto-coupler, Bipolar Junction Transistor (BJT), Relay, and Diode). These relays work as switching of these devices. When it gets the high pulse from data port then it turn on switch.

```
inputvalue = Inp(Val("&H37A" ))
if inputvalue = 10 then
```

```
.    Out Val("&H378", 1) ‘ Device number 1 will be turn on
Elseif inputvalue = 9 then
.    Out Val("&H378", 2) ‘ Device number 2 will be turn on
End if
```

Data port is connected with opto-coupler. When the opto-coupler gets high pulse from data port then it switches on.

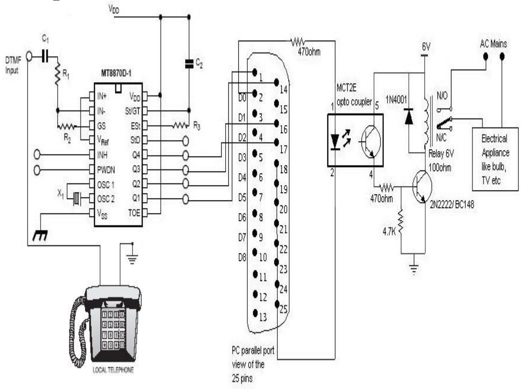

Figure 9: Circuit Diagram for Device Controlling

7. Conclusion

In this paper, we have shown that how we can monitor our home using a telephone from remote location. We have described here one example with proper flowchart, algorithm, circuit, and block diagrams so that anyone can easily understand and implement it. Moreover telephone-based monitoring system makes our life easier and faster.

8. References:

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