An Embedded based Intelligence Auditorium System

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***Abstract*— In this paper we present a robust and reliable Intelligence Auditorium System Model for achieve several tasks in an auditorium to reduce manpower such as Counting the strength, Temperature Monitoring, Message Display and Smoke Detection. This system consists of ARM Microcontroller, Sensors, LCD and personal PC to do several functions. This system design provides a good tradeoff between the system performance and size of the code using the limited amount of available sources. The hierarchical process of the system, experimental results and limitations are discussed.**

Keywords—LPC 2129 ARM Microcontroller; sensors; UART; MAX 232; LCD Display.

I. INTRODUCTION

This system performs the following tasks in an auditorium (1) counting the strength in an auditorium at any particular instant of time with the help of an microcontroller incorporated with a two pin switch one pin connects to microcontroller and other connects to an external interrupt pins (2) Temperature monitoring based on temperature present in an auditorium user will switch on/off the several devices (3) The data that is to be conveyed to the person in the auditorium is achieved through Message Display. Here the message is conveyed through an LCD Display. (4) Smoke detectors are one of the most important safety devices we can have in Auditorium and also in our home. Smoke detectors helps to give the early warning of fire to activate the user for taking an immediate action. They are low cost and require less maintenance. This system reduces the usage of manpower and reliable information is given to the user within a low cost.

The rest of the paper is framed as follows: Section 2 represents the System Block Diagram, Section 3 revise the basic data about sensors and LPC 2129 Microcontroller, Section 4 shows the hierarchical process of an algorithm, Section 5 presents simulation results of this system and finally we conclude the conclusion and future scope of work in Section 6.

II. SYSTEM BLOCK DIAGRAM

An Intelligence Auditorium System have consists of three sections.

A. Sensing Section

This Section takes parameters from sensors and converts the output from the sensors to a form that is more suitable for the processor. The first stage consists of some amplifiers and buffers .Since the output voltage of the transducer or sensor is very small (of the order of microvolt or mill volt), amplifier stages are a must. Also the processor deals only with digital data. So, the analog signal are converted to a digital form by employing A/D converters. The sensing section in this system measures counting the strength, Temperature Monitoring and Smoke Detection. [1]

B. Processing Section

After the sensing section has provided the measurements of all the parameters, it is up to the processing section for taken the action .It works out on some logic and issues commands to the control section. Here the processing section of our system is an LPC2129 microcontroller.

C. Control Section

An action is recommended by the processing section is actually implemented by the control section. control section which takes the actions for temperature-monitoring. The system block diagram is shown in Figure 1.

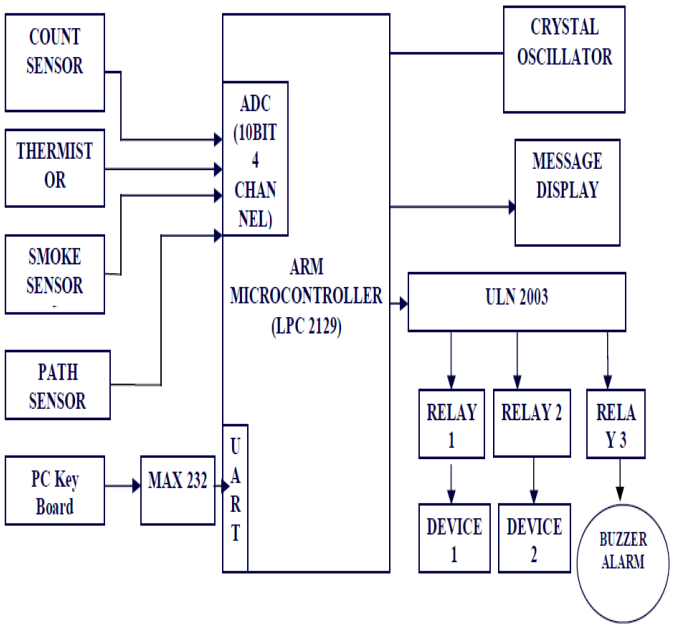

Figure 1: System Block Diagram

III. BLOCK DIAGRAM MODULES

The System consists of several modules to achieve the tasks.

A. LPC 2129 ARM Microcontroller

The ARM7TDMI-S is a general purpose 32-bit microprocessor has very low power consumption and offers high performance. This processor architecture is based on RISC Instruction Set Computer (RISC) supports the real-time interrupt response from a small and cost-effective processor core. The pin configuration of LPC 2129 microcontroller is shown in Figure 2.

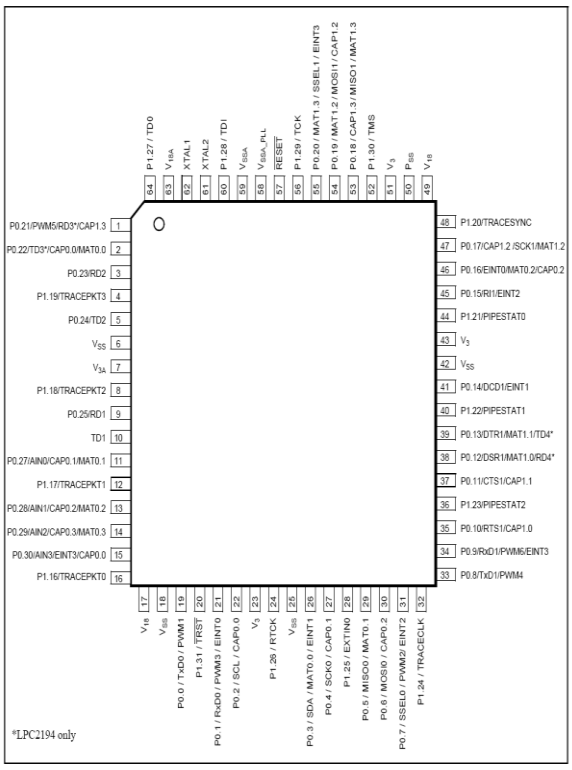

Figure 2: LPC2129 64-Pin Package

This system uses several pins in LPC 2129 ARM Micro-controller for enabling the external interrupts. Some of them are:

1) Pin Connect Block: It allows the individual pin configuration. The main purpose of the pin connect block is to configure the microcontroller pins to the desired functions. It allows selected pins of the microcontroller to have more than one function.

2) A/D Converter: It has 10-bit successive approximation analog to digital converter. Measurement range 0 to 3V and it input multiplexing among 4 pins.

3) GPIO: The main fetures of General Purpose I/O are to control the direction of individual bits. Mainly system model used GPIO to drive LCDs and to sense the digital inputs.

4) UART: A Universal Asynchronous Receiver/ Transmitter are one of the vital parts in computer hardware to translate the data between series/parallel forms. Now-a-days UART is commonly included in microcontrollers. The main purpose is to receive and transmit 16 byte of data.

B. Sensors

Sensor (or) Detector is one of the converter that measures a physical quantity and converts in to a signal which can be read by an observer or by an instrument. This system uses several types of sensors for different purposes.

1) Sensor for Counting: Counting the strength in an auditorium uses a normal two pin switch and here two switches are used one for sensing entry and another for exit for this purpose one pin of the switch is connected to the ground and the other is connected to the external interrupt pins of the microcontroller.

2) Temperature Sensor: This system used LM35 Precision Centigrade Temperature Sensors whose output voltage is linearly proportional to the centigrade temperature. This sensor is suitable for remote applications and offers low cost due to wafer level trimming and it operates in the range from 4 to 30v. The LM35 temperature sensor is shown in Figure 3.

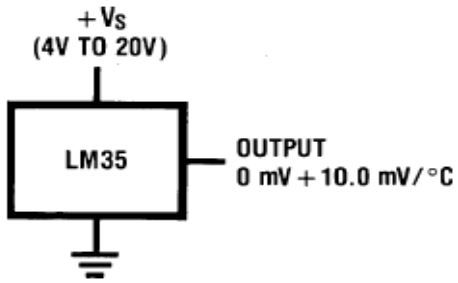

Figure 3: LM35 Temperature Sensor

3) Smoke Sensor: This system used GJ-312 Gas Module (MQ-2) in order to detect smoke inside the auditorium. This module can also help to detect liquified petroleum gas, Butane, Propane, Methane, Ethanol, Hydrogen etc. The smoke sensor pin diagram is shown in Figre 4.

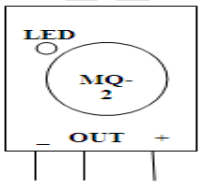

Figure 4: Smoke Sensor

C. LCD Display

The LCD is a reflective TN type liquid crystal module with a built-in controller/driver LSI and a display capacity of 16 characters. The block diagram of LCD is shown in Figure 5.

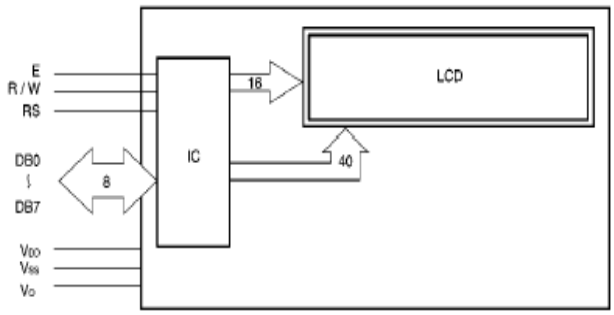

Figure 5: Block Diagram of LCD

In this system LCD uses to accomplish the conveying the message to a particular person. LCD provides high contrast with wide viewing angle and it supports 5X7 dot character matrix with cursor.

D. ULN 2003

It consists of seven darlingtons arrays each containing seven open collector darlington pairs with common emitters and it gives output current of 500mA and output voltage 50V. These versatile devices are useful for driving a wide range of loads including solenoids, relays. The Schematic Diagram of ULN 2003 is shown in Figure 6. [3]

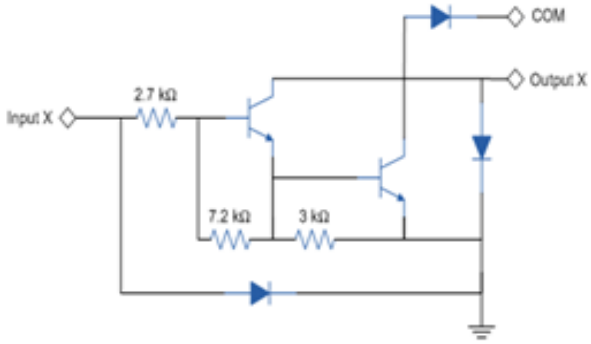

Figure 6: Schematic Diagram of ULN 2003

IV. HIEARCHICAL CODE

This system uses keil software for activate the microcontroller pins and the algorithmic flow of the system is as follows.

```
#include<lpc21xx.h>                    //Header Files
#include<serial.c>
#include<lcd.c>
#include<ADC.C>
#include<ADC.h>
……
//global variable declaration
Void delay ()                          //Function for providing delay
 {
  long int i;
  for (i=0; i<999999; i++);
  }
```

```
Void CONVERT_DISPLAY (unsigned char d)
                                    //Logic  for Entry (or) Exit
{
  Unsigned char dig1, dig2, dig3;
  Unsigned char temp;
  temp=d;
  temp=temp/10;
  dig1=d%10;
  dig2=temp%10;
  dig3=temp/10;
   dig3=dig3 | 0X30;
    PUTCHAR_0 (dig3);
 dig2=dig2 | 0X30;
 PUTCHAR_0 (dig2);
 dig1=dig1 | 0X30;
 PUTCHAR_0 (dig1);
}
     /***INTERRUPT SEGMENT***/
Void entry (void) __irq                          //For Entry
{
c++;
PUT_STRING_0("\n\rstrength inside the auditorium is:  ");
 delay ();
 CONVERT_DISPLAY(c);
 delay ();
  EXTINT = 0x00000001;        //Clearing the EXT INT0
VICVectAddr=0x40000000;       //  Remapping the Main
  }
……….
  // Void exit (void)_irq                                  //For Exit
……
 void message_display(void)  __irq   //For Message Display
{
    x=1;
   lcd_clear ();
  for (j=0;j<200;j++)
    {
       k[j]=0;
     }
```

```
        for(j=0;j<200;j++)
          {
          k[j]=GETCHAR_0();
           if(k[j]=='>')
      {
          temp=j;
         lcd_clear();
          break;
       }
    }
    m=U0LSR;                          //Clear serial Interrupt
    U0IIR|=0X01;
    VICVectAddr=0x40000000;           //Remapping to Main
    }
```

```
/*Function for converting the ADC output in to user understandable format and display*/
Void DISPLAY_ADC(unsigned char ADC_DATA)
{
 if (adc_data==0x4e||adc_data==0x4f)
PUT_STRING_0("20 C ");
else if (adc_data==0x50||adc_data==0x51)
PUT_STRING_0("21 C ");
……
……
else
PUT_STRING_0(" ABOVE 40 C " \n \r ON cooling system”);
/* Main Segment*/
……..
    Lcd_clear ();
    IOPIN0|=0x00040000;   //ON buzzer
    lcd_print("smoke detected");
    }
    }
    }        // end of main
```

V. SIMULATION RESULTS

After intefacing the LPC 2129 microcontroller with the personal computer using RS232 port .When ever Power supply given to the integration Kit Temperature sensor senses the room temperatute and display in our computer using Hyper terminal link then temperature will monitor continously as shown in Figure 7.

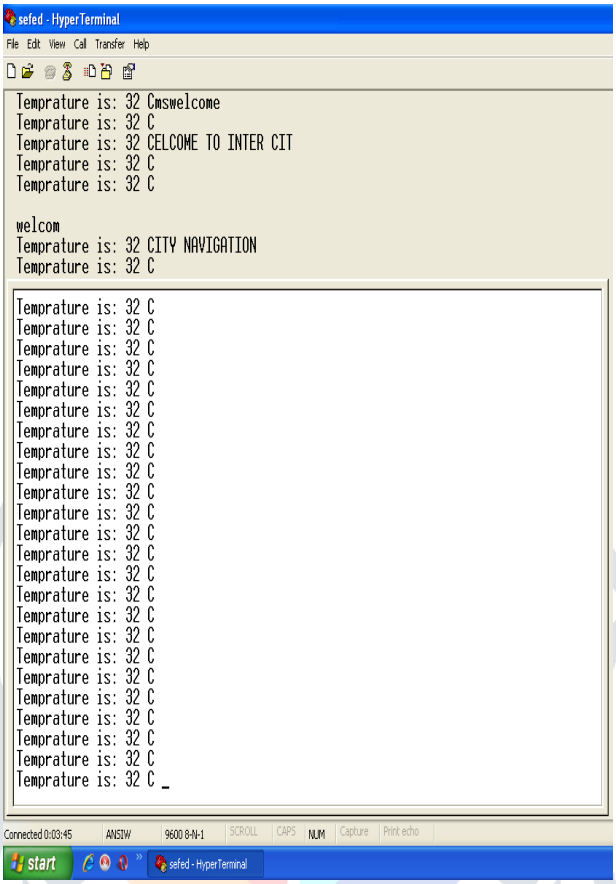

Figure 7: Temperature Monitoring

When a person entering the auditorium the count will incremented as shown in Figure 8.

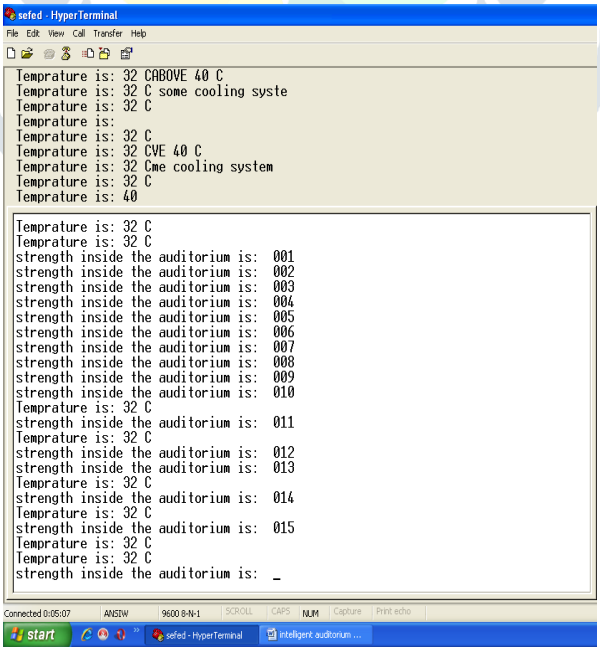

Figure 8: Count the entering persons in an auditorium

When ever a persons leaving the auditorium the count will decremented as shown in Figure 9.

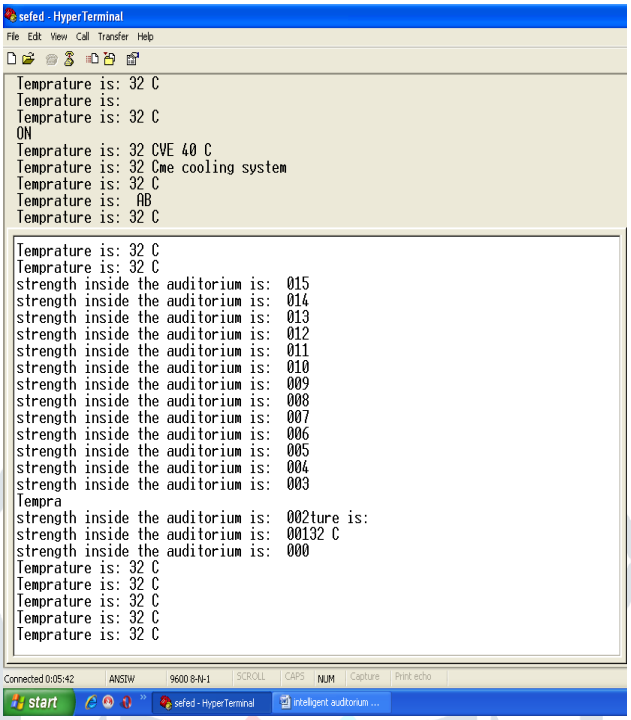

Figure 9: Count the persons leaving an auditorium

VI. CONCLUSION

Embedded system for Auditorium control has been designed. This system gives accurate and reliable information regarding the count the number of persons in an auditorium, Temperature Monitoring, Message Display and Smoke Detection.

The major problems encountered are the output of the sensor is very low so here using a few amplification stages and buffer stages. Secondly, the availability of some sensors (like smoke sensor GH-312) is uncommon. World Wide Web (The Internet) has helped us in acquiring these products and other details.

It is very close to real time system and can be implemented physically on an auditorium at an ease. The project can further be expanded by considering other parameters like Automatic Door Control, speaker control, and system control using remote.

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