Smart Sensor Based Indoor Accident Prevention Circuit for Specially Abled Persons

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Abstract:
In Indian with disabilities are 26,814,994, in male 14,988,593 and female 11,826,401. The disability prevalence ratio is 2.2%, Likewise in Tamil Nadu revealed that 6,97,478 persons are disabled in urban and 9,45,019 rural. In the districts of Nagapattinam 50,958, Thanjavur 59,468, Tiruvarur 37,371 and Cuddalore 64,426 are the values of the disables. In order to support the specially abled persons that the fire and gas detection sensors are designed, In the prior literature reveals separately both sensors are utilized, but in this present circuit PIC Microcontroller 16F877A will be used to control the fire and gas sensors. The voice control circuit is use to announces the nature of fire detection either by electrical short circuit or gas leakage and the GSM Modem is used to send SMS alert to the relatives of specially abled persons, nearest police station and fire service office. The buzzer in this circuit generates alarm, this will bring the attention of the neighbours and they ran to help the specially abled persons, so far that not only immediate help rendered but also a moral support rendered by the neighbours. In this way this circuit prevents the lives of disables when they are stay lonely in house.

Keywords: ARM Microcontroller, Fire Sensor, Gas Sensor, GSM Modem, PIC Microcontroller, Specially Abled Persons

I. INTRODUCTION:
A disability is a condition caused by an accident, trauma, genetics or disease which may limit a person’s mobility, hearing, vision, speech or mental function. Suddenly everything in their life was different. We can help to provide them unconditional love, support and patient. We can help them to make their lives easier and happier. A wheel-chair has been provided for their mobility. Hence the device “Fire Cum Gas Sensor Based Indoor Accident Prevention Device” is designed and fitted to the wheel chair by using the hardware’s voice sensor, GSM are to render support to the disable who is stay alone in house. Here for the safety in the wheel chair the Microcontroller unit PIC16F877Aisfixed to check the leakage of Gas and ignition of fire inside all rooms of the house and generate sound through voice board and alert the person of the house the fire will generated or Gas leakage arise then this critical condition the hardware send SMS alert of the family members of the disable persons preprogrammed in memory, This project is specially designed to support the disable person.

Prior Models Block Diagram

![Figure 1. Block diagram of prior works reviewed](image1.png)

Proposed Model

![Figure 2. Proposed model block diagram](image2.png)
Figure 3. IC of PIC

Figure 3. IC of PIC

PIC16F877A:
- PIC Peripheral Interface Controller
- 16-Series number
- F-Flash memory
- 877- Series number
- A- Analog Comparator

General Description
The microcontroller is a device that can perform a specific function according to the coding/program burnt into its program memory. The microcontrollers are special purpose devices used in many applications like automobile, medical, instrumentation, battery management, smart phones, accessories, motor and control drives, USB and wireless technology, etc., as shown in fig.3. One of the most reputed manufacturers of micro-controller is MICROCHIP PCB design. They have the vast series of micro-controllers from 8-bit, 16, 32-bit controllers both in SMD and through whole packages.

Product Description
This board is in fig. 5 built with PIC16F877A as a microcontroller unit. The input supply to the board can be fed from both ac and dc. It uses a crystal oscillator for generating frequency. A serial communication is achieved by an UART protocol. This board is specially designed for connecting digital and analog sensors which have input voltage range 5 or 12VDC as well as it can be interfaced with serial communication devices, relay boards etc. The output can be monitored in LCD as well as pc. Data EEPROM is used to store data defined by the user. PCB design. When a variable is defined it is stored in program memory and the value of the variable is stored in data EEPROM Synchronous serial ports are used to communicate with other peripheral devices like serial EEPROMS, A/D converters and shift registers. PCB design. They have two modes. 1- SPI Serial Peripheral Interface 2- I2C Inter Integrated Circuit

Applications
- Real time applications
- Academic applications

PIC Controller Features:
High-Performance RISC CPU:
- Only 35 single-word instructions to learn
- All single-cycle instructions except for program branches, which are two-cycle
- Operating speed: DC – 20 MHz clock input DC – 200 ns instruction cycle
- Up to 8K x 14 words of Flash Program Memory, Up to 368 x 8 bytes of Data Memory (RAM), Up to 256 x 8 bytes of EEPROM Data Memory
- Pin out compatible to other 28-pin or 40/44-pin
- PIC16CXXX and PIC16FXXX microcontrollers

PIC Assembled PCB
Peripheral Features:
- Timer0: 8-bit timer/counter with 8-bit prescale
- Timer1: 16-bit timer/counter with prescaler, can be incremented during Sleep via external crystal/clock
- Timer2: 8-bit timer/counter with 8-bit period register, prescaler and postscaler
- Two Capture, Compare, PWM modules
- Capture is 16-bit, max. resolution is 12.5 ns
- Compare is 16-bit, max. resolution is 200 ns
- PWM max. resolution is 10-bit
- Synchronous Serial Port (SSP) with SPI™ (Master mode) and I2C™ (Master/Slave)
- Universal Synchronous Asynchronous Receiver Transmitter (USART/SCI) with 9-bit address detection
- Parallel Slave Port (PSP) – 8 bits wide with external RD, WR and CS controls (40/44-pin only)
- Brown-out detection circuitry for Brown-out Reset (BOR)

Analog Features:
- 10-bit, up to 8-channel Analog-to-Digital Converter (A/D)
- Brown-out Reset (BOR)
- Analog Comparator module with:
  - Two analog comparators
  - Programmable on-chip voltage reference (VREF) module
  - Programmable input multiplexing from device inputs and internal voltage reference
- Comparator outputs are externally accessible

Special Microcontroller Features:
- 100,000 erase/write cycle Enhanced Flash program memory typical
- 1,000,000 erase/write cycle Data EEPROM memory typical
- Data EEPROM Retention > 40 years
- Self-reprogrammable under software control
- In-Circuit Serial Programming™ (ICSP™) via two pins
- Single-supply 5V In-Circuit Serial Programming
- Watchdog Timer (WDT) with its own on-chip RC oscillator for reliable operation
- Programmable code protection
- Power saving Sleep mode
- Selectable oscillator options, In-Circuit Debug (ICD) via two pins

CMOS Technology:
Low-power, high-speed Flash/EEPROM technology, Fully static design, Wide operating voltage range (2.0V to 5.5V, Commercial and Industrial temperature ranges, Low-power consumption

DEVICE OVERVIEW:
This document contains device specific information about the following devices: PIC16F873A, PIC16F874A PIC16F876A, PIC16F877A PIC16F873A/876A/877A devices are available only in 28-pin packages, while PIC16F874A/877A devices are available in 40-pin and 44-pin packages. All devices in the PIC16F87XA family share common architecture with the following differences:
• The PIC16F873A and PIC16F874A have one-half of the total on-chip memory of the PIC16F876A and PIC16F877A
• The 28-pin devices have three I/O ports, while the 40/44-pin devices have five
• The 28-pin devices have fourteen interrupts, while the 40/44-pin devices have fifteen
• The 28-pin devices have five A/D input channels, while the 40/44-pin devices have eight
• The Parallel Slave Port is implemented only on the 40/44-pin devices shown in fig.4

Pin Diagram:

Figure.4. Pin out diagram of PIC

Figure.5. PCB Board of PIC

Power Supply:
Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others given in fig. 6. A 230v, 50Hz Single phase AC power supply is given to a step down transformer to get 12v supply. This voltage is converted to DC voltage using a Bridge Rectifier. The converted pulsating DC voltage is filtered by a 2200uf capacitor and then given to 7805 voltage regulator to obtain constant 5v supply. This 5v supply is given to all the components in the circuit. A RC time constant circuit is added to discharge all the capacitors quickly. To ensure the power supply a LED is connected for indication purpose.

Figure.6. Power supply Unit

Rectifier
A rectifier is an electrical device that converts alternating current to direct current or at least to current with only positive value, a process known as rectification. Rectifiers are used as components of power supplies and as detectors of radio signals.

LCD (16×2):

Description:
LCD stands for liquid crystal display. They come in many sizes 8x1, 8x2, 10x2, 16x1, 16x2, 16x4, 20x2, 20x4, 24x2, 30x2, 32x2, 40x2 etc. Many multinational companies like Philips Hitachi Panasonic make their own special kind of LCD'S to be used in their products. All the LCD'S performs the same functions (display characters numbers special characters ASCII characters etc).Their programming is also same and they all have same 14 pins (0-13) or 16 pins (0 to 15). Alphanumeric displays are used in a wide range of applications, including palmtop computers, word processors, photocopiers, point of sale terminals, medical instruments, cellular phones, etc. The 16 x 2 intelligent alphanumeric dot matrix displays is capable of displaying 224 different characters and symbols shown in fig.7.

Figure.7. LCD module

Features:
Input voltage: 5v, E-blocks compatible, Low cost Compatible with most I/O ports in the E-Block range, Ease to develop programming code using Flow code icons.

Application:
- Monitoring

Description
The ULN2003 is a monolithic high voltage and high current Darlington transistor arrays. It consists of seven NPN darlington pairs that features high-voltage outputs with
common-cathode clamp diode for switching inductive loads. The collector-current rating of a single darlington ton pair is 500mA show the fig. 8

**USART**

The Universal Asynchronous Receiver/Transmitter (UART) is the key component of the serial communications subsystem of a processor. The UART takes bytes of data and transmits the individual bits in a sequential fashion. At the destination, a second UART re-assembles the bits into complete bytes. Serial transmission of digital information (bits) through a single wire or other medium is much more cost effective than parallel transmission through multiple wires. A UART is used to convert the transmitted information between its sequential and parallel form at each end of the link. Each UART contains a shift register which is the fundamental method of conversion between serial and parallel forms.

**MAX232**: The MAX232 is an integrated circuit show the fig. 9 that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits.

- The MAX232 is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals.
- The drivers provide RS-232 voltage level outputs (approx. ±7.5 V) from a single +5 V supply via on-chip charge pumps and external capacitors. This makes it useful for implementing RS-232 in devices that otherwise do not need any voltages outside the 0 V to +5 V range, as power supply design does not need to be made more complicated just for driving the RS-232 in this case.
- The receivers reduce RS-232 inputs (which may be as high as ±25 V), to standard 5 V TTL levels. These receivers have a typical threshold of 1.3 V, and a typical hysteresis of 0.5 V.

Later MAX232A is backwards compatible with the original MAX232 but may operate at higher baud rates and can use smaller external capacitors – 0.1 μF in place of the 1.0 μF capacitors used with the original device.

**GSM (Global System for Mobile)**

GSM (Global System for Mobile) / GPRS (General Packet Radio Service) TTL -Modem is SIM900 Quad-band GSM / GPRS device, works on frequencies 850 MHZ, 900 MHZ, 1800 MHZ and 1900 MHZ. It is very compact in size and easy to use as plug in GSM Modem. The Modem is designed with 3V3 and 5V DC TTL interfacing circuitry, which allows User to directly interface with 5V Microcontrollers (PIC, AVR, Arduino,8051, etc.) as well as 3V3 Microcontrollers (ARM, ARM Cortex XX, etc.). The baud rate can be configurable from 9600-115200 bps through AT (Attention) commands. This GSM/GPRS TTL Modem has internal TCP/IP stack to enable User to connect with internet through GPRS feature. It is suitable for SMS as well as DATA transfer application in mobile phone to mobile phone interface. The modem can be interfaced with a Microcontroller using USART (Universal Synchronous Asynchronous Receiver and Transmitter) feature (serial communication).

**Loudspeaker**

Sound can also be used as an output device to produce an alert noise or act as an alarm, and loudspeakers, buzzers, horns and sounders are all types of sound transducer that can be used for this purpose with the most commonly used audible type output sound actuator being the “Loudspeaker” show in the fig.10

**LM35 Temperature Sensor**

Fig.11 the LM35 temperature sensor is used to detect precise centigrade temperature. The output of this sensor changes describes the linearity. The o/p voltage of this IC sensor is
Applications of LM35 Temperature Sensor
The applications of LM35 temperature sensor include the following:
- Measuring temperature of a particular environment and HVAC applications
- Providing thermal shutdown for a component/circuit
- Checking battery temperature

Gas Sensor:
- Gas sensor measures the concentration of gas in its vicinity. Gas sensor interacts with a gas to measure its concentration. Each gas has a unique breakdown voltage i.e. the electric field at which it is ionized. Sensor identifies gases by measuring these voltages. The concentration of the gas can be determined by measuring the current discharge in the device.

MQ-6 Semiconductor Sensor for LPG:
- Gas sensor in Fig.12 Sensitive material of MQ-6 gas sensor is SnO2, which with lower conductivity in clean air. When the target combustible gas exist, the sensor’s conductivity is more higher along with the gas concentration rising, we use simple electronic circuit, Convert change of conductivity to correspond output signal of gas concentration.
- MQ-6 gas sensor has high sensitivity to Propane, Butane and LPG, also response to Natural gas. The sensor could be used to detect different combustible gas, especially Methane, it is with low cost and suitable for different application.

Flame detector:
A flame detector is a sensor designed to detect and respond to the presence of a flame or fire, allowing flame detection. Responses to a detected flame depend on the installation, but can include sounding an alarm, deactivating a fuel line (such as a propane or a natural gas line), and activating a fire suppression system. When used in applications such as industrial furnaces, their role is to provide confirmation that the furnace is properly lit; in these cases they take no direct action beyond notifying the operator or control system. A flame detector can often respond faster and more accurately than a smoke or heat detector due to the mechanisms it uses to detect the flame.

CIRCUIT DIAGRAM
Description:
When the hardware is switched On that time the set point checked by the Microcontroller for fire sensor flame or wavelength in 760 nm to 1100 nm range of light source and for gas MQ-6 can detect gas concentrations anywhere from 200 to 10000ppm the fire sensor is a digital sensor hence if fire detected it give output logic1 otherwise logic 0 but for gas it is analog sensor hence it out vary from 0 to 5v nature of ppm leakage of gas, the controller senses each room of the house through input but kitchen only gas if get leakage it alerts the neighbors by voice and on the exhaust fan run the DC motor to spray water and parrellely send SMS alert, ignite alarm of loud speaker to alert the neighbors they rushed to the house for help. Here we use additionally one temperature sensor LM 35 for checking temp. during fire intensity to pour more water into fire, Circuit diagram in fig.16.The circuit designed using MPLAB, run the program using Proteus software that dialog box shown in the fig.17,then we designed our hardware real time demonstrate it in fig.18 for operation its performance is well. The program developed by ourself given fig.19 this developed program embedded into the Microcontroller for our logic explained prior
secure them since the circuit heart is PIC Microcontroller unit which can easily control the Fire and Gas sensor output permanently fixed on rooms of the houses, the gas leakage sense by MQ6sensor and a flame detector unit check the flame if it get input through the controller it alert the disable and on the exhaust fan next voice board announces the nature of the fire and an SMS alert is send through GSM module to the preprogrammed mobile numbers of the relatives and police station to save the disable the speaker sound alert the neighbors to safeguard the disable. This is the importance of our circuit performance.

**Figure 17. Program for Fire and Gas sensor Activation:**

```c
#include<stdio.h>
#include<htc.h>
define _XTAL_FREQ 10E6
define lcd_data_port PORTD
define en RE0
define rw RE1
define rs RE2
define flame1 RB0
define flame2 RB1
define flame3 RB2
define relay1 RB4
define relay2 RB5
define play RC0
define c1 RC1
define c2 RC2
unsigned char x,y,z,a=0,b=0,c=0;
unsignedint e=0;
void delay(unsigned char k)
{
    inti,j;
    for(i=0;i<=k;i++)
    for(j=0;j<=1075;j++);
}
voidlcd_command(unsigned char command)
{
    lcd_data_port=command;
    rs=0;
    rw=0;
    en=1;
    delay(10);
    en=0;
}
voidlcd_ins()
{
    lcd_command(0x01);
    lcd_command(0x38);
    lcd_command(0x38);
    lcd_command(0x38);
    lcd_command(0x07);
    lcd_command(0x06);
    lcd_command(0x0C);
    lcd_command(0x80);
}
voidlcd_disp_string(unsigned char *s)
{
    while(*s)
    lcd_data(*s++);
}
voiduart_init(void)
{
    TXSTA=0X20;
    RCSTA=0X90;
}
```

**II. RESULT AND DISCUSSION:**

If an disabled (Mentally affected, Leg/hand impaired, Paralysis attacked) is staying in a house so they can easily affected by vulnerable Fire / Gas leakage, the designed device easily
SPBRG=15;
}
unsigned char getch(void)
{
    unsigned char temp;
    while(RCIF==0);
    temp=RCREG;
    return temp;
}
voidputch(unsigned char val)
{
    while(TXIF==0);
    TXREG=val;
    delay_ms(30);
}
voidgsm_init(void)
{
    printf("AT\r");
    delay_ms(1000);
    printf("AT+CMGF=1\r");
    delay_ms(1000);
}
void main()
{
    CMCON=0x07;
    CVRCON=0x00;
    TRISD=0x00;
    TRISE=0x00;
    TRISB=0x0F;
    PORTD=0X00;
    PORTE=0X00;
    TRISC = 0x1C;
    PORTC = 0X00;
    relay1=0;relay2=0;
    lcd_ins();
    uart_init();
    gsm_init();
    PCFG1=1;
    delay(100);
    lcd_command(0x80);
    lcd_disp_string("welcome");
    lcd_command(0x01);
    while(1)
    {
        ADCON0=0B10000001;
        delay(1000);
        GODONE=1;
        while(GODONE)
        continue;
        x=ADRESH;
        lcd_command(0x0C);
        lcd_data('G');
        lcd_data('="
        lcd_data((x/100)+0x30);
        lcd_data((x%100)/10)+0x30);
        lcd_data((x%10)+0x30);
        for(e=0;e<100000;e++);
        if (flame1== 1||flame2 ==1||flame3 == 1)
        {
            lcd_command(0x80);
            lcd_disp_string("Fire Alert");
            relay1 = 1;
            printf("AT+CMGS=\"");
            delay_ms(500);
            printf("Fire Alert\r");
            delay_ms(500);
            putch(26);
            c1=1; c2=0; play = 0;delay(30000); play=1;
            lcd_command(0x01);
        }
        else if(x>150)
        {
            lcd_command(0x80);
            lcd_disp_string("Gas Alert");
            relay2 = 1;
            printf("AT+CMGS=\"");
            delay_ms(500);
            printf("Gas Alert\r");
            delay_ms(500);
            putch(26);
            c1=0; c1=1; play = 1;delay(30000); play=0;
            lcd_command(0x01);
        }
        else
        {
            relay1=0;relay2=0;
            lcd_command(0x01);
        }
    }
}

III. REFERENCE


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