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Air pollution detection

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ABSTRACT

This project aims at detecting and alerting the user about the carbon di-oxide and the carbon monoxide levels in the surrounding. This is a programmed project so that the threshold levels can be changed according to the surroundings. For example: house, storage facility, chemical laboratory, etc.

Introduction

Ideally, if you have a combustion heater in tour home, there should be some means of monitoring the air quality. This is where the Air Pollution Detection comes in. This Air Quality Monitor measures both carbon dioxide and carbon monoxide levels in the air and displays the results on LCD display. If concentration of either of these gases rises above a preset level, a loud alarm will sound, which means that you should turn off the heater and open the room up to fresh air.

Background

Some gas heaters attempt to get around the problem of degradation of air quality by employing an oxygen depletion sensor. These extinguish the heater if the oxygen concentration in the room is reduced by 20%. While better than having no sensor at all.

Why? Because regardless of whether the oxygen depletion sensor, a pretty crude device, is working, the heater may still produce some carbon monoxide as well as the normal combustion products of carbon dioxide , water vapour, nitrogen oxides, sulphur dioxide and formaldehydes.

Block Diagram

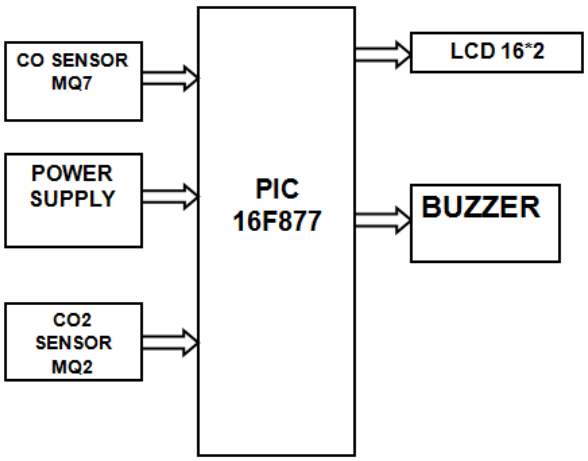

Figure 1: Block diagram

Block Diagram Description

- The CO2 sensor[MQ 2] produces potential difference when it comes in contact with CO2 gas.
- The CO sensor[MQ 7] gives the output in voltage. It can directly give input to microcontroller.
- The microcontroller converts the analog to digital signal and feeds it to the LCD display.

Power Supply

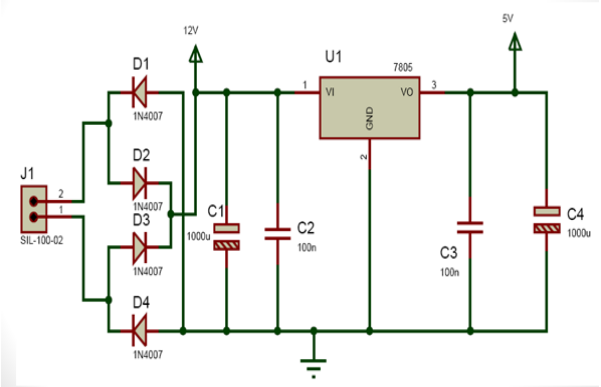

Figure 2: Power supply design

- Power for the circuit is derived from a DC Power supply of 0-15V,500mA.
- The bridge rectifier and capacitor i/p filter produce an unregulated DC voltage which is applied at the I/P of 7805.As the minimum dropout voltage is 2v for IC 7805, the voltage applied at the input terminal should be at least 7 volts .
- C1 (1000 µf / 65v)is the filter capacitor and C2 and C3 (100n f) is to be connected across the regulator to improve the transient response of the regulator.
- Assuming the drop out voltage to be 2 volts, the minimum DV voltage across the capacitor C1 should be equal to 5volts (at least).

Software Aspects

- The software we used for programming the PIC microcontroller is MPLAB IDE COMPILER.
- The program basically is written for obtaining the Values from the sensors through the ADC available in PIC and then compare with the pre defined levels to select the LCD display.

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•The program is written in C language because the higher languages are more effective to write longer programs and easier to debug.
•We used Proteus to simulate the design the PCB layout.

Hardware Aspects

Micro-Controller

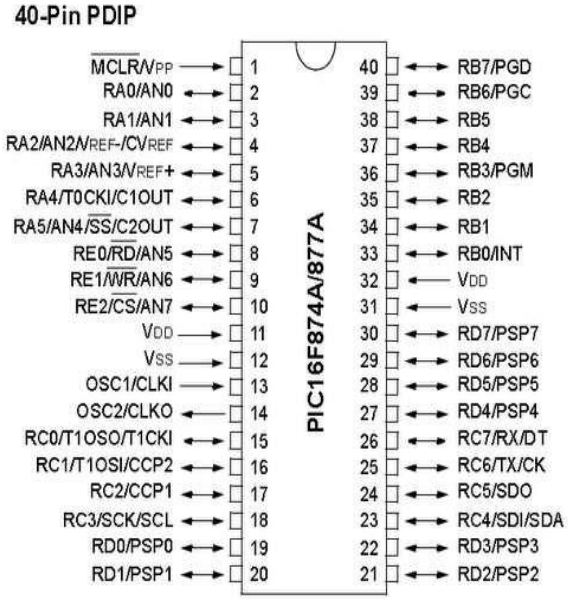

Figure 3: Pin Diagram of PIC 16F88

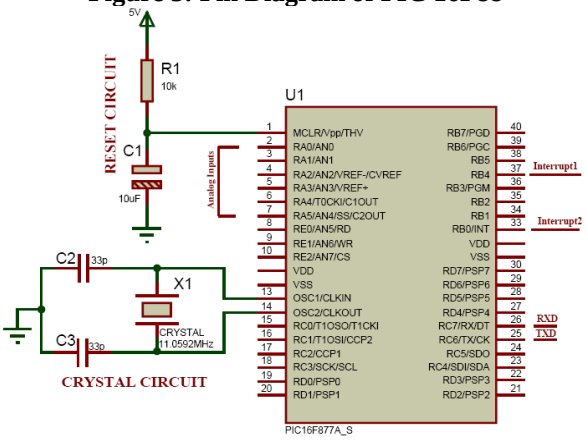

Figure 4: Minimum circuit for PIC 16F88

FEATURES OF PIC 16F88

•10 BIT INBUILT ADC 8 CHANNELS (AN0 – AN7)
•40 PIN I/O (A0-A5,B0-B7,D0-D7,C0-C7, E0-E2)
•RESET PIN NO. 1 (ACTIVE LOW)
•CRYSTAL PINS AT 13 -14 PIN
•1 SERIAL HALF DUPLEX PORT (RC7 (RX.) –RC6 (TX.))
•INTERRUPTS (RB0 (INT0)- RB1 (INT1))
•INBUILT I2C BUS (RC3 (SCL) – RC4(SDA))
•INBUILT SPI BUS (SS,SDI,SCK,CS)
•OPERATING VOLTAGE RANGE-2.0V TO 5.5V
•HIGH SINK/SOURCE CURRENT-25mA

Algorithm

- Start
- Initialize LCD
- Display "WELCOME"
- Is time == 2sec
- If no → wait
- If yes → Select Channel 1
- Read ADC
- Store & display CO2 on LCD
- If reading > 650 start buzzer
- Select Channel 2
- Read ADC
- Store & display CO on LCD
- If reading > 600 start buzzer
- Repeat the process until desired
- STOP

Flow Chart

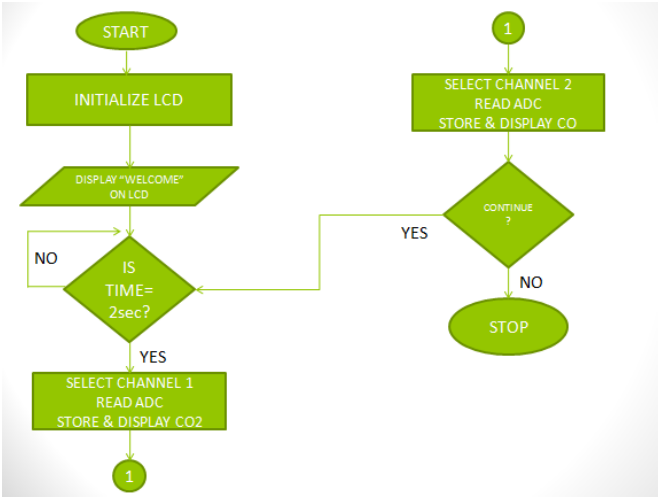

Figure 5: Flowchart

Logic Levels

For CO2 gas:
- LEVEL: 11 if <350
- LEVEL: 21 if >350
- LEVEL: 31 if >550
- LEVEL: 41 if >600

For CO gas:
- LEVEL: 11 if <250
- LEVEL: 12 if >250
- LEVEL: 13 if >500
- LEVEL: 14 if >650

Circuit Diagram

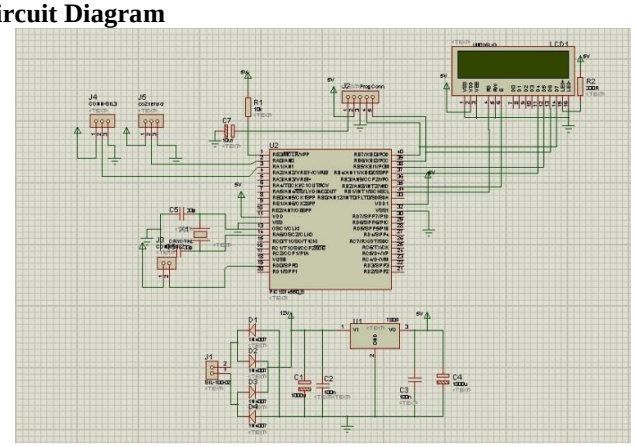

Figure 6: Circiut diagram

Application

• CO2 has a concentration of about 0.03% in fresh air and is not dangerous at such low levels. However, higher concentration results in accelerated breathing, and an increase in heart rate, and can lead to headaches and dizziness.
• Poor combustion can result in production of the oxygen – starved carbon monoxide (CO) gas. Carbon monoxide is extremely dangerous because it has a 200-times greater affinity for haemoglobin than oxygen.
• To avoid all such problems we go for AIR POLLUTION DETECTION. Ideally if you have a combustion heater in your home, there should be some means of monitoring the air quality.
•Air Quality Monitor measures both CO2 and CO levels, and displays the results on LCD displays. If the concentration of

either of gases rises above a preset level ,a loud alarm will sound, which means that you should turn off the heater and open the room up to fresh air.

Future Scope

• In today's rapid developing world where we encounter problems like green house effect, ozone layer depletion and hence we are exposed to ultra-violet radiation. These problems (air, land, water pollution) will affect a lot in the future, hence such detection and monitoring techniques for quality measurement of the climatic conditions and environment will be beneficial. Other than such natural reasons, emission of CO, CO2 and many other harmful gases exhausts from various vehicles, air-conditioning systems, generators and so on.

• So, one of the methods to curb this issue is to detect and monitor CO, CO2 emission. Hence to monitor the quality of air we can easily use the air pollution detector.

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