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Design of smoke detection using Microcontroller

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Abstract:
Approximation methods exist to provide estimates of smoke detector response based on optical density, temperature rise, and gas velocity thresholds. The objective of this study was to assess the uncertainty associated with these estimation methods. Experimental data was used to evaluate recommended alarm thresholds and to quantify the associated error. With few exceptions, less than 50 percent of the predicted alarm times occurred within ± 60 seconds of the experimental alarms. At best, errors of 20 to 60 percent (in under-prediction) occurred for smouldering fires using an optical density threshold. For flaming fires, errors in predicted alarm times on the order of 100 to 1000 percent in over-prediction of the experimental alarms were common. Overall, none of the approximation methods distinguished themselves as vastly superior. Great care must be exercised when applying these approximation methods to ensure that the uncertainty in the predicted alarm times is appropriately considered.

Keywords: microcontroller, sensor, registers, capacitors, transformer, buzzer driver, LED.

I. INTRODUCTION

A **smoke detector** is a device that senses smoke, typically as an indicator of fire. Commercial and residential security devices issue a signal to a fire alarm control panel as part of a fire alarm system, while household detectors, known as **smoke alarms**, generally issue a local audible or visual alarm from the detector itself.

Smoke detectors are typically housed in a disk-shaped plastic enclosure about 150 millimetres (6 in) in diameter and 25 millimetres (1 in) thick, but the shape can vary by manufacturer or product line.

Most smoke detectors work either by optical detection (photoelectric) or by physical process (ionization), while others use both detection methods to increase sensitivity to smoke. Sensitive alarms can be used to detect, and thus deter, smoking in areas where it is banned.

Smoke detectors in large commercial, industrial, and residential buildings are usually powered by a central fire alarm system, which is powered by the building power with a battery backup.

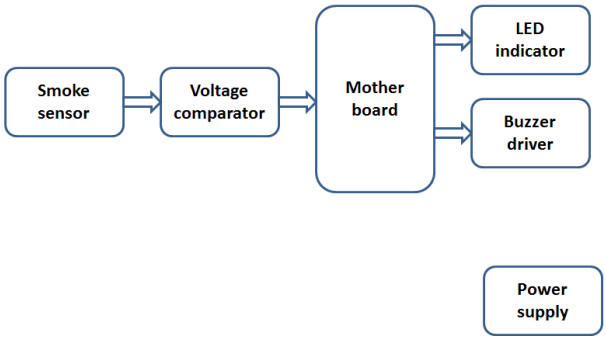
However, in many single-family detached and smaller multiple family housings, a smoke alarm is often powered only by a single disposable battery.

Design principle:

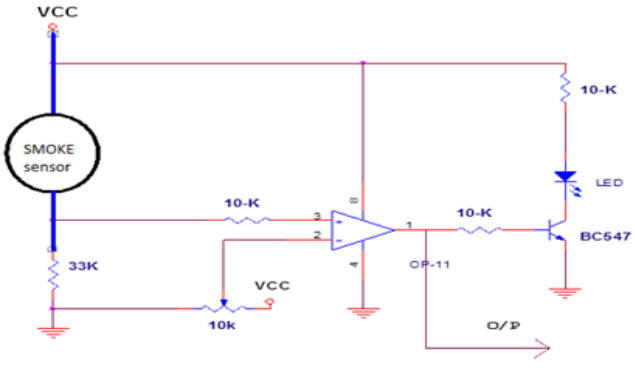
In the present scenario technological environment the embedded system is getting first choice for designer for its flexibility and miniature size. This telecom interfaced security system is very much useful product for remote surveillance and one can monitor the office, home, industrial premise etc from the remote place.

The micro controller based system monitors the condition of the system and on receiving the fault the controller activate a buzzer for information and monitor it in a LED.

Microcontroller based smoke detection



MICROCONTROLLER:



Smoke detection circuit

Smoke detection using mq-7 sensor: The analog gas sensor - MQ2 is used in gas leakage detecting equipment in consumer

and industry markets, this sensor is suitable for detecting LPG, i-butane, propane, methane ,alcohol, Hydrogen, smoke. It has a high sensitivity and fast response time. And the sensitivity can be adjusted by the potentiometer

Power supply

In this project the power supply required is very much precession and also requires different level of power supply. Basically the power supply used for the transmitter and receiver is arranged from a battery. Along with the battery the power supply requirement are +12 Volt and +5Volt.

description

The power supply designed for catering a fixed demand connected in this project. The basic requirement for designing a power supply is as follows,

1. The different voltage levels required for operating the devices. Here +5Volt required for operating microcontroller. And +12Volt required for drivers etc.

2.The current requirement of each device or load must be added to estimate the final capacity of the power supply.

The power supply always specified with one or multiple voltage outputs along with a current capacity. As it is estimate the requirement of power is approximately as follows,

Out Put Voltage = +5Volt, +12Volt

Capacity = 1000mA

The power supply is basically consisting of three sections as follows,

1. Step down section
2. Rectifier Section
3. Regulator section

Design principle:

There are two methods for designing power supply, the average value method and peak value method. In case of small power supply peak value method is quit economical, for a particular value of DC output the input AC requirement is appreciably less. In this method the Dc output is approximately equal to V_m. The rectifier output is approximately charged to Vcc due to charging of the capacitor. The capacitance provides the backup during the discharge period. So, the value of the capacitor is calculated

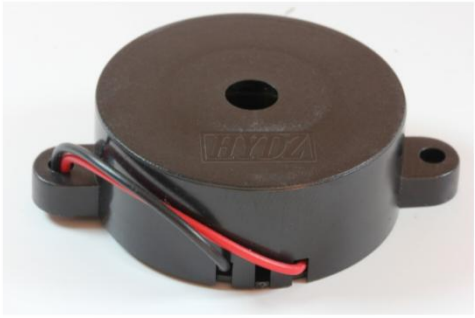
Circuit connection: - In this we are using Transformer (0-12) vac, 1Amp, IC 7805 & 7812, diodes IN 4007,LED& resistors. Here 230V, 50 Hz ac signal is given as input to the primary of the transformer and the secondary of the transformer is given to the bridge rectification diode. The o/p of the diode is given as i/p to the IC regulator (7805 &7812) through capacitor (1000mf/35v). The o/p of the IC regulator is given to the LED through resistors.

Circuit Explanations:- When ac signal is given to the primary of the transformer, due to the magnetic effect of the coil magnetic flux is induced in the coil(primary) and transfer to the secondary coil of the transformer due to the transformer action." Transformer is an electromechanical static device which transformer electrical energy from one coil to another without changing its frequency". Here the diodes are connected in a bridge fashion. The secondary coil of the transformer is given to the bridge circuit for rectification purposes. During the +ve cycle of the ac signal the diodes D2 & D4 conduct due to the forward bias of the diodes and diodes D1 & D3 does not conduct due to the reversed bias of the diodes. Similarly during the –ve cycle of the ac signal the diodes D1 & D3 conduct due to the forward bias of the diodes and the diodes D2 & D4 does not conduct due to reversed bias of the diodes. The output of the bridge rectifier is not a power dc along with rippled ac is also present. To overcome this effect, a capacitor is connected to the o/p of the diodes (D2 & D3). Which removes the unwanted ac signal and thus a pure dc is obtained. Here we need a fixed voltage, that's for we are using IC regulators (7805 & 7812)."Voltage regulation is a circuit that supplies a constant voltage regardless of changes in load current." This IC's are designed as fixed voltage regulators and with adequate heat sinking can deliver output current in excess of 1A. The o/p of the bridge rectifier is given as input to the IC regulator through capacitor with respect to GND and thus a fixed o/p is obtained. The o/p of the IC regulator (7805 & 7812) is given to the LED for indication purpose through resistor. Due to the forward bias of the LED, the LED glows ON state, and the o/p are obtained from the pin no-3.

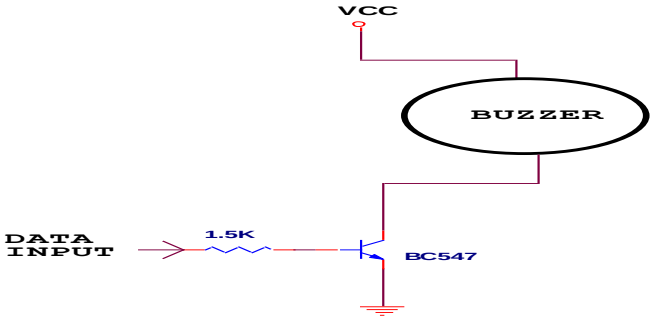
II. BUZZER DRIVER

This section interfaces one audible piezo electric buzzer with the controller. The controller activates the buzzer whenever there is any fault appears in any of the channel.

Piezoelectric Buzzer



BUZZER DRIVER



III. CONCLUSION:

This project is designed and tested in the laboratory condition and found to be working satisfactorily. The response time for any fault in this design is approximately 1 sec. The system tolerance is well below the limits of experimental errors.

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