Automatic Smoke Detector and Fire Alarm System

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Abstract:

6 million fire accidents occur in India every year with 27,000 deaths in India alone. Modern buildings must have smoke detectors to alert occupants to the presence of a fire. We suggest creating a smoke detector system based on the 8051 microcontrollers in this project. One MQ2 sensor is used to detect the presence of smoke. LCD display is used to show the level of smoke present in the environment. And a LED and a buzzer is used to alert the nearby people when smoke exceed the certain level.

Keywords: 8051 Microcontroller, MQ2 Sensor, Buzzer, Technology, LCD 16x2,

Introduction:

In a year around 1.6 million fire accidents occur with a cost of 27000 lives in India alone. This number become very huge if we consider the fire accidents around the globe. Lack of comprehension, poor design of buildings, and insufficient supplies all add to the various fire threats and events that can occur in both residential and commercial environments. Fire entails the loss of life and property even though it continues to be one of the most avoidable accidents. Regardless of a promising reduction of fire-related deaths and injuries, the significantly higher proportion of deaths when compared to injuries is worrying. This could be an indication of the severity & traits of the fire accidents contributing to higher fatal outcomes.

Modern buildings must have smoke detectors because they can alert occupants to the presence of a fire and possibly save lives. We suggest creating a smoke detector system based on the 8051 microcontrollers in this project. Due to its simplicity, low power consumption, and adaptability, the 8051 microcontroller is a popular option for many embedded systems.

A smoke sensor module will be utilised by our suggested smoke detector system to find smoke in the surrounding area. The 8051 microcontrollers, which will oversee processing the sensor output and raising an alert in the event of smoke detection, will be interfaced with the smoke sensor module. In addition, the system will have a keypad for user input and an LCD display to provide visual feedback.

Designing and implementing a smoke detector system that is dependable, accurate, and affordable is the primary objective of this project. The technology will be designed to work in a variety of settings, including office and residential buildings. The project will use a variety of hardware and software components, including the LCD display, keyboard, smoke sensor module, and 8051 microprocessors.

Overall, this project can make a substantial contribution to the field of fire prevention by creating a reliable, effective, and affordable smoke detector system.

The study could have a substantial impact on the design of future fire alarm systems and will offer useful insights into the usage of microcontroller-based gadgets for smoke detection.

In this project, a smoke sensor will be employed to build a prototype fire detection device. The display screen is going to display the message "smoke detection" if the emission sensor detects up smoke.

Project Methodology:

A. System Requirements:

1. Our project's design must be able to meet the following functional requirements based on the system's requirements:
2. The device can detect smoke using MQ2 sensors.
3. The sensor can transmit data of the smoke detection to the microcontroller 8051.
4. The data is sent in the digital form to the controller.
5. 8051 can process the data sent by the MQ2 sensor.
6. 8051 can send the commands to the LCD display to tell whether the smoke is detected or not.

The 8051 family microprocessor AT89C52 gets used in the hardware. The AT89C52 includes 256 bytes of RAM and 8KB of Flash programmable and erasable read-only memory (PEROM). It contains 1000 Write/Erase cycles, which corresponds to a maximum of 1000 programming and erasing cycles.

A sensor from the MQ sensor series is the MQ2 smoke sensor. A MOS (Metal Oxide Semiconductor) sensor indicates what it is. When exposed to gases, the sensing material's resistance evolves which is the basis for the device's sensing. The MQ2 gas sensor uses approximately 800mW and runs at 5V DC. It has a 200–10,000 ppm detecting range for LPG, smoke, alcohol, propane, hydrogen, methane, and carbon monoxide. Multiple gases have been identified but they cannot be identified.

LCD LM016L is used to display the message whether smoke is detected or not. It is 16x2 LCD which operates at 4.7V-5.3V.

Flowchart:

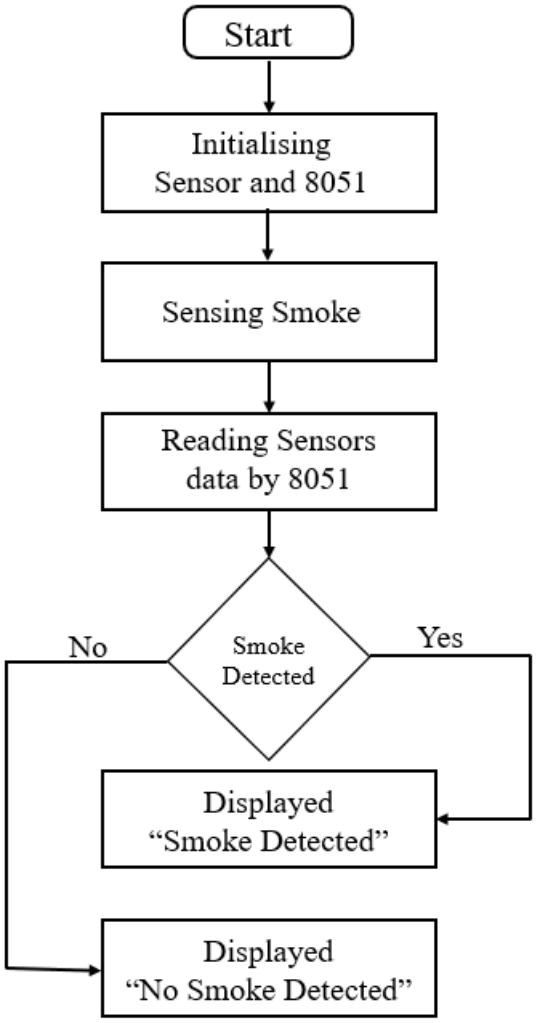

Fig. 1 Flowchart

The following is an explanation of Fig. 1:

1. At the start of the device power on the power supply.
2. Sensor will detect whether the smoke is present or not, it will gather data and send it to the microcontroller.
3. Microcontroller will read the data of sensor.
4. If smoke is detected then proper message will be displayed.

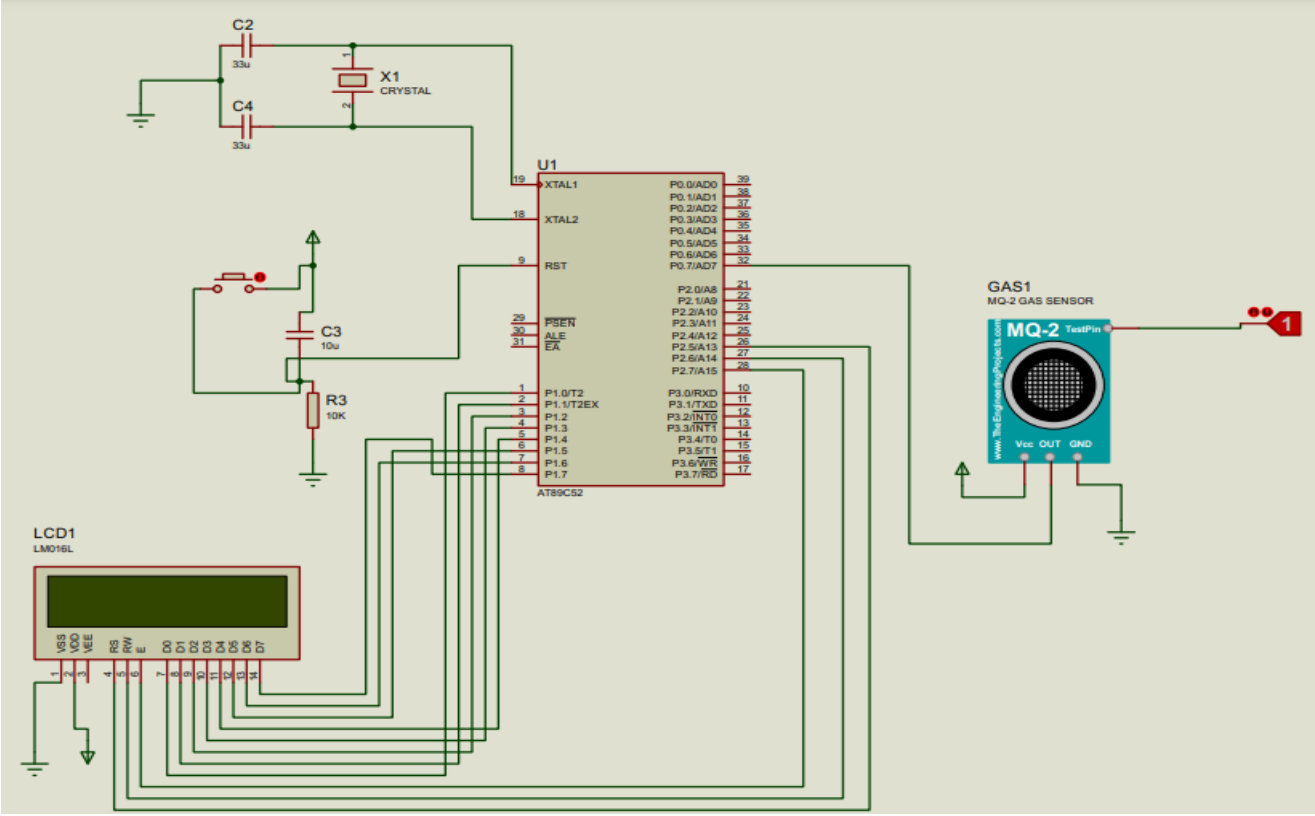

Fig. 2 Schematic diagram of Smoke Detector

Schematic and Prototype

Fig. 2 shows a schematic diagram. The Pin configuration for AT89C52 is as follows:

1. Pin 32 of the microprocessor is hooked up to the MQ2 sensor Dout.

2. A digital signal that is produced by the MQ2 sensor.

3. The Rs, Rw, and E pins of the LCD display are linked to pins 26, 27, and 28.

4. The D0-D7 pins of the display are linked to pins 1 through 8.

5. The switch's 9th pin is linked for reset purposes.

6. The crystal is connected to pins 18 and 19.

The sensor may function under two circumstances:

1. Smoke is considered to have been identified once the reading from the sensor is HIGH.

2. The occurrence of smoke is thought to exist when the smoke sensor response is LOW.

Literature Survey

Dr.M.Karthikeyan et al "Automatic Smoke Detector and Fire Alarm "

> Now-a-days fire disaster is one of the great threats to humans. Real-time monitoring, alarming, and surveillance are all offered by automatic fire alarm devices. After a fire is identified, it sends an alarm and decreases the damage. The author proposed a design to detect the smoke as well as heat and to activate the speaker by using LDR. In this study PIC microcontroller is used. This design is a combination of electronic devices working together to detect the fire and then quickly alert people after detection. These alarms get activated when smoke detectors detect smoke after the fire happens Following this, a motor to pump the water to spray on fire is triggered via actuating a relay. The automatic fire detection system successfully satisfies the design requirements, according to test results for the proposed solution. The simulation in this paper has been carried out employing the proteus simulation software, and the programming was performed in C [1].

Marco Antonio A. Galo et al "A Review on Microcontroller based LPG Gas Leakage Detector "

The authors of this project developed an LPG gas detector which utilises a stepper motor in addition to the standard LPG gas leakage detectors. This helps in turning off the switch when no one is in risk because the standard LPG gas leakage detector only detects gas leakage and sends an SMS to the provided emergency number, alerting the user. The sensor used in this investigation has a quick response time and good sensitivity. In addition to LPG gas, the sensor also grabs up tobacco products, propane, LNG, and butane. A background or logic of the 8051 microcontroller and mobile communication, their interface, and the AT commands set utilised in communication are additionally addressed in the studies [2]

Vasudev Yadav et al "Fire Early Warning System Using Fire Sensors, Microcontroller, and SMS Gateway"

A fire early detection system has been developed in this research investigation applying an ATmega8 microcontroller, smoke, heat, and gas sensors. When gas is detected, an SMS is sent and an alarm sounded to alert users

In order to prevent fire catastrophes, this technology is utilised to provide information on early fire detection. This technique can help decrease the probability of a fire. To reduce the risk of fire, this method is typically utilised in houses. In order to acquire the desired response from the employed sensors, numerous experiments were carried out. This study examined SMS message reactions to fire detection, temperature testing, gas testing, smoke testing, and temperature testing. Using SMS and alarm, this study creates a fire early warning system [3].

Ardi Setiyansah et Al "GAS LEAKAGE DETECTION SYSTEM USING 8051 MICROCONTROLLERS"

The system proposed in this study can detect LPG leaks and alert users via SMS, buzzer sound, and LED blinking. Along with an 8051 microprocessor, the system also includes the MQ6 gas sensor, GSM module, exhaust fan, buzzer and LED pins. The technology is affordable and provides a high level of precision. The paper presents a model for gas leak detection and a transport system to identify and stop gas leaks in areas of greatest risk. The system utilises a gas sensor to identify LPG leaks,

and a GSM module can be utilised to give a client an SMS concern. A message is sent to the supervisor through GSM module when the system detects any LPG leaks; an alert is generated and shown on the LCD, buzzer, & relay. A gas leakage identifying kit was set up in areas at risk with the goal to avoid gas leaks [4].

"A Smart Real Time Fire and Smoke Detection System"

The authors of this study have simply created a system to identify fire and smoke at an early stage and send a push notification to the closest fire station. The notification includes the location information and a warning about fire or smoke. When a fire starts, the fire sensor detects it from the very beginning. The smoke sensor detects smoke in the air and alerts users that there is a potential for fire, which enables firefighters to put out the fire before it spreads and causes more damage. This processor is reasonably priced and includes built-in Wi-Fi [5].

"Notifire: A Microcontroller (Arduino) Operated Device for Early Fire Detection and Risk Reduction"

Authors of this research have simply designed a system to detect temperature, gas and flame, which are possible signs of a fire. The tool consists of the circuit containing an Arduino module, GSM module for message sending, sensors, buzzer and LEDs, and an acrylic casing to residence the circuit The tool also has correctly sent textual content message to precise cell phone wide variety indicating the situations the device has detected along with excessive temperature and gas leak [6].

"Design of Microcontroller Based Fire Detector with Output Warning SMS Information and Automatic Extinguisher"

In this research paper a fire detection device is designed with information output of an SMS gateway and automatic extinguishing. The tool is designed for early detection of fire symptoms by using several censors such as, MQ-2 smoke censor, fire censor, DS18b20 temperature sensor with the Arduino Uno microcontroller as a data processor. By the censor sensing, if two of the three censors detect early signs of fire, it will activate an alarm in the form of a siren and SMS will be sent to the contact which has been set as information and it will turn on the pump to spray water into the area where the fire is happening so it does not enlarge [7]

"Automatic Smoke Detector and Fire Alarm System"

This proposed work was designed to monitor smoke and heat and activate a speaker by using a light dependent resistor (LDR) based on PIC microcontroller. It consisted of a combination of electrical equipment to detect the presence of fire and alert people through audio or visual medium. The simulation work was done with PROTEUS software and the coding was done with C programming. This work has proved that the smoke detector fire alarm technology is better suited than ionization technology [8].

"FOREST FIRE DETECTION SYSTEM USING IOT"

The research presented here proposes an approach to detect forest fires this, after evaluating pictures of the fire taken by a drone, sends the necessary assistance for

putting these down. The Sobel edge algorithm is used to process the drone photos in the Django application. Because it is rapid, reliable, and accurate, it enables the forest officials to learn as soon as possible about the fires. The system's speed is its most important feature because it will enable forest officials to learn about fires as soon as possible, assisting to stop fires from spreading across a vast area. Furthermore, it facilitates real-time disaster information sharing, cutting the loss of human resources and animal habitat. However, it has drawbacks like failing to send pictures right to the Django Web app for processing and lack of an onboard computer for aircraft to develop AI [9].

Neelam kumari et Al "Design of smoke detection using Microcontroller "

On the foundation of optical density, temperature rise, and gas velocity thresholds, approximation methods can be utilised to provide estimates of smoke detector response. The objective of this investigation was to gauge the level of uncertainty underlying distinct calculating techniques. To evaluate the proposed alerting thresholds and estimate the appropriate error, experimental data were employed. Very rarely did the predicted alarm times tumble within 60 seconds of the experimental alarms, with less than 50% of them occurring altogether. When using an optical density threshold, errors of 20 to 60 percent (in under-prediction) was at their highest for smouldering fires. For flaming fires, overprediction of the experimental alarms alongside errors in predicted alarm times on the order of 100 to 1000 percent was common. In general, no approximation approach stood out. unquestionably superior to others. When with these approximation methods extreme caution must be collected to ensure that the uncertainty in the predicted alarm times is accurately taken into account [10].

M. Pavan Kumar et al "SMOKE DETECTOR ALARM"

The study uses an Arduino Uno and MQ2 smoke sensor to generate a smoke detector on guard. A smoke detector in the proposed system activates its alarm once it senses smoke and sends a low voltage signal to every other smoke detector nearby. The other smoke detectors produce a tone to inform bystanders that one of the detectors has picked up smoke when this low voltage signal activates their unique relays. This system does not require a base as the transmitter and receiver are built into one device. All the electronics needed to send and receive signals are contained within each smoke detector [11].

Yang Wang et Al "Design of Smoke Alarm Disperser Based on Single-chip"

The subject of this paper is based on the way a smoke dispenser operates. In order create a smoke alarm, the necessary procedures in this article are measuring the smoke sensor's sensitivity to the level of smoke in the air and the sensor's linear change, which converts an analogue signal into a digital signal. The motor speed can be changed by building the fan in a way it adapts to fluctuations in smoke density. Furthermore, the alarm module has a capacity to automatically silence the alarm when the smoke concentration decreases whereas concurrently speaking an alarm when it is certain[12].

Dr. Aziz et Al "GSM Based SMS Alert Fire Alarm System"

Throughout this paper, the work on the GSM-based Fire Alert System is presented. The primary goal of what is done for home security is to prevent accidental fires that might harm those who live and the

belongings inside the dwelling. distinct alarm systems, such as detectors that detect smoke and temperatures sensor-based infrastructure, were created in order to prevent losses gave on by fire accidents. developing and use of a reliable, inexpensive, and GSM-based SMS Alert fire alarm system. The gadget will be able to send SMS alerts to a built-in Cellular number the monitor the environment's temperature the smoke level. The system will rapidly display an alert alerting on the LCD should it detects an internal temperature of 100C or greater [13].

Rilwanu Bello et Al "Design Analysis and Implementation of Automatic Fire Extinguishing System Using ATmega16 Microcontroller as Control"

The fire suppression device using the ATmega16 microcontroller is addressed in this paper. Two sensors, a microcontroller, a buzzer, and an pump/sprinkler make up the system. The outside temperature sensor utilises an embedded chip termed an LM35, and the smoke sensor corresponds to an MQ-2 gas sensor. An input/output port across the mcontroller is employed to connect all the sensors. The programming language C was employed for developing the system's controlling software. The popular high performance, low power 8-bit microcontroller from the renowned 8-bit AVR series microprocessor with excellent performance and little power has been used. At the very least, the entire system had been put to the test by including fire characteristics (smoke and temperature) close to the odour and heat sensors, respectively. When the parameters in the detectors increase above the predetermined level, an alarm goes off, a light indicator, and a pump/sprinkler are turned on. It was carried out to compare the system's recorded temp to the reference temp [14].

Santhiya et Al "Smart Forest Fire Identification and Notification System Using Iot"

The research presented here discusses an IoT-based system that will aid in identifying forest fires. The recommendation is to set up an Internet of Things platform that can recognise fires as quickly as feasible before they've spread throughout an expansive region and prevent poaching. The temperature sensor, a smoke sensor, a webcam, and a buzzer all have been interfaced with a raspberry. This project utilises the capabilities of a GSM connection to deliver the final SMS to the consumer via the number entered in the simulator programme. the flame sensor utilised to show the degree of the blazes, the temperature sensors used to show the difference between high and low temperatures, the PIR sensor intended to detect human movement on the display's LCD screen, and the forest fire sensor visible on the LCD display. Once the picture is big enough, its processing is used to find out how precise the fire rate is. Our system of control uses a system of wireless sensors (WSN) for processing information and input. By identifying the level and sending the location of the forest fire to the server using GSM communications contact and GPS functionality [15]

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