

Study and Comparison of GSM Based Smoke Detection and Temperature Monitoring System using Microcontroller AT89S52 and Arduino

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Abstract—In our daily life as security and automation is the prime concern, so the approach to home and industrial automation and security system design is almost standardized nowadays. In this paper, an advanced smoke detection and temperature monitoring system is designed to detect fire or its manifestations such as smoke, light, heat etc. These monitoring systems are basically based on Microcontroller AT89S52 or Arduino. Smoke sensors, heat sensors, proximity sensors and gas sensors are used as common components for both the devices.

In this paper, we have tried to understand the differences and similarities of both the systems side by side and which one of them is better in comparison at working fields. This paper will help us to choose the best monitoring system between Microcontroller AT89S52 and Arduino.

Index Terms— Microcontroller AT89S52, Arduino, Gsm, Smoke detector, Temperature monitoring system.

1 INTRODUCTION

A typical fire alarm control system shall be capable of detecting fire and transmitting it to central monitoring station. Fire points (detectors or sensors) communicate with fire alarm control unit. As part of compliance in case of any fire related event information need to be communicated to monitoring station for just in time response.

The Microcontroller AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pinout, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications.

Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. Arduino is common term for a software company, project, and user community that designs and manufactures computer open-source hardware, open-source software, and microcontroller-based kits for building digital devices and interactive objects that can sense and control physical devices. The Arduino software is free, the hardware boards are pretty cheap, and both the Software and hardware are easy to learn has led to a large community of users.

2 METHODOLOGY

2.1 MICROCONTROLLER

AT89S52 microcontroller is the main controlling device which controls and synchronises all Operations by receiving the signals from the sensors such as smoke sensor, LM35 (temperature sensor). The temperature is detected by the temperature sensor and smoke sensor senses the smoke. A LCD display is used to display the high temperature which is obtained from the signal conditioning unit. By using signals from the AT89S52 microcontroller, a GSM modem is used to send the appropriate alert message to the fire station as well as to the persons responsible for the fire safety of the premises

2.2 INPUT

The input section is having sensors, switches. Switch is connected to the reset pin of microcontroller to reset the circuit. Sensors are temperature sensor, smoke sensor, humidity sensor etc. In this, sensors are used as input section i.e., temperature sensor (LM35), Smoke Sensors (MQ2). Smoke sensors senses the smoke and the temperature sensors detects the temperature or fire.

2.3 PROCESSING UNIT:

The information is fed to the microcontroller, here microcontroller is processing the data and convey the process data to the output devices.

2.4 OUTPUT

Coming to the output section, it is having LCD, LED's, buzzers and GSM. LCD is used to display the high temperature. A simple buzzer is an audio signalling device used to alert the people in the vicinity. It produces sound when temperature is high. A status indicator LED indicates the state of the system. If LED glows red, it indicates occurrence of fire and if it glows green there is no fire. GSM is used to send the appropriate alert message to the fire station as well as to the persons responsible for the fire safety of the premises.

2.5 POWER SUPPLY

The power supply circuit consists of two regulators LM7805 and LM7812. LM7812 produces 12V supply which is for GSM modem because GSM 2.5 interfacing circuit requires 12V to activate. LM7805 produces 5V supply to the microcontroller AT89S52 and other remaining components.

2.6 LCD INTERFACING

To interface with microcontroller, LCD requires 5V supply to activate. The ports of microcontroller i.e., port1, port2, port3 are having pull up resistors internally. But the port0 does not have pull up resistors internally. So it can't produce 5V supply. So in order to interface with the microcontroller, it requires external pull up resistors and these pull up resistors increases the voltage at port0 to nearly 5V and it activates the LCD. The LCD prompt for necessary information. To send any command to the LCD, make Pin RS=0. For data, make RS=1. Then send a high-to-low pulse to the E pin to enable the internal latch of the LCD.

2.7 TEMPERATURE SENSOR INTERFACING

Temperature sensor senses the temperature. It is conditioned to particular value, if that value rises/drops to a certain level then the microcontroller gets that information. The LM35 produces output voltage which is linearly proportional to the temperature. In order to interface with the microcontroller, LM35 needs ADC0804 because the output of the LM35 is in the form of analog signals. But the microcontroller accepts digital signal. So ADC0804 is used to convert analog signal to the digital signal. Analog to digital (A/D, ADC) converters are electrical circuit devices that convert continuous signals, such as voltages or currents, from the analog domain to the digital domain where the signals are represented by numbers. The ADC 0804 shown in figure can be functionally divided into 2 basic sub circuits these two sub circuits are an analog multiplexer and an A/D converter. The multiplexer uses 8 standard CMOS analog switches to provide to up to 4 analog inputs. The switches are selectively turned on depending on the data latched in to 3-bit multiplexer address register. The second functional block, the successive approximation A/D converter, transforms the analog output of the multiplexer to an 8-bit digital word.

2.8 SMOKE SENSOR INTERFACING

The smoke sensor is used for detecting the smoke. The smoke sensor has 6 pins. Three of which are connected to Vcc, one is grounded and two are connected to microcontroller through amplification circuit. The amplification circuit uses BC547 transistor which has more withstanding capability. The smoke sensor is connected to port2 which act as input to the microcontroller. It produces zero output when there is no smoke and when there is smoke it produces an output signal according to intensity of smoke which is transmitted to the microcontroller. The smoke sensor consists of heater internally which ionises the smoke particles, they will act as charge carriers so a voltage will built up at output.

2.9 GSM MODEM INTERFACING:

GSM modem interfacing with microcontroller for sms control of several applications. The SIM300 GSM module is a special type of modem which accepts a sim card and operates like a mobile phone subscribed to a cell phone operator. Text message may be sent through the modem by interfacing only three

signals of the serial interface of modem with microcontroller i.e., Tx, Rx and GND.

2.1.0 CIRCUIT DESCRIPTION

The supply to the circuit is obtained from the power supply circuit. The power supply circuit consists of two regulators LM7805 and LM7812. LM7812 produces 12V supply which is for GSM modem because GSM circuit requires 12V to activate. LM7805 produces 5V supply to the microcontroller AT89S52 and other remaining components. The main components in the circuit are microcontroller AT89S52, smoke sensor (MQ-2), and temperature sensor (LM35) and GSM modem. The AT89S52 consists of four ports which can be used for both input and output. The circuit uses port1 as input, port2 as in-out, port3 and port0 as output ports. A switch is connected to pin9 to reset the circuit. The crystal oscillators which are present internally in the microcontroller produce frequency which is varying. So, to produce fixed frequency an external crystal oscillator is connected to pins 18 and 19. The smoke sensor is used for detecting the

3 ARDUINO

Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. Arduino is common term for a software company, project, and user community that designs and manufactures computer open-source hardware, open-source software, and microcontroller-based kits for building digital devices and interactive objects that can sense and control physical devices. Finally Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible Package. The Arduino software is free, the hardware boards are pretty cheap, and both the Software and hardware are easy to learn has led to a large community of users.

3.1 SMOKE DETECTOR

A smoke detector is a device that senses smoke, typically as an indicator of fire. Commercial 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.

3.2 GSM:

GSM (Global System for Mobile communication) is a digital mobile telephony system that is widely used in Europe and other parts of the world. GSM uses a variation of time division multiple access (TDMA) and is the most widely used of the three digital wireless telephony technologies (TDMA, GSM, and CDMA). GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1800 MHz frequency band.

3.3 GSM MODULE

GSM/GPRS module is used to establish communication between a computer and a GSM-GPRS system. Global System for Mobile communication (GSM) is an architecture used for mobile communication in most of the countries. Global Packet Radio Service (GPRS) is an extension of GSM that enables higher data transmission rate. GSM/GPRS module consists of a GSM/GPRS modem assembled together with power supply circuit and communication interfaces (like RS-232, USB, etc) for computer. GSM/GPRS MODEM is a class of wireless MODEM devices that are designed for communication of a computer with the GSM and GPRS network. It requires a SIM (Subscriber Identity Module) card just like mobile phones to activate communication with the network. Also they have IMEI (International Mobile Equipment Identity) number similar to mobile phones for their identification. A GSM/GPRS MODEM can perform the following operations:

1. Receive, send or delete SMS messages in a SIM.
2. Read, add, search phonebook entries of the SIM.
3. Make, Receive, or reject a voice call.

The MODEM needs AT commands, for interacting with processor or controller, which are communicated through serial communication. These commands are sent by the controller/processor. The MODEM sends back a result after it receives a command. Different AT commands supported by the MODEM can be sent by the processor/controller/computer to interact with the GSM and GPRS cellular network.

3.4 POWER -USB / BARREL JACK

Our Arduino board needs a way to be connected to a power source. The Arduino UNO can be powered from a USB cable coming from your computer or a wall power supply that is terminated in a barrel jack. In the picture above the USB connection is labeled and the barrel jack is labeled. The USB connection is also how you will load code onto your Arduino board.

3.5 PINS (5V, 3.3V, GND, ANALOG, DIGITAL, PWM, AREF)

The pins of Arduino are the places where connect wires to construct a circuit. The Arduino has several different kinds of pins, each of which is labeled on the board and used for different functions.

5V: The 5V pin supplies 5 volts of power. Most of the simple components used

Arduino run happily off of 5 or 3.3 volts.

GND: Full name is Ground. There are several GND pins on the Arduino, any of which can be used to ground circuit.

ANALOG: The area of pins under the 'Analog In' label (A0 through A5 on the UNO) is Analog In pins. These pins can read the signal from an analog sensor and convert it into a digital value that we can read.

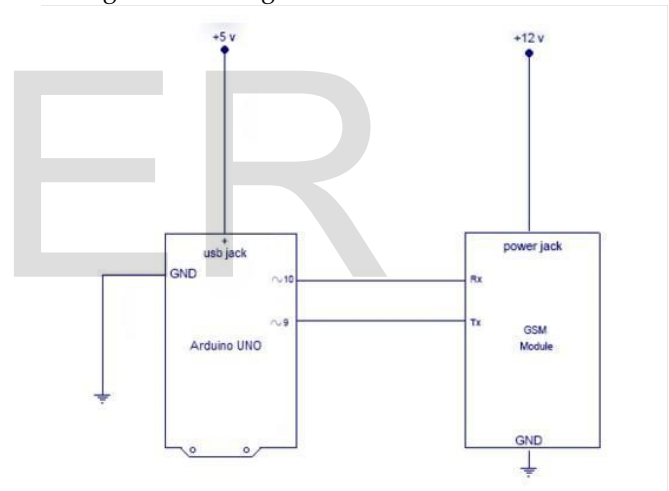
DIGITAL: Across from the analog pins are the digital pins (0 through 13 on the UNO). These pins can be used for both digital input and digital output (like powering an LED).

PWM: The digital pins (3, 5, 6, 9, 10, and 11) on the UNO are the PWM (~) pins. These pins act as normal digital pins, but can also be used for something called Pulse-Width Modulation (PWM).

AREF: Stands for Analog Reference. It is sometimes used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins.

3.6 SCHEMATIC DIAGRAM FOR ARDUINO AND GSM MODULE.

Fig:- Circuit Diagram for Arduino and GSM module



4 DISCUSSION

In this Paper we compare about the construction of fire alarm system using Microcontroller AT89S52 and Arduino both the system side by side. And find out that Arduino is an advanced system in comparison to Microcontroller. In Microcontroller we need to burn the program in an IC using burner which is a complex method, but in Arduino there is no such process. Arduino gives a digital output. This is a reliable and efficient system for fire alert and intimation to the fire station through GSM mobile communication.

5 FUTURE SCOPE

- GPS based fire Alarm system - Where Fire Service will be able to locate the shortest path using GPS system.

- Gas leakage detection – It is a very project to detect LPG leak or presence of other types of gases like Hydrogen, CO etc.
- Digital thermometer – To build a thermometer with display.
- Temperature Logger – To build a temperature monitor and LOG temperature levels.
- It can be used for high security in Bank and other organizations.
- Provision to store several mobile numbers.
- Video recording once Alarm gets triggered.

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