

# An SMS Based Fire Alarm and Detection System

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**ABSTRACT-** A fire outbreak is a major tragedy that must be avoided by every possible means due to the potential loss of lives and property, fire when not controlled can grow large and may require days to bring under control. Hence this technology must be applied to minimize or even eliminate this great hazard. In This study, a fire alarm and detection system was developed. This system was built with the GSM module embedded in it, which helps to send SMS (Short messaging service) to the home owners and the fire service personal, when there is fire outbreak before it gets out of range. Furthermore, this study provides a technology that would be accessible and affordable to the world at large so that homes, offices, and schools can adopt the use in other to protect lives and property. If and when the developed system is commercialized, it will help reduce uncontrolled fires by 50% because it warns of dangerous conditions before a fire outbreak.

**Keywords** —SMS (Short messaging service), Fire alarm, Detection system, GSM module and Technology

## I. INTRODUCTION

Fire alarm system provides an early warning of fire so that people can be evacuated and immediate action can be taken to stop or eliminate of the fire effect as soon as possible so that properties and lives will not be at stake [1]. As human technology advances, the concerns of fire safety have rapidly increased as well. Fire hazards have become one of the prime consequences of advanced technology and have claimed lots of lives, as well as destroying countless properties and equipment in the household setting and the industrial environment[2]. Most systems make use of Fire Alarm Control Panel (FACP) fitted with a Digital Alarm Communicator Transmitter (DACT), which sends information to the central station. However, only some panels are fitted with this DACT, others need an external DACT unit for transmission. This brings about obsolescence due to the requirement of additional hardware and interfacing. The current fire alarm systems also do

not have a means of communicating to the outside world. The sensors and detectors are designed to report only to the FACP. This suggests that individuals outside cannot know the situation inside a building in case of fire. The fire fighter cannot determine the extent to which the fire has dynamically spread within the building, from outside it [3]. A home owner who travelled, cannot know the status of his burning house from his location. [4]Shows in their study, that major loss of lives and properties could occur before a fire hazard can be detected and tackled. Some remote monitoring systems can be designed by using Wireless sensor networks, Ethernet and other digital technologies, but they are faced with the issues of being too complex, expensive and having some levels of redundancy, as well as low compactness, all this brought to the development of an SMS based fire alarm and detection system that utilizes an SMS system that is configured to report to specified number of occupants and a nearest Fire Services Department [5]. It is a cost-effective fire alarm system which performs reliably to ensure safety from fire, and can be easily installed in homes, industries, offices, restaurants etc. Larger scale industrial or residential area can be monitored through the proposed system installing multiple modules, each for one floor or unit. The aim of this project is to provide a reliable and swift responsive fire alarm system through the use of SMS.

## II. RELATED WORKS

During the course of the research some related works were found, a few are briefly discussed in this section:

### A. Developed Intelligent Fire Alarm System

[1] Developed an intelligent fire alarm system built for the development of technology applications to commercialize fire alarm market demand growth. The system includes a control panel, alarm initiating devices, notification appliances, and the accessory

equipment necessary for a complete Fire Alarm System.

### B. Fire Detection System with GSM Using Arduino

[6] Developed a fire detection system with GSM using Arduino. This system has an ideal gas sensor used to detect the presence of a dangerous LPG leak in any place like cars, service station, cylinders, storage tank, and homes amongst other components. The system is monitored by the Arduino Uno to identify the leakage of LPG if the signal is high then turns ON an exhaust fan for removing gas out from the area and sends a message as “FIRE ALERT” to the registered mobile number.

### C. Fire-Detectors Review and Design Of An Automated Quick Responsive Fire-Alarm System Based On SMS

In this work a review of existing fire-detector types has been carried out along with the development of a low cost, portable and reliable microcontroller based automated fire alarm system for remotely alerting any fire incidents in household or industrial premises. The system was designed to alert the distant property-owner efficiently and quickly by sending short message (SMS) via GSM network [2].

### D. Development Of Fire Alarm System Using Raspberry Pi and Arduino Uno

The development of fire alarm system using raspberry pi and Arduino Uno is a real-time monitoring system that detects the presence of smoke in the air due to fire and capture images via a camera installed inside a room when a fire occurs. This system has the ability to remotely send an alert when a fire is detected and will also need the user confirmation to report the event to the Firefighter using Short Messaging Service (SMS) [7].

## III. PROPOSED SYSTEM

In the research, special attention is put on the critical condition that makes the component and the module operate efficiently. All components are discussed and the functions in this section. The major problem accosted in engineering design is to fully and correctly specify the requirements of the design. The ‘Fire Alarm System using SMS’ system design process involves the following:

1. Full analysis of the system specification.
2. Hardware design.

The hardware tasks include the definition and analysis of suitable circuit components used in achieving the circuit design of the Fire Alarm System

using SMS. We have the environmental sensors S1 to S4, these sense a fire /high temperature /interior pollution event and pass the information to the Microcontroller MC; the microcontroller then assesses whether the combination of readings from the sensors is actually a fire event or a false alarm; based on this, assuming an actual fire event, then the microcontroller activates the GSM module and sends an alert SMS to the various response centers [8]. To retard the fire, the microcontroller also operates the servo to tilt a fire bucket and douse the fire with flame-retardant materials. The figure 1 shows the operational block diagram of this proposed system.

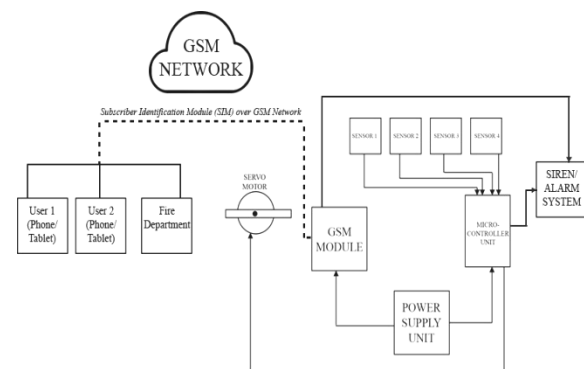


Fig 1: The operational block diagram of the project.

### A. Microcontroller Arduino Pro Mini

This is a microcontroller board based on the Atmega 328 microcontroller; it runs at 16 MHz and has 1 hardware serial port, 6 ADC inputs, 14 digital I/O pins and runs on 5volt power [9]. A microcontroller is a miniaturized computer in a chip of silicon and can accept instructions and follow those instructions. To change the operation of the microcontroller, we only need to write a new set of instructions or program. The Atmega 328 microcontroller is a very versatile device that is adequate for the role intended in this project, which is to monitor and control the rest of the hardware. It is able to provide 40mA of drive current for any device connected to its ports. The board also has an on-board 5volt regulator, which means it can run from a power supply even higher than 5 volts.

### B. SIM800L GSM MODULE

The SIM800L is a 2G module that can operate on the common GSM bands. It requires a 4 volts supply and has quite a number of features that make it very useful for the project. Some of these are:

1. Voice Communications;
2. SMS service;

3. GPRS communication;
4. HTTP protocol;
5. FTP Protocol;

This module will operate under the control of the microcontroller to send alert messages to reassigned numbers, thus summoning assistance in the event of a fire.

### C. Servo

Since the aim of this research is not only to detect a fire, but to also initiate fire control, a servo motor (SG-90) is required to tilt a fire bucket filled with flame retardant materials, thus slowing down the progress of the fire pending when the firefighters arrive. The SG-90 requires a 5 volt supply and has a limited rotation angle of 0-170 degrees. A servo motor is an electrical device that converts electrical power into mechanical (motion) power.

### D. Power Supply

The required power for the device is provided by a Lithium Ion Battery which is charged by a normal 5 volts cell phone charger through an on-board USB charging port. This arrangement has a major advantage which is that even when there is no electrical power, the operation of the device is not impeded

### E. CIRCUIT DIAGRAM

The research adheres to all specifications for all Integrated Circuit (IC) as stated in the manufacturers' data sheet. The proposed systems' circuit diagram showing the interconnection between devices is shown in figure 2.

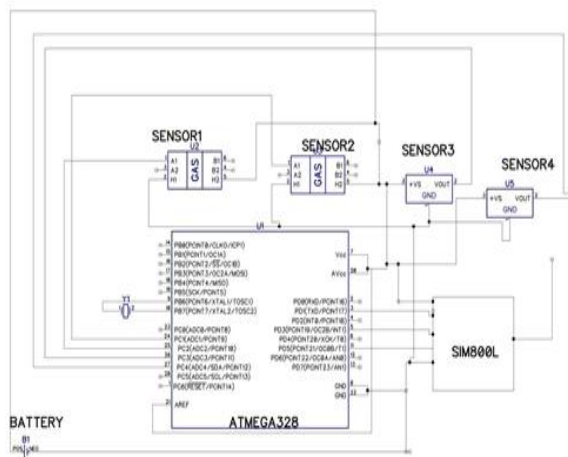


Fig 2: The circuit diagram of the fire alarm system using SMS.

## IV. SYSTEM OPERATION

During the system start up, the microcontroller tests all the hardware to confirm hardware errors. It then proceeds to shut down the GSM module for proper power management. Subsequently, it begins reading the sensors and averaging their readings to eliminate errors and prevent false alarms. When any sensor reading goes out of the range considered normal, the GSM module is brought online, allowed to acquire the network and a message is sent indicating which sensor. This gives the user a greater awareness of the environmental parameters in his residence or office. If a combination of readings meets the preset criteria for a fire, an alert message is sent to the server.

Note that: The system works as expected and the sensors produce repeatable, that is, similar output every time the environmental triggers, namely hot temperature and smoke pollution, occur within the model house. This indicates reliability. Also, the system easily identifies the zone in which the environmental anomaly originates. All In all, it gives a dependable system for early detection of fire and smoke hazards.

## V. CONCLUSION

In conclusion, the Fire Alarm and Detection System Using SMS is a cost effective and medium coverage method of detecting, alerting and controlling fire and fire related incidents in a residential setting or industrial environment. It makes use of a familiar technology and takes advantage of SMS capabilities in order to achieve its proposed goal effectively. This system work would save cost, provide reliable services, and alert nearest fire department, thereby reducing (or even eradicating) loss of lives and property. Its applications range from the common household setting even to large industrial environments, posing large scalability.

## VI. FURTHER WORK

After carrying out this research work, the following recommendations were made based on the limitations encountered during the implementation face of the study.

- Multiple sensors could be included systematically to cover wider range, or sensor with higher range coverage could be developed for the purpose of the system.
- Fire proofing the system would be recommended in order to prevent damages to hardware components.

- A better and less damaging method could be implemented towards extinguishing fire and controlling fire incidents.

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