Fire Detection System using GSM Module

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ABSTRACT

Fire accidents are an unplanned and undesirable event that brings damages to social wealth and human life needs to be prevented at all cost. In order to prevent the losses accrued from fire accidents, various alarm systems have been developed such as smoke detectors and temperature sensor based systems etc. The availability of a GSM technology is now started into the fire alarm system in order to prevent the menace that could be caused by fire accidents. This project is design and implementation of a cost effective and reliable automated GSM based fire alarm system. The device is able to detect fire in the environment, the system sends SMS and call alert to an inbuilt GSM number when necessary, and make loud sound to alert occupants on pending danger. This was achieved by the use of 12 Volt power supply system that powers the device using step down transformer, programming Arduino Uno Microcontroller using embedded C programming Language in the Arduino IDE, and integrating the program with Arduino Uno Microcontroller with GSM SIM900 module.

KEYWORDS: *GSM modules, Flame Sensor, Buzzer, 16x2 LCD, Atmega328 Microcontroller*

1. INTRODUCTION

A fire alarm system is number of devices working together to detect and warn people through visual and audio appliances whenever fire caches. These alarms may be activated automatically from flame detectors or heat detectors or may also be activated via manual fire alarm activation devices such as manual call points or pull stations. Alarms may be either motor bell or wall mountable sounders, horns. They can also be speaker strobes which sound alarm, followed by a voice evacuation message which warns people inside the building not to use the elevators. Fire and smoke that spread within a building can be affected by various factors such as the geometry, dimension, layout and usage of the building. In order to prevent fire accident in building, it is critical to detect fire at its early stage and nip it to the bud. In most instances, fire outbreaks are reported to the fire brigades or authorities very late, often when the entire building has been burnt down. This makes the case for design of automatic fire alarm system a necessity. A fire alarm system is designed to detect the unwanted presence of fire by monitoring environmental changes associated with the combustion. Automatic fire alert system is required not only in industrial complexes but also residential buildings. In general, fire alarm systems are designed as either automatically actuated or manually actuated. However, some fire alarm systems have been reported to have incorporated both designs in integrated manner. Automatic fire alarm systems are designed to automatically pick fire signals and notify the building occupants of pending dangers. Here in this project model we are going to implement a system using flame detector sensor which detects the any flame in front of sensor, we are using GSM module to send and call alert, both GSM and flame sensor is interfaced to atmega 328 arduino microcontroller with 16x2 LCD to display alert.

2. HARDWARE DESCRIPTION:

The hardware part used in this solar power bank are mentioned below,

A. Flame Detector Sensor:

Fig.1

The sensor which is most sensitive to a normal light is known as a flame sensor. That's why this sensor module is used in flame alarms. This sensor detects the flame otherwise wavelength within the range of 760 nm – 1100 nm from the light source. This sensor can easily damaged by high temperature. So this sensor can be placed at certain distance from the flame. The flame detection can be done from a 100cm distance and the detection angle will be 600. The output of this sensor is an analog signal or digital. These sensors are used in fire fighting robots like as a flame alarm.

B. GSM Module:

Fig: 2

GSM is mobile communication module, stands for global system for mobile communication. The idea of GSM was developed at Bell Laboratories in the 1970. It is largely used mobile communication system in the world. GSM is digital cellular technology used for transmitting mobile voice and data services operates at the 900MHz, 1800MHz, 850MHz, and 1900MHz frequency bands. We are interfacing GSM module to send sms and call alert if fire detected near system.

C. LCD Display:

Fig: 3

LCD stands for Liquid Crystal Display, this screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic and is very commonly used in many devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons are: LCD is economical, easily programmable, no limitation of displaying special & even custom characters.. A 16x2 means it can display 16 characters per line and there are 2 such lines, each character is displayed in 5x7 pixel matrix. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc.

D. Buzzer:

Fig: 4

The buzzer is the electrical device that makes a buzzing noise is used for signaling. Here in this project we are using a buzzer to create beeps sounds when fire detect for alerting nearby people.

E. MicrocontrollerATmega328:

Fig: 5

It is a Atmel 8-bit AVR RISC-based microcontroller with 32KB ISP flash memory and read-while-write capabilities, 1KB EEPROM, 23 general purpose I/O lines, 32 general purpose working registers, 3 flexible timer/counters with compare modes, internal, external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts.

Key parameters for ATmega328:

Flash (KBytes):32kBytes, Pin count: 28, Max. Operating Frequency (MHz): 20MHz, CPU: 8-bit AVR, Touch channels: 16, Hardware touch Acquisition: No, Max I/o pins: 22, Ext Interrupts: 24, SPI: 221, TWI (12c):1, UART: 1, ADC Channels: 8 ADC Resolution (bits): 10, ADC speed (kbps): 15, Analog comparator: 1, DAC Resolution:0, Temperature sensor: yes, Operating voltage: 1.8 to 5.5

3. SOFTWARE DISCRIPTION (ARDUINO IDE):

Arduino IDE is open source software that is mainly used for writing and compiling the code into the Arduino Module. It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process. It is easily available for operating systems like MAC, Windows, Linux and runs on the Java Platform that comes with inbuilt functions and commands that play a vital role for debugging, editing and compiling the code in the environment. A range of Arduino modules available in market, each of them contains a microcontroller on the board that is actually programmed and accepts the information in the form of code. The main code, also known as a sketch, created on the IDE platform will ultimately generate a Hex File which is then transferred and uploaded in the controller on the board. The IDE environment mainly contains two basic parts: Editor and Compiler where former is used for writing the required code and later is used for compiling and uploading the code into the given Arduino Module. This environment supports both C and C++ languages.
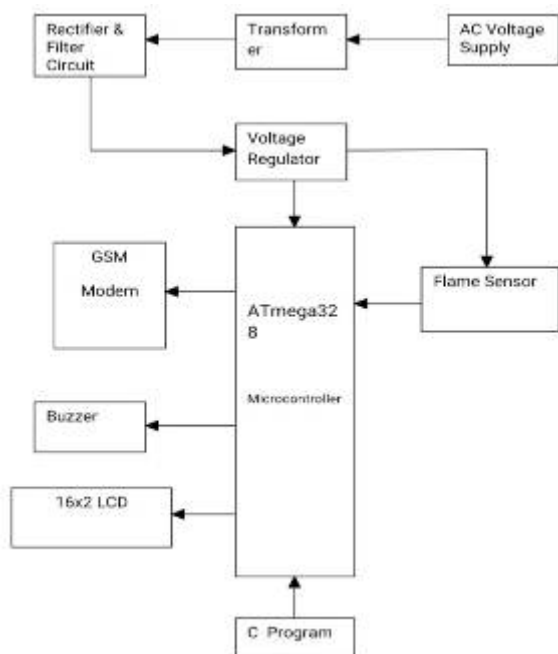
4. BLOCK DIAGRAM:

Fig: 6

WORKING OF THE SYSTEM:

As shown in block diagram we have made the circuit connections. First the AC power applied to primary coil of step down transformer, at secondary coil we get the unregulated AC 12v. Then this 12V AC applied to bridge rectifier and filter capacitors, so we will get a pure DC output. This pure DC output given to the 7805 an 7812 voltage regulators, so we will get a regulated DC 5 and DC 12 Voltages. The 5 v is given to the microcontroller, flame sensor and LCD. The 12 Volt DC is for GSM module and Buzzer. In this system 16x2 LCD is used to show the current status of fire detection. 16x2 LCD's data pin DB4, DB5, DB6, DB7 are connected with pin D5, D4, D3, D2 of microcontroller. And command pin RS and EN is directly connected with pin D12, D11 of microcontroller. RW pin of LCD is directly connected with ground. The output of flame sensor is connected toD7 pin of microcontroller, buzzer is connected to D8 pin and GSM Module's Rx And Tx pin is connected to D1 And D0 pin of microcontroller respectively. We have written a C code in Arduino IDE as like, When the sensor detects the fire the microcontroller send signal to the buzzer for beeping and also indicates about fire detected on LCD displays. The microcontroller sends AT commands to GSM module to send text message and to make call to occupants.

5. RESULT:

The results shows the final implementation of the system and its output sms sent to the recipient person's mobile.
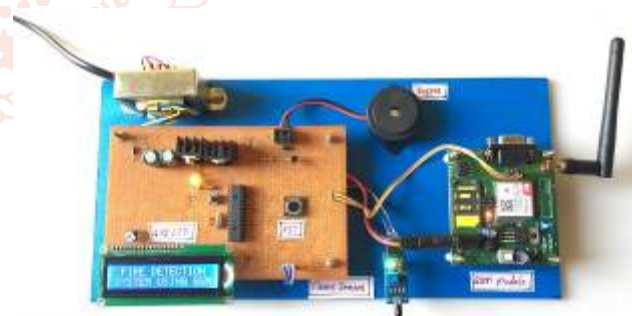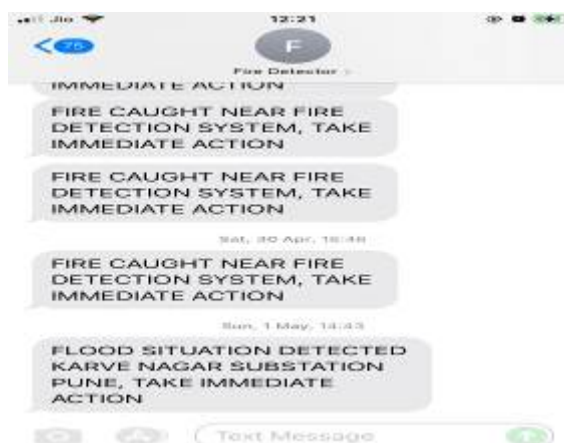

Fig 7: Final Implementation

Fig 8: System Output

6. CONCLUSION

Fire accident claims the lives of innocent people around the world every single day. A small amount of fire is able to damage a huge part of a society. Although heat detectors and fire alarms alert people of danger, they often have few choices other than escaping from a building and calling the fire department. In this paper, it can be concluded that the proposed system can provide a secure, safe, and efficient way for preventing or combating fire accident. This was achieved by the implemention of 12 V power supply system that powers the device, programming Arduino Uno Microcontroller using C++ programming Language in the Arduino software platform, and integrating the program med Arduino Uno Microcontroller with GSM SIM800 module. The GSM SIM800 module was incorporated in the system in order to send sms and call to the occupant of the building on any impeding danger so as to combat the situation on time and to prevent losses.

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