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Fire Alarm System with location using IoT

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ABSTRACT

Fire alarm systems have become increasingly sophisticated and functionally more capable and reliable in recent years. They are designed to fulfil two general requirements: protection of property and assets and protection of life As a result of state and local codes, the life-safety aspect of fire protection has become a major factor in the last two decades. To solve the problems caused by the fires, several safety measures have been put in to place to reduce the number of fatalities and losses. So our idea is to develop a fire alarm system. The primary purpose of fire alarm system is to provide an early warning of fire so that people can be evacuated from the fire-affected place and immediate action could be taken to control the fire. The system will have a GPS module , Flame sensor to detect the flame , Smoke sensor to detect the smoke , Buzzers and led to alert the environment and GSM or wifi to send the notification to authorities. In addition this system reduces the occurrence of false positives with time delay.

Keywords : Wifi Module, False Positives, GPS Module

I. INTRODUCTION

Fire alarm systems have been boosted extraordinarily in the past few years. Moreover they helped a lot in the safety of people and property against fire hazards. On the contrary they can lead to unnecessary false alarms which are expensive if the occurrence happens in a commercial building. In addition, false fire alarms have been a nuisance to the fire department and cause link-up with resources and needless disturbance that leads to nervousness. The problem was to detect fires and reduce occurrence of false positives in a commercial environment.

The National Crime Records Bureau indicates that a total of 113961 people lost their lives due to fire accidents from 2010 to 2014. This is an average of 62 deaths a day .Maharashtra alone accounted for 24293 deaths due to fire accidents.

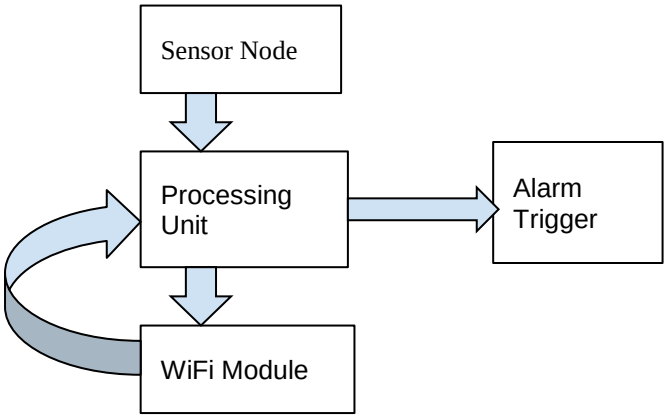
The major characteristics of fire are it extends exponentially with time. Hence, timely detection of fire is critical for avoiding a major accident. Hence, the essence of having a sophisticated fire alarm and monitoring system is quite obvious. The early detection of fire can be made with the rise of temperature, the presence of smoke and flame. Hence appropriate sensors have to be installed at the vulnerable places to detect the mentioned physical quantities. The alarm information is generated by comparing them with predefined threshold values and send to a central processor that may be a microcontroller.

There are lot of disadvantages in the available fire detection, monitoring and alarm system. The few disadvantages are small surveillance capacity, simple human computer interface system, poor reliable in detection, slow response time and non flexible network interface system. The traditional fire

monitoring system has false negative responses and false positive responses are high in number. The rate of occurrence of malfunctions in these system are large and the time delay in detection is very serious. It is necessary to design a system to overcome these problem and satisfy the application user requirements.

II. SYSTEM OVERVIEW

Basically the designed system is a combination of WiFi module and WSN communication. Thresholds and control variables act as indicators when a fire or smoke is detected and when a false positive occurs. The below figure shows the basic concept for fire alarm system which includes a Sensor network node, processing unit, WiFi module, Trigger.



IoT:

The internet of things (IoT) is a computing concept that describes the idea of everyday physical objects being connected to the internet and being able to identify themselves to other devices. The ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

IoT encourages companies to rethink the ways they approach their businesses, industries and markets and gives them the tools to improve their business strategies.

Arduino:

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board. Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package.

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 smoke detectors, also known as smoke alarms, generally issue a local audible or visual alarm from the detector itself.

For smoke detectors, the individual coverage can be represented by a square measuring 10.6m x **10.6m** giving a coverage of 112m² per device, which is usually approximated to 100m². With heat detectors this figure is 7.5m x **7.5m**, giving an area of coverage of 56m² per device which is rounded down to 50m².

Flame Sensor:

A flame detector is a sensor designed to detect and respond to the presence of a flame or fire, allowing flame detection. Responses to a detected flame depend on the installation, but can include sounding an alarm, deactivating a fuel line (such as a propane or a natural gas line), and activating a fire suppression system. When used in applications such as industrial furnaces, their role is to provide confirmation that the furnace is working properly; in these cases they take no direct action beyond notifying the operator or control system. A flame detector can often respond faster and more accurately than a smoke or heat detector due to the mechanisms it uses to detect the flame. Detects a flame or a light

source of a wavelength in the range of 760nm-1100nm. Detection angle about 60 degrees, it is sensitive to the flame spectrum.

ESP8266 Wifi Module :

ESP8266 is Wi-Fi enabled system on chip (SoC) module developed by Espressif system. It is mostly used for development of IoT (Internet of Things) embedded applications.

It employs a 32-bit RISC CPU based on the Tensilica Xtensa L106 running at 80 MHz (or overclocked to 160 MHz). It has a 64 KB boot ROM, 64 KB instruction RAM and 96 KB data RAM. External flash memory can be accessed through SPI. ESP8266 module is low cost standalone wireless transceiver that can be used for end-point IoT developments.

To communicate with the ESP8266 module, microcontroller needs to use set of AT commands. Microcontroller communicates with ESP8266-01 module using UART having specified Baud rate.

GPS module:

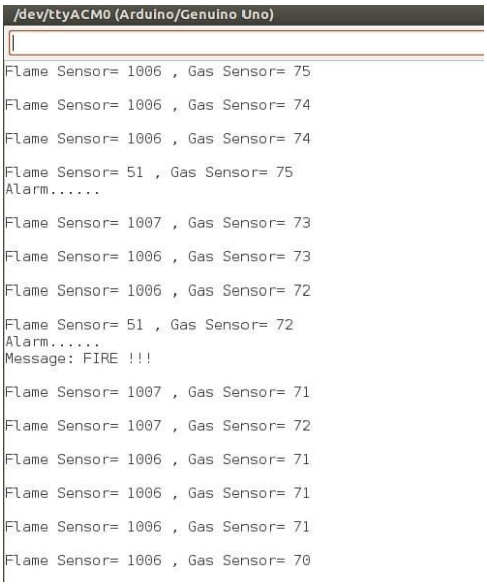
GPS stands for Global Positioning System by which anyone can always obtain the position information anywhere in the world. GPS consists of Space segment(GPS satellites), Control segment(Ground control stations), User segment(GPS receivers).

The GPS does not require the user to transmit any data, and it operates independently of any telephonic or internet reception, though these technologies can enhance the usefulness of the GPS positioning information. The GPS provides critical positioning capabilities to military, civil, and commercial users around the world. The United States government created the system, maintains it, and makes it freely accessible to anyone with a GPS receiver.

III. EXPERIMENTS AND DISCUSSIONS

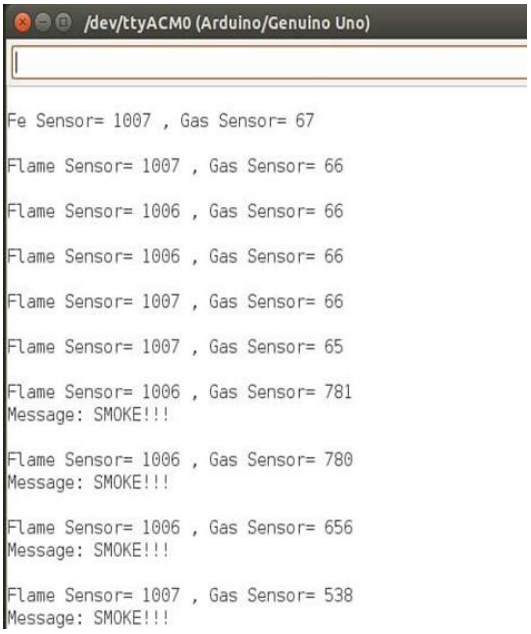
Experiment 1:

By using flame sensor, we can detect the fire. Firstly, there are some initial values in the sensor (ex: 1006,1007), when these values decrease (ex: 51,52) then it is said to be the indication of fire. Then, it gives the message as FIRE!!.



Experiment 2:

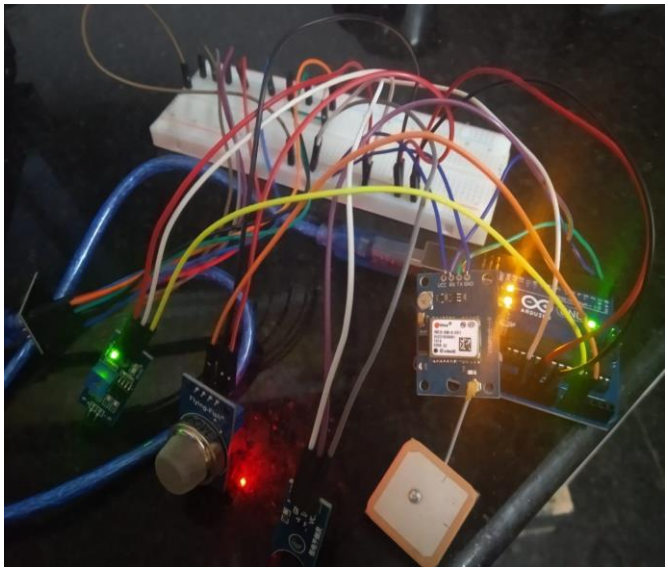
By using smoke sensor, we can detect the fire. Firstly, there are some initial values in the sensor (ex: 66,65), when these values increase (ex: 538,781) then it is said to be the indication of fire. Then, it gives the message as SMOKE!!.

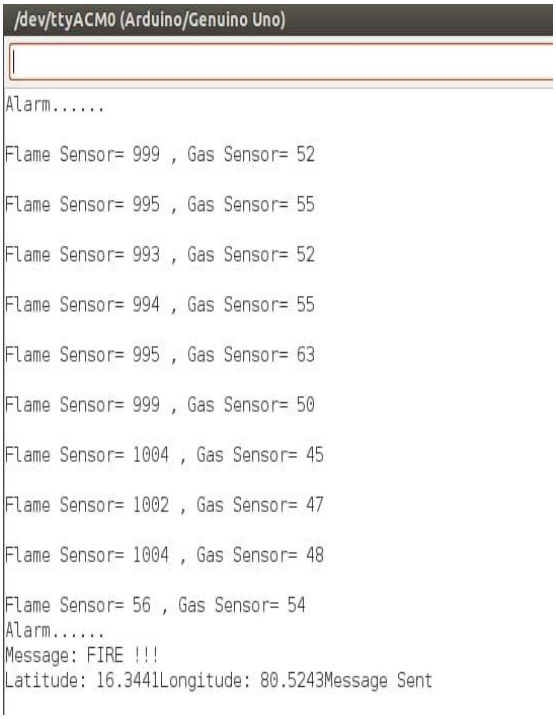


Experiment 3:

When these sensors detect fire, then the message is sent to the authorised departments with exact location. By connecting all these sensors to arduino and by using GPS, Wifi modules we can send exact location (Latitude, Longitude) in the form of message.

The circuit diagram is shown below:





IV. CONCLUSION

This paper deals with fire alarm system and the occurrence of fire accidents detected by placing sensors like flame sensor, smoke sensor at different locations. In addition, the system consists of GPS module, WiFi module which are used to detect the exact fire affected location and to send this location to the corresponding authorised department respectively. Moreover, it brings the advancement of reducing the false positives and fake alarms by impeding the time lap. This system is cost effective, flexible and user friendly.

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