

# Raspberry Pi Based – A Cyber Defensive Industrial Control System with Redundancy and Intrusion Detection

Teresa Jose<sup>#1</sup>, Rithika Devi M<sup>\*2</sup>, Priya Darshini S<sup>#3</sup>, Sharon Mathew<sup>#4</sup>, Dr D Selvaraj<sup>#5</sup>  
BE student<sup>1-4</sup>, Professor<sup>5</sup>, Panimalar Engineering College,  
Poonamallee, Chennai 123

## Abstract

In this paper, we have propounded a system which is capable to detect fire and can provide the location of the affected region. Raspberry Pi 3 has been used to control which are integrated with a couple of sensors and camera. We have provided a confirmation of the fire suspecting system to avoid any false alarm. The system will immediately send an email along with the image of the affected spot and device location. Also an emergency message is sent.

**Keywords** - Camera, gas sensor, fire sensor, PIR sensor, buzzer, raspberry pi, Gsm module

## I. INTRODUCTION

IoT plays a major role in industrial safety and control. Technologies based on IoT make the industries smarter, safer and more environmentally sustainable. Fire accidents are a major threat to industries. It results in severe losses. IoT can help in intelligent fire monitoring and detection by integrating information from sensors to detect fires and take immediate response action. It helps in speeding up the response times and provides information for evacuation, rescue and fire suppression. It can also help to identify the cause for the fire. The notification devices such as alarm, horn, buzzer can be activated to provide alerts in case of fire. Several advanced features in mass notification systems including the capability to communicate alerts via email to targeted recipients, can thus help in creating quick and effective awareness. The sensor information is transmitted over the internet and can be viewed using laptops, mobile phones. This data can also be used for investigation purposes after the accident has occurred.

## II. FUNCTIONAL REQUIREMENTS

1. Research based on raspberry pi and implementation development platform to build a complete application system.
2. Research and implementation of remote transmission of monitoring data in the existing environment.

The important computer room are monitored by sensors and the collected data are sent to the raspberry pi development platform for processing.

By installing Ethernet shield network adapter on the development board the collected data is sent to the sensor network for data processing and display

Remote user can any micro computer for accessing IP network and run the network for real time monitoring.

## III. HARDWARE REQUIREMENT

The basic hardware components used:

### A. Raspberry Pi Development Board

The Raspberry PI-3 Model B is a credit card sized computer with inbuilt Wi-Fi and Bluetooth connectivity.

**SoC:** Broadcom BCM2837

**CPU:** 4× ARM Cortex-A53, 1.4GHz

**GPU:** Broadcom VideoCore IV

**RAM:** 1GB LPDDR2 (900 MHz)

**Networking:** 10/100 Ethernet, 2.4GHz 802.11n wireless

**Bluetooth:** Bluetooth 4.1 Classic, Bluetooth Low Energy

**Storage:** microSD

**GPIO:** 40-pin header, populated

**Ports:** HDMI, 3.5mm analogue audio-video jack, 4× USB 2.0, Ethernet, Camera Serial Interface (CSI), Display Serial Interface (DSI)

### B. Flame Sensor

A flame detector is a sensor designed to detect and respond to the presence of a flame or fire. It also can detect ordinary light source in the range of of a wavelength 760nm-1100 nm. The detection distance is up to 100 cm.

### C. Gas Sensor

The MQ2 gas sensor is useful for gas leakage detection. It can detect H<sub>2</sub>, LPG, CH<sub>4</sub>, CO, Alcohol, Smoke or Propane. Due to its high sensitivity and fast response time, measurement can be taken as soon as possible.

### D. PIR sensor

A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) radiation being emitted from objects in its field of view.

**E. MCP3008- ADC Converter**

The MCP3008 is a low cost 8-channel 10-bit analog to digital converter. It can read the analog input from the sensors and convert it into digital signals.

**F. Relay**

A relay is an electrically operated switch. It takes some amount of power and distributes it to allow other devices to be powered in certain circumstances.

**G. Motor**

A water sprinkler mechanism can be connected to the shaft of the dc motor, which will sprinkle the water when the fire is detected by the sensor.

**H. Camera**

A rotatable web camera is used which captures the image of the intruder when motion is detected.

**I. GSM Module**

GSM module is used for the sending and receiving of the message through SMS it can be controlled at home and can access various appliances at one place and it act as a security alert subsystem gives automatic security monitoring.

**IV. SOFTWARE COMPOSITION**

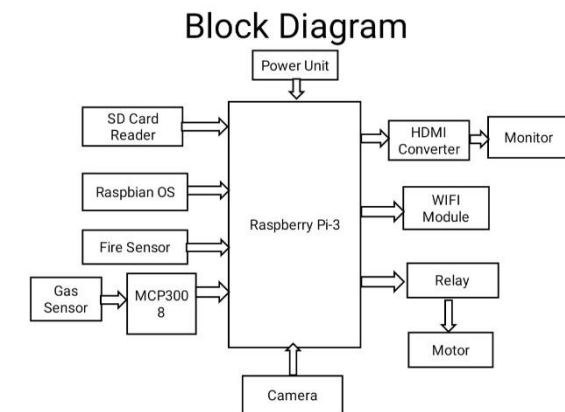
**A. The Raspberry Pi Development Software**

The RASPBIAN OS is implemented in the raspberry pi for the processing the sensor value and stored in the SD card.

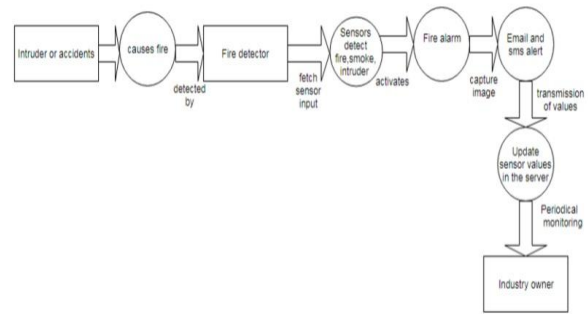
The PYTHON language is used to develop the main program and OPEN CV is used the machine learning language and for including libraries and header file. These algorithm came used in the image capturing and processing and tracking moving objects, identify the objects.

Php and XML language is used for the IOT page to store the sensor values.

**BLOCK DIAGRAM**



**Flow Diagram**



**V. WORKING**

Initially the raspberry pi is set as the main device control and GSM module is connected to a zone. The gas and flame sensor, camera and PIR module is connected to all rooms of the zone.

When the person is entered to the room the PIR module is sensed and the camera turns on the person image is captured and then the image is synchronized and send to the mail via internet. if any gas leakage occurs the toxic gas sensed and alarm is raised. If any fire accident is occurred by the person or occurred at any place of the room or zone the image is captured and stored in the email of the authorized person and the fire sensed and alarm is raised the relay is switched on water is sprinkled if the fire range is exceeded it message is to the authorized person and at the same message is send to nearby fire brigade through WIFI or GSM module. The fire sensed value is seen in the IOT page and the image captured is seen the email of the authorized person.

**VI. PERFORMANCE ANALYSIS**

Features	Raspberry Pi 3 Model B	Arduino	Raspberry Pi 2 Model B	Raspberry Pi Model B+	Raspberry Pi Model A
Ethernet port	Yes	Yes	Yes	Yes	No
Processor speed	Quad core @1.2GHz	16MHz	Quad core @900MHz	Single core @700MHz	Single core @700MHz
Built-in Wi-Fi	Yes	No	No	No	No
Memory	1GB RAM	256KB	1GB RAM	512MB RAM	256MB RAM

## VII. CONCLUSION

The Fire Monitoring and Alerting system is described with the drawbacks of the existing system. The requirements and the implementation methodologies of the system are clearly explained. Industrial safety is a major concern and therefore this system can help in emergency situations with immediate response and quick action.

The system can further be developed by adding more sensors and using face recognition and image processing to identify the intruder. An android application can be developed to provide confirmation on the decision to be taken on the outbreak of a fire. The sensor data can be combined with algorithm and big data analytics to develop better emergency evacuation strategies and analyse the entire system.

## REFERENCES

- [1] Ahmed Imteaj, Tanveer Rahman, Muhammad Kamrul Hossain, Mohammed ShamsulAlam and Saad Ahmad. "An IoT based Fire Alarming and Authentication System for Workhouse using Raspberry Pi 3," International Conference on Electrical, Computer and Communication Engineering (ECCE), February 16-18, 2017, Cox's Bazar, Bangladesh
- [2] S.Tanwar, P. Pately, K. Patelz, S. Tyagix, N. Kumar, M. S. Obaidat, "An Advanced Internet of Thing based Security Alert System for Smart Home" Computer, Information and Telecommunication Systems (CITS), 2017 International Conference on 21-23 July 2017.
- [3] MdIftekharulMobin, MdAbid-Ar-Rafi, MdNeamul Islam3, and MdRifat Hasan, "An Intelligent Fire Detection and Mitigation System Safe from Fire (SFF)", International Journal of Computer Applications (0975 - 8887) Volume 133 - No.6, January 2016.
- [4] Adil Hamid Malik, Aaqibjalal, Bilal Ahmed Parray, Meenakohli, "Smart City IoT Based Weather Monitoring System", 2017 International journal of Engineering Science and Computing (IJESC) Volume 7 Issue no.5.