

# AN IMAGE BASED FIRE MONITORING ALGORITHM WITH IOT ENABLED MESSAGING SYSTEM

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## ABSTRACT

Most of the fire detection are performed by sensor-based systems which have perceived the temperature and smoke by themselves and utilized in various type of industry after combining with the fuzzy theory. Generally this kind of methodology is useful for many spots of fire occurrences. However, it could not satisfy the requirement of accuracy and reliability on some environment. For example, large spaced factories, common area of electric power facility, communication facility are vulnerable to the sensing accuracy and too expensive to cover the entire place. Thus, fire might spread widely over the spots and hard to extinguish even though those sensors detect the fire. For the more it could be worse in the area that causes high temperature, humidity, dust, vibrations. In this study, we tried to improve the problems by using camera image processing instead of sensors. We designed the prototyped system and implemented it after suggesting some type of fire detection algorithm. We are proposing the new idea of using cameras and IOT technology to detect fire and to build flexible alert message transfer system. Flame and smoke are two obvious vision features of fire. In order to detect the cause of fire, we have a camera included that captures all fire images once fire is detected in any direction, A notification is sent to the admin & people immediately about the incident. We make use of the Internet Of Things (IoT) using which the entire system were connected together for data transfer. A Raspberry pi is used as a processing unit. Using this system, the reason of fire can be known remotely and it is easy to take precautions in future and people lives can be saved.

**Keyword:** - Fire detection, Alert message, Image processing, Machine learning, SMTP.

## 1. Introduction

These days, development effort for the automated fire detection system is increased rapidly and sensor based detection became the main category of solution methodologies, thus, occupied most of the market. Generally this kind of methodology is efficient for various types of fire occurrence cases. But it has a few deficiencies as follows in spite of several merits.

- In case of sensor failure, malfunction, it is difficult to find out correct status
- Generally, taking considerable time to detect and analyse the fire occurrence comparing with other methods.

- It can't be installed in special sector like extreme heating spots or vibrations and hard to expect the effects.
- Needed so many sensors in case of the wide spaced factory or field, thus also costs a lot more.

So, this system was developed to overcome above issues and to provide a flexible messaging system.

### 1.1 Statement of the problem

Fires eradicate forests, houses, burn the infrastructure, and may result in high human death toll near urban & rural areas. Common causes of fire accidents includes lightning, human carelessness, and exposure of fuel to extreme heat and aridity.

### 1.2 Objectives

The aims of this project are as follows:

- To detect fire using AI cameras.
- To generate alarm sound.
- To send alert message to the user.

The project will be useful for early and reliable detection and localization of the fire. The project target is to detect fire before and after happening to avoid severe losses and to save people.

## 2. System Overview

The system is developed by python that aims to detect the happening of fire & some python libraries were used to build alerting system. This project is intended to save the people from fire accidents. The fire detecting module detects the fire & images will be captured for comparing it with various datasets. After the confirmation an alarm sound will be generated and alert message will be sent to the user side. The process involves an IOT based SMTP protocol for setting up the communication module.

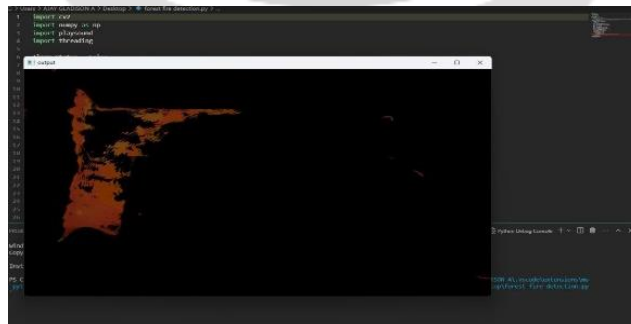


Fig -1: System Screenshot

## 2.1 Fire Detection

The fire is detected with the help of image processing. Image from the camera would be processed in the pi with the HAAR Cascade, and if the image contains fire, the system will recognize the fire and will give the output as fire detected. And if the fire was detected automatically an alarm sound will be generated with the help of playsound an python library.



Fig -1: Sample datasets

## 2.2 Messaging System

Integrating a flexible messaging service helps to alert people in various locations. For the process we have used Simple Mail Transfer Protocol (SMTP). SMTP is an internet standard communication protocol for electronic mail transmission. It is a part of the application layer of the TCP/IP protocol. As an email protocol, it establishes the rules for easy information exchange between the different email clients and accounts.

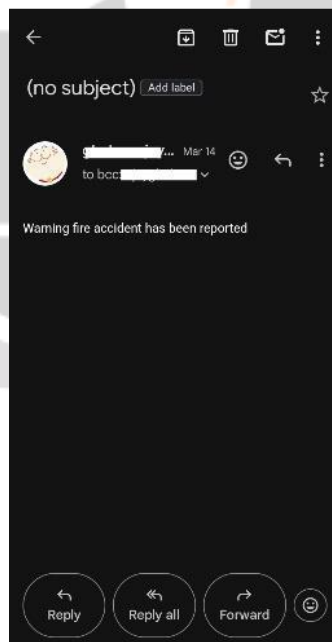


Fig -2: Alert Notification

### 3. Methodology

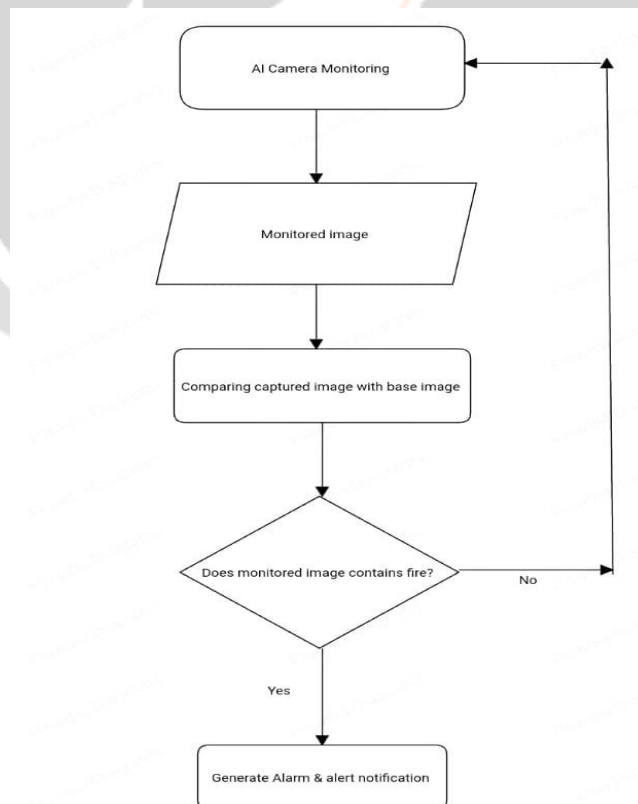
The project begins by sourcing datasets required for detecting fire. Rigorous data cleaning and preprocessing are conducted to enhance the quality and reliability of the dataset. Integration of alarm sound for alerting nearest people. And implementation of messaging system that follows SMTP protocol. Then the processed datasets were connected to the system integrated with messaging service and weather detection module. The developed model undergoes through evaluation using established metrics to ensure their effectiveness in real-world scenarios.



Chart -1: Workflow chart

#### 3.1 Architecture diagram

Below is the architecture diagram to show how the system works.



#### 4. CONCLUSION

The proposed system for fire detection using image processing and machine learning was found to be an effective method for detecting fire and provides more accurate results. And the flexible messaging service integrated with the system acts as a primary alerting system for alerting people in various locations and save them from fire accidents.

#### 5. ACKNOWLEDGEMENT

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