ZKG INTERNATIONAL
ISSN: 2366-1313

A SAFETY ALARM BASED FIRE DETECTION BY USING MACHINE LEARNING

P. PREM CHAND[1], S. BALA KRISHNA[2], N. BHARGAVI[3], N. KAVITHA[4], V. NITISH[5].

[1] Associate Professor, CSE,Chalapathi Institute of Technology,Guntur, India
[2]UG Student,CSE,Chalapathi Institute of Technology,Guntur, India
[3]UG Student,CSE,Chalapathi Institute of Technology,Guntur, India
[4]UG Student,CSE,Chalapathi Institute of Technology,Guntur, India
[5]UG Student,CSE,Chalapathi Institute of Technology,Guntur, India

ABSTRACT: The existing equipment of civil aircraft cargo fire detection mainly uses photoelectric smoke detectors, which has a high false alarm rate. According to Federal Aviation Agency’s statistics, the false alarm rate is as high as 99%. Since,in the cargo of civil aircraft, visible image processing technology cannot be used todetect smoke in the event of a fire due to the closed dark environment, a novel smoke detection method using infrared image processing technology is presented. Experiments were conducted under different environment pressures in the full-size cargo of civil aircraft. The results show that the proposed method can effectively detect smoke at the early stage of fire which is applicable for fire detection in civil aircraft cargoes. Fire-detection systems play a pivotal role in green buildings. Kate Houghton, director of marketing for Kidde Fire Systems says, By detecting a fire quickly and accurately and providing early warning notification, a fire-detection system canlimit the emission of toxic products created by combustion, as well as global- warming gases produced by the fire itself. These environmental effects often are overlooked, but undoubtedly occur in all fire scenarios. Therefore, reducing the likelihood of a fire is an important partof designing a green building.

1. INTRODUCTION

Fire detection systems are designed to discover fires early in their development when time will still be available for the safe evacuation of occupants. Cargo fire detection is an important guarantee for the flight safety of civil aircraft. In recent years, flight safety accidents caused by false alarms in aircraft cargo fires have emerged one after another. According to the Federal Aviation Agency (FAA) Technical Center, only one of every 200 fires is a real fire.

The existing equipment of civil aircraft cargo fire detection mainly uses photoelectric smoke detectors which are effective for the early detection of the fire. Since the smoke particle size of the cargo fire is related to the combustion material, the photoelectric smoke detector cannot accurately distinguish the smoke particles and the dust in the air as well as the goods with floating characteristics such as feathers. Visual images for smoke detection cannot be achieved due to the dark cargo environment. Hence, infrared image frames considering the visual smoke detection algorithms are used to obtain smoke features. Due to complexity and cost, there is no infrared camera for smoke detection in the cargo hold of aircraft in the world.

Therefore, this article studies the infrared detection methods from the perspective of reducing false positives and makes preparatory tests for infrared detection and refitting aircraft. Because the high-altitude variable pressure environment will directly

ISSN: 2366-1313

lead to changes in oxygen concentration, it will have a greater impact on the combustion rate and smoke characteristics of different materials.

Infrared image frames captured from the aircraft cargoes are divided into blocks using the conventional vision- based smoke detection techniques. The outstanding features are extracted and employed to classify the blocks into smoke and non-smoke.

Over-complete dictionaries are used to achieve the sparse representations of smoke component and non-smoke component in one block of the frame which leads to a convex optimization problem. To solve this problem, dictionaries learning process for infrared smoke image frames is conducted in an enclosed air cargo under different pressure conditions and trained with real samples to accommodate different image content.

Thus, the sparse representations of two components with relation to the atmospheric pressures can be achieved and imported to the classifier.

The innovation of this article lies in two points, one is the infrared image method in smoke detection and the other is the experiments under different pressure parameters which influence the oxygen concentration during the burning process.

2. LITERATURE SURVEY

Advanced Fire Detection using Multi-signature Alarm Algorithms" by D.T. Gottuk, M.J. Peatross, R.J. Roby, C.L. Beyler Year-2002.

The objective of this work was to assess the feasibility of reducing false alarms while increasing sensitivity through the use of combined conventional smoke detectors with carbon monoxide (CO) sensors. This was accomplished through an experimental program using both real (fire) and nuisance alarm sources. A broad selection of sources was used ranging from smoldering wood and flaming fabric to cooking fumes. Individual sensor outputs and various signal-conditioning schemes involving multiplesensors were explored.

The results show that improved fire-detection capabilities can be achieved over standard smoke detectors by combining smoke measurements with CO measurements in specific algorithms. False alarms can be reduced while increasing sensitivity (i.e., decreasing the detection time for real fires). Patented alarm criteria were established using algorithms consisting of the product of smoke obscuration and the change in CO concentration. Alarm algorithms utilizing ionization detector smoke measurements proved to be more effective than measurements from photoelectric detectors. A simple model for the dynamic response of point-type smoke detectors is described. The model is based on two independent parameters: the characteristic length and the static response threshold. Experimentally determined values of the parameters for six commonly used point-type smoke detectors are reported. In the tests the free stream flow velocity was varied in the range of 0.2–0.8 m/s and the rate of rise of smoke density in the range of 0.1– 2 dB/ms typical of shouldering fires. The response of photoelectric detectors was described by the model reasonably well. In the case of ionization detectors, significant deviations were found. A method of using the model in fire safety engineering calculations is also presented.

ISSN: 2366-1313

3. EXISTING SYSTEM:

Existing systems uses electronic sensors to detect fire or smoke. The change in temperature indicates the presence of fire or smoke in a region which can be detected by the sensors using radiation heat. As forests are in a remote location, installation and maintenance of sensors over large area is difficult.

So the sensors cannot be used to deploy over large area such as forests, petrochemical plant, and saw mills etc. The other consequence is, the sensor would detect heat or smoke only when it reaches nearer. Nowadays, the vision based fire detection technique is used widely to detect fires.

Along with the surveillance systems the vision based fire detection technique can be incorporated at relatively low additional cost. The advantages of vision based fire detection techniques are listed here

- The fast response to fires.
- The location of fire is sensed using this method not just the radiation
- The captured images can be analyzed and it can be used for future purposes and storage
- It can be used for outdoor places which covers large area

4. PROPOSED SYSTEM:

In a proposed system, experiment on the fire detection and pre-alarm generation. The current work is totally depends on accuracy factor of video processing and correct alert generation over existing false alarm rate.

In a proposed system, proposed system going to overcome existing drawbacks of fire alert systems and existing techniques of video surveillance systems by providing pre alert generation system.

Our work is based on machine learning techniques for video analysis on fire video sequences with better accuracy over pre work and fire detection with advantages of alert generation.

5. IMPLEMENTATION

A module is a software component or part of a program that contains one or more routines. One or more independently developed modules make up a program. An enterprise-level software application may contain several different modules, and each module serves unique and separate business operations. Modules make a programmer's job easy by allowing the programmer to focus on only one area of the functionality of the software application. Modules are typically incorporated into the program (software) through interfaces.

Fire detection is based on the following modules:

- Fire detection
- Alert generation

The input to the system is given as video. The video is then processed inside the system, converting it into video frames. If fire is detected then the output is produced in the form of alarms.

6. SOFTWARE MODULE:

Machine learning is used for controlling the neural network in which fire and non-fire data are being trained and identified. The Open CV and Tensor Flow are the libraries used for the training and identification. The models were tested on images and videos downloaded from the Internet. The models were also tested on real time video to check performance in real-time.

The models were tested only on CPU. However, in GPU enabled device the performance of the models would improve leading to higher processing rate.

ISSN: 2366-1313

Artificial Intelligence :

The proposed model focuses on the system which is capable to detect the Fire in Real Time. The Fire is detected on the basis of color. Contours and Bounding Boxes are used for the detection purpose. If two fires are seen in the frame, the system has the ability to separate them on the basis of numbers. The system is enhanced with Google Text to Speech Recognition due to whichit is capable of generating the alert to the user when fire is detected.

The system also consists of five other masks in which it was seen how first mask consists of noisy data with the image and how inner and outer noisy data is reduced in other masks.

Including this, it also consists of Bitwise-AND mask in which a colored image of that particular fire can be and also the system have the Edge Detection ability. Both the Bitwise-AND mask and Edge Detection .

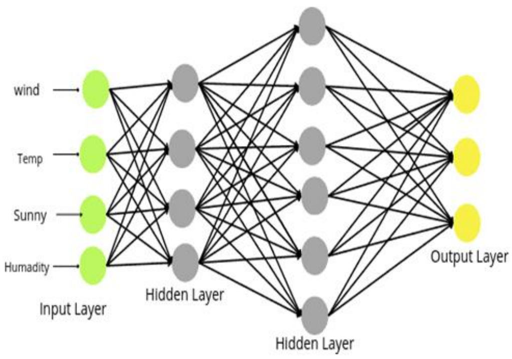


Fig: Artificial Intelligence

Securing Data:

Fire panels are an Securing the data of enterprise life-safety systems, connecting to a multitude of monitoring and control devices throughout your facility. While essential, fire panels generate even more sensor information that must be monitored to be useful.Traditionally, these devices are monitored on distinct applications, resulting in a very siloed view of life-safety and security functionalities: one platform for fire panel alarms, another for video monitoring, another still for access control and mustering, yet another one for public address... In such situations, operators are bombarded by events and alarms from all sides, making it difficultto filter through the data and focus on what needs to be done.

What if you could consolidate all the data coming in from across your various critical systems in a single platform, reducing alarm fatigue and speeding up emergency response Now, with Securing the data you can do just that!

Don't wait for the next integration, A typical way of integrating a fire system is to create a custom integration through panel-specific APIs. These results in a fully customized solution for a specific panel, ensuring all desired functionality is brought into the Genetic platform.

However, this method requires significant software development, as well as continuous maintenance to keep up with fire panel software versions. This putseach fire panel integration in competition with an array of other development priorities. Add to that the fact that fire panel certification is highly regionalized, leading to a large number of manufacturers and a fragmented market – coding panel-specific integrations to all these panels is a daunting task.

ISSN: 2366-1313

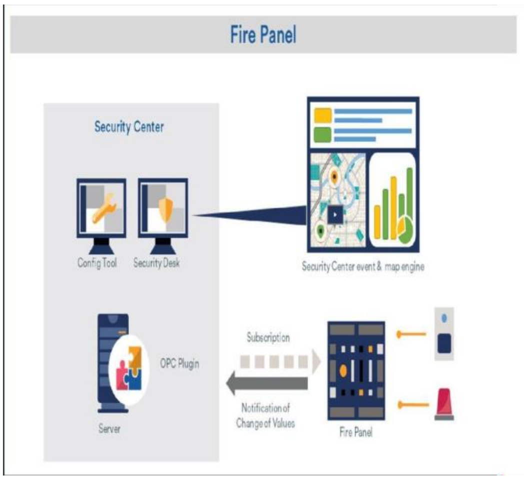
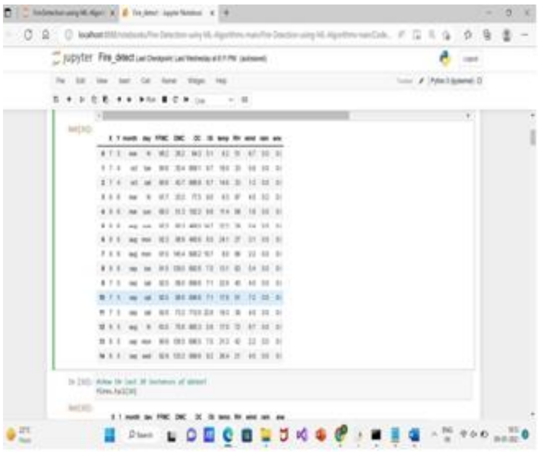


Fig: Securing Data in Fire Panel

7. SCREEN SHORTS



8.CONCLUSION

Fire has always been a potential threat to humans (and most land-based creatures),so the ability to detect a fire is something that has been part of our evolution. There are many ways in which can use the principles of physics and chemistry to provide a technological solution to fire detection and these methods often mimic human abilities. Over the past 150 years modern fire detectors have saved many lives and prevented a great deal of property damage. Although no technology is perfect, the economic benefits of installing automatic fire detection systems in conjunction with other fire safety measures have been demonstrated manytimes over.

Different fire detection techniques have been proposed for safety and protection of the people and environment. It is very crucial to develop an appropriate detection system to avoid dangerous situation caused due to fire. Though fire detection using image produce satisfying result we now go for fire detection to produce accurate result. Wavelet based smoke detection is used for smoke detection in video sequences of outdoor environment. Covariance method is for flame detection. This method use temporally extended covariance matrices representing all the information together.By these approaches we cannot completely protect the forest from fire but we reduce the level of damage. Perception Neural Network along with Multi Threshold algorithm classified image pixels of cloud, land, smoke, and background and produced accurate result of smoke.

The Future of Fire Detection :

Fire detectors and alarms are migrating from just the detection of smoke, to combination detectors and multicriteria detectors. The first fire detectors were for the detection of heat, and as time and technology advanced, they were also used for fixed temperature, rate-of-rise, rate anticipation and linear.

These detectors are still in use today and for a number of applications remain a viable means of detection, though not for the purpose of life safety.

This may be through messaging via notification appliances but could also be through the interface of the detection and notification system to the smart device that the building occupants would have on them.

REFERNACES :

C. Todd, Fire Detection - Overcoming the False Alarm Problem, International Fire

ISSN: 2366-1313

and Security Product News, Vol. 23, No. 3, 1998, pp.39 – 40.

D.T. Gottuk, M.J. Peatross, R.J. Roby, C.L. Beyler: Advanced Fire Detection using Multi-signature Alarm Algorithms, Fire Safety Journal, Vol. 37, No. 4, June 2002, pp. 381 –394.

J.A. Milke, M.E. Hulcher, C.L. Worrell, D.T. Gottuk, F.W. Williams: Investigation of Multi-sensor Algorithms for Fire Detection, Fire Technology, Vol. 39, No. 4, Oct. 2003,pp. 363 – 382.

J.B. Bowles, C.E. Pelaez: Application of Fuzzy Logic to Reliability Engineering,Proceeding of the IEEE, Vol. 83, No. 3, March 1995,PP435-449.

J. Reed: Control and Indicating Equipment for Fire Alarm Systems, International Fireand Security Product News, Vol. 20, No. 5, 1995, PP. 41 – 42.

L.A. Cestari, C. Worrell, J.A. Milke: Advanced Fire Detection Algorithms using Datafrom the Home Smoke Detector Project, Fire Safety Journal,
Vol. 40, No. 1, Feb. 2005, pp. 1 – 28.

P. Radonja, S. Stankovic: Generalized Profile Function Model Based on Neural Networks, Serbian Journal of Electrical Engineering,
Vol. 6, No. 2, Nov. 2009, pp. 285 –298.

R. Siebel: Test of Fire Detection Algorithms using Artificially Generated Events,Fire Safety Journal, Vol. 41, No. 4, June 2006, pp. 258 – 265.

V. Gurevich: Microprocessor Protection Devices: The Present and the Future,Serbian Journal of Electrical Engineering, Vol. 5, No. 2, Nov. Nov. 2008, pp. 325 – 339.

Y.C. Tsai: The Design and Implementation of Early Fire Detection and HierarchicalEvacuation Alarm System, Master Thesis, Graduate Institute of Networking and Communication Engineering, Taiwan,2007