Fire Detection Using Digital Image Processing

B. TRIVENI[1], K. SIVA MOUNIKA[2], B. JEEN RAHELU[3]
[1, 2, 3] *Department of Electronics and Communication Engineering, Vasireddy Venkatadri Institute of Technology, Namburu, Guntur, Andhra Pradesh, India*

Abstract- ***The process of oxidation of any material in the exothermic process of combustion, releasing heat and light as byproducts, is called Fire. The light parameter and the color of the flame help in detecting fire. Fire detection using color information has many applications in computer vision and other domains. Our color model based method used for fire detection has many advantages over conventional methods of smoke detection etc., such as simplicity, feasibility and understandability. In order to enhance the performance parameters of fire flame detection based on a live video stream, we propose an effective color model based method for fire detection. Each and every pixel is checked for the presence or absence of fire using color features, and periodic behavior in fire regions is also analyzed. Dynamic boundary check is also done to detect the edges of the fire Region of Interest (ROI). Candidate fire regions are detected using the chromatic and dynamic measurements. This project is implemented using the Open CV module.***

I. INTRODUCTION

When there is an emergency situation especially when there is an outbreak of fire in building or cars or public places or forest we need to take some basic precaution is to stop or at least to stop that fire, Fire detection using color information has many applications in computer vision and other domains. Our color model based method used for fire detection has many advantages over conventional methods of smoke detection etc., such as simplicity, feasibility and understandability. In order to enhance the performance parameters of fire flame detection based on a live video stream, we propose an effective color model based method for fire detection

The purpose of the project is to solve the existing problem of unreliable fire detection systems used in industrial warehouses. The project is aimed at using surveillance cameras in order to detect and monitor the occurrence of fire. Since the cameras are already installed in places, this system is aimed at diminishing the disadvantages of false alarm, making the system cost effective and fast method of detecting fire. The system uses Open Source Computer Vision, also known as Open CV, is an open source freeware which is aimed at computer vision

Main objective is to predict the fire accidents and emergencies caused by the fire accidents. Large numbers of techniques have been developed for the fire detection from images of videos due to the number of vision based algorithms proposed in various literature surveys. Conventional methods of fire detection have been practically replaced with Video-based smoke detection methods due to various advantages over conventional methods like such as early fire detection, speedy response and non-presence of spatial limits.

This procedure is to determine the benefits and savings that are expected from a candidate system and compare them with costs. It benefits out weight costs, and then the decision is made to design and implement the system. Otherwise, further justification or alternation in proposed system will have to be made if it is to have a chance of being approved. This is an ongoing effort that improves in accuracy at each phase of the system life cycle. This project is economically feasible project.

II. SYSTEM REQUIREMENTS

The software requirements for this System are Intel Pentium 4 and above processors, Speed 2.00 GHz, 2GB Ram , Hard disk of 10GB, 32 or 64 bit processor or operating system , Floppy drive of 5.00MB, Keyboard, Mouse, Monitor, Camera and Laptop.

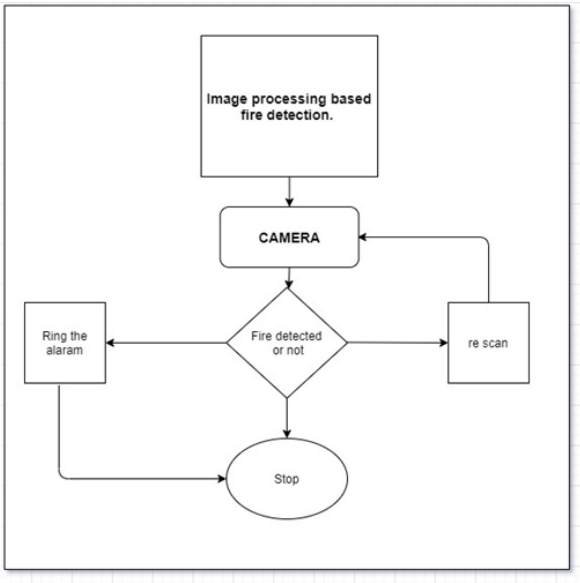

Fig.1 Image processing based Fire Detection

System analysis is also one of the most important phase of the project development, which is used to analyze the complete project requirement specifications. It's the best way to know the path before the hitting the final end work of the project, this phase will never the less do the same. Content diagram is shown in Fig.2 and after analyzing the requirements of the task to the performed, the next step is to analyze the problem and understand its context. The first activity in the phase is studying the existing system and other is to understand the requirements and domain of the new system. Both the activities are equally important but the first activity server as a basis of giving the functional specifications and then successful design of the proposed system.

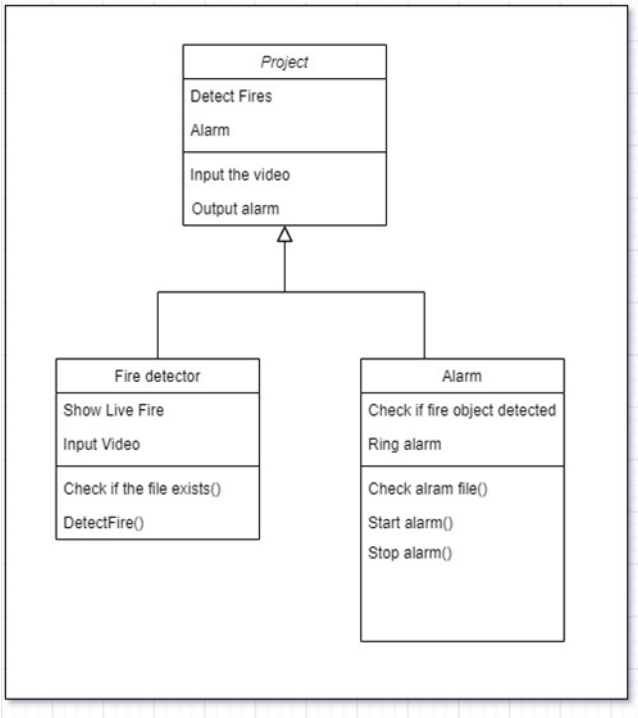

Fig.2 Content Diagram of image processing of fire detection

III. METHODOLOGY

This Standalone application can be implemented by using python language. This implementation can be done in different programs Python, compute vision, Tensor flow, and Camera software

A fire image can be described by using its color properties. There are three different element of color pixel: R,G and B. From the original image color pixel can be extracted and represented in three separate elements R,G and B which is used for color detection. RGB color model is used to detect red color information in image. In terms of RGB values, the corresponding inter-relation between R, G and B color channels: R>G and G>B. The combined condition for the captured image can be written as: R>G>B.

In fire color detection R should be more stressed then the other component, and hence R becomes the domination color channel in an RGB image for fire. The above equation decided that R as to be over some pre- determined threshold value RTH.[1] All of these conditions for fire color in image are summarized as following: Condition1:R > RTH

Condition2: R > G>B

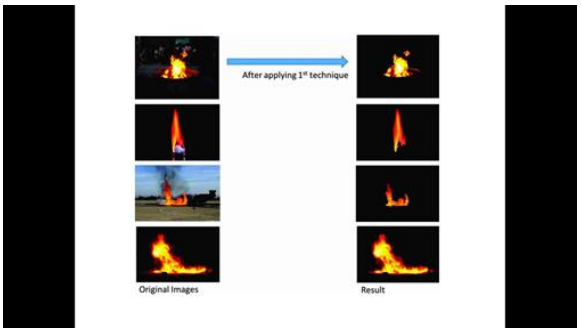

Fig.3 background subtraction

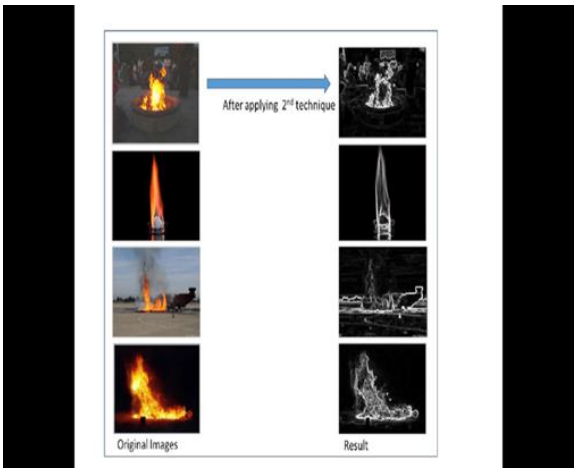

Fig.4 Sobel Edge detection

IV. ALGORITHM

Activity diagrams are graphical representations of workflows of stepwise activities and actions with support for choices, iteration and concurrency. In the Unified Modeling Language, activity diagrams are intended to model both computational and organizational processes. Activity diagrams show the overall flow of control. Activity diagrams are constructed from a limited number of shapes, connected with arrows.

Step0: Start
Step1: Detect objects in the frame
Step2: Detect the outlines of fire object
Step3: If found give a message that found fire
Step4: Else keep on observing the video
Step5: Stop

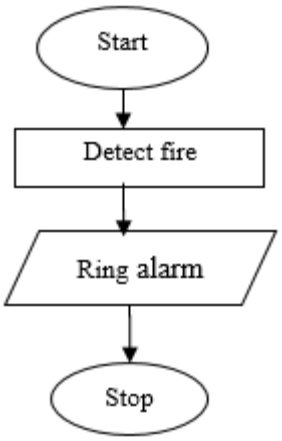

Fig.5 Algorithm for fire detection

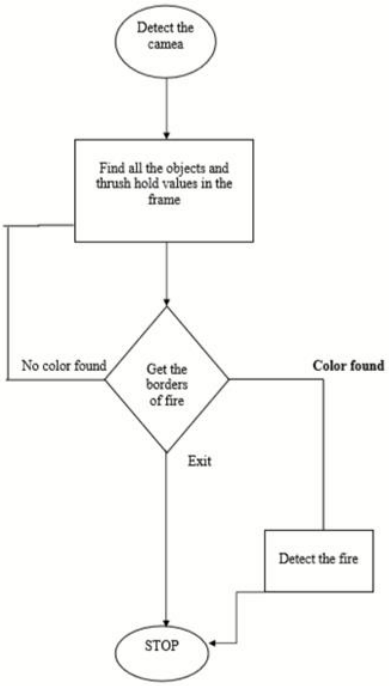

Fig.6 Flow chart of Fire detection

V. RESULT

This project will be useful to the users who are willing to know the fire accidents in the industries, forest and any other public places. This project evolves to a good application for dumb people if we extend it to a great level.

Fig. 6 Input image

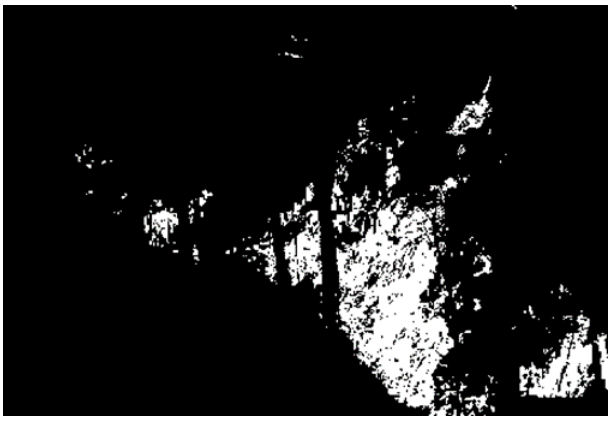

Fig. 7 Resulted image

VI. CONCLUSION & FUTURE SCOPE

We proposed a fire detection algorithm based on image processing techniques. The algorithm uses RGB color model to detect the color of the fire which is mainly comprehended by the intensity of the component R which is red color. The growth of fire is detected using sobel edge detection. Finally a color based segmentation technique was applied based on the results from the first technique and second technique to identify the region of interest (ROI) of the fire. The algorithm works very well when there is a fire outbreak. The overall accuracy of the algorithm is greater than 90%, indicating the effectiveness and usefulness of the algorithm. In future work, a real-time based algorithm could be considered as it might increase the efficiency of the algorithm which is currently 80.64%.

REFERENCES

[1] Md Saifudaullah Bin, Rosni Abu " Development of Fire alarm system", Published in Electrical, Electronics and system Engineering ICEESE 2013.

[2] C.Shunxia and C. Yanda, "Design of Wireless Intelligent Home Alarm System", Industrial Control and Electronics Engineering (ICICEE), 2012.

[3] V.Rakesh, P. Sreesh and S. N. George ,"Improved real-time surveillance system for home security system", 2012 Annual IEEE India Conference (INDICON).

[4] J.San-Miguel-Ayanz and N. Ravail, "Active fire detection for fire emergency management: Potential and limitations for the operational use of remote sensing," Natural Hazards, vol. 35, no. 3, pp.361-376, 2005s.

[5] Turgay Celik, Fast and Efficient Method for Fire Detection Using Image

[6] T. Chen, P. Wu, and Y. Chiou, "An Early Fire-Detection Method Based on Image Processing" Proc. IEEE Int. Image Process, 2004, pp. 1707-1710.

[7] B.U. Toreyin, Y. Dedeoglu, and A.E. Cetin, "Flame Detection in Video Using Hidden Markov Models," Proc. IEEE Int. Conf. Image Process, 2005, pp. 1230-1233, 2005.

[8] B.U. Toreyin, Y. Dedeoglu, and A.E. Cetin, "Computer Vision Based Method for Real Time Fire and Flame Detection," Pattern Recognition Lett. vol. 27, no. 1, 2006, pp. 49-58.