iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** III **Month of publication:** March 2023

DOI: https://doi.org/10.22214/ijraset.2023.49573

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue III Mar 2023- Available at www.ijraset.com

Fire Detection System with the Help of Video Sequence Using Machine Learning

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***Abstract:** In the daily life of a human being, accidents will play a major role in the financial issues of the family. [1] In this paper, we are going to propose a real-time fire detection system that is going to predict the difference between fire and non-fire video sequences. [2] Here, we are going to compare the video sequences by splitting them into a set of frames and comparing those frames to predict whether the area is under fire or not. [3] This is going to benefit large areas like offices, houses, and buildings. [4] This would also send an alert message to the building's system.*

I. INTRODUCTION

Fire accidents are more dangerous than compared to the other accidents, as the fire accidents may lead to financial losses and, at times, even the loss of human life, which is going to affect the family's situation.

In order to stop the fire accidents and protect the people and commercial areas. The fire detection sensors were being used rapidly by the people to detect the fire activities at an initial stage. As the fire detection sensors will work until the smoke from the fire reaches the sensor, after the smoke reaches the sensor, it will activate the fire alarm. So, to detect them at a very early stage of the fire activity, we are going to replace the fire sensor detection with the video sequence with the help of camera resolutions.

As camera footage does not need to wait for the smoke from the fire, it will detect the fire activity at an early stage to stop the fire activity without being physically present at that specific area. As all the algorithms are based on colour pixel recognition and motion detection features, these features are playing a major role during the image processing process to predict whether the area was under fire or not. The entire process is going to be divided into several phases in this fire detection system. In this initial stage, we are going to create a dataset that contains some fire and non-fire image activities, and along with the recorded video clips, we are going to use those images to describe the area that was under the fire-like activity or not. In the next step, we are going to apply the RGB colours to the specific images, which will bring about better conformation. Later, it will be validated against the images in the dataset to predict activity at an early stage. For a better classification of the image, we can use the Keras library in Python to get some better results.

II. EXSISTING SYSTEM

In the real world, we are going to use a fire detection sensor system in the building to alert people that an area is under fire activity. As the fire detection sensor system is a manual system that will not detect the fire until the smoke reaches the sensor system, even if the area is under fire, the fire sensors cannot detect the fire activity. Hence, this is the major drawback during the fire activity to detect the fire activity at an initial stage. So, we proposed this fire detection system using the video sequence, which is going to detect the activity at an initial stage. As it is going to benefit areas where people cannot make the effort for the manual system. They can establish cameras for the surveillance, and we can use those cameras for the fire detection activity.

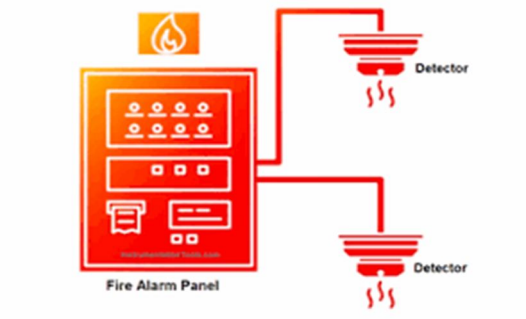


Fig 1: Manual Fire Alarm System

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III. PROPOSED SYSTEM

In this project we categorised them into several groups including shape and density, Gray-Level Co-Occurrence Matrix (GLCM), Gray Level Difference Method (GLDM), Fast Fourier Transform (FFT), and Wavelet transform as an better extraction of the image clarification. As these all are going to help to extract the image for the better clarification for the prediction of the activities.

Here we are using frames which will be extracted from the video sequence as a way that, It is going to be used for the comparison of the frames continuously in a way that it will be updates with continuous improvement of data set

As the collection of the large amount of video data containing of fire incidents and non-fire incidents as it is going to help the machine learning model to train the dataset and it will be helpful during the execution of the project.

Also, the algorithm is going to pre-process the images during the collection of the data to remove noises and enhance the contrast of the images. The below image is going to explain the procedural steps of the process in the backend for the working nature of the fire detection system.

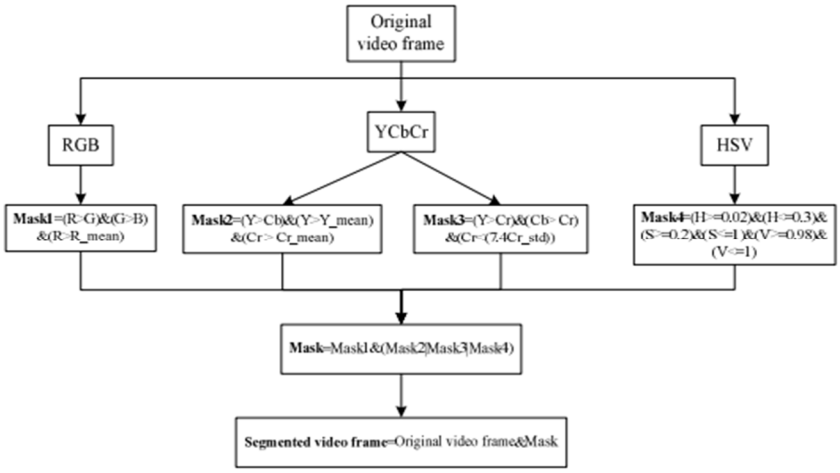


Fig 2: Step-by-step procedure for the video sequence detection

IV. ARCHITECTURE

1) *Video Input:* The cameras deployed in the structures, businesses, or places under surveillance would broadcast footage to the system continually, 24/7/365.
2) *Pre-processing:* The video frames would undergo pre-processing to remove important aspects from the pictures and reduce the noise from the video clips.
3) *Alert System:* An alarm system would be activated if the machine-learning model discovered a fire. This could initiate alarm sounding or alarm system activation to sound an alarm and notify the building's security.

To improve accuracy in the real-world experiment, the machine learning model will constantly train the dataset.

By applying machine-learning techniques, the system will eventually continually monitor the video streaming to look for the presence of activity.

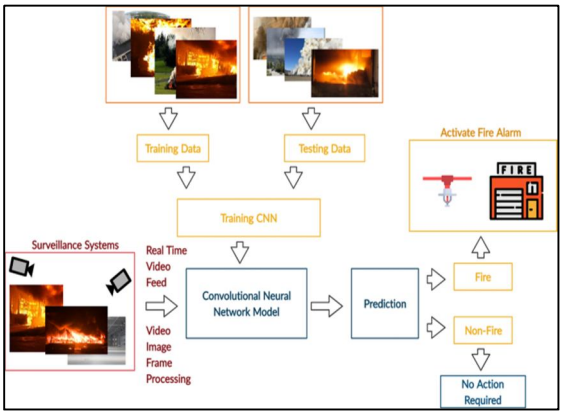


Fig 3: Working nature of the fire detection system with of help of video sequence.

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V. LITERATURE SURVEY

Surapong Surit, Watchara Chatwiriya, has proposed a method to detect fire by smoke detection with the help of video. This approach is based on an image processing approach with static and dynamic characteristic analysis.

Dimitropoulos proposed an algorithm where a computer vision approach for fire-flame detection is used to detect fire activity at an early stage.

Akshata & Bhosale proposed another method where the local binary pattern acts as a base for fire detection and wavelet Decomposition is used to detect fire. Pixel-level analysis is required for this method. This method uses the YCbCr colour model to detect fire.

Celik proposed a general model for fire and smoke detection without the use of sensors. This is based on the colour models such as YCbCr, HSV, and RGB colours for fire and smoke detection.

Cheng proposed a fire detection system based on neural networks. Here, neural networks are used in the detection of temperature and smoke density to determine whether the area is under a fire accident or not.

VI. RESULTS

After the implementation of the source code, the code will access the camera to detect fire activity or not.

Here, we are going to discuss the process of implementing the fire activity or not.



Fig 4: The matchstick was not lit.

As the matchstick was not lit, the machine learning algorithm considers it a non-fire activity, and hence it will not send any messages to the fire system.



Fig 5: The matchstick was lightened.

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As the matchstick was under fire, hence the machine learning algorithm is going to detect the fire from the matchstick.

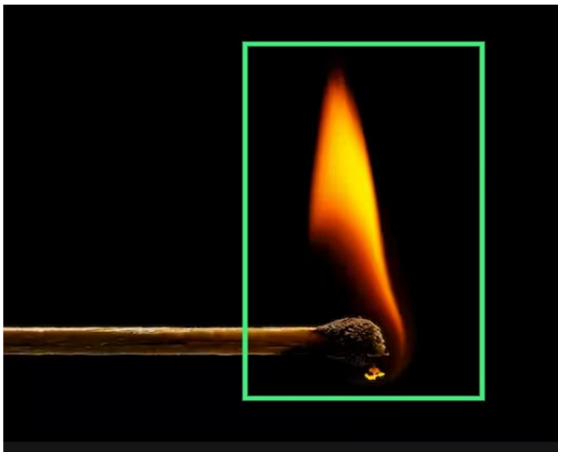


Fig 6: Algorithm is detecting the fire for the conformation.

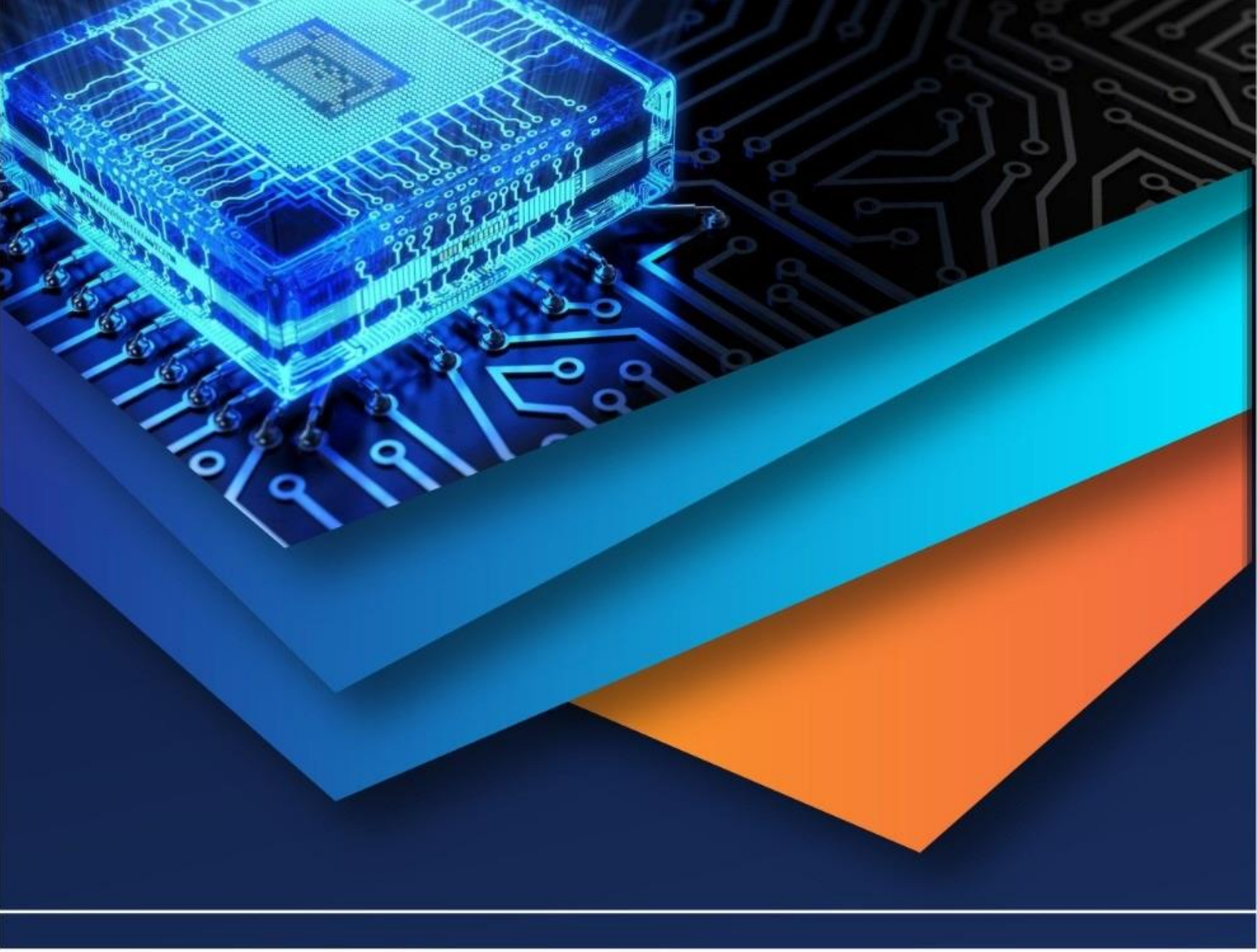
As machine learning has detected fire activity, after the confirmation of the fire activity, the algorithm is going to send an alert message to the fire alarm system.

VII. CONCLUSION

In this paper, we proposed an efficient scheme for the fire detection system using the video sequence. Initially we are going to first create a dataset of which contains about 246 fire like activities and 256 non-fire like activities to predict the real time activity. In second step, we are going to split the video sequence into several frames which is going to predict the fire activities. In the third step, these frames will undergo into the algorithm to get verified whether the area is under the fire activity or non-fire activity. After that the algorithm will define the activity based on the test cases from the dataset. Later that the algorithm is going to extract the frames by applying the RGB colours and resizing the frames to get more accuracy images from the dataset. In the final step the algorithm is going to send the messages to the fire alarm system and sends an alert message to the fire department.

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