IJRAR.ORG E-ISSN: 2348-1269, P-ISSN: 2349-5138

INTERNATIONAL JOURNAL OF RESEARCH AND ANALYTICAL REVIEWS (IJRAR) | IJRAR.ORG

An International Open Access, Peer-reviewed, Refereed Journal

Alarm based Fire Detection Using Image Processing

Saladi Saritha*[1], Alla Kusuma[1], Molakala Srilekha[1], Adabala Devi Prasanna[1]

[1]School of Electronics Engineering, VIT-AP University, Amaravati, Andhra Pradesh, India.

Abstract: In image processing, the input image is transformed into another image as output with certain techniques applied to it.The project aimed to detect fire by using the image processing technology that will alert people by early detection of fire. The project is implemented by using Open CV, image processing and to the webcam as hardware(or) in-built cam. Webcam is taken as an input source, which captures the video feed from the surrounding and feeds. The entire code is written in pure python language using the open CV library for image processing.

IndexTerms - Fire Detection, Web camera, Open CV, Python, Video Processing, Visual based Approach.

I. INTRODUCTION

Fire is extremely harmful and can cause significant property damage and human loss. Thousands of fire-related incidents occur worldwide each year as a result of power outages, unintentional fires, and natural lightning. Thus, numerous systems are being developed to control fire. The current systems are sprinkler and smoke sensor types, which are meant to detect fire from smoke and turn on when the temperature reaches a predetermined level. However, there are a number of drawbacks to this type of system, including false alarms, coverage of space, signal transmission, and fire alarm delays.

Time delays occur because smoke takes time to ascend to ceilings where smoke detectors are installed. Another issue with the current method is that it is difficult to apply in public spaces and major infrastructures, such as stadiums and airplane hangers, because of the large area that these facilities cover. Numerous opportunities arise when image processing technology is used for fire detection. The technique can be used in dangerous locations where there is constantly a risk of fire and extreme heat and temperature. These locations should be under constant observation due to the high-risk area associated with this technology. The technology is able to provide accurate site information.

In order to achieve cost-effectiveness, low power consumption, and portability, the project is developed with an open CV and image processing. In addition to these benefits, Open CV provides lots of opportunities for networking and software use, which will be helpful for this project going forward and for other initiatives as well. The significance of the suggested thesis is to create a smart, safe, and dependable system that eliminates restrictions and flaws like false alarms, which, when used with modern technology, can cause panic attacks in people and even financial loss. And protect the areas from dangerous fire. Traditionally, fire extinguishers are used to put out fires. The user physically extinguishes the fire in the affected region by going there. The amount of time it takes for the user to arrive at the location could cause the fire to get more intense or to spread farther. The project's goal is to develop an effective image-processing-based gadget that can put out a fire as soon as it begins. Since the system will be completely automated, human involvement would not be necessary.

II. PROPOSED SYSTEM

While doing computer vision tasks like in this project, in computer vision tasks like this one, we can use a variety of methods to obtain information about the object, including image processing, image models, RGB/HSV conversion techniques, and HAAR cascade classifiers. In this project, we use the Haar Cascade Classifier algorithm, which is a simple way to identify objects in an image. Viola Jones created the Haar Cascade Classifier as an object detection technique. This technique is based on combining the classifier with Haar-like features, which strengthens the cascade. Haar- like features are frequently used for object detection because they provide a quick extraction process and can depict images with lower resolution. Numerous object detection applications have effectively used this technique. And we use the RGB color model, A fire image can be described by using its color properties. One can use the color properties of an image to describe a fire. Three distinct color pixel elements are present: R, G, and B. For the purpose of color detection, the color pixel can be separated into these three separate elements: R, G, and B.

To identify red color information in an image, utilize the RGB color model. The corresponding relationship in RGB values between the color channels R, G, and B is R>G and G> B. R>G>B is the combined condition for the image that was captured. R should be given greater attention in

fire color detection than the other component, making it the dominant color channel in an RGB image of fire. This places a requirement on R that it be greater than a preset threshold value.RGB to Grey level conversion, An RGB color space is any additive color space based on the RGB color model. The red, green, and blue additive primaries' three chromaticity's define a specific RGB

color space, which can produce any chromaticity that is the triangle defined by those primary colors. The application is based upon the python language, which is a high-level programming language easy to use, and with python, the system uses the open CV library for all the image processing systems.

PYTHON

Python is considered as a high-level, general-purpose programming language. Python code is easier to read than code written in other languages like C, C++, or Java. The process of writing code involves a lot of syntax and is far too complex to understand in one sitting. Python, on the other hand, has a smaller code base. Python is a great choice because of its ease of use and code compatibility. Additionally, Python supports a wide range of libraries and frameworks, making it easier and providing developers with greater flexibility to create and finish projects. NumPy is one of the libraries that the system uses. It is an important library for the multidimensional array function, matplotlib, which is the plotting library that gives the visual datasets and is also helpful for the statistical analysis of the data. Due to simplicity, mostly python is used in R&D. Mostly nowadays, python is used for Machine Learning and Artificial Intelligence.

OPEN CV

OpenCV is an open-source package and machine learning library, which is designed for real- time computer vision applications. The cross-platform library Open CV supports a wide range of programming languages, including Python, Java, C++, C, and others. Originally created by Intel, this library is available for use without charge under the terms of the open-source BSD license. It is one of the most popular libraries for use in human-computer interaction, deep learning applications, image and video detection, machine learning, and 2D and 3D feature toolkits. More than 2500 algorithms, including machine learning and computer vision algorithms, are available in the library.

III. FLOW CHART SYSTEM

A vision-based fire detection system, at first the image is captured. Since the project's goal is to find a low-cost solution, using a regular video surveillance camera to take the picture is suggested.

The captured image is then changed to an appropriate color space. In the image, noise reduction is applied. Next, a variety of the image's data is examined in accordance with the detection algorithm. Almost all fire detection systems analyze the image's color and motion data.

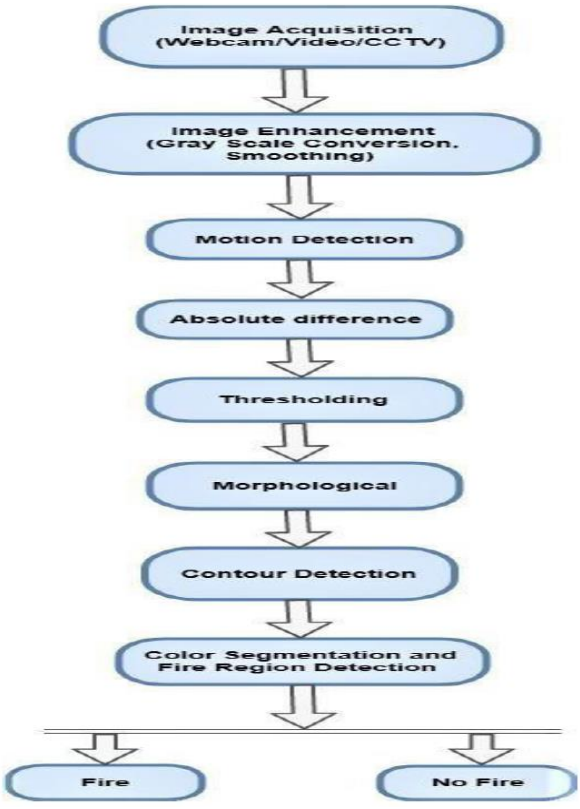


Figure 1: Implementation of the work done.

IV.EXPERIMENTAL DETAILS

(i) Results of tests at distance 50 centimeters.

For the very first test, we chose to keep the distance short for the initial test. We adjusted the fire's intensity by using different fire sources at different angles, and the system's accuracy was as follows:

Table1: Detection upto 50cm distance

Distance	Test no.	Real fire	Accuracy
50 cm	1	Detected	100%
	2	Detected	
	3	Detected	
	4	Detected	
	5	Detected	

(ii) Results of tests at distance more than 100 centimeters.

Then we changed the distance to more than 1 meter for detecting fires at long distances the distances and angles of the fire were different this time. The accuracy of the system was as follows:

Table2: Detection upto 100cm distance

Distance	Test no.	Real fire	Accuracy
>100 cm	1	Detected	90%
	2	Detected	
	3	Detected	
	4	Detected	
	5	Detected	

V. RESULTS



Figure2: Sample Image1



Figure3: Sample Image2

The main goal of the thesis was to make a fire detector system. Following the successful coding implementation and integration into Python, the system demonstrated its capability to detect fires. As depicted in Figure 5, the system identifies flames, interpreting them as small fires. The results conclusively confirm the system's effectiveness in fire detection. Notably, Figure illustrates the presence of a green rectangular box, which materializes upon the detection of a flame. The size of the rectangle varies, depending on the magnitude of the fire. During the coding process, specific threshold values were established to ensure accurate detection of the fire region within the rectangle.

VI. CONCLUSION

The project's unique approach, which deviated from current systems, attempted to innovate fire detection. Although they have proven to be very effective, current solutions like sprinkler water discharge systems and smoke detectors are not without their drawbacks. The goal of this thesis is to optimize the current system considering technological advancements. Considering how quickly technology is developing, the objective was to design a system that would both keep up with new developments and get around the drawbacks of existing approaches. In order to overcome these obstacles, a new system was created. The system uses an image processing technology to detect fires by using a camera to replace a person's eye. When the system notices a fire, it records video, uses specialist software to process the image, and notifies the user right away. Using image processing technology can significantly reduce constraints because of its affordability, ease of use, and portability. The method of detecting fires has worked well. A comprehensive review analysis, system design, algorithmic details, testing protocols, and the resulting results are all included in the thesis.

REFERENCES

[1] Science Direct.Image Processing. [online],URL: https://www.sciencedirect.com/topics/engineering/imge- processing Open CV.
[2] Open CV. Face Detection Using Haar Cascade [online], URL: https://opencv-python tutroals.readthedocs.io/en/
[3] A. Rehman, N. Masood, S. Arif, U. Shahbaz, F. Sarwar, K. Maqsood, M. Imran, & M. Pasha, IEEE Paper on "Autonomous Fire Extinguishing system"
[4] Murali, K., Kumar, K. U., Chandra, D., Babu, M., & Sai, A. (2022). Fire Detection Using Image Processing. International Journal of Research in Engineering, IT and Social Sciences, 12(7), 1-5. ISSN 2250-0588.
[5] Pannu, N. S., Muradkar, S., & Chaurasia, A. (2022). Image Processing Based Fire Detection System. Title of the Journal or Conference Proceedings.
[6] Shrestha, Bibek. "Fire Detection Using Image Processing." (2020).