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FIRE DETECTION & LOCALIZATION USING CCTV SURVEILLANCE

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Abstract: The heavy fires cause large amount of human loss as well as property loss. Fire accident incidents can be avoided by implementing a system with alarm output and sending a message to alert the nearby people to focus on the lives of humans and properties. An intelligent Fire Detecting system is developed to detect fire and trigger alarm to alert the people as one way to prevent growth of fire, save people and reduce losses and sufferings. The fire identification framework has surrendered condition of-the-artistic work execution in picture grouping and other PC vision errands. These Fire Detection System is significantly developed with a unique, computationally proficient Model for fire recognition, restriction, and semantic comprehension of the location of the fire. It utilizes more modest technologies and color models, which helps downplay the computational prerequisites. Regardless of its low computational requirements, the trial results show that our proposed Fire Detection system accomplishes correctness's that are practically identical to other, more intricate models, primarily because of its expanded profundity, there is significant inclination to change to fire location techniques utilizing PC vision-based frameworks. Now in this framework we are providing new method i.e.; it captures the fire accident image and sent to respective authorities for their reference to know about growth of fire as well as provide the information about location of fire involved and different color models are compared based on that i.e.; the RGB to HSV color model conversion gives the best results as compared with other models.

Index Terms **– Fire Detection, RGB and HSV Color Model, OpenCV, NumPy**

1.INTRODUCTION

The main purpose of the report is the development and implementation of system capable to detect and alert , in real time fire detection applications. To forestall harms brought about by fire, a few fire recognition frameworks were created. One can track down various specialized arrangements. The greater part of them depends on sensors, which is likewise commonly restricted to inside. Nonetheless, those strategies have a tragic defect where they will just work on arriving at a specific condition. Hence, in this work the authors are focused on the video monitoring of a fire using camera module. Two general classifications of approach can be recognized for fire detection: conventional alarms and vision sensor-helped fire recognition. Conventional alarm frameworks depend on sensors that require nearness for initiation, like infrared and optical sensors. These sensors are not appropriate to basic conditions and need human association to affirm a fire on account of a caution, including a visit to the area of the fire. Moreover, such frameworks can't normally give data about the size, area, and consuming level of the fire. To beat these constraints, various vision sensor-based strategies have been investigated by analysts in this field [1-4]; these enjoy the benefits of less human obstruction, quicker reaction, reasonable expense, and bigger reconnaissance inclusion.

Such frameworks can affirm a fire without requiring a visit to the fire's area and can give point by point data about the fire including its area and size, and so forth in spite of these benefits, there are still a few issues with these frameworks, e.g., the intricacy of the scenes under perception, unpredictable lighting, and bad quality edges; specialists have put forth a few attempts to address these angles, thinking about both shading and movement highlights. Chen et al. [5] inspected the unique conduct of flames utilizing RGB and HSI shading models and proposed a choice rule-helped fire location approach, which involves the unpredictable properties of fire for recognition. Their methodology depends on outline to-outline contrasts, and consequently can't recognize fire and fire-hued moving locales. Marbach et al. [6]. The YCrCb colour space is generally utilized in advanced video, picture handling and so forth. In this luminance data is addressed by a solitary part, and variety data is put away as two variety contrast parts, Cb and Cr. The CIELAB colour space in which equivalent distances are planned to address edge or suprathreshold saw colour contrasts of equivalent size[7]. It is one of the most generally utilized colour spaces. The common applications incorporate colour determination and colour contrast assessment.

2.ANALYSIS

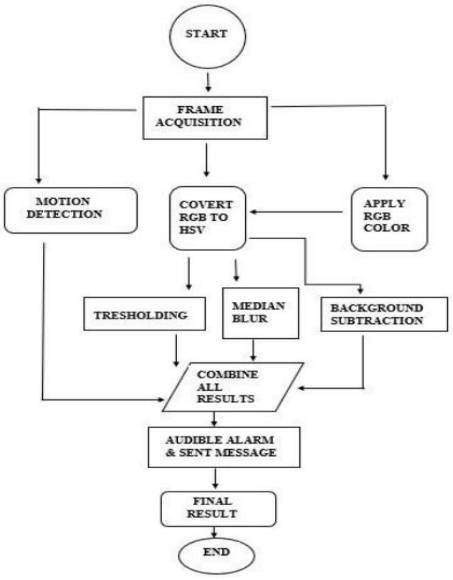

Fig.1.1. A Fire Detection System Flow

The figure 1.1 shows the complete operation flow system of this work. Detection of fire starts with the help of inbuilt camera module then based on the video i.e., converted into frames. At present RGB colour model is applied then the real frames are changed over completely to HSV colour design. In view of the Motion Detection and HSV colour model. The thresholding worth still up in the air, Motion haze can be applied, and Background subtraction can be applied by combining all the results if the threshold value greater then as defined the fire is detected, then the Play Sound module will trigger, alarm is generated, and the message will be sent to Fire Station through E-mail.

RGB color model is an added substance shading model in which red, green and blue tones are blended in different extents to frame an alternate exhibit of tones. e. In this model, colors are ready by adding parts, with white having all tones in it and dark without the presence of any color[8]. HSV (Hue, Saturation, Value) color space is extensively nearer to RGB shading space in which people portray color sensations and see tones. s. Immersion is how much white light arranged with hue.

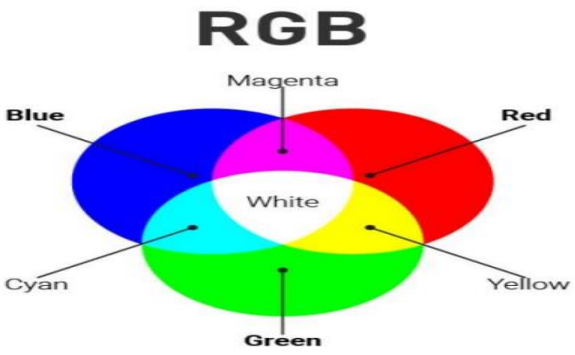

Fig.1.2. RGB Colour Model

RGB colour model is utilized in different advanced showcases like TV and video shows, Computer shows, computerized cameras, and other light- based presentation gadgets. A color model is an interaction for making more tones utilizing a couple of essential tones. There are two sorts of shading models they are Additive shading mode and the Subtractive shading model. Value is the splendor/Intensity. In short structure, Hue refers to color, Saturation refers to shade and value refers to tone[9]. A HSV variety space can be seen as a mathematical chamber, where the angular dimension represents Hue(H), starting at the primary red at 0º, and moving to primary green at 120º and primary blue at 240º, and then finally wrapping at 120º and primary blue at 240º, and afterward at long last wrapping back to red at 360º.

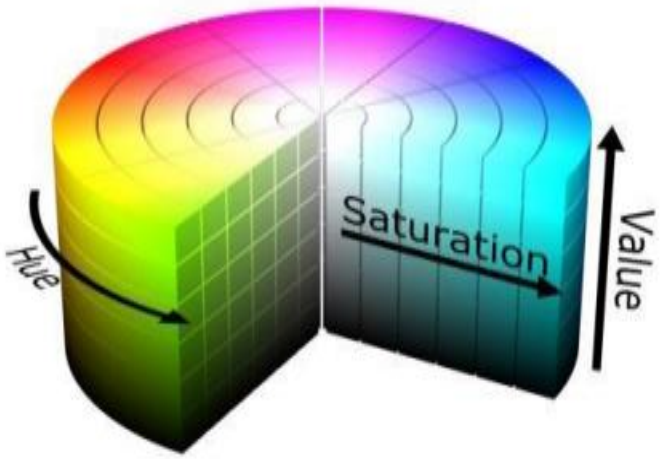

Fig.1.3. HSV Colour Model

3. IMPLEMENTATION

3.1. METHOD OF IMPLEMENTATION

Step 1 – Take image as input from a camera.

Step 2 – Process the input video with the help of OpenCV library.

Step 3 – Gaussian blur is applied with the help of RGB and HSV colour model.

Step 4 – Based on the described threshold value fire can be predicted.

Step 5 – Classifier will categorize whether the threshold value of fire is above and below the described threshold value.

Step 6 – If the threshold value is greater than the described value, the script undergoes into the process.

Step 7 – Detects Fire level based on the threshold value i.e., inputted in the script.

Step 8 – Triggers the alarm and takes the picture of the Fire accident.

Step 9 – And then the picture is sent to Respective authorities through E-mail using SMTP protocol and location of Fire Accident is also shared in the Email for the reference.

3.2. SOFTWARE REQUIREMENT SPECIFICATION

a) PYTHON

- Python 3.8

b) LIBRARIES

- OpenCV
- Numpy
- PlaySound
- SMTP protocol
- IMGHDR
- Eamil.Message

c) OPERATING SYSTEM

- Windows

3.3. HARDWARE REQUIREMENT SPECIFICATION

- CCTV Camera
- Ethernet Cable
- Adapter
- PC/Desktop

4. RESULT AND DISCUSSION

Fig 1.4: The Input image from the video using webcam

The figure 1.4 shows the input image from the video using camera that can be captured using CCTV camera.

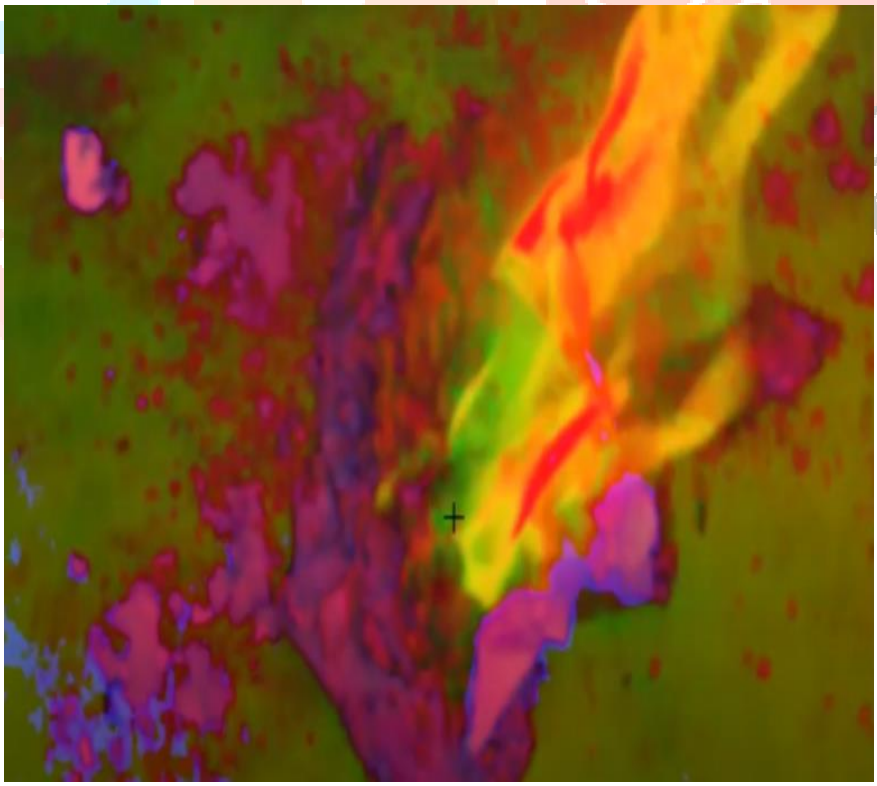

Fig 1.5 After applying RGB2HSV color model to the input video.

The figure 5.2 shows the input image after applying RGB2HSV colour model 5 to the input video that can be captured from the webcam.

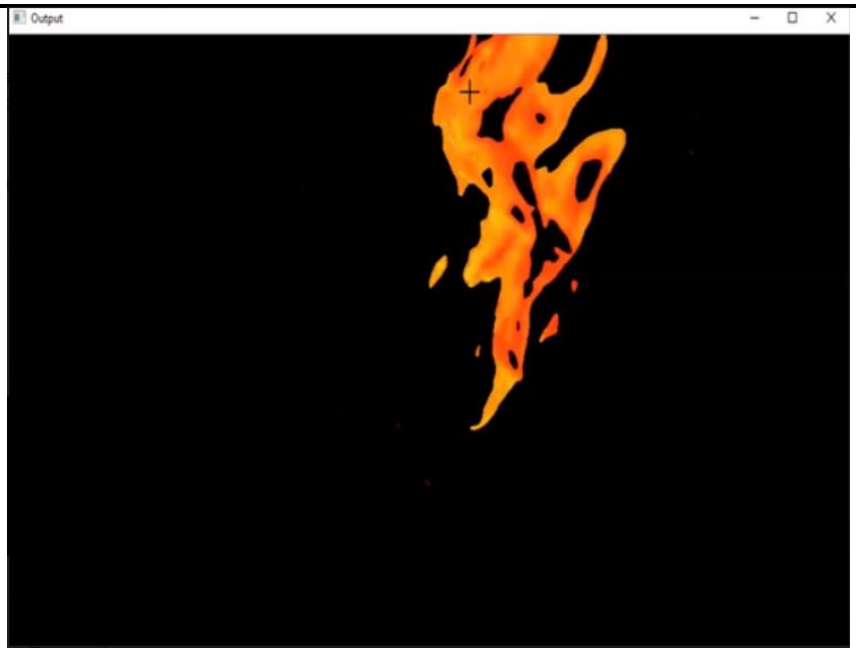

Fig 1.6 After applying Gaussian then fire is detected

The figure 1.6 shows the input image of the video after applying Gaussian blur to the input video then the fire will be detected.

The Detection of fire starts with the help of in-built camera module then based on the video i.e., converted into frames. Now RGB color model is applied then the real frames are converted to RGB color format then HSV color model is applied then it can be converted to HSV color format. Based on the Motion Detection and HSV color model. The thresholding worth will be determined, Gaussian-blur can be applied, and Background subtraction can be applied by combining all the results if the threshold value is greater than as defined the fire is detected, then the Play Sound module will trigger, alarm is generated, and the message will be sent to Fire Station through E-mail. Fire discovery utilizing handmade highlights is a monotonous assignment, because of the tedious technique for highlights designing. It is especially difficult to identify a fire at a beginning phase in scenes with changing lighting conditions, shadows, and fire like items. Customary low-level element-based strategies produce a high pace of deceptions and have low location precision. To defeat these issues, we research profound learning models for conceivable fire identification at beginning phases during observation. Thinking about the precision, the quantity of deceptions, we analyse different profound Fire Detection models for the objective issue.

5.1. TESTING AND VALIDATION

Table.1. Test Parameters

SL No:	Test Condition	System Behaviour	Expected Result
1.	Input video with no fire	NO Fire Detected	No Fire Detected
2.	Input video with only smoke and no fire	NO Fire Detected	NO Fire Detected
3.	Input video with small amount of fire i.e., less than threshold value	NO Fire Detected	NO Fire Detected
4.	Input video with large amount of fire i.e., greater than threshold value	Fire Detected	Fire Detected

The System can be undergoing into various test cases in different conditions that can be carried out to check the system behavior and to compare with the results with the expected output. For four test conditions the system behavior and the expected outputs are matched with each other. So that the system efficiency is better than the existing system. The proposed fire detection model which is free from sensors as the ordinary fire detection systems contain. The fire discovery framework can be tried over different circumstances and different constant circumstances. And the Artificial Intelligence is growing exponentially, so the future prospective is very advanced. By combining the fire detection system with the AI will be an efficient way to reduce the damage caused by the fire accidents in real time. The system is expected to detect fire while it is small and has not grown to massive proportions. Also, the system construction is minimal, and cameras are everywhere in this world.

5.2. COMPARISON OF COLOR MODELS

Table.2. Comparison of different colour models

SL No:	Colour Model	Threshold Value	Expected Result
1.	CIELAB colour space	3000	Fire Detected
2.	YCrCb colour space	4000	Fire Detected
3.	HSV colour space	2000	Fire Detected

In Table-1 the different colour models are compared to detect the fire, when we apply CIELAB colour model the fire is detected but there is a colour complexity, it can also detect for the colour similar to fire, this is the major drawback using CIELAB colour space. And by using YCrCb colour model the fire can be detected but there is colour complexity here and the accuracy is as well as low. At last, the HSV colour model is used to detect the fire, this model detect the fire accurately based on the Threshold Value[10].

5.3 SENDING AN E-MAIL

Fig 1.7. Sending a message through E-Mail.

The Figure 1.7 shows the image of E-mail sent by Fire Detection department, it contains an image detecting the fire for the reference to know the amount of fire in particular location and the mail has information of location of the Fire involved. The mail can be sent using smtp protocol by directly connecting to the server[11].

6. CONCLUSION

In conclusion, fire detection technology is a people safety technology to help preventing accidents caused by enormous fire. It is important to detect the fire and alert the people at an early stage before any unwanted fire accidents happens that may possibly lead to lot of human loss as well as economic loss. The proposed Fire Detection system using RGB and HSV color model that applies the Gaussian blur to the input video. The data gathered by the video undergoes into fire detection process and it determines the threshold value. The threshold value is compared with the described threshold value, when the threshold value is greater than described value, the fire can be detected. Alert system using alarm helps in reducing the accidents caused fire hence reducing the severe human death and property loss. As of now, the fire detection system is able to detect the fire with very minimum limitations. The alarm is also working well and able to trigger sound alarm to alert the nearby people and send the messages to Fire Station, Hospital, Police Station, Disaster Management Team, and Rescue Team using SMTP protocol through E-mail. Several recommendations are suggested for future works on this area. The system should be able to automatically determine the threshold value of fire and predict the growth of fire and detect the fire accurately at an early stage of fire.

7. ACKNOWLEDGEMENT

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