REAL-TIME FIRE DETECTION SYSTEM

UNDER THE MENTORSHIP OF

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INTRODUCTION

- Fires are one of the main causes of death amongst the worlds. Although there are various fire detection systems most of them did not proof its effectiveness in detecting fires due to inefficiency or restrictions. The presented the project I worked on with the aim of implementing a more efficient and trustworthy Realtime fire detecting system. The project was done by using various image processing techniques to detect fire flames and turn on the fire alarm if the fire is detected.
- To put out fire, traditionally use of Fire Extinguishers is done. The user goes to the area affected, and manually uses the fire extinguisher there. The time required for the user to reach the place may result in an increase in the intensity of fire or spreading of fire around the place.
- The project aims at creating an advanced device based on Image Processing to cease the fire as soon as it starts. The system would be fully automated and hence no need for any human interference is required.

Some of the reasons for fire breakout are as follows:

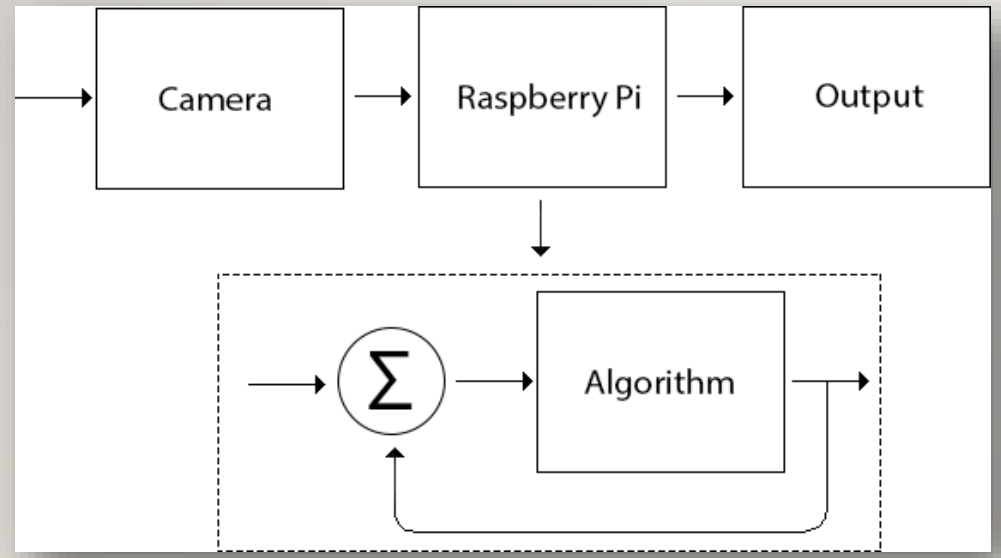
- Low ceiling heights.
- No short circuit protection in household wiring.
- No safety equipment remained available for emergencies.
- Excess number of flammable objects like wood, paper, plastic stored in one place.
- No Fire prevention measures are taken.

In this concept, we will create a fire detecting device using a camera and a ML model and apply the concepts of IoT and Image Processing to get real time fire detection results. When the Model is started, it continuously monitors the area in front of the camera for fires. This is done by using HAAR Cascade Classifier Algorithm. Once detected the system could just set an alarm.

METHODOLOGY

- The Algorithm we use in this project is Haar Cascade Classifier, which is a method for detecting objects in an image easily. The Haar Cascade Classifier is an object detection method developed by Viola & Jones. This method is based on Haar-like features, combined with the classifier which results in the cascade becoming strengthened. Haar-like features are features that are widely used in detection of objects, offering rapid extraction process and can represent a lower resolution image. This method has been successfully applied in many object detection applications.
- The classifier is made with training a cascade file from several positive & negative images, which have the same size. After assessment of the image is done, the areas which are like the object are marked as 1 whereas its marked as 0 for the areas that do not match. After the training, the cascade is now ready to examine further input images.

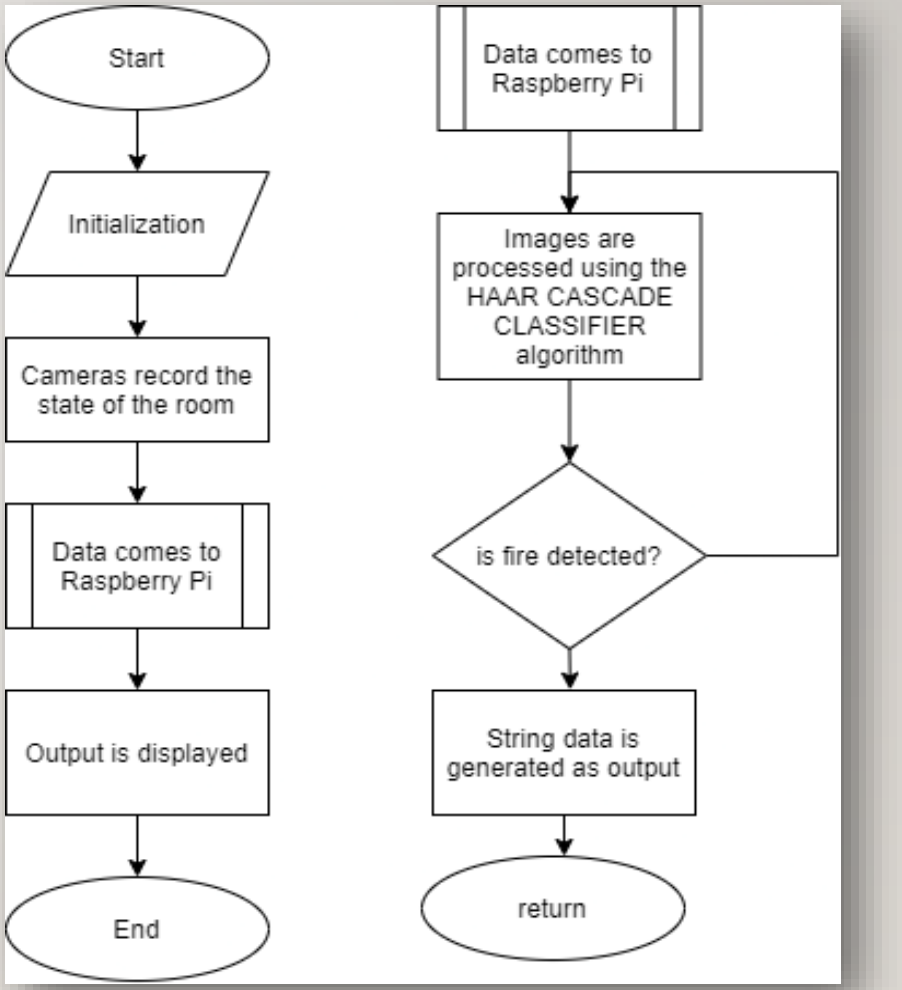
SYSTEM DESIGN



We are using ML model, device camera for the input, as it is a bit faster than the regular USB camera because the USB cameras require the CPU to work with the USB interface which takes more time rather than just the on-board camera. The image data would then be supplied to the python script that we are running with OpenCV to detect fire by using Haar Cascade.

FLOWCHART

- The flowchart of the system working is shown in the figure below. First the camera is set up with ML model using OpenCV. Image from the camera would be processed with the HAAR Cascade, and if the image contains fire, the system will recognize the fire and will give the output as fire detected.



To start the detection, we need to make the cascade file for detection of fire. To train a boosted cascade of weak classifiers, we need to use a bunch of positive and negative images. Positive images are the ones in which the images check the object that we are trying to detect, while negative images are the ones which strictly do not contain the object that we are trying to detect. We are using the software Cascade Trainer GUI.

There are around 300 positive images and 600 negative images in our Classifier and the efficiency of the classifier was more than 85%. After the training process, the trained cascade was saved in xml format and was ready to use.

RESULT AND DISCUSSION

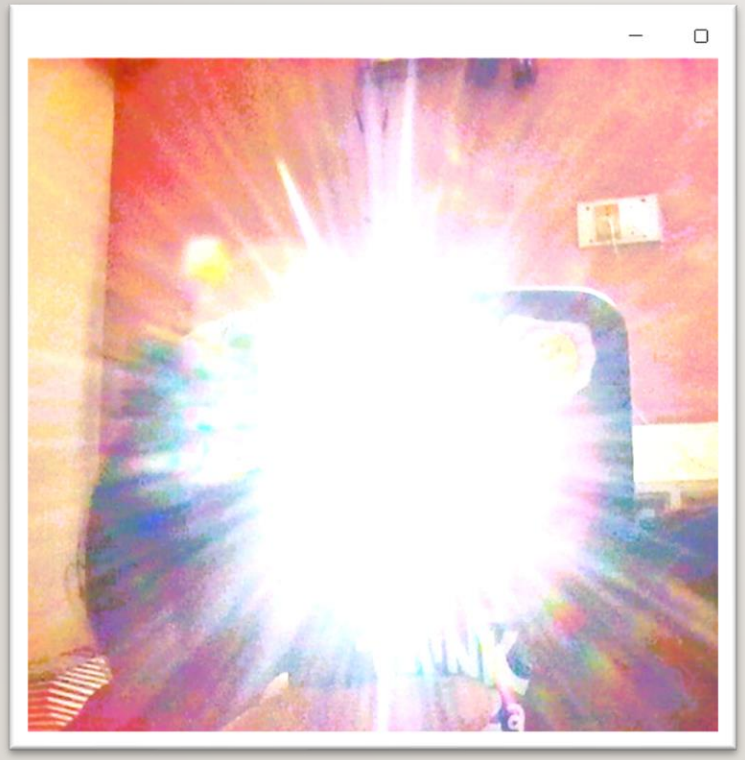
RESULTS OF TESTS AT DISTANCE 50 CENTIMETERS.

Distance	Test no.	Real fire	Other light sources	Accuracy
50 cms	1	Detected	Not Detected	100%
	2	Detected	Not Detected	
	3	Detected	Not Detected	
	4	Detected	Not Detected	
	5	**Detected**	**Not Detected**	

RESULTS OF TESTS AT DISTANCE MORE THAN 100 CENTIMETERS.

Distance	Test no.	Real fire	Other light sources	Accuracy
>100 cms	1	Detected	Not Detected	80 %
	2	Detected	Detected	
	3	Detected	Not Detected	
	4	Detected	Detected	
	5	Detected	**Not Detected**	

INPUT AND OUTPUT



```
Python 3.11.4 (tags/v3.11.4:d2340ef, Jun  7 2023, 05:45:37) [MSC v.1934 64 bit (
AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>
= RESTART: C:\Users\siddharthjain\Downloads\Fire_detection_python_project-main\F
ire_detection_python_project-main\Fire_detection_python_project_git\fireDetectio
n.py
Fire alarm initiated
Mail send initiated
Mail is already sent once
Fire alarm initiated
Mail is already sent once
```

CONCLUSION AND FUTURE WORK

- In this project, a fire detecting system has been proposed which is a more accurate and reliable way of detecting fires in small houses or office places, rather than conventional methods such as smoke detectors.
- With the accuracy of 85%, The system can be used in various areas like in parking lots to check the vehicle has paid the parking fee. Counting the number of cars passing through the junction, which helps to store data for the improvements in road traffic congestions, agriculture, farming, there are many uses of object detection.
- Our approach was limited due to the devices used and it can be improvised to be even more accurate than the system already is.
- The system can be made more accurate and precise by using other machine learning algorithms like YOLO (You Only Look Once), TensorFlow, Keras algorithm, neural network like CNN, RCNN, which are more advanced than the current algorithm used for this project.
- Future scopes also include following aspects:
- using this system along with fire extinguishers to make them automated.
- Notify the person using mail, SMS, or any other communication.
- Alert government bodies to act accordingly.

THANKYOU☺