International Journal of Engineering Technology and Management Sciences
Website: ijetms.in Issue: 4 Volume No.6 July – 2022
DOI:10.46647/ijetms.2022.v06i04.0045 ISSN: 2581-4621

Forest Fire Detection using Yolov3

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ABSTRACT
Fire detection systems play a key role in industries, shops, malls, etc. in detecting fire at the initial stages and help in saving lives and property. Commercial fire detecting systems usually have an alarm signaling with a buzzer, which has been found inadequate. To overcome these deficiencies, this project aims to design a fire detection system. In the proposed model YOLO v3 is used to detect the fire in images. Initially, it will train the dataset and after the training, the trained model is used for further process. The user has an option to upload the image and click submit, after this request hitting on the backend endpoint, identification of features will be done and soon the output will be shown saying that the image has fired or not. Also, if the fire is detected, an email and the location will also be sent to the given email address. There are quite a few such existing systems, however, they are not as effective as the situation demands to need. So a new system to detect fire from infrared images have proposed. By making use of computer vision and machine learning techniques to make it efficient and reliable. Also, the system uses brightness classification along with image processing and histogram-based segmentation. All these are made to increase the accuracy and make the system more suitable for real-time implementation. Thus, the proposed system not only solves the existing problems but also provides a new and efficient approach. Here YOLO V3 is used as a classifier to classify based on the parameters learned during the training process and the binary cross-entropy loss function is used to figure out how good our model is. Accuracy is used as an evaluation metric. Hence the main goal of the project is to accurately detect the presence of the fire as early as possible.

Keywords—IoT, CNN, Convolution Neural Network, Fire detection

1. Introduction

Fire occurrence can cause severe threats to life. Risk management in fire protection can involve a set of measures and a fire detection alarm is considered as the early detection of fire. Traditional fire detection is based on photometry, thermal or chemical detection can react within several minutes, but this requires a lot of fire to trigger the alarm and traditional alarm does not provide any information about exactly where the fire is caused. The image-based fire monitoring system can detect if the image has fire or not. When a fire is detected based on the picture, it will send an email alert to the administrator. The process is done by YOLO. Unlike most of the previous detection algorithms which apply a model to an image at multiple locations and regions considered as detection, YOLO uses a completely different approach. It applies a single neural network to the entire image, which divides the image into multiple regions and predictions are done using bounding boxes and probabilities based on each region. Since YOLO uses a single network for the evaluative the entire image, this makes it faster than most of the other algorithms like R-CNN and Fast R-CNN. One can find different technical solutions. Most of them are sensor based sensor-based generally limited to

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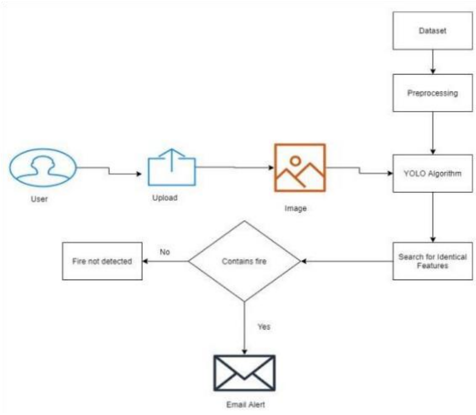
indoors. They detect the presence of particles generated by smoke and fire by ionization, which requires a proximity to fire. Consequently, this cannot be used in large covered areas. Moreover, they cannot provide information about initial fire location, direction of smoke propagation, size of the fire, growth rate of the fire, etc. Detecting fire at early stage before they turn to catastrophic event is crucial to prevent fire disastrous and save people's life and properties. Though fire and smoke detection sensors are widely installed in indoor environments, they generally require the fire to burn for a while to produce large amount of smoke and then trigger the alarm. Besides, these devices cannot be deployed in large scale outdoor environments, e.g., forest, wild area. In contrary, vision-based fire detection system capture images from cameras and detect fire immediately, thus suitable for early fire detection. Such system is also cheap and easy to install. There have been several methods in the literatures for vision-based fire detection. Color model, motion, spatial and temporal features are primarily used as fire has extremely specific characteristics compare to another object. All the proposed methods follow similar detection pipeline, i.e., first find moving pixels using background subtraction then apply color model to find fire color regions. These regions are further analyzed spatially and temporally to detect the irregular and flickering characteristics of fire. Since motion is the dominant feature, these methods work only with fixed camera, i.e., in surveillance scenarios. In this work, our method is not limited by such constraints. We employ the modern powerful deep learning method to learn feature representations from the data and train discriminative classifiers for fire region detection. We use deep convolution neural networks (YOLOv3) and YOLO v3 as the learning machine.

2. METHODOLOGY

2.1 Proposed Solution

To prevent this problem, we use a video-based monitoring system. Initially, the model is trained with images in the preprocessing stage and then tested for efficiency and further training can be done to improve accuracy. In the proposed model we use YOLOv3 to detect the fire images. We are making use of computer vision and machine learning techniques to make it efficient and reliable. Also, the system uses brightness classification along with image processing and histogram-based segmentation. All these are made to increase the accuracy andalso make the system more suitable for real-time implementation. Thus the proposed solution not only solves the existing problems but also provides a new and efficient approach.

2.2 Architectural Design:



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2.3 Scope of the Project

To develop a detection system for fire using the fire dataset and perform accurate classification of images with fire and without fire.

3. COMPONENTS USED
3.1 HARDWARE COMPONENTS
3.1.1. Microcontroller - RASPBERRY PI

Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to the promote teaching of basic computer science in schools and in developing countries. The original model became far more popular than anticipated, selling outside its target market for uses such as robotics. It does not include peripherals (such as keyboards and mice) and cases. However, some accessories have been included in several official and unofficial bundles.

3.1.2. Buzzer
A Buzzer or electronic device is an audio signaling device, which can be a mechanical device, alert a user of an event corresponding to a switching action, counter sig,nal or sensor input.

3.1.3.USB camera
It is an optical instrument that captures a visual image. This is used to detect the fire in this project.

3.1.4.Micro SD card
It is a storage device which is used to stores the codes for the detection procedure.

5.Power supply adapter 5V 2.0 A, dual USB 10000mAh Battery
3.2 SOFTWARE USED
3.2.1. JUPYTER

Jupiter is a free, open-source, interactive web tool known as a computational notebook, which researchers can use to combine software code, computational output, explanatory text and multimedia resources in a single document. Jupyter Notebooks have also gained traction within digital humanities as a pedagogical tool. Multiple Programming Historian tutorials such as text Mining in Python through the HTRC Feature Reader, and Extracting Illustrated Pages from Digital Libraries with Python, as well as other pedagogical materials for workshops, make reference to putting code in a Jupyter notebook or using Jupyter notebooks to guide learners while allowing them to freely remix and edit code. The notebook format is ideally suited for teaching, especially when students have different levels of technical proficiency and comfort with writing and editing code. The purpose of Jupyter notebooks is to provide a more 16 accessible interfaces for code used in digitally-supported research or pedagogy. Tools like Jupyter notebooks are less meaningful to learn or teach about in a vacuum, because Jupyter notebooks themselves don't do anything to directly further research or pedagogy.

3.2.2.PYTHON
Python is a general-purpose interpreted, interactive object-oriented, and high-level programming language. It was created by Guido van Rossum during 1985- 1990. Like Perl, Python source code is also available under the GNU General Public License (GPL). Python is a high-level, interpreted, I interactive and object-oriented scripting language. Python is designed to be highly readable. It uses English keywords frequently where as other languages use punctuation, and it has fewer syntactical constructions than other languages. Python is an extremely useful programming language for

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cybersecurity professionals because it can perform a multitude of cybersecurity functions, including malware analysis, scanning, and penetration testing tasks. Some of the key advantages of Python: Python is Interpreted − Python is processed at runtime by the interpreter. You do not need to compile your program before executing it. This is like PERL and PHP. Python is Interactive − You can sit at a Python prompt and interact with the interpreter directly to write your programs. Python is Object-Oriented − Python supports Object-Oriented style or technique of programming that encapsulates code within objects. Python is a Beginner's Language − Python is a great language for the beginner-level programmers and supports the development of a wide range of applications from plain text processing to WWW browsers to games.

3.2.3. VNC Viewer

VNC viewer furnishes us with a remote access to our pc, from anyplace on the planet. VNC viewer lets us see our PC's work area. It is essential component of any project involving raspberry pi

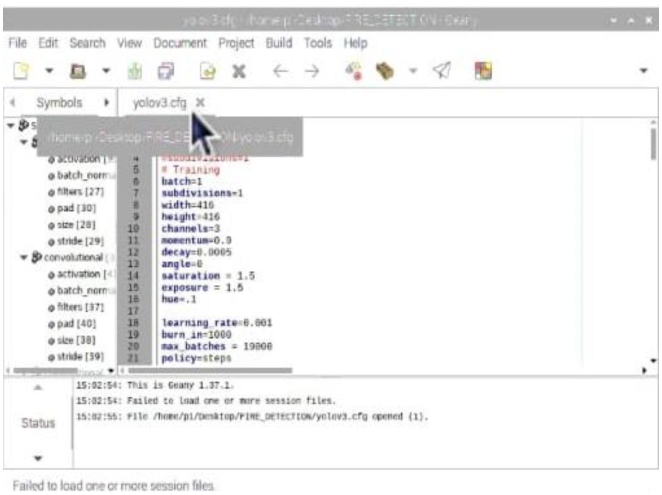
4. FUTURE SCOPE

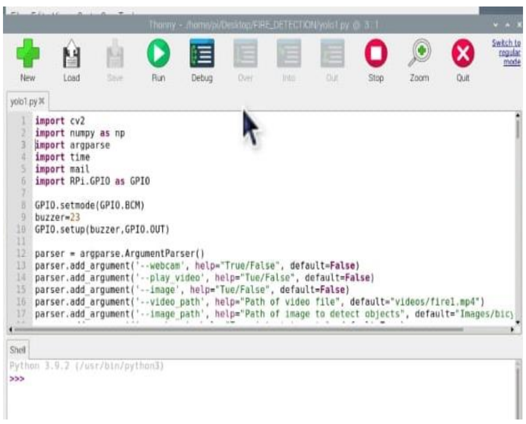
The performance of the proposed fire detection system can be further improved by considering smoke at early stages of fire. However, detecting smoke is a challenging task and prone to high false detections caused from fog, different lighting conditions caused by nature, and other external optical effects. Such high false detections can be resolved by analyzing every smoke-like region. However, this yields a high computational load. Also, instead of using camera images if we go for videos, then we can calculate the spread of fire with time. Further, the nature of fire can be utilized so as to reduce false alarm rate.

CONCLUSION

This paper proposes an approach to detection of fire through the usage of photographed data of fire followed by computer processing of the data by a method for reading information, pre-processing of an image color components, the segmentation and data classification using rms prop optimization algorithm is proposed and predict the accuracy of fire. The efficiency of the proposed procedures is shown: 88 % detection accuracy and 27.90% false detection is shown. The proposed method can be used in the monitoring systems of the area to detect fire.

RESULT





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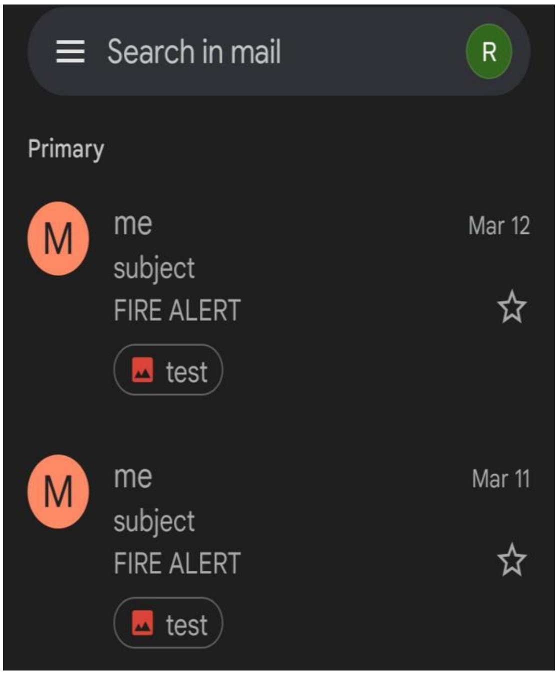
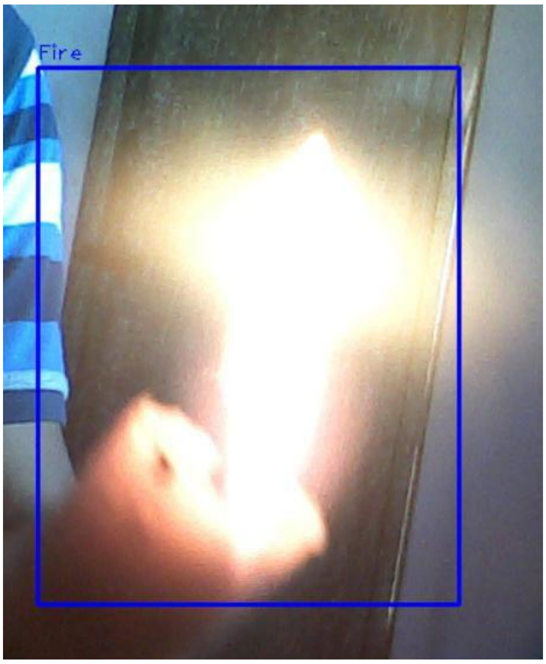


OUTPUT CAN SEND THROUGH MAIL



SAMPLE OUTPUT IMAGE

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