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Sonic Wave Based Forest Fire Extinguisher and Detection using Deep Learning

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ABSTRACT: Forest fires are a significant threat to ecologically healthy grown forests and environmental protection, as well as causing tragic loss of life and precious natural and individual properties, Hundreds of homes and thousands of hectares of trees."Thousands of forest fires rage every year around the world, wreaking havoc on people and property. This problem has piqued researchers' interest for years, and there are a plethora of well-researched solutions available for testing or even ready-to-use to address it. For many countries around the world, forest and urban fires have been and continue to be a serious problem.. Currently, there are a variety of solutions available for detecting forest fires. However, for vast areas of woodland, this is not an option. We discuss a new approach to fire detection in this paper, which incorporates modern technologies. We propose a platform based on Artificial Intelligence in particular. Based on still images or video input from the cameras, computer vision techniques for recognising and detecting smoke and fire. For calculating the amount of smoke and fire, a deep learning technique called "convolution neural network" is used. For calculating the amount of smoke and fire, a deep learning technique called "convolution neural network" is used. The precision is determined by the algorithm we'll use, as well as the datasets we'll use and how they'll be divided into train and test sets.

KEYWORDS: Web Camera, Arduino UNO, SD card module, SD card, Speaker, Amplifier, Speaker

I.INTRODUCTION

Forests are the guardians of the planet's ecological equilibrium. Unfortunately, forest fires are usually only discovered after they have spread across a large area, making control and extinguishment difficult, if not impossible. The result is catastrophic loss and irreversible environmental and atmospheric damage, as well as irreversible ecological damage. Long-term catastrophic effects such as impacts on local weather patterns, global warming, and extinction of rare species of flora and fauna are just a few of the horrifying consequences of forest fires. In the fight against forest fires, quick and accurate detection is crucial. To prevent uncontrollable wide-spread forest fires, it is important to detect fires early and stop them from spreading. It is critical to get sufficient fire equipment and qualified operational manpower to the fire source as quickly as possible. A sufficient supply of extinguishing devices and maintenance, as well as continuous monitoring of fire spread, is also required. Furthermore, effective forest firefighting requires staff training. An integrated approach for forest fire detection and suppression is based on a combination of different detection systems based on wildfire risks, area size, and human presence, and includes all required components such as early detection, remote sensing techniques, logistics, and simulation-based training, as well as fire-fighting vehicles. The applied sensing techniques are defined by various risk levels, area size, and human presence. Local staff should monitor small, high-risk areas. Satellite and aero tracking can be used for very large and low-risk areas. Several hundred observation towers with camera-based systems have been erected to monitor forests, particularly in the eastern part of Germany. Image sequences are recorded and sent to a control center, where they are analysed using appropriate software. An alarm is sent directly to the fire department if a fire is clearly detected. Wireless Sensor Networks (WSNs) are becoming increasingly important components of IoT systems. These systems have a wide range of applications, and their creativity will benefit the environmental monitoring field. The IoT concept aims to turn everyday electronic devices, appliances, and other objects into intelligent, interconnected virtual objects. A better global humans-devices-humans communication can be achieved by keeping the user informed about the state of things and giving the user control.



II. BLOCK DIAGRAM

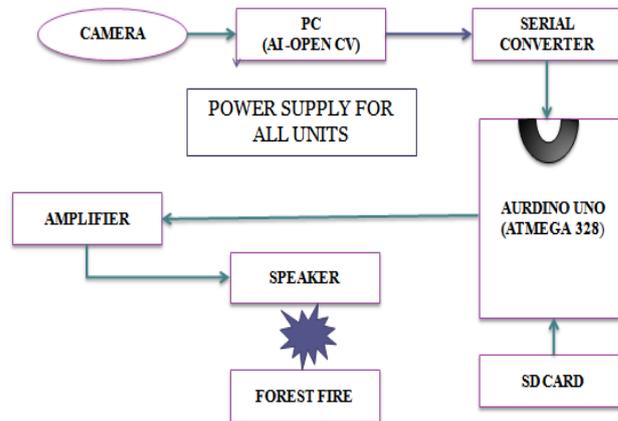


Fig -1: Overall Block Diagram

In Artificial Intelligence, we propose a platform based on deep learning. The identification and detection of smoke and fire using machine vision techniques. This approach necessitates the use of a training model, and we'll use coconet-pi for that. To train the model, we should provide a wide range of images. The training model will generate a convolutional neural network based on the picture (CNN). The model then became a pre-trained model. Now we can feed new data to a model that has already been trained to predict fire or smoke. After a fire or smoke is predicted, the fire should be extinguished. A new technology is used in this case. A Sonic Fire Extinguisher uses sound waves to put out fires. We will send data from the PC to the ARDUINO UNO microcontroller once the fire or smoke has been predicted using deep learning. A SD card is connected to the microcontroller, and the sound files are stored on it.

III.COMPONENT DESCRIPTION

A. POWER SUPPLY:

A source of electrical power is referred to as a power supply. A power supply unit, or PSU, is a device or system that provides electrical or other kinds of energy to an output load or group of loads. A step-down transformer is used in almost all power supplies to decrease the dangerously high mains voltage (230V in the UK) to a safer low voltage. In bridge rectifier alternate pairs of diodes conduct, switching connections so that alternating AC directions are converted to a single DC direction. A large value electrolytic capacitor connected across the DC supply acts as a reservoir, providing current to the output when the rectifier's varying DC voltage falls. And the regulator It regulates the positive voltage.

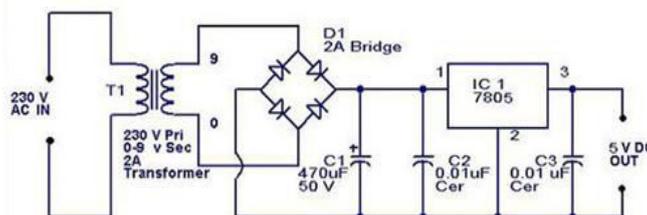


Fig -2:Power Supply



B. AMPLIFIER:

An amplifier, also known as an electronic amplifier or (informally) amp, is a device that can boost the power of a signal (a time-varying voltage or current). It's a two-port electronic circuit that uses power from a power supply to boost the amplitude of a signal applied to its input terminals, resulting in a signal with proportionally higher amplitude at the output. The gain of an amplifier is defined as the ratio of output voltage, current, or power to input voltage, current, or power. A circuit with a power gain greater than one is known as an amplifier.

C. WEB CAMERA:

A webcam is a video capture device that connects to a computer or computer network via a USB port, Ethernet or Wi-Fi if connected to a network, or built-in for some laptops.



Fig -3: Web Camera

D. MICRO CONTROLLER :

A microcontroller (MCU stands for microcontroller unit) is a small computer built on a single MOS integrated circuit (IC) chip. A microcontroller is a computer that has one or more CPUs (processor cores), memory, and programmable input/output peripherals.

Arduino UNO:

The Arduino/Genuino Uno microcontroller board is based on the ATmega328P microcontroller. It features fourteen digital input/output pins (six of which can be used as PWM outputs), six analogue inputs, a sixteen MHz quartz crystal, a USB port, a power jack, an ICSP header, and a reset button. Arduino is a free and open-source electronics platform with simple hardware and software. It's for everyone working on multimedia projects. It's a physical computing platform based on a simple microcontroller board that's open source.



Fig -3 : Arduino UNO



E. SD CARD:

A memory card that is commonly found in digital cameras and other portable devices. It's flash memory, and it's analogous to a USB flash drive in that it can be used to store files. On a normal desktop, however, you'll need to use a card reader to read or write to the SD card.

F. SD CARD MODULE:

The SD and micro SD card modules let you communicate with the memory card and write and read data from it. The SPI protocol is used for module interfaces. The SD library is required to use these modules with Arduino. The Arduino programme comes with this library preinstalled.



Fig -4: SD Card Module

G. SPEAKER:

An electro acoustic transducer (also known as a loudspeaker, loud-speaker, or speaker) is a system that transforms an electrical audio signal into sound. Before the signal is transmitted to the speaker, an audio power amplifier must amplify or enhance the sound source (e.g., a sound recording or a microphone). A speaker enclosure, also known as a speaker cabinet, is a rectangular square box made of various types of wood or plastic. Multiple loudspeaker transducers, each reproducing a part of the audible frequency range, are frequently mounted in the same enclosure when high fidelity sound reproduction is required.

IV. METHODOLOGY

In Artificial Intelligence, we propose a platform for deep learning. Computer vision strategies for detecting and recognizing smoke and flames. This approach necessitates the use of a training model, for which we will use coconet-pi. We should provide a large number of different pictures to the training model. The training model will build a convolutional neural network based on the picture (CNN). The model then became a pre-trained model.

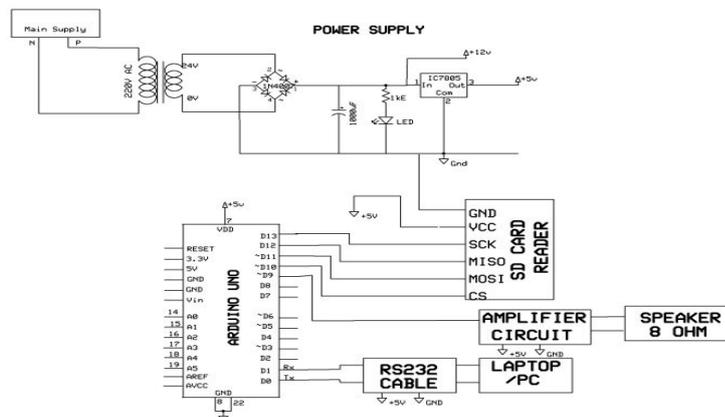


Fig -5: Circuit diagram



Now we can feed new data to a model that has already been trained to predict fire or smoke. After a fire or smoke is predicted, the fire should be extinguished. A modern technology is used in this case. A Sonic Fire Extinguisher uses sound waves to put out fires. Usually, fires are put out by the use of water or carbon dioxide. Extinguishing a fire with sound bass seems insane. As opposed to the other chemical compounds used in traditional extinguishers, this innovation provides the cleanest method of extinguishing flames. We will submit data from the PC to the ARDUINO UNO microcontroller once we have predicted the fire or smoke using deep learning. A SD card is attached to the microcontroller and is used to store the sound files. The microcontroller is attached to a speaker and amplifier circuit. When the microcontroller receives the fire detection data from the PC, it reads the sound files from the SD card and generates high-frequency sound waves to extinguish the fire.

V. HARDWARE DEVELOPMENT



Fig -6: SPEAKER



Fig -7: CAMERA

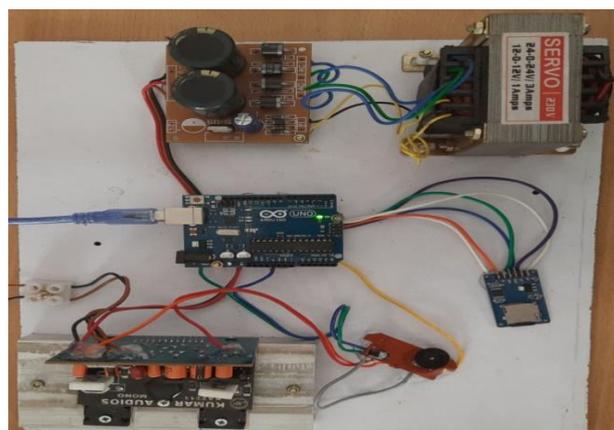


Fig -8: Working Model



VI. SOFTWARE DEVELOPMENT

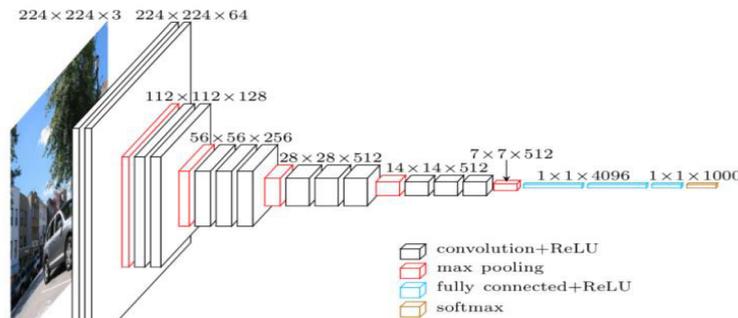


Fig -7: Layers in CNN

Convolutional Neural Network (ConvNet/CNN) is a Deep Learning algorithm that can take an image as input, assign importance (learnable weights and biases) to various aspects/objects in the image, and distinguish one from the other. As compared to other classification algorithms, the amount of pre-processing needed by a ConvNet is significantly less.

Image data should be included in the CNN input layer. A three-dimensional matrix is used to represent image data. Since features of the image are extracted within this layer, it is often referred to as the feature extractor layer. After convolution, a pooling layer is used to reduce the spatial volume of the input signal. Weights, biases, and neurons are all part of the fully connected layer. It binds neurons from one layer to those from another. It is used to train people to identify images into various categories. The final layer of CNN is called Softmax or Logistic. It's at the bottom of the FC layer. Binary classification is done with logistic, while multi-classification is done with softmax. The mark, which is encoded in one-hot format, is stored in the output layer.

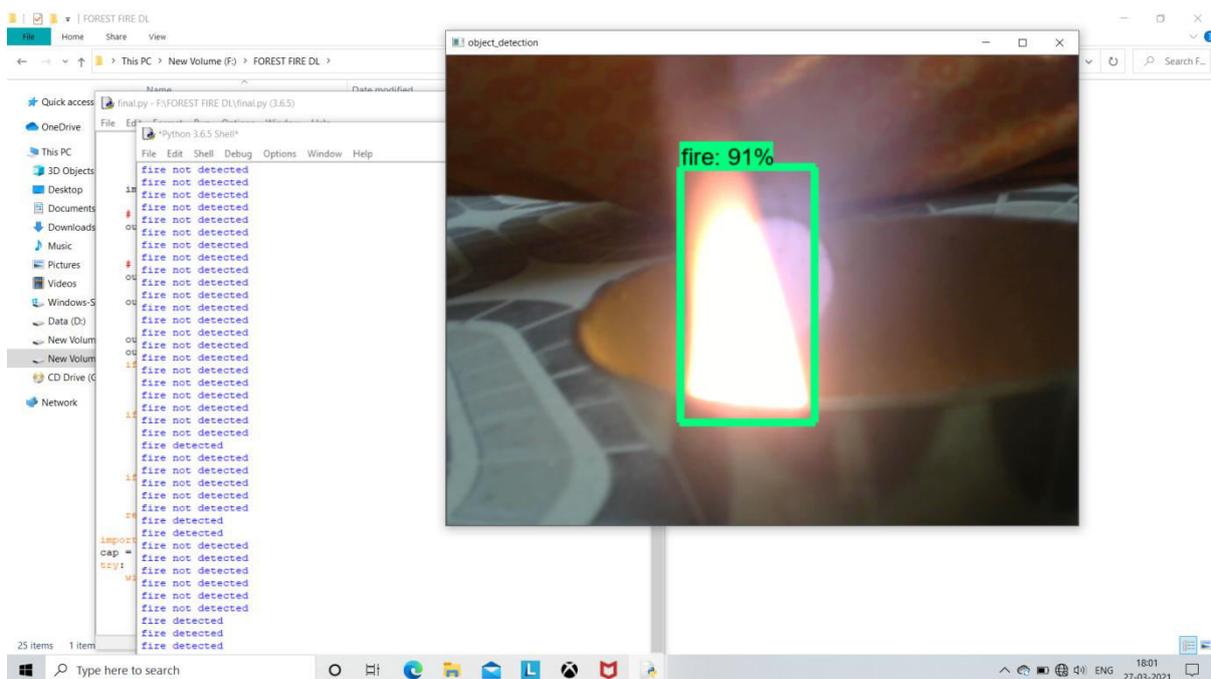


Fig -8: Program Output



OpenCV (Open Source Computer Vision Library) is a programming library aimed primarily at real-time computer vision. TensorFlow is a deep learning-focused open-source library created by Google. It also allows for conventional machine learning to be used.

VII. ADVANTAGES

- As compared to chemical extinguishers, there are no traces.
- And while fluids and chemicals are successful at putting out fires, they can also cause additional property damage and health hazards, this is the most environmentally friendly way to do so.
- Environmental pollution is minimized.
- Toxic-free.
- It is not necessary to refill the container.

VIII. CONCLUSIONS

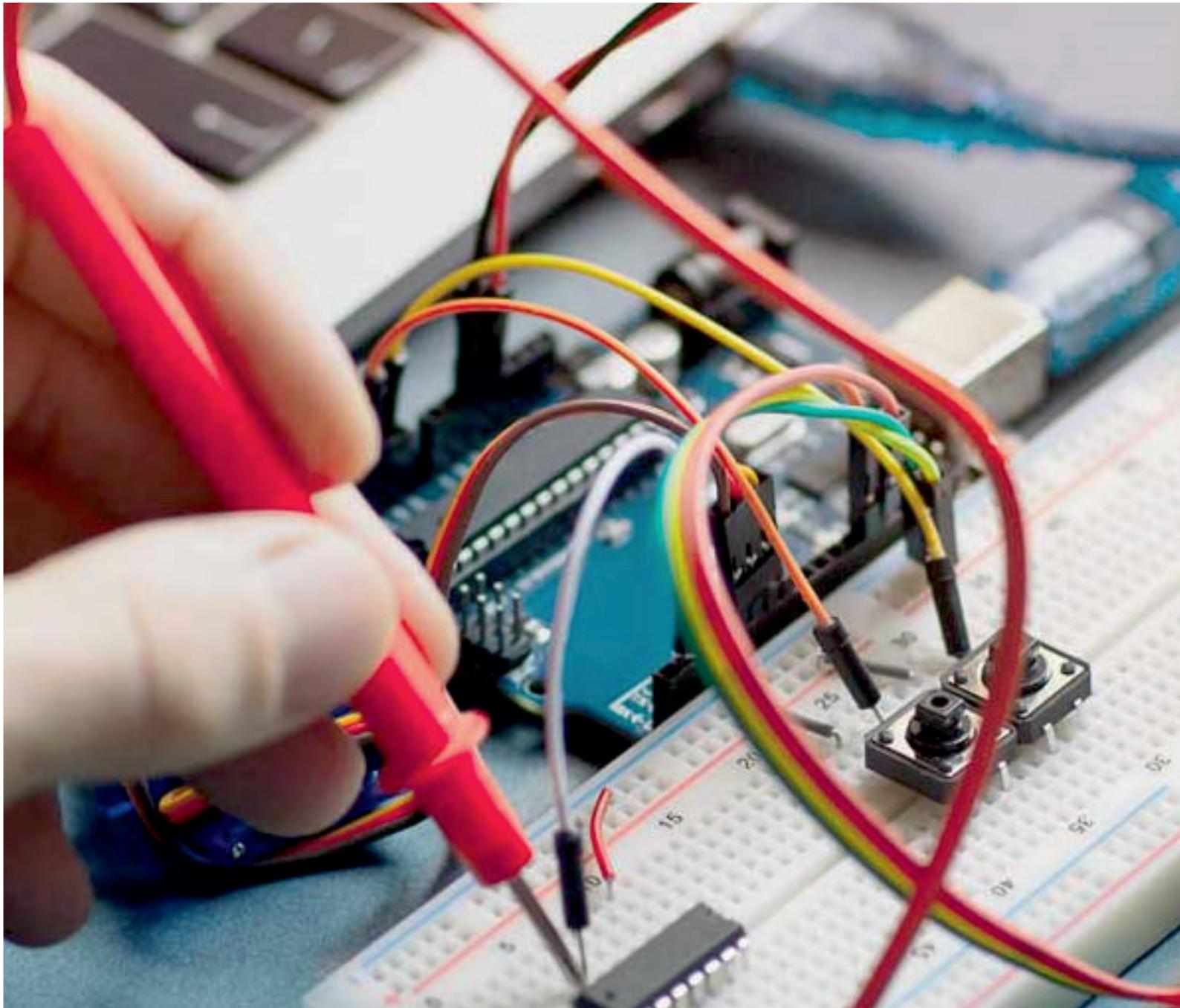
The recent improvements in smart device processing capabilities have yielded promising results in surveillance systems for detecting various suspicious incidents, such as fires, injuries, and other emergencies. Fire is one of the most dangerous events that, if not managed rapidly, can result in major losses. As a result, early fire detection systems are critical. As a result, we suggest a cost-effective fire detection CNN architecture for forest architecture in this research paper. While this work improved the accuracy of flame detection, the number of false alarms remains high, indicating that further research is needed in this area. Furthermore, existing flame detection frameworks can be intelligently tuned for fire detection. This will allow forest video surveillance systems to manage more complicated real-world situations.

IX. ACKNOWLEDGEMENT

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REFERENCES

- [1] E.Muñoz, A.Zozaya, and E.Lindquist, “Satellite Remote Sensing of Forest Degradation Using NDFI and the BFAST Algorithm”, IEEE LATIN AMERICA TRANSACTIONS, VOL. 18, NO. 7, JULY 2020
- [2] Tanase.M.A, Aponte.C, Mermoz.S, Bouvet.A, Le Toan.T, Heurich.M, “Detection of windthrows and insect outbreaks by L-band SAR: A case study in the Bavarian Forest National Park”, *Remote Sens. Environ.* **2018**, 209, 700–711.
- [3] Bu.F, Gharajeh.M.S, “Intelligent and vision-based fire detection systems”, A survey. *Image Vis. Comput.* **2019**, 91, 103803.
- [4] Sousa.M.J, Moutinho.A, Almeida.M, “Wildfire detection using transfer learning on augmented datasets”, *Expert Syst. Appl.* **2020**, 142, 112975.
- [5]. Jadon.A, Omam.M, Varshney.A, Ansar.M.S, Sharma.R, Firenet, “A specialized lightweight fire & smoke detection model for real-time iot applications” ,*arXiv* **2019**, arXiv:1905.11922.



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