IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 3, May 2024

An Improved Fire Detection Approach Based On Yolo-v8 for Smart Cities

Madhukara S[1] and Divya Reddy P R[2]
Assistant Professor, Department of ECE[1]
Studnet, Department of ECE[2]
SJC Institute of Technology, Chickballapur, Karnataka

Abstract: *Systems for detecting fires are essential for preventing property damage and saving lives. defending people and property. Conventional techniques frequently depend on sensor-based strategies, which have limitations in intricate settings. In order to improve accuracy and efficiency, this study suggests an intelligent fire detection system that makes use of machine learning and computer vision techniques. The technology analyzes video streams in real time using deep learning algorithms to identify fire incidents based on visual patterns and attributes. Future research on fire detection systems will benefit from the information this study will provide for smoker and fire detection issues in both indoor and outdoor situations. The improved fire detection technique for smart cities that is based on the YOLOv8 algorithm is the smart fire detection system (SFDS), which uses deep learning to identify fire-specific properties in real-time. The SFDS strategy may be more cost-effective, reduce false alarms, and improve fire detection accuracy when compared to traditional methods.*

It can also be extended to find other intriguing aspects of smart cities, such as gas leakage or flooding. The proposed smart city framework consists of four primary levels: the application layer (i), cloud layer (iii), fog layer (ii), and internet of things layer (iv). The recommended technique uses fog, cloud computing, and the Internet of Things layer to collect and understand data in real time. This reduces the chance of damage to persons or property and enables faster reaction times. The SFDS demonstrated state- of-the-art performance in terms of precision and recall, with a high precision rate of 97.1% across all classes. Among the potential applications are intelligent security systems, forest fire monitoring, and public space fire safety management.

Keywords: smart city, fire detection,yolo-v8, deep learning

I. INTRODUCTION

The way we think about urbanization, sustainability, and safety in use is being drastically altered by smart cities. The main contribution of this study is: As the globe moves toward smart cities, it is becoming more and more important to ensure the safety of its citizens and their belongings. One of the deadliest and most dangerous types of natural catastrophes, fires have the capacity to seriously harm both people and property. Fire accidents pose a severe threat to smart cities because they have the potential to inflict fatalities, damage essential infrastructure, and disrupt daily operations. Therefore, having a reliable and effective early fire detection system is crucial. Systems for detecting fires are essential for protecting people and property. Conventional techniques frequently depend on sensor-based methodologies, which may have limitations in intricate settings. In order to improve accuracy and efficiency, this study suggests an intelligent fire detection system that makesuse of computer vision and machine learning approaches.

The technology analyzes live video streams using deep learning algorithms to find fire incidents based on patterns and features in the images. Early fire detection and containment can reduce property damage and save lives. However, this article calls for handling difficulties such as the unpredictability of fire, the requirement for continuous observation, and the enormous amounts of data produced by smart cities.

In the field of fire detection, 360-degree sensors and neuralnetwork convolutions (CNNs) are commonly utilized.An alarm is set off when sensors identify the chemicalcomposition of smoke. But this strategy might set offalarms. Temperature, gas, and smoke sensors havehistorically been the main parts of fire detection systems. Because of its

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 3, May 2024

effective use of computational resources, it can be deployed on devices with limited resources, such as embedded systems and smartphones. The use of deep learning algorithms to improve the real-time detection of fires has been spurred by the advent of IoT-enabled smart cities. Utilizing the earlier iterations of the YOLO model, the YOLOv8 model offers a single framework for training models to conduct detection, instance segmentation, and image classification. It is also faster and more accurate than its predecessors.

Convolutional neural networks (CNNs) have shown remarkable performance in image recognition applications, including object detection. The You Only Look Once (YOLO) method is one such CNN-based object recognition framework that is widely used in computer vision applications. The latest YOLO v8 version offers significant improvements in speed and accuracy, making it a viable option for real-time fire detection in smart cities. This study presented an early fire detection system for smart cities based on YOLO v8. The experimental findings show how well the system design works in real-world flame detection scenarios. The suggested approach compares our proposed system with other fire detection systems now in use to highlight the advantages of our proposed system. The main contribution of this work is presenting an architecture for smart cities that is comprised of four basic layers: application, fog, infrastructure, and cloud. Smart streets, smart homes, smart hospitals, and smart government. proposing an improved YOLOv8-based fire detection technique for smart cities. Increasing precision In comparison to current methods, the suggested methodology may increase the accuracy of fire detection in smart cities by identifying and identifying fire- specific characteristics that may be difficult to identify through the use of traditional image processing techniques. YOLOv8, which leverages the advantages of deep learning algorithms, is one such program. instantaneous detection.

Reduced false alarms: By using deep learning to comprehend fire-specific features, the proposed method may be able to reduce false warnings, which are common in conventional fire detection techniques. By doing this, unnecessary emergency reactions can be avoided and the cost of false alarms can be reduced. enhanced object-detecting capabilities, especially with smaller items. YOLOv8 is quicker than earlier iterations because it is designed for real-time object recognition. For applications like augmented reality, surveillance, and autonomous driving, this is essential.

II. THE PROPOSED SMARTCITY FRAMEWORK

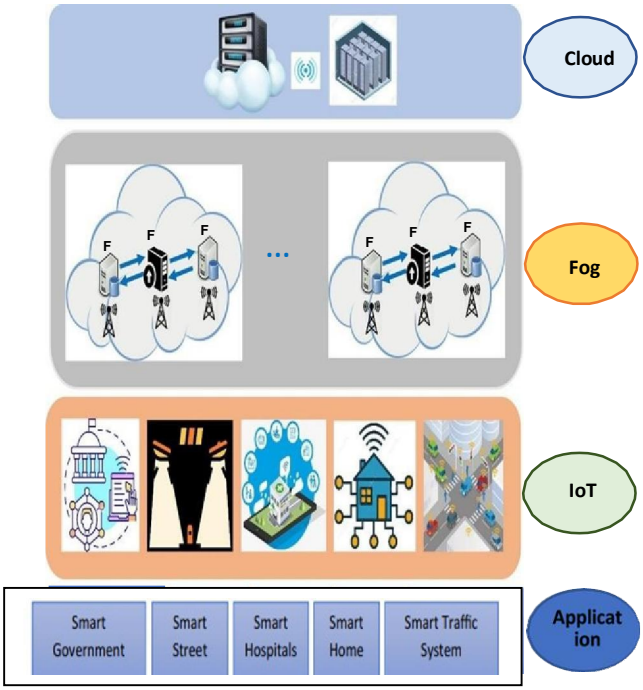

Fig1-Proposed Framework

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 3, May 2024

The application layer, which concentrates on specific applications like the Smart Fire Detection System (SFDS), is a crucial aspect of the recommended framework for a smartcity. The SFDS's capacity to recognize fire hazards in a range of contexts, including public areas, governmental buildings, hospitals, residential areas, and roadways, can ensure the safety of people and property. The Application layer plays a major role in the SFDS's ability to support various applications, including Smart Government, Smart Streets, Smart Hospitals, Smart Homes, and Smart Traffic Systems. The Smart Fire Detection (SFD) Algorithm uses computer vision to detect fires in real-time using recorded or live video feeds. As shown in Algorithm 1, it uses a pre-trained Yolov8object detection model on a large dataset of pictures showing and not showing fire. Using a collection of video frames as input, it produces recognized things as output, including fire-related classes like "flames," "smoke," and "embers."

Every frame of the video is continuously scanned by the algorithm, which preprocesses each one before forwarding itto the Yolov8 model for object detection. An algorithm raises the alarm and alerts the relevant authorities when it finds a class that is associated to fire. The software highlights the items it has discovered in the resulting movie and savesit. The SFD approach is a powerful tool for real-time fire detection and enables quick and effective responses to potential fire threats.

III. TECHNOLOGY

Yolov8, a cutting-edge deep learning model, is used in computer vision applications to recognize objects in real-time.

Yolov8, Ultralytics; documentation; object recognition; YOLO series; advanced architectures; accuracy; speed; real-time object detector; pre-trained models.

In real time, the YOLOv8 image classificationmodel can identify 1000 pre-defined classes in photos.

In real time, the YOLOv8 image classificationmodel can identify 1000 pre-defined classes in photos.

IV. ADVANTAGES

- Real-time monitoring.
- Early Detection.
- Enhanced Safety.
- Reduced false alarms.

V. APPLICATIONS

- Urban Surveillance.
- Wildfire Monitoring.
- Building safety.
- Traffic Management.

VI. CONCLUSION

Strong real-time detection capabilities are provided by YOLOv8 fire detection system implementation, which helps with early fire detection and prevention. Owing to itsexceptional precision and effectiveness, it's a usefulinstrument for augmenting safety protocols in a range of contexts, including residential and commercial ones. To guarantee its dependability and efficacy in various situations, though, ongoing assessment and development are necessary. When compared to conventional fire locationtechniques, the SFDS approach can be more economical,minimize false alarms, and increase fire location accuracy. It is also possible to expand its scope to encompass other interesting phenomena found in clever cities, such as gas leaks or flooding. The proposed structure is resilient to several environmental factors, including smoke, and has the ability to detect flames at different scales and introductions. Natural checking, mechanical security, and open security are among possible applications for the recommended fire discovery methodology. It can help prevent death and minimize property and environmental damage by assistingwith the early detection and containment of fires.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 3, May 2024

REFERENCES

[1]. Karthi M. et al. carried out a comparative study of deep learning algorithms for the detection of forest fires in 2023. In: 2023 International Conference on Concurrent Engineering: Knowledge Discovery and Artificial Intelligence (ICECONF). IEEE

[2]. Wu CC, Chen YT, Huang PY (2019) A deep learning-based fire detection system for smartbuildings. 37(4) J Intell Fuzzy Syst: 5541–5551.

[3]. Avazov K et al. (2021) Deep learning-based methodology for fire detection in smart city settings. 11(1) Electronics: 73.

[4]. Zhang F, Zhao P, Xu S, Wu Y, Yang X, Zhang Y (2020) Optimising watchtower deployment for wildfire detection by integrating numerous parameters.

[5]. Anjum and Rehman (2016) published "Recent Trends in Fire Detection and Fire Alarm Systems" in the International Journal of Advanced Research in Computer Engineering & Technology.

[6]. El-Hosseini M. and colleagues (2021) A power-aware scheduling-based fire detection model for the Internet of Things sensors in partially covered smartcities. Human-computer interaction 12(2021):2629–2648.

[7]. Khan S, Khan A (2022) FFireNet: deep learning- based forest fire classification and detection in smartcities. Symmetry 14(10):2155

[8]. Zheng, W., Zhao, C., L., and Zhi, L. 2022: Fire- YOLO: a fire inspection technique for tiny target object detection. 4930 in Sustainability 14 (9):

[9]. A review of early forest fire detection utilizing IoT-enabled WSN was conducted by Amira Sairi, Said Labed, Akram Kout, and Said Labed.A publication from 2023.

[10]. Lijuan, L. and Songnan, C.: An enhanced SSD-based real-time smoke detection model. J. Xinyang Normal University 33(2), 2020, pp. 305–311.

[11]. Avazov K et al. (2021) Deep learning-based technique for fire detection in smart city settings. 11(1) Electronics: 73.

[12]. Zhao, L., Zhi, L., Zhao, C., and Zheng, W. [12] Zhao. 2022: Fire-YOLO: a fire inspection technique for tiny target object detection. 14 (9) Sustainability:4930.