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AI-Powered Real-Time Threat Detection and Security Monitoring System using AWS: A Review

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ABSTRACT: The paper presents a Threat Detection and Security Monitoring system built on Amazon Web Services (AWS). It provides real-time surveillance, Threat Detection object identification, and automatic alert generation using AWS AI services. The system performs frame-by-frame object detection from live video streams and sends SMS notifications for detected anomalies. It's scalable, cost-effective, and suitable for diverse domains like security, healthcare, and industrial surveillance.

KEYWORDS: Deep learning, Cloud computing, Autonomous monitoring, False positive, Motion detection

I. INTRODUCTION

Cloud computing has revolutionized the way organizations deploy and manage applications by offering scalable, cost-effective, and easily accessible infrastructure over the internet. Among various cloud providers, Amazon Web Services (AWS) stands out as one of the most widely adopted platforms, offering a vast range of services that enable businesses to build and manage applications without maintaining physical servers. Through services such as AWS Lambda, Rekognition, and Kinesis, developers can integrate machine learning and automation capabilities into their systems, enhancing efficiency and reducing operational costs.

The increasing demand for real-time surveillance and remote monitoring has made traditional systems inefficient, as they rely heavily on human supervision and fixed hardware infrastructure. Critical infrastructures like airports, hospitals, and industrial plants require continuous observation to prevent unauthorized access or hazardous events. To address these challenges, serverless cloud-based monitoring systems are emerging as a robust alternative, providing on-demand scalability, automation, and data-driven insights without the need for dedicated hardware or maintenance.

This research focuses on designing and implementing a serverless autonomous video monitoring system using AWS. The system integrates deep learning-based object detection with a real-time notification mechanism to ensure quick response to security events. By leveraging AWS Rekognition for visual analysis, AWS Lambda for event-driven processing, and AWS SNS for alerting, the proposed solution provides an intelligent, flexible, and low-latency monitoring framework that can be applied across multiple domains such as industrial security, healthcare surveillance, and smart city infrastructure.

Background

The paper reviews an AI-Powered Real-Time Threat Detection and Security Monitoring System built on Amazon Web Services (AWS), leveraging services like Lambda, Rekognition, and Kinesis for scalable, cost-effective, and autonomous monitoring. The system uses Deep Learning for frame-by-frame object detection from live video streams and sends automatic SMS alerts for detected anomalies.

II. LITERATURE SURVEY

Marouane Salhaoui [1], This paper introduces smart IIoT monitoring and control system based on an unmanned aerial vehicle that uses cloud computing services and exploits fog computing as the bridge between IIoT layers. Its novelty lies in the fact that the UAV is automatically integrated into an industrial control system through an IoT gateway platform, while UAV photos are systematically and instantly computed and analyzed in the cloud.

Fatima Rani [2], This data deluge requires automated workflows for efficient handling and analysis to draw meaningful predictions and conclusions. Small and medium-sized enterprises (SMEs) face technical barriers in ingesting industrial

data but are eager to integrate legacy factory machines and adopt IIoT for data-driven processes. To address these challenges, we propose creating a scalable, flexible data pipeline within the ecoKIplatform .

Nazir [3], A smart home provides better living environment by allowing remote Internet access for controlling the home appliances and devices. Security of smart homes is an important application area commonly using Passive Infrared Sensors (PIRs), image capture and analysis but such solutions sometimes fail to detect an event. An unambiguous person detection is important for security applications so that no event is missed and also that there are no false alarms which result in waste of resources.

ChidiebereJoshua [4], This paper explores the design and optimization of edge-aware object detection frameworks that leverage lightweight architectures and adaptive preprocessing to enhance performance under low-visibility conditions. By integrating context-sensitive edge detection techniques with multi-modal sensor data fusion, the proposed models achieve improved object localization and classification accuracy while maintaining low latency and energy consumption.

Davies Aklamati [5], —In the last few years, Cloud computing technology has benefited many organizations that have embraced it as a basis for revamping the IT infrastructure. Cloud computing utilizes Internet capabilities in order to use other computing resources. Amazon Web Services (AWS) is one of the most widely used cloud providers that leverages the endless computing capabilities that the cloud technology has to offer.

Qing Lan[6], The rapid growth in the volume of remote sensing (RS) image data necessitates efficient computational methods to handle large-scale datasets. Traditional RS image processing methods, although effective for small datasets, face significant challenges when scaled up. In this research, we present a novel cloud-native serverless computing framework for RS data processing (CSC-RS), which integrates traditional parallel techniques with modern serverless computing technology.

Soban Ahmed [7], The analysis shows that our presented models result in improved mAP scores on high-performance GPUs (such as RTX 2080TI), as well as on low-cost edge computing GPUs (such as JetsonNano) for weapon detection in live CCTV camera surveillance videos

Mohammad Rohan [8], In this paper, we describe the implementation of a serverless remote video monitoring solution on the Amazon Web Services (AWS) cloud. It can provide surveillance of an area against unauthorized access, identification of objects in the scene, and investigating security incidents. This autonomous prototype application provides a frame-by-frame object detection of the live video.

EmilijaVelinova [9], This research paper presents an automated monitoring system developed with diverse technologies combining cloud computing and Internet of Things (IoT). The system includes motion sensing, image capturing, and facial recognition by the cloud (AWS Rekognition) powered artificial intelligent (AI) algorithms for the better security measures of tracking and recognizing people within surveillance areas.

Mohd. Jawed Khan [10], This smart camera purpose is to stop the robbery by sending the alarm to the owner and making him/her alert. This camera provides a reliable monitoring mechanism that can detect any kind of suspicious object like human or animal through OpenCV Library using Haar cascade algorithm. The purpose of this project is to provide high level security with less storage capacity requirement with maximum efficiency with speed.

VeeramaniGanesan [11], This research study provides a concept and implementation method for successful cloud-based video surveillance that makes use of cloud computing features like parallel processing, large storage spaces, scalability, and motion detection. The system can be built using Amazon cloud services, RTSP protocol, and the open-source Motion service SDK to implement video input processing, real-time picture analysis, storage, live streaming, and playback processes.

URBANUS, John Bille [12], This study presents the development and implementation of a software framework for a face recognition system using Amazon Rekognition, a cloud-based image and video analysis service provided by Amazon Web Services (AWS). The face recognition system is designed to offer a scalable, accurate, and efficient

solution for identity verification and authentication, primarily targeting applications in security, access control, and user authentication systems.

Analysis / Comparison

The proposed system focuses on visual threat detection (object identification in video streams). It contrasts with traditional Network Intrusion Detection Systems (IDS), which struggle with the dynamic, decentralized nature of cloud networks and produce excessive false positives. It also differs from AWS-native tools like **Amazon GuardDuty**, which analyze AWS service logs (CloudTrail, VPC Flow Logs) to identify multi-stage attack sequences and compromised credentials. The proposed system's strength is its AI-driven, real-time automation for a specific surveillance need.

III. RESEARCH GAPS

Key gaps in AI-powered cloud security include:

1. **Data Quality & Bias:** Difficulty in acquiring high-quality, comprehensive training data, which often leads to poor threat detection and model bias.
2. **Scalability and Performance:** The challenge of maintaining accuracy and speed in processing the massive, rapidly growing volume of data in dynamic cloud environments.
3. **Explainable AI (XAI):** The need for security models to be transparent ("not a black box") so analysts can understand and justify threat decisions for auditing and trust.
4. **Adversarial AI:** Securing the AI models and training data themselves from threats like data poisoning and model theft.

Existing system

The existing surveillance systems mainly use CCTV cameras that require manual monitoring by security personnel. These systems store data locally, making them costly to maintain and difficult to scale when more cameras or locations are added. They often suffer from delays in detecting and responding to security threats.

Traditional systems also lack automation and real-time alerts. They cannot analyze video feeds intelligently or identify suspicious activities automatically. This leads to inefficiency, high manpower requirements, and limited remote accessibility, highlighting the need for a cloud-based, automated monitoring solution.

Proposed system

The proposed system introduces a serverless, cloud-based video monitoring solution built on Amazon Web Services (AWS). It leverages services like AWS Lambda, Rekognition, Kinesis, SNS, and DynamoDB to provide real-time object detection, data storage, and instant alert notifications. The system automatically captures video frames from live streams, analyzes them using AI-based object detection, and sends SMS alerts when suspicious activity or unauthorized entry is detected.

This solution eliminates the need for manual supervision and costly on-premise infrastructure. It offers high scalability, low latency, and remote accessibility through a web interface. The system is suitable for various applications, including industrial surveillance, healthcare monitoring, and public security, providing a reliable, automated, and cost-efficient approach to modern surveillance.

IV. CONCLUSION

The system effectively demonstrates the use of serverless AWS architecture for real-time video analytics. It achieves high reliability, low cost, and instant alerts with minimal configuration. It significantly improves security monitoring efficiency. Future work includes implementation on Google Cloud Platform and performance benchmarking in terms of latency and bandwidth.

Future Direction

1. **Predictive Security:** Shifting to AI that forecasts attacks instead of just reacting to them.
2. **Autonomous Agents:** Implementing self-governing AI to automatically investigate and respond to incidents.
3. **Unified Multi-Cloud:** Standardizing platforms to manage security across all cloud providers.

4. **Security for AI:** Developing methods to protect the AI models themselves from poisoning and theft.
5. **Self-Learning Systems:** Creating AI that continuously improves accuracy without constant human retraining.

REFERENCES

1. S. Nazir, Y. Poorun, and M. Kaleem, "Person detection with deep learning and IOT for Smart Home Security on Amazon Cloud," 2021 International Conference on Electrical, Computer, Communications and Mechatronics Engineering (ICECCME), pp. 1–6, 2021.
2. D. Aklamati, B. Abdus-Shakur, and T. Kacem, "Security analysis of AWS-based Video Surveillance Systems," 2021 International Conference on Engineering and Emerging Technologies (ICEET), pp. 1–6, 2021.
3. G. D. McBride and M. Sumbwanyambe, "Design and construction of a hybrid edge-cloud smart surveillance system with object detection," 2021 International Conference on Computing, Communication, and Intelligent Systems (ICCCIS), pp. 642–647, 2021.
4. G. Yang, J. Liu, M. Qu, S. Wang, D. Ye and H. Zhong, "FaasRS: Remote Sensing Image Processing System on Serverless Platform," 2021 IEEE 45th Annual Computers, Software, and Applications Conference (COMPSAC), 2021, pp. 258-267, doi: 10.1109/COMPSAC51774.2021.00044.
5. S. R. Poojara, C. K. Dehury, P. Jakovits, and S. N. Srirama. "Serverless data pipeline approaches for IoT data in fog and cloud computing," Future Generation Computer Systems, vol. 130, pp. 91-105, 2022.
6. M. Salhaoui, A. Guerrero-González, M. Arioua, F. J. Ortiz, A. El Oualkadi, and C. L. Torregrosa, "Smart industrial IOT monitoring and control system based on UAV and cloud computing applied to a concrete plant," Sensors, vol. 19, no. 15, p. 3316, 2019.
7. Soban Ahmed1, MuhammadTahirBhatti1 ,MuhammadGufranKhan1,* , Benny Lövsström 2 and MuhammadShahid "Weapon Detection in Surveillance Videos" Detection in Surveillance Videos. Appl. Sci. 2022, 12, 5772. <https://doi.org/10.3390/app12125772>
8. Mohammad Rohan, Shurjeel Ahmed, Mohammad Kaleem, SajidNazir "Serverless Video Analysis Pipeline for Autonomous Remote Monitoring System" Published in: 2022 International Conference on Emerging Technologies in Electronics, Computing and Communication (ICETECC)
9. EmilijaVelinova , Valentin Cvetanoski, KlimentChakarovski, Daniela Mechkaroska, Ervin Domazet "Cloud-Based AI Surveillance for Motion Detection and Facial Recognition" publication at: <https://www.researchgate.net/publication/393581504> June 2025.
10. Mohd. Jawed Khan*1, Adarsh Kumar*2, Ajay Kumar*3, AnkitPrajapati*4, Arpan Kumari "AUTOMATIC SMART SECURITY CAMERA" published year :05/May-2023.
11. VeeramaniGanesan "Effective IP Camera Video Surveillance With Motion Detection and Cloud Services" International Journal of Innovative Science and Research Technology ISSN No:-2456-21651, January – 2022.
12. URBANUS, John Bille, Dr. Yusuf Musa Malgwi "Software Framework for Face Recognition System Using Amazon Rekognition" International Journal of Computer Science and Mathematical Theory (IJCSMT) E-ISSN 2545-5699 P-ISSN 2695-1924 Vol 10. No.5 2024 www.iiardjournals.org



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