MINISTRY OF EDUCATION AND RESEARCH OF THE REPUBLIC OF MOLDOVA

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„___” _____ 2025

RESEARCH ON MICROSERVICES ARCHITECTURE FOR AN AUTOMATED SURVEILLANCE SYSTEM

Master's project

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Chisnau, 2025

ABSTRACT

This work presents an exploration of designing an Automated AI Surveillance System using a microservices architecture. The study begins with an analysis of the research domain, providing an overview of automated surveillance systems. The concepts of microservices are introduced, outlining their benefits and drawbacks. The discussion emphasizes the relevance of microservices to automated surveillance systems, contrasting them with monolithic architectures in this context. This comparison sets the stage for advocating a microservices-based solution to address the challenges identified in monolithic systems.

System requirements are detailed, containing both functional and non-functional aspects. Functional requirements specify the essential capabilities of the surveillance system, such as real-time video processing, event detection, notification mechanisms, and user management. Non-functional requirements address performance metrics, scalability, security, and compliance considerations. A detailed breakdown of each service is presented. For each service, the roles, responsibilities, technologies used, communication protocols, deployment strategies, and infrastructure considerations are elaborated. This granular examination demonstrates how each microservice contributes to the overall functionality, performance, and reliability of the system.

This thesis contributes to the field of intelligent surveillance by presenting a scalable, secure, and high-performance system architecture capable of meeting the demanding requirements of modern security applications. Future work will explore enhancements such as edge computing integration, adaptive AI models, and advanced privacy-preserving techniques to further augment the system's capabilities and efficacy.

In conclusion, this work demonstrates that a microservices architecture offers significant advantages for automated AI surveillance systems. By addressing the limitations of monolithic architectures, the proposed design achieves greater scalability, maintainability, and adaptability. The comprehensive analysis of requirements, detailed system design, emphasis on security and performance, and rigorous testing contribute to a robust and effective surveillance solution capable of meeting current and future challenges.

REZUMAT

Această lucrare prezintă o explorare a proiectării unui Sistem Automatizat de Supraveghere AI utilizând o arhitectură bazată pe microservicii. Studiul începe cu o analiză a domeniului de cercetare, oferind o privire de ansamblu asupra sistemelor de supraveghere automate. Sunt introduse conceptele de microservicii, evidențiindu-le beneficiile și dezavantajele. Discuția subliniază relevanța microserviciilor pentru sistemele de supraveghere automate, contrastându-le cu arhitecturile monolitice în acest context. Această comparație pregătește terenul pentru promovarea unei soluții bazate pe microservicii pentru a aborda provocările identificate în sistemele monolitice.

Cerințele sistemului sunt detaliate, incluzând atât aspecte funcționale, cât și non-funcționale. Cerințele funcționale specifică capacitățile esențiale ale sistemului de supraveghere, cum ar fi procesarea video în timp real, detectarea evenimentelor, mecanismele de notificare și gestionarea utilizatorilor. Cerințele non-funcționale abordează metricile de performanță, scalabilitatea, securitatea și considerentele de conformitate. Este prezentată o defalcare detaliată a fiecărui serviciu. Pentru fiecare serviciu, sunt elaborate rolurile, responsabilitățile, tehnologiile utilizate, protocoalele de comunicație, strategiile de implementare și considerentele de infrastructură. Această examinare granulară demonstrează modul în care fiecare microserviciu contribuie la funcționalitatea generală, performanța și fiabilitatea sistemului.

Această teză contribuie la domeniul supravegherii inteligente prin prezentarea unei arhitecturi de sistem scalabile, securizate și de înaltă performanță, capabile să îndeplinească cerințele solicitante ale aplicațiilor moderne de securitate. Munca viitoare va explora îmbunătățiri precum integrarea calculului la margine (edge computing), modele AI adaptative și tehnici avansate de protecție a confidențialității pentru a spori și mai mult capacitățile și eficacitatea sistemului.

În concluzie, această lucrare demonstrează că o arhitectură bazată pe microservicii oferă avantaje semnificative pentru sistemele automate de supraveghere AI. Prin abordarea limitărilor arhitecturilor monolitice, designul propus atinge o scalabilitate, întreținere și adaptabilitate mai mare. Analiza cuprinzătoare a cerințelor, designul detaliat al sistemului, accentul pus pe securitate și performanță și testarea riguroasă contribuie la o soluție de supraveghere robustă și eficientă, capabilă să facă față provocărilor actuale și viitoare.

CONTENTS

INTRODUCTION

The domain of surveillance systems transformed significantly in the past decade due to the fast advancement of the technology. Due to global escalation of security concerns, the demand for hard, sophisticated surveillance systems solutions increased. The systems should not only be efficient, but also flexible, secure and scalable. The usual monolithic architecture doesn't fin all these requirements due to limitations in flexibility, adaptability and scalability.

This thesis work aims to find, explore and design a microservices based architecture for an automated surveillance system using artificial intelligence (AI). The purpose of this analysis consists of the following:

- identify limitations of existing software architectures: examine current existing surveillance system architectures to understand their drawbacks in handling real-time data processing, large volumes of data and traffic, and easy integration with AI algorithms;
- establish best practices and principles: research and identify design principles and architectural patterns that can be effectively applied to automated surveillance systems;
- design an optimized microservices architecture: propose a microservices architecture that ensures modularity, flexibility, scalability, and security, adapted to the specific needs of automated surveillance.

By conducting this analysis, the thesis seeks to contribute to the analysis and development of advanced surveillance systems capable of addressing contemporary existing security challenges while being adaptable to the future technological evolutions and new requirements.

The integration of AI algorithms with a microservices based architecture represents a modern approach to the problems and limitations of the already existing automated surveillance systems. By introducing the advantages of the microservices architecture, it is possible to implement surveillance systems solutions that are more secure, scalable, flexible and responsive. Besides the fact that this leads the system to meet complex demands of security, the microservices architecture helps to effectively adapt to different technologies.

Furthermore, this study will investigate possible challenges and problems for deploying a microservices-based surveillance systems, for example system reliability, inter-service communication. The findings done within the research will provide valuable information for researchers in this field, providing knowledge about development and designing modern surveillance systems solution. Also, the thesis will connect the theoretical part about microservices architecture with the practical one by designing a scalable surveillance systems system.

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