Graduate School of Science and Technology Master's Thesis Abstract

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Thesis title	Bridging Modern and Legacy Vehicles, Modular Multi-Engine IDS and Lightweight CAN Security		

Abstract

Modern vehicles combine high-performance gateways with legacy, resource-constrained electronic control units, creating challenges for deploying practical automotive intrusion detection systems (IDSs). Many existing approaches are either too resource-intensive or fail to remain effective across the vehicle lifecycle. This thesis proposes a unified, resource-efficient, and lifecycle-aware intrusion detection strategy for automotive systems. A modular, containerized multi-IDS framework is introduced for modern gateways, demonstrating that enterprise-grade IDS engines can be orchestrated under automotive resource constraints while reducing false positives through cross-engine correlation. For legacy vehicles, a lightweight and interpretable IDS based on statistical profiling of Controller Area Network traffic is developed, achieving accurate detection of denial-of-service, fuzzing, and injection attacks without reliance on machine learning. A maintenance-aware recalibration mechanism enables controlled adaptation to legitimate post-production changes. Experimental results using multiple public datasets show that effective, explainable, and deployable automotive intrusion detection is achievable for both modern and legacy vehicle architectures.

Keywords:
Automotive Cybersecurity, Intrusion Detection Systems, Controller Area Network, Resource Optimization, Containerization, Event Correlation, Lightweight IDS, Maintenance-Aware Recalibration