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An Automated Reverse Engineering Cyber Module for Cyber-Physical Systems Security Assessment Module for Industrial Process Programmable Logic Controllers

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Keywords: cybersecurity; industrial control system; programmable logic controller; Industry 4.0; Industrial Internet of Things; smart manufacturing; Industrial 5.0; machine learning; artificial intelligence; automated reverse engineering

Abstract:
Industrial Control System (ICS) components have been subject to heightened cyber risk as hardware/software supply chain vulnerabilities have been illuminated and cyberattacks have become more sophisticated. Programmable Logic Controller (PLC) firmware is the Programmable Logic Controller (PLC), a key component of industrial control systems (ICS) that directly interfaces with and controls the control of an actuator. Many PLCs were designed for another time, in a "trusted" environment, and implement security features in a variety of legacy fields (e.g., custom programming language, etc.). This described sub-optimal paradigm also exists within the rules of the Industrial Internet of Things (IIoT) communication protocols between actuation (e.g., ECU, CAV specifies 2 seconds) for the operating environment. Hence, the designing/architecting/implementing of a Cyber-Physical Systems Security Assessment Monitoring/Detecting/Mitigating Module (MDMM) is non-trivial. The proposed MDMM is a cyber module that is a Cyber-Physical Module (CPM) or ICS Cyber Assurance Communications (CACC) module (PLC-CACC) that is a Cyber-Physical Module (CPM) that is a PLC module. In the paradigm, Central to its viability, the MDMM leverages an anti-scan cycle traffic, utilize Machine Learning (ML)/Substitute PLC (SPLC) Reverse Engineering, and implements a Cyber-Physical Module Automated Reverse Engineering (ARE) mechanism. The introduced MDMM requires further quantitative benchmarking, but the qualitative material results show promise.

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