Critical Infrastructure Systems and the Role of SCADA Systems

The vulnerabilities with critical infrastructure systems are things such as human factors which include poorly trained employees or careless workers this could led to mistakes which can cause an incident. Another vlunerablility of these systems is their reliance on digitalization ("As more systems become interconnected and reliant on digital platforms, they become more exposed to cyber threats. Additionally, outdated security measures increase vulnerability" (*Critical Infrastructure Vulnerabilities in 2025*, 2025). Hackers can exploit outdated software when updates are not applied regularly. SCADA systems help prevent cyberattacks by using threat detection ("ICS/SCADA security works through layered defense mechanisms including network segmentation, specialized protocols, intrusion detection systems, and access controls protecting industrial networks from cyber threats" (Security, n.d.). Using threat detection software can lessen the effects of human error and catch an incident before it occurs.

SCADA systems also prevent the loss of millions in damages from an attack ("ICS/SCADA security protects industrial control systems and supervisory control and data acquisition networks that manage 90% of critical infrastructure globally, preventing cyberattacks that cause average damages of $5.9 million per incident"(Security, n.d.). These systems are updated regularly to by virtual patching to fix vulnerabilities in servers. A human-machine interface can be used within an SCADA system to allow real-time monitoring and give processed data ("The HMI is linked to the SCADA system's databases, to provide the diagnostic data, management information, and trending information such as logistic information, detailed schematics for a certain machine or sensor, maintenance procedures, and troubleshooting guides.(SCADA Systems Article).

Overall, critical infrastructure systems are highly vulnerable to a range of threats and weaknesses, primarily due to unpatched software, human factors such as user error or negligence, and limited risk monitoring capabilities. Supervisory Control and Data Acquisition (SCADA) systems play a crucial role in mitigating these vulnerabilities by promptly patching software flaws, providing real-time monitoring of infrastructure, and offering robust defenses against cyberattacks. These cyber-attacks, if successful, can lead to catastrophic consequences, including operational disruptions and damages costing millions of dollars. Therefore, strengthening these systems and increasing their resilience through regular updates, comprehensive risk assessments, and improved security measures is essential for safeguarding essential services and infrastructure.

Works Cited

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