

Artificial Intelligence Approach to Enhancing Detection and Verification of Illicit Trafficking and CFSI within Nuclear Supply Chain

The nuclear supply chain (NSC) extends the vulnerabilities through disruption by illicit trafficking and counterfeit, fraudulent, and suspect items (CFSI) of nuclear and radioactive materials (NRM). These pervasive issues of illicit trafficking and CFSI can diminish the integrity of systems, structures, components or devices that poses a significant nuclear cyber and physical security threat and public safety. Therefore, it is essential to ensure the cyber physical security and safety in the NSC by enhancing the existing detecting, preventing, and deterring illicit trafficking and CFSI instruments. Therefore, an integrated approach is required for building a sustainable NSC to facilitate the border controls of illicit trafficking and CFSI of NRM. Despite the potential of vulnerabilities, threats, and risks with illicit trafficking and CFSI of NRM within the NSC, states lack in addressing these issues properly when they should not be. In this aspect, member states require to reformulate the existing framework through incorporating artificial intelligence (AI) approach to govern these nuclear safety and security risks. These are the prime motivation of this research. Drawing upon these limitations, this research introduces AI approach through integrating of Blockchain Technology (BT), Machine Learning (ML), and Data Analytics (DA) to enhancing detection and verification of illicit trafficking and CFSI within its NSC. First, to address these issues, this study aims to design a robust blockchain architecture based on cloud infrastructure to enhance detection with ensuring the technical sustainability for NSC. The complex structure of the NSC involves tremendous processes and data derived from diverse actors are sources for big data analytics which can be enhanced by ML. Therefore, this study introduces this important issue of integrating machine learning into data analytics on cloud infrastructure to enhancing detection and verification of illicit trafficking and CFSI within NSC.

Illicit trafficking and CFSI of NRM within the global supply chain are growing security concern that poses a significant threat to public safety because of its frequent occurrences, growing complexity, inherent uncertainty of the extent of infiltration, and dynamic nature of the problem. The developed cloud based BT that aims to create a tamper-proof and transparent ledger of all transactions within the NSC. Hence, this would provide an immutable record of all activities, making it easier to track and verify the movement of NRM. The developed ML algorithms that aim to analyze large amounts of data from sensors and other monitoring devices to identify patterns and anomalies that may indicate potential threats or issues in the supply chain. Hence, ML enables early detection and prevention of potential security breaches or accidents. Integration of data analytics that aims to process and analyze big data from various sources including border controls systems, regulatory agencies, suppliers, and customers. Hence, it is possible to identify trends, patterns, and other insights that can improve the efficiency and effectiveness of the supply chain. To combine, the use AI approach through integrating BT, ML, and DA technologies provide a powerful tool for detecting potential vulnerabilities, threats and improve the overall efficiency and effectiveness of the NSC. The findings shed light on trust building between the various stakeholders in the NSC through providing a professional, planned response as rapidly and appropriate manner and stimulating organizational security culture through inter-stakeholder's communication, cooperation and collaboration. Finally, the combined outcome of developed AI approach through integrating BT, ML, and DA provide an enhanced, leveraged effectiveness of the detection and verification system at border control within NSC through mitigating the risk of illicit trafficking and CFSI which can be used to reformulating member states existing framework to building a robust nuclear security regime.

Country or International Organization

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Instructions

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Track Classification: Track 4 Computer Security and Emerging Technologies