

A Study into the Security Issues and Countermeasures for the Industrial Internet of Things (IIOT)

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Abstract

Industrial internet of things are essential factors for an organisation to maintain relevant work strategy. In this study, several types of security issues and countermeasures for IIOT are discussed critically. Various kinds of sensors, applications and devices are used by a company to identify security issues for IIOT. Visibility of work is overseen by a firm to gather several types of information related to work. Every company always tries to enhance troubleshooting and maintenance capabilities. Regulatory compliance is controlled by an organisation to understand issues of IIOT. Operational efficiency improves by these security issues for IIOT process. Quality assurance and artificial intelligence are controlled with help of these security issues. Digital transformation helps a company to mitigate those issues for IIOT. Lack of visibility, security integration and poor testing related issues are faced by a firm. Centralised connectivity helps an organisation to connect all networks in an organised way. This centralised connectivity plays an essential role to control performance. Secondary network system is managed by a company to mitigate security issues for IIOT. Several types of modern IoT devices are used for mitigating security issues.

Keywords

Security issues, IIOT, IOT, centralised connectivity.

INTRODUCTION

An ecosystem of devices, applications, sensors and associated networking equipment works together for an organisation to enhance their performance. These devices, sensors and applications are effectively helpful to gather several types of data related to work processes in global market. Internet of things (IOT) helps a company to maintain organisational operations significantly [1]. Company management team has a responsibility to monitor and analyse all gathered data in a simple manner. For this reason, a firm can easily enhance their profitability and productivity. Work visibility of an organisation is maintained by this analysis process gathered data. Analytical process of data related to work helps a company to enhance troubleshooting and maintenance capabilities [2]. In case a company increases their capabilities of work within a workplace, this firm fulfils demand of market and customers in an organised way. Several types of data are available globally to maintain a smooth process of work. Operational managers have a responsibility to maintain proper safety and security of data in workplace. This industrial IoT process helps a company to increase efficiencies and improve security, safety of gathered data.

A wealth of actionable data from operations of a company is maintained with help of this industrial internet of things. This process helps an organisation to control work process in a significant way [3]. Every company always tries to maintain worker safety and security in workplace to enhance their rate of production. Company management team has a

responsibility to maintain quality and quantity of products at time of working. Better quality products are immensely advantageous for a company to attract more customers. A firm can earn high profit from market by this industrial IoT framework. IoT helps an organisation to increase production uptime by predictive maintenance of machinery in workplace [4]. Several types of modern machines are implemented by a company to maintain their rate of production and quality of products. Regulatory compliance of a firm is maintained properly by this IoT process during working time. A major factor of IIOT security issues is centralised connectivity. This centralised connectivity helps a company to connect all network systems in a single way.

MATERIALS AND METHODS

Research design refers to a framework of research work, by which everyone can easily understand work process and strategy. Several types of techniques are available in global market to finish a research work within a given deadline. Research design helps researcher to choose relevant techniques of work. Researcher can easily maintain a suitable research process for subject matter. Several types of research types are available such as: “qualitative”, “quantitative” and “mixed method”. In this study “qualitative” research type is used by a researcher. Human behaviour and habits are known to every researcher with help of this particular research type [5]. These individuals can easily interpret any data in several types of ways to gain better ideas about concerned subject matter. Research aims and objectives are gained by a researcher with help of this “qualitative” research design.

Research approach is a process of work selected by researcher to gather, analyse and interpret data related to work. Overall process and strategy are identified by this research approach. Methods for data collection, analysis and interpretation are described by a research approach. Several types of factors are available for a research work to select a research approach such as: experience of research, audience of research study and research objective. Researcher follows an “inductive” research approach to maintain a suitable strategy of work. A method of drawing conclusions by going from specific to general related to a study is managed by this “inductive” research approach [6]. Specific observations to broader theories and generalisations are maintained by a researcher with help of this “inductive” approach. Researcher can easily begin to detect patterns and regularities related to research work.

Different methods are used to conduct research in a simple manner. Goals, timelines and purposes of a research work are maintained by researcher to finish their work within proper time. Researcher uses a secondary research type for this particular study. For this reason, these individuals can easily collect several types of data related to work. Various kinds of information are available to maintain a smooth process of work. Every research work needs a certain amount of money and time, consequently, researcher may not be able to finish their work in an organised way. Hence secondary research types can easily reduce time and budget related issues significantly to enhance their performance for this particular study [7]. Secondary data are collected from peer reviewed journals which are published after 2019. Authentic and relevant data is collected by researcher to maintain simple manner of a research process. Several types of online books, journals and newspapers are available to collect accurate data related to this particular study.

Qualitative research design is included by researcher for this study with help of secondary data collection methods. Researcher uses an “inductive” research approach to maintain necessary process of work. Deductive research approach is excluded by researcher for this study to manage their performance. Researcher may not be able to use quantitative research types here.

RESULTS

A brief idea about industrial IoT security

Usage of network connected sensors and other monitoring devices are managed by a company with help of this IIOT security process. Manufacturing process of an organisation is maintained by these security methods. Quality and quantity of products are managed by a company in global market to enhance their profitability and productivity [8]. IIOT security process helps a company to maintain machine health within a workplace. For this reason, work process cannot be able to hamper due to lack of machines. Sometimes defective parts of a machine create a negative impact on work strategy of a company. Every firm always tries to improve their quality and quantity of products. Consequently, a company can

easily earn high profit from market. Quality assurance is maintained by IIOT methods in the workplace. IIOT process is immensely helpful for a company to reduce human error in quality assurance [9]. In case a company may not be able to maintain their QA process in workplace, quality and quantity of products are hampered. Artificial intelligence is also beneficial for a company to enhance their performance in global market.

Different types of machines are available within an organisation to produce better quality products in a company. IIOT process helps to monitor status and health of machines at all times to maintain their manufacturing process [10]. Various kinds of sensors are available such as: vibration sensor and temperature sensor. These two sensors are immensely helpful for a company to manage their financial health. Overall status of machines is monitored by temperature sensors. Different types of components are available within a machine and health of those components are measured by this vibration sensor. In case one component of a machine is disturbed, this machine is replaced by another better machine in workplace. Consequently, overall damage of a machine is managed by an organisation with help of IIOT method [11]. Operational managers have a responsibility to maintain their efficiency and strategy of work. IIOT method helps an organisation to improve operational efficiencies. Rate of production is enhanced by this operational efficiency.

Operational managers have a duty to maintain their quality and quantity of products during working hours. Smarter control of a work process is managed by IIOT method. This helps to enhance security and personal protection of an organisation. Automatic process of work helps to save a lot of time in workplace. Modern information related to work is gained by IIOT process of work [12]. These methods are effectively beneficial for a company to maintain their communication process. Employees are from different backgrounds and cultures; hence these individuals have different ideas and thoughts related to work strategy. These are immensely helpful for a company to enhance their organisational and financial performance. Modern strategy and process of work is managed by IIOT process in workplace [13]. Regular plans of a company management team are managed by this particular process. In case an operational manager may not be able to remember their daily work plans, this IIOT process helps these individuals to maintain proper plans on a daily basis.

Major concerns of industrial IoT security

Industrial IoT security connects several types of machines and devices within an industry such as: transportation, manufacturing, power generation and transmission. Digital transformation of an organisation is managed by this process. This particular transformation helps a company to enhance their rate of production and profitability. In case a firm may not be able to maintain digital transformation due to lack of money, this company cannot be able to earn high profit from market. Analog information sources are replaced by digital transformation to enhance their performance [14]. IIOT

process helps a firm to maintain a secure network system at time of working. Secure network system helps a company to increase their economic growth significantly. Actionable insights are managed by an organisation to develop their applications and strategy of work. In recent days, everyone uses several types of network equipment on a daily basis to maintain a healthy lifestyle. Switches, routers and wireless equipment are connected with IIOT devices to provide better bandwidth in a firm [15]. This equipment is immensely helpful for an organisation to support communication protocols. This IIOT process helps a firm to maintain workplace flexibility. Visibility of a firm is managed with help of this network equipment.

Centralised connectivity development and monitoring process of work is effectively advantageous to monitor and scale their deployments. Modern equipment helps a company to manage centralised viability of devices within a workplace. Edge devices and equipment are used by a company quickly and accurately with help of this centralised connectivity deployment [16]. Upgradation process of configuring connectivity is beneficial for an organisation to enhance their profitability and productivity. Asset tracking and monitoring of IIOT processes are managed by a company to manage proper process of work. Several types of machines are used by a company to produce modern products. In case a component of a machine is disturbed, this machine cannot be able to provide better performance. Therefore, company management team has a responsibility to check their equipment on a daily basis to maintain a smooth process in an organised way.

Strong cybersecurity is managed by a firm to use IIOT process significantly. Threat surface is enhanced by these all-connected devices. Vast networks of connected physical objectives are referred to as IIOT [17]. This process is beneficial to exchange data with other systems and devices via internet to maintain proper strategy of work. A highly distributed network system is managed by an organisation. IIOT process helps a company to maintain connectivity with sensors and lightweight applications within a workplace. Consequently, quality and quantity of products are maintained properly. Different types of tools, processes, systems and strategies are covered by IIOT process. An umbrella term is referred to as an IoT security to protect all data related to work. Protection of physical components, applications, network connections and data are managed by this process. This process is effectively beneficial for an organisation to ensure integrity, availability and confidentiality of IoT ecosystems [18]. High volume of flaws discovers in IoT framework on a daily basis to maintain security challenges.

Security consideration and issues in adopting industrial IoT

Transportation and manufacturing related industries are immensely benefited by this IIOT process in market. Several

types of technical challenges are faced by a company in workplace to take necessary steps of work. Predictive maintenance of a firm is managed by installing several types of sensors within an organisation [19]. These sensors are immensely helpful to gather and analyse performance data. Sometimes, employees may not be able to know usage of sensors. Consequently, work process and strategy are hampered due to lack of knowledge and skills. Communication skills among employees are a big issue for a company to enhance their performance. In case employees cannot be able to communicate with each other, new ideas and thoughts related to work strategy are not shared among themselves in workplace. Potential risks related to work process are not managed by an organisation [20]. Maintenance process of a company cannot be able to manage in a simple way. Company management team has a responsibility to operate their employees for maintaining better quality work in an organisation.

Lack of visibility is a major issue for a company to maintain IIOT process. Sometimes users deploy several types of IoT devices without knowledge of IT departments. Consequently, an accurate inventory process of work is not controlled properly. Several types of IoT devices are used by a company to enhance skills and knowledge related to IIOT process among employees. Limited security integration is faced by a company to maintain their work strategy [21]. Variety and scale of IoT devices are available in market to control security systems ranges from challenging to impossible. A better flow of critical information is supervised by an integrated security system. This integrated security framework allows all information to facilitate a better response across all systems. Open-source software is used by a firm in workplace to survive with IIOT process [22]. Open-source code vulnerabilities are faced for maintaining this IoT framework at time of working. Vast amounts of data volume are available; hence all data are not relevant and accurate for this IIOT framework.

Poor testing process creates a negative impact on IIOT process of a company. Most IoT developers cannot focus on security related to this strategy. Therefore, every user fails to perform effective vulnerability testing to identify weaknesses of IoT systems [23]. In case a company cannot be able to identify weaknesses in IoT framework, this firm faces several issues related to this process. All data related to data are not secured properly within a company due to weaknesses in IoT devices. Different types of passwords are used by a company to control security issues in IIoT. Passwords are immensely weak to mitigate security issues in an organisation. Sometimes company management team cannot be able to remember necessary passwords. These individuals change passwords on a daily basis. Therefore, cyber security process of an organisation is hampered within a workplace. Weak passwords are made by users that can be easily guessed by anyone within an organisation.

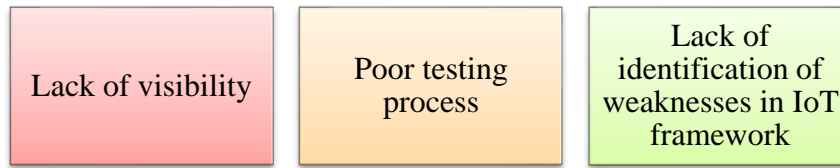


Figure 1: Issues in undertaking IIoT

Mitigation process of security issues in industrial IOT

Security issues are faced by a company in workplace to secure connection process of IoT devices. Secure connection framework helps a company to mitigate security issues in IIOT [24]. Strong passwords must be used to secure IoT connection process. Every company must use a secondary network system to maintain their work process. Two network systems are better than one. All data is sent with help of a single network system in workplace to maintain proper strategy of work. Sometimes employees are confused about all data in an organisation. In case a company focuses on two network systems, security realtor issues are mitigated by these secondary network systems. A stranger cannot be able to connect to internet of a firm. Every company must focus on their quality of work in workplace to mitigate issues related to IIOT process. A lot of IoT gadgets are available in market

to maintain relevant and accurate processes of work.

Cheaper purchase of a company is effectively beneficial to manage their security related issues. In case a more secure higher end security process must be used by a firm to control their issues. Cyber threats must be mitigated by a company with help of this IIOT devices during working hours. Company management team has a responsibility to provide proper guidance to their employees. These individuals can easily control security issues related to IOT devices. Decision making skill, problem solving skill and communication skill among employees are enhanced due to proper guidance of high authority within a company [25]. Company management team has a responsibility to upgrade all their devices in workplace. For this reason, employees can easily enhance their skills by which these individuals mitigate security issues in IOT devices within an organisation.

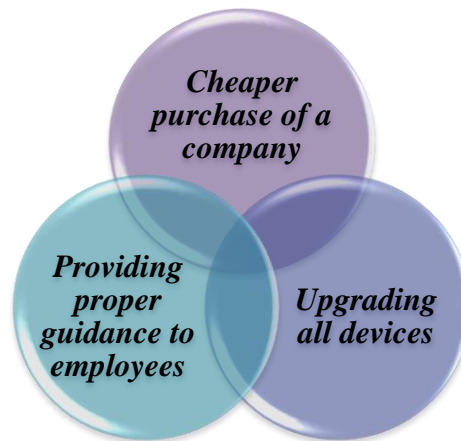


Figure 2: Mitigation procedure of security issues in IIoT

A key concern and important challenge for any IOT applications are managed by a company with help of these five pillars of IOT security. Various kinds of pillars of IOT security are available such as: non-repudiation, integrity, availability, confidentiality and authenticity [26]. Current updates must be supervised by a company on a daily basis. Consequently, strengths and weaknesses of current updates are known to everyone. Company management team has a responsibility to identify security issues in IOT devices. Upgradation process of machines within a workplace is managed by these IOT devices. IIOT devices allow

communication with all internet connections within a company.

DISCUSSION

Different types of networks are used by a company to maintain IIOT process within a workplace. Several types of machines are used by a firm to produce modern products. Therefore, IoT related issues are mitigated by an organisation in a significant way. Company management team has a responsibility to check health of machines on a daily basis to manage a smooth work process. In case components of a machine is disturbed during working hours, this creates a

negative impact on performance of a company. Quality assurance of an organisation is maintained properly with help of this IIOT process. This particular process helps a company to control work process in an organised way. Every company always tries to enhance audit process on a daily basis. IoT security process helps a company to oversee a smoother regulatory audit process. Temperature sensor and vibration sensor are used by a firm in workplace to control issues related to IoT process. Every company tries to maintain an automatic process of work, by which security issues and countermeasures for IIOT process are managed properly.

Digital transformation process creates a positive impact on financial growth of a company. This transformation needs a high amount to oversee major concerns of IIOT security. In recent days, every company uses digital processes to maintain their work strategy. Analog information is not controlled by a firm in workplace. Application of work process helps to supervise actionable insights in a simple manner. This process helps an organisation to connect with all networks during working hours. For this reason, higher authority of a firm can easily gather proper information related to work. In case any issues arise within a firm, this security process helps to identify all issues. Centralised connectivity development is effectively beneficial for a firm to monitor their deployments. Every company has a responsibility to oversee strong cyber security. In case a company follows this cyber security issue, IIOT process is supervised in an organised way. Integrity, availability of IoT ecosystems is ensured properly by this IIOT security process.

Technical challenges for an organisation play an essential role to manage their performance. Several types of sensors are available in global market. Every firm tries to install modern sensors in workplace to control necessary strategy of work. Communication process creates a major issue within a company. In case employees cannot be able to communicate with each other, work strategy is not supervised by an organisation properly. Lack of visibility creates a negative impact on IIOT security process globally. Consequently, employees may not be able to maintain a secure inventory process of work. Visible strategy helps an organisation to enhance their better flow of critical information. Security integration is supervised by a firm due to a proper security management framework. Centralised connectivity of a company must be overseen for mitigating security issues for IIOT.

Company management team must engage an experienced technical person to get relevant ideas and thoughts to mitigate technical challenges. Usage of modern sensors is not known to every employee. Therefore, a firm must organise training sessions to understand proper usage of all sensors significantly. Secondary network systems must be controlled by a company to mitigate network related issues. Strong password should be used by a firm, by which a person may not be able to guess this password. Five pillars of IoT devices are beneficial to oversee organisational and financial performance. Upgraded machines are used by an

organisation to mitigate security issues and countermeasures for IIOT.

CONCLUSION

IOT devices are effectively advantageous for an organisation to maintain their work strategy and process. Several types of issues are faced by a company for maintaining IIOT devices. Several types of services and sensors are available in the market to use IoT devices within a company. Two types of sensors are already mentioned in this study to mitigate all security issues in IoT devices. Vibration and temperature sensors are effectively advantageous for an organisation to enhance their performance. Importance of IoT devices is also mentioned in this study to mitigate security related issues. Operational efficiencies are managed by a company in workplace. Network equipment is used by a firm to use several types of routers, switches. Communication protocols are controlled by an organisation with help of these IoT devices in workplace.

A brief idea about industrial IoT security is critically evaluated here. Types of IoT security are mentioned here such as: firmware assessment, network security and embedded network system. This should be beneficial for a firm to supervise security issues in IoT devices. Better bandwidth of IOT devices is managed by a company with help of these IoT devices. Lack of visibility and limited security integration related issues are faced by an organisation to manage usage of IoT devices within a company. Poor testing processes create a negative impact on organisational performance. Lack of support is also a major issue in workplace to mitigate security challenges for an organisation. Personal privacy of a company is not maintained properly during working hours. For this reason, operational efficiency is hampered due to lack of privacy security in the workplace. Mitigation processes of those issues are mentioned in this study to maintain a smooth process of work. Every company tries to manage a centralised connectivity framework globally.

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