ISSN: 2959-6386 (Online), Vol. 2, Issue 2, July 2023

Journal of Knowledge Learning and Science Technology

journal homepage: https://jklst.org/index.php/home

Implementing Technology Manufacturing with Robotics Process Automation (RPA)

Abimbola Dolapo Badmus[a]
[a] **Prairie View A&M University**

Abstract

Rapid growth in manufacturing has spurred the exploration of the potential of the Wireless Sensor Network (WSN) and the Robotics Process Automation (PRA) to improve the efficiency of manufacturing. The industry ranges from raw material procurement to customer service and support. The Robotics Process Automation is regarded as a key technology of Industrial Revolution 4.0 and offers promising prospects for creating efficient services and applications in manufacturing. in real time about the working environment. This article examines the impact of the RPA on sustainability, especially in manufacturing. This will further develop the current. RPA production scenario and lead researchers to pioneer cyber-integrated, production research.

Keywords: Data analytics,Software Engineering, Robotics Process Automation, Artificial Intelligence, Manufacturing
Article Information:
Article history: *Received:*May 16, 2023*Accepted:* June 22, 2023 *Online:* July 16, 2023
DOI: https://doi.org/10.60087/jklst.vol2.n2.p103
[i] **Correspondence author: Abimbola Dolapo Badmus**

1. Introduction:

Since the Industrial Revolution, the manufacturing sector has played a dominant role in national and corporate economies. In the new era of modern industrial revolution 4.0, we are living in an era where integrated cyber manufacturing is urgently needed. RPA-enabled smart manufacturing enables interactive communication between smart machines to exchange data and information, which is essential for complex systems to make real-time decisions in their working environment. From a day-to-day perspective, achieving increases in resource use and energy efficiency are key strategies for achieving sustainability in production. Today's business organizations face many challenges due to technological advances and fierce global competition. Overcoming these challenges will require innovations in products and processes to ensure sustainable development in the future. The Robotics Process Automation is a technology that companies use to focus on improving product and process development. Despite the tremendous growth of RPA in various sectors such as healthcare, energy management, smart retail, agriculture, etc., the adoption of RPA in manufacturing is in its infancy. The third industrial revolution, also called the digital revolution, in which electronic products such as transistors, microprocessors, communications, and computers appear, still relies on a significant part of the manufacturing process. This revolution has led to the development of factory automation tools such as programmable logic controllers (PLCs) and robots. These provisions paved the way for increased production in an industry that required less time and money.

However, fierce competition and globalization are driving the industry to seek the next level of technological advancement. New business models integrated with the RPA enable organizations to develop innovative, high-performance products. Manufacturing must produce 4,444 more products using less raw materials and less energy. According to the study above, smart production lines and industries will increase annual efficiency by 3.3% over the next few years, reducing annual costs by 2.6%. This is prompting companies to invest in RPA and according to a recent survey, European companies will allocate around €140 billion to upgrade the way products are manufactured. A well-designed RPA network leads to informed production in organizations connecting four key elements: products, people, processes and infrastructure. This improves the organization's entire process, from supplying raw materials to servicing customers. RPA brings more benefits to manufacturing, including increased connectivity between manufacturers and machines, smarter business decisions, and improved global supply chain management.

2. Smart Manufacturing Challenges:

RPA leads to the enhancement of product quality and manufacturing process efficiency, but still, there are huge uncertainty issues that the industries face during the implementation. There are three big challenges identified, one is the general hesitancy of machine builders and end users to actually contrivance this technology. The second one is the security issues, where the collected information about the industry has to be made as big data and to be shared with the co-partners for making it really an RPA-cultured organization. Finally, partnering the other industries, where only a few industries make it possible to bring all the supporting firms into one coherent package. System integration is the biggest challenge to implementing RPA and the development of a connected manufacturing strategy.
The various real-world challenges of implementing RPA include:

2.1 Vertical sector specific requirements

Each vertical segment of production has its own processes and requires different gateways and platforms to collect data from different sensors with different levels of sensitivity. Connecting all devices is a major emerging issue in the RPA and will change entire communication protocols and underlying technologies. Currently, a centralized paradigm is used to collect data from different network nodes [17]. However, when the number of devices that need to connect to the reaches billions, it will be difficult to maintain the same strategy in the future. Additionally, the cost of maintaining cloud computing would be very high to maintain this vast amount of data. In the future, a decentralized network is required to connect the various nodes of the network. Each node communicates directly with other nodes with its own authentication, without intermediaries. This communication method also has the disadvantage of security issues that can be overcome with modern technologies such as blockchain.

2.2 Security:

Data generated in smart manufacturing needs to be stored in the cloud. Stakeholders can use it to monitor the execution of each manufacturing process and use real-time information to safely control and adjust manufacturing actions. Safety plays an important role in the development of smart factories. Researchers analyze different frameworks for ensuring security and privacy in networks [19-20]. The wealth of information available on the internet today has helped hackers identify the weaknesses and shortcomings of smart businesses. Data transmission from industrial plants to the cloud server must be completely secure.

Security Issues in RPA Technology Manufacturing

2.2.1 Security limit device

Devices with low capabilities (memory, storage, processing power) are not well-suited to quickly perform complex encryption and decryption, which is critical to the security approach. A security limit device is a type of safety mechanism used in various machines and equipment to prevent them from exceeding safe operating limits. These devices are typically designed to monitor specific parameters such as temperature, pressure, or mechanical stress, and will trigger an alarm or shutdown the system if those parameters exceed safe levels. Security limit devices can be found in a variety of applications, including industrial machinery, power generation and distribution systems, and transportation equipment such as elevators and aircraft. Some common examples of security limit devices include pressure relief valves, temperature sensors, and overload protectors. The purpose of security limit devices is to protect both the equipment and the people operating it from damage or harm caused by unsafe operating conditions. By continuously monitoring critical parameters and taking action where necessary, safety limiting devices ensure the safe and reliable operation of equipment and prevent accidents or failures.

2.2.2 Device authentication

Device authentication is the process of verifying the identity of a device and ensuring that it is authorized to access a particular system or service. In other words, device authentication is the process of making sure that a device is who it claims to be before allowing it to access sensitive data or systems. Authentication systems are Password and PINs, Biometric authentication, Certificates and digital signatures, Two factor authentication, Public key infrastructure.

2.2.3 Update devices

Device authentication is the process of verifying the identity of a device before allowing it to access a network, system, or application. It involves ensuring that a device is genuine and authorized to access the network or system by validating its credentials, such as a unique identifier, security key, or digital certificate. The purpose of device authentication is to prevent unauthorized devices from accessing sensitive information and resources on a network or system. It is an important security measure used to protect against various types of attacks, including data theft, malware infections, and network intrusions.

2.2.4 Secure Communication

Secure communication refers to the process of transmitting information or data in a manner that is protected from unauthorized access, interception, or tampering. Secure communication is essential for ensuring the confidentiality, integrity, and authenticity of sensitive data, such as financial transactions, personal information, and confidential business communications. Such as Encryption, Virtual Private Networks (VPNs), Secure Sockets Layer/Transport Layer Security (SSL/TLS), Secure Email, Two-Factor Authentication, Two-Factor Authentication.

2.2.5 Data privacy and integrity

Data privacy and integrity are two important aspects of information security. Data privacy refers to the protection of sensitive and confidential information, such as personal information, financial information, and business secrets, from unauthorized access or disclosure. Data integrity, on the other hand, refers to the accuracy, completeness, and consistency of data over its entire lifecycle. Such as Access control, Encryption, Data backup and disaster recovery, Privacy policies and agreements, Privacy policies and agreements, Data validation and quality control,

2.2.6 Secure cloud applications

Secure cloud applications are cloud-based software applications that are designed to protect data and information from unauthorized access, theft, and misuse. Cloud computing has become increasingly popular for businesses of all sizes, as it offers a cost-effective, scalable, and flexible way to store and process data. However, cloud applications can also introduce new security challenges that need to be addressed. Secure cloud applications includes Encryption, Access Control Regular software updates and patching, Data backup and disaster recovery, compliance with regulatory requirements, multi-factor authentication.

2.2.7 Availability

In information security, availability refers to the ability of a system, network, or application to be accessible and operational when needed. Availability is one of the three pillars of the CIA triad, which also includes confidentiality and integrity, Predict and Manage vulnerabilities. Availability includes redundancy disaster recovery and business continuity planning, system monitoring and maintenance, load blancing, scalability and network segmentation.

3. Standards

Connectivity and utility standards present significant challenges to RPA adoption. There are many proprietary methods and custom integrated solutions followed by manufacturers. Standardization leads to transparent interaction between machines and assets. Standardization involves the creation of standard mechanisms that allow devices to interact. The most commonly used standard in RPAis IEEE 802.15.4 including communication technologies such as ZigBee. Continuous research has been conducted for years to develop a sustainable standard for the Robotisc Process Automation .

4. Cloud Architecture of an RPA Manufacture System

An RPA manufacturing system typically involves the use of a large number of sensors and devices that collect and transmit data to the cloud. The cloud architecture of such a system can be designed using a combination of various cloud-based services and components, such as RPA devices, Gateways, Cloud services, Data storage, Data analysis, Machine learning, APIs.

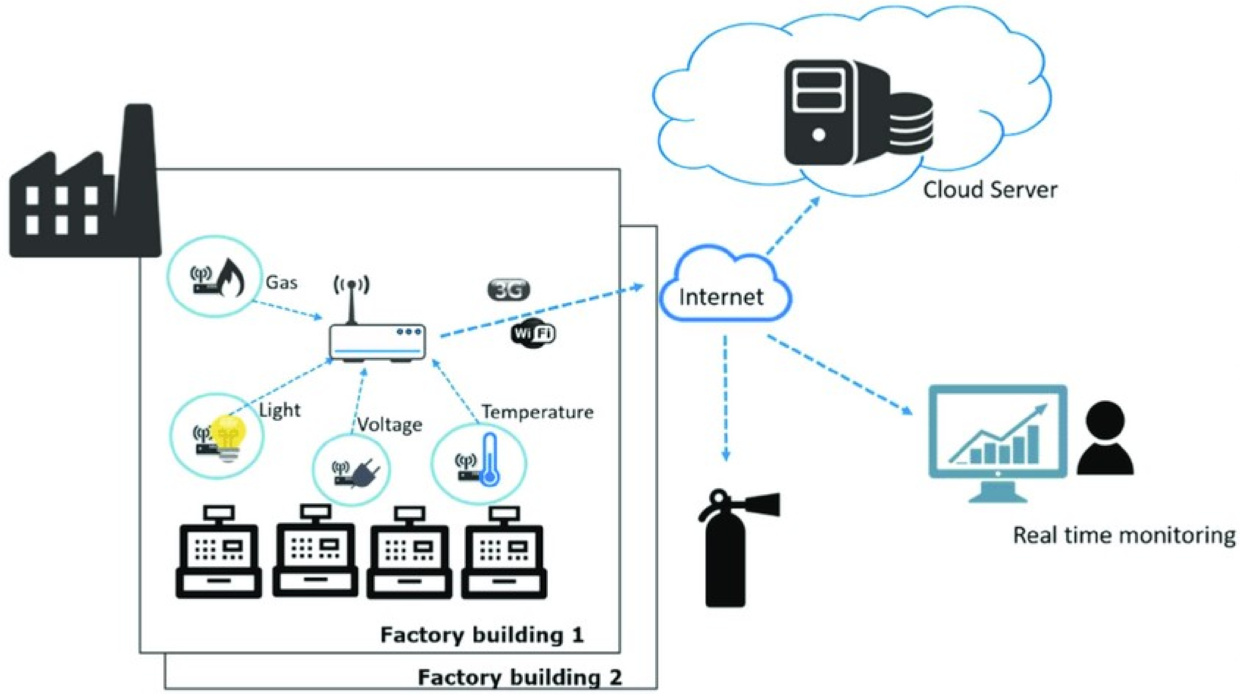


Fig 1: Cloud Architecture of an RPA Manufacture System

5. RPA-Enabled Smart Manufacturing

A smart supply chain in a manufacturing factory refers to the use of advanced technology and data analytics to improve efficiency, visibility, and collaboration across the supply chain. The goal of a smart supply chain is to enhance the flow of information and products, reduce costs, increase agility, and improve customer satisfaction

Robotisc Process Automation (PRA) sensors: This involves the use of sensors to track inventory, monitor equipment performance, and enable real-time visibility into the supply chain.

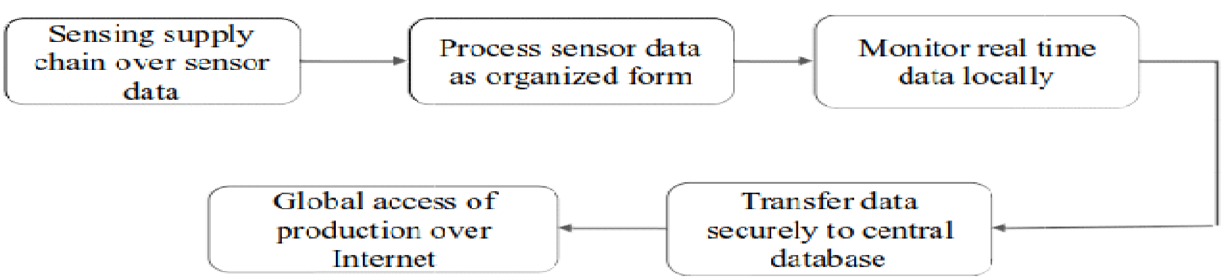


Fig 2: RPA Based Smart Manufacture Supply Chain System

5.1 Sensing supply chain over sensor data

Sensing supply chain over sensor data refers to the use of sensors to monitor and track the movement of goods and materials through a supply chain, as opposed to simply collecting sensor data for analysis. By monitoring the supply chain in this way, organizations can gain real-time visibility into the location and status of their inventory, and make data-driven decisions to optimize their operations and improve their overall efficiency. Sensing the supply chain involves the deployment of a network of sensors throughout the supply chain, such as in trucks, shipping containers, warehouses, and retail stores. These sensors can collect data on various aspects of the supply chain, such as the location of goods, temperature, humidity, and other environmental factors that may affect the quality of the products being transported.

5.2 Processing sensor data as organized form

Processing sensor data as organized form refers to the process of transforming raw sensor data into a structured and organized format that can be easily analyzed and interpreted. This involves a number of steps, including data cleaning, normalization, and transformation. This includes Data Cleaning, Normalization, Transformation, Data Integration, Analysis and visualiazation.

5.3 Monitor real time data locally

Monitoring real-time data locally refers to the process of collecting, analyzing, and visualizing data in real-time, on a local system or network. This approach is often used in situations where data needs to be processed and acted upon quickly, such as in industrial control systems, smart building automation, or real-time process monitoring. Components are used Data sources, Data collection systems and Data processing system.

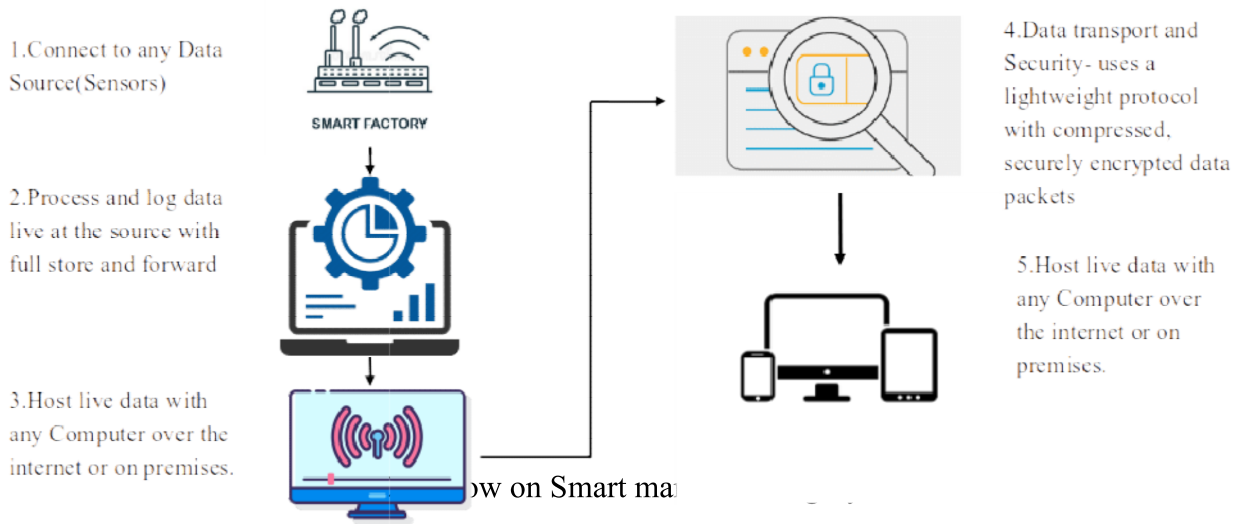
5.4 Transfer data securely to central database

Transferring data securely to a central database is important to protect sensitive data from unauthorized access or interception. Here are some steps to ensure that data is transferred securely to a central database includes Secure transmission protocol, Data encryption, Authentication and authorization, Firewall and intrusion detection, Data backup and disaster recovery, regular security audits.

5.5 Global access of production over internet

Global access of production over the internet refers to the ability of users to access production systems and data from anywhere in the world through the internet. While this can provide many benefits, such as improved collaboration and increased efficiency, it can also pose security risks if not properly managed.

6. Data Flow on Smart Manufacturing System



7. Hardware and Software required to design the Prototype

- 1. RPA development Board (Arduino/Nodemcu-esp32/esp8266).
- 2. Motion Sensor (Used for arrival of new objects/products).
- 3. Leaser (Used as counter to count the products).
- 4. Motor (Used for running supply chain).
- 5. Servo Motor (Used for packaging).
- 6. Arduino IDE or ESP IDF

8. Advantage and Disadvantages

8.1 Advantage

- 1. System will be fully automatic.
- 2. Able to count and monitor all the product as realtime state.
- 3. All the data will store in a central database system
- 4. Reduce the labour cost.
- 5. System will be less time consume etc.

8.2 Disadvantage:

- 1. Tough to manage a vast amount to real time data.
- 2. Data security need here very effectively.
- 3. Possibility in hacking of data etc.

9. Conclusion

The Robotisc Process Automation (PRA) is widely recognized as a new technology that plays an important role in the development of manufacturing. All components from the manufacturing sector can be integrated, including sensors, processing units, communication units and actuators. These highly integrated, intelligent cyber-physical systems open the door to new business and market opportunities in manufacturing and pave the way for the new Industrial Revolution 4.0. In manufacturing, this presents tremendous opportunities to improve system performance in a globalized and distributed environment.

References

[1] Yee T, Yen N and Onathan S 2017. Robotisc Process Automation real-time monitoring of energy efficiency on manufacturing shop floors. Procedia CIRP 61 376-381.

[2]RPA in manufacturing. [online] https://www.visualcomponents.com/ (Accessed 20 August 2018).

[3] Design for manufacturing's 'Robotisc Process Automation ' June 2014, Cognizant.

[4] Ahmed M and Thorat S 2015. Robotisc Process Automation (PRA) Standards, Protocol and Security issues. International Journal of Advanced Research in Computer and Communication Engineering, 4(11) 491-495.

[5]O. F. Badmus, "Application of AI technology in Program Management," Journal of Engineering Research and Reports, vol. 25, no. 8, pp. 48–55, Aug. 2023. doi:10.9734/jerr/2023/v25i895
https://journaljerr.com/index.php/JERR/article/view/958