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The role of the fourth industrial revolution in improving the production process

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Abstract—The fourth industrial revolution has brought about significant changes in the way industries operate, with the integration of the Internet of Things (IoT) in industrial automation being one of the most notable advancements. This integration has led to the improvement of the production process, resulting in increased efficiency, reduced costs, and improved quality.The IoT involves the connection of devices and machines to the internet, allowing for the exchange of data and communication between them. In industrial automation, this means that machines can communicate with each other, share data, and make decisions based on that data. This has led to the development of smart factories, where machines can operate autonomously, with minimal human intervention. The impact of the IoT on industrial automation has been significant. It has led to the development of predictive maintenance systems, where machines can detect faults and notify maintenance personnel before a breakdown occurs. This has reduced downtime and maintenance costs, resulting in increased productivity. Additionally, the IoT has enabled the collection of vast amounts of data, which can be analyzed to identify inefficiencies in the production process and make improvements. The integration of the IoT in industrial automation has also led to the development of new business models. This has led to increased revenue streams and reduced waste. However, the integration of the IoT in industrial automation also presents challenges. One of the most significant challenges is cybersecurity. With machines connected to the internet, they are vulnerable to cyber-attacks, which can result in significant damage to the production process and the company's reputation. In conclusion, the integration of the IoT in industrial automation has had a significant impact on the improvement of the production process.

Keywords-*The fourth industrial revolution, Production Process, industrial automation, Internet of Things.*

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1. Introduction

In the past years, technology innovations are having unprecedented consequences on all the facets of our humanity and society, including business operations processes. There is now compelling evidence about the disruptive capability of technology transformation on business and human activities, especially in the service sector, and in facilitating teaching and learning(Liu z, 2019). During the last few decades, flexibility has been used as an effective factor in the design of production lines. particularly Industry 4.0 has also been identified as a major determinant in improving production flexibility(Cavalcantea et al. 2019; Dubey et al. 2019; Frank et al. 2019). So far, all the industrial revolutions that took place in the past two centuries is promoted by altering production mode enabled by a specific emerging technology at that time(Liao et al., 2017). The arrival of steam engine promoted the first industrial revolution; the application of electricity led to the second revolution, and the widespread use of information technology and electronics products support the third revolution(Liao et al., 2017). The recent popularization of the IoT and cyber-physical system (CPS) has attracted the attention of both enterprise and academics. Leveraging those two emerging technologies is promising to enable the higher level of connection between information, products and people , thereby making contributions to the current production mode(Ibarra et al., 2018).

Industry 4.0 is an emerging concept deriving from technological advancement and disruptive developments in the industrial sector worldwide in the past few years (Dallasega et al., 2017). It defines a methodology applying emerging technologies to revolutionize the current production that transits from machine dominant manufacturing to digital manufacturing (Oztemel and Gursev, 2018). Some consider it as the integration of technologies such as CPS, IoT, Big Dara and Clomanufacturing (Pereira and Romero, 2017). However, there is a discourse arguing that industry 4.0 is not only regarding integrating technologies but concerning the whole concept of how to acquire, share, use, organize data and resource to make the product/service deliver faster,cheaper, more effective and more sustainable (Piccarozzi et al., 2018). ndustry 4.0 is an emerging concept deriving from technological advancement and disruptive developments in the industrial sector worldwide in the past few years (Dallasega et al., 2017). It defines a methodology applying emerging technologies to revolutionize the current production that transits from machine dominant manufacturing to digital manufacturing (Oztemel and Gursev, 2018). Some consider it as the integration of technologies such as CPS, IoT, Big Dara and Cloud manufacturing (Pereira and Romero, 2017). However, there is a discourse arguing that industry 4.0 is not only regarding integrating technologies but concerning the whole concept of how to acquire, share, use, organize data and resource to make the product/service deliver faster, cheaper, more effective and more sustainable (Piccarozzi et al., 2018). Through Industry 4.0 connectivity, automation, fast information exchange and analytics, a new dimension of flexibility can be reached and new approaches to planning and controlling production systems designed. Cloud-based manufacturing is a technology which can contribute significantly to the realization of Industry 4.0 advantages (Thames and Schaefer 2016; Yin et al. 2018; Shukla et al. 2019; Ivanov and Dolgui 2020; Ivanov et al. 2016, 2018b). The aspiration of cloud manufacturing is to form production networks capable of dynamic reconfiguration and high flexibility, while intelligent big data analytics can provide global feedback to achieve high efficiency (Wang et al. 2016; Ahn et al. 2018; De Sousa Jabbour et al. 2018). Workstations and a material handling system collect and share rich process data within the cloud in real time. Information about workstation utilization and performance can support decentralization of the decision point and enable the production system to react dynamically to demand and supply changes, so that materials can be distributed according to capacity. To enable cloud manufacturing, current production systems have to be adapted. A few studies demonstrate ways to achieve these goals, with a strong emphasis on digitalizing machines and establishing IT infrastructures. Left ignored, however, was the role of material handling systems. In this research, we seek to answer the question of how and through what ways the fourth industrial revolution affects the improvement of the production process.

2. Research methodology

The method of this research was to investigate the effects of the industrial revolution on the improvement of the production process by involving the Internet of Things in the matter of industrial automation. The innovative

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aspect of this research is that, unlike other similar researches, instead of relying on the articles worked on this topic, it seeks a precise answer to the main question of the research by asking detailed questions about artificial intelligence technology. These questions were proposed based on the professional experiences of the authors from being in manufacturing industries and creative research projects. Chat gpt works as a large-scale natural language processing project. This structure is used to sift through huge amounts of data obtained from Internet sources. The basis of this network is based on the deep learning model. This technology is used as a versatile and versatile process to facilitate the content creation process. This technology is used as a versatile and versatile process to facilitate the content creation process. As a versatile tool, this technology was able to be used in this project as a guide for the use of the Internet of Things in advancing the industry's goals.

3. Technologies in industry 4.0

Lu (2017) defines industry 4.0 as an integrated, adapted, optimized, service-oriented and interoperable manufacturing process in which algorithms, big data and high technologies are included. Technologies are considered as the very heart of industry 4.0 as the interconnection in the industry 4.0 is supported by the adoption of software, sensor, processor and communication technologies (Bahrin et al., 2016). Five technologies are frequently discussed in the literature: IoT, big data analytics, cloud, 3D printing and robotic systems (Piccarozzi et al., 2018; Kamble et al. 2018), where technologies such as AI, ML, digital twin and 5G are emerging.

Deep learning in the future Industrial Internet of Things.

(www.researchgate.net,2023/6/8, 11:23)
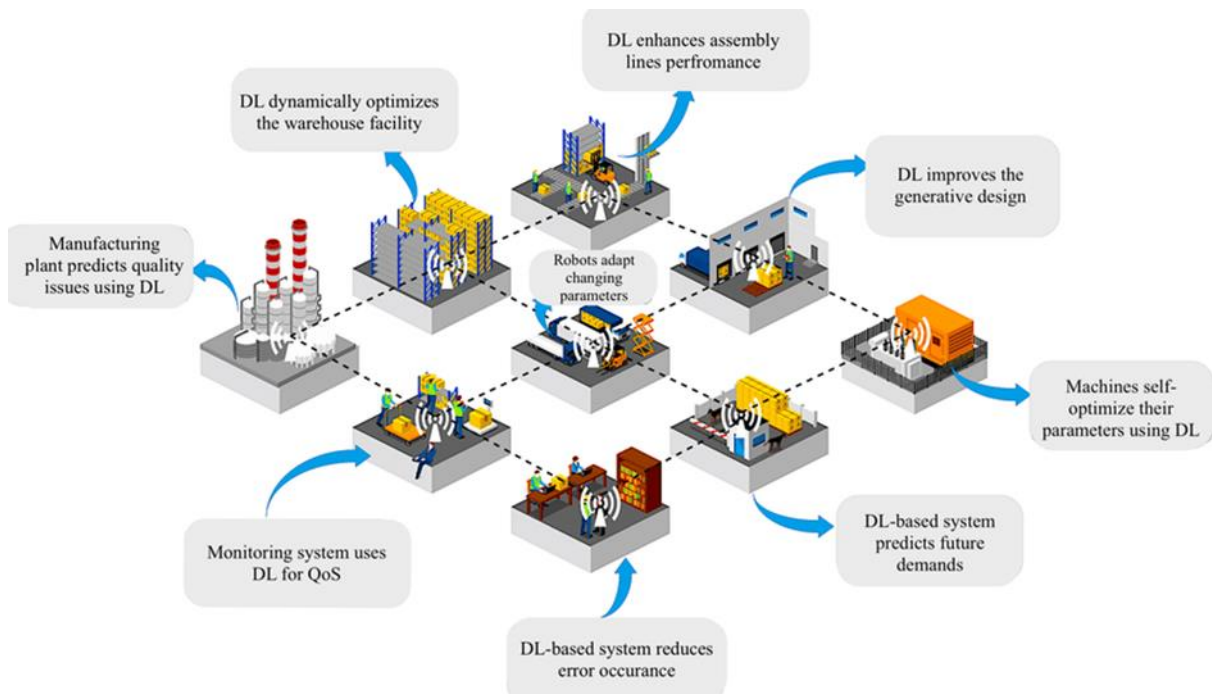
4. Internet of Things (IoT)

The IoT is an emerging industrial ecosystem. It facilitates the combination of intelligent machines, advanced predictive analytics and machine-human collaboration, aiming at promoting productivity, efficiency and reliability (Kamble et al., 2018). In industry 4.0, IoT can support the smart factory. It can lead to the creation of virtual networks to support the smart factory (Xu et al., 2018); meanwhile, it provides the factory with the ability to collect real-time data and transmit the data swiftly (Yang et al., 2017). Therefore, it enables the remote operation of manufacturing activities and affects collaboration among stakeholders (Yang et al., 2017). IoT can benefit the integration and coordination of product and information flow (Tao et al., 2014), and enable the decentralization of decision-making, interconnected devised can perform automatic analytics and decision-making, thus improving the responsiveness to the environment change (Wang et al., 2014).

5.Methods of influencing the fourth industrial revolution on the improvement of the production process

The fourth industrial revolution, with its emphasis on automation, data exchange, and the Internet of Things (IoT), has had a significant impact on performance and productivity across industries. Here are a few key ways in which the fourth industrial revolution has affected these areas:

1- Improved Efficiency: Automation and interconnected systems allow for faster decision-making and streamlined processes. By reducing human error and automating repetitive tasks, the fourth industrial revolution has improved efficiency and allowed companies to produce more with less.

2-More Accurate Predictive Analytics: Analytics systems that gather and analyze data from sensors and IoT devices have allowed companies to make better predictions about future performance, resulting in more informed decision-making.

3 -Enhanced Flexibility: The fourth industrial revolution has enabled companies to adapt to changing customer demands and market conditions through the use of interconnected, flexible systems. This has allowed them to be more responsive to changes and opportunities.

4- Increased Collaboration: The use of interconnected systems and data sharing has promoted collaboration between teams and departments, resulting in more efficient and effective problem-solving.

Overall, the fourth industrial revolution has had a significant impact on performance and productivity by improving efficiency, increasing accuracy and predictability, enhancing flexibility, and promoting collaboration.

The Fourth Industrial Revolution has brought many advantages, such as the use of automation, robotics, and other advanced technologies, to improve productivity and safety in the workplace. However, it has also posed new risks and challenges to occupational health and safety. For instance, the use of robots and automated equipment requires employees to work closer to moving machinery, which can be dangerous if proper safety measures are not in place.Moreover, the digitization and interconnectivity of systems and machines can result in new forms of cybersecurity threats, putting workers and organizations at risk of data breaches and cyber-attacks. In response, it is essential for companies to invest in safety training and risk management strategies to mitigate these potential hazards. Additionally, new technologies, such as augmented and virtual reality, can be utilized to provide employees with immersive and realistic training experiences, improving their safety and health in the workplace.Name a practical example of a project using the Internet of Things in industrial automation in a factory with how to implement it and mention the details.

One practical example of a project using the Internet of Things (IoT) in industrial automation is the implementation of smart sensors in a factory's machinery to monitor and optimize performance. The sensors would be connected to a centralized system through the use of IoT technology, allowing real-time data collection and analysis. To implement this project, the first step would be to identify the machinery that would benefit most from the use of smart sensors. Once identified, sensors would be installed and integrated with the

existing systems. The data collected by the sensors would need to be analyzed and translated into actionable insights, which could be used to improve performance and productivity. The details of this project could include selecting the type of sensors to be used, ensuring they are compatible with the existing machinery, and designing a user-friendly interface for data analysis and control. Additionally, proper cybersecurity measures would need to be put in place to protect against potential risks associated with the IoT technology .Overall, the implementation of smart sensors in industrial automation through the use of the IoT can improve productivity, reduce downtime, and increase safety in the workplace.

The Internet of Things (IoT) plays a crucial role in the fourth industrial revolution, also known as Industry 4.0. IoT refers to the network of physical devices, vehicles, home appliances, and other items embedded with sensors, software, and connectivity that enables them to connect and exchange data. In Industry 4.0, IoT is used to connect machines, devices, and sensors to create a smart factory environment. This allows for real-time monitoring and control of production processes, as well as the ability to collect and analyze vast amounts of data. By leveraging IoT, companies can optimize their production processes, reduce downtime, and improve quality control. For example, sensors can be placed on machines to monitor their performance and detect any issues before they become major problems. This allows for predictive maintenance, which can save time and money by preventing costly downtime. Additionally, IoT can be used to track inventory levels and monitor supply chain logistics, allowing for more efficient and cost-effective operations. IoT also enables the creation of new business models and revenue streams. For example, companies can offer predictive maintenance services to their customers, using IoT data to identify potential issues and proactively address them. Additionally, IoT can be used to create new products and services, such as smart home appliances that can be controlled remotely via a smartphone app. Overall, the Internet of Things is a key enabler of Industry 4.0, allowing for real-time monitoring and control of production processes, as well as the ability to collect and analyze vast amounts of data. As companies continue to adopt IoT technologies, we can expect to see even greater improvements in industrial production processes and new business models emerging.

The fourth industrial revolution, also known as Industry 4.0, is transforming the way we produce goods and services. With the help of advanced technologies such as artificial intelligence, the Internet of Things, and robotics, Industry 4.0 is making industrial production more efficient, flexible, and sustainable. One of the key benefits of Industry 4.0 is the ability to collect and analyze vast amounts of data in real-time. This data can be used to optimize production processes, reduce waste, and improve quality control. For example, sensors can be placed on machines to monitor their performance and detect any issues before they become major problems. This allows for predictive maintenance, which can save time and money by preventing costly downtime. Another way that Industry 4.0 is improving industrial production is through the use of robotics. Robots can perform repetitive tasks with greater speed and accuracy than humans, freeing up workers to focus on more complex tasks. They can also work around the clock, increasing productivity and reducing labor costs. Additionally, robots can be used in hazardous environments, such as those with high temperatures or toxic chemicals, to keep workers safe. Artificial intelligence is also playing a major role in Industry 4.0. AI algorithms can analyze data from sensors and other sources to identify patterns and make predictions about future performance. This can help companies optimize their production processes and make better decisions about inventory management, supply chain logistics, and more. Finally, Industry 4.0 is helping to make industrial production more sustainable. By optimizing processes and reducing waste, companies can reduce their environmental impact and save money on resources such as energy and water. Additionally, the use of renewable energy sources such as solar and wind power can help to further reduce carbon emissions. In conclusion, the fourth industrial revolution is transforming the way we produce goods and services. By leveraging advanced technologies such as AI, robotics, and the Internet of Things, Industry 4.0 is making industrial production more efficient, flexible, and sustainable. As companies continue to adopt these technologies, we can expect to see even greater improvements in the years to come.

The Internet of Things (IoT) is playing a significant role in improving production lines by enabling machines and devices to communicate with each other and share data in real-time. This connectivity allows for greater visibility and control over the production process, leading to increased efficiency, reduced downtime, and

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improved quality control.One of the key benefits of IoT in production lines is the ability to monitor and analyze data from sensors and other devices. This data can be used to identify patterns and trends, predict maintenance needs, and optimize production processes. For example, sensors can be placed on machines to monitor their performance and detect any issues before they become major problems. This allows for predictive maintenance, which can save time and money by preventing costly downtime. IoT can also help to improve quality control by providing real-time data on product performance. For example, sensors can be used to monitor the temperature and humidity levels in a production facility to ensure that products are being stored and transported under the correct conditions. This can help to reduce waste and improve customer satisfaction by ensuring that products are of the highest quality. Another way that IoT is improving production lines is through the use of automation. By connecting machines and devices, IoT can enable automated processes that can reduce the need for human intervention. For example, machines can be programmed to automatically adjust their settings based on real-time data from sensors, reducing the need for manual adjustments. Finally, IoT can help to improve supply chain management by providing real-time data on inventory levels, shipping times, and other key metrics. This can help companies to optimize their supply chain logistics, reduce costs, and improve customer satisfaction. In conclusion, the Internet of Things is playing a critical role in improving production lines by enabling greater connectivity, automation, and data analysis. As companies continue to adopt IoT technologies, we can expect to see even greater improvements in production efficiency, quality control, and supply chain management.

The Internet of Things (IoT) and industrial automation are two technologies that are rapidly transforming the way we live and work. While they are distinct technologies, they are closely related and often work together to improve industrial processes.At its core, the IoT is all about connecting devices and sensors to the internet so that they can communicate with each other and with humans. This connectivity allows for real-time data collection and analysis, which can be used to optimize processes and improve efficiency. In an industrial setting, this can mean connecting machines, sensors, and other devices to a central system that can monitor and control them.Industrial automation, on the other hand, is all about using technology to automate tasks that were previously done by humans. This can include everything from assembly line robots to software that automatically schedules maintenance tasks. Automation can help to reduce labor costs, improve quality control, and increase productivity.When the IoT and industrial automation are combined, the result is a powerful system that can optimize industrial processes in ways that were previously impossible. For example, sensors can be placed on machines to monitor their performance and detect any issues before they become major problems. This allows for predictive maintenance, which can save time and money by preventing costly downtime. Additionally, data from sensors can be used to optimize production processes, reduce waste, and improve quality control. Another way that the IoT and industrial automation are working together is through the use of robotics. Robots can perform repetitive tasks with greater speed and accuracy than humans, freeing up workers to focus on more complex tasks. They can also work around the clock, increasing productivity and reducing labor costs. Additionally, robots can be used in hazardous environments, such as those with high temperatures or toxic chemicals, to keep workers safe. In conclusion, the Internet of Things and industrial automation are two technologies that are closely related and often work together to improve industrial processes. By connecting devices and sensors to a central system and automating tasks, companies can optimize their production processes, reduce costs, and improve quality control. As these technologies continue to evolve, we can expect to see even greater improvements in the years to come.

5. Conclusion

The Fourth Industrial Revolution, which is characterized by the integration of advanced technologies such as artificial intelligence, robotics, and the Internet of Things, has the potential to increase efficiency, reduce costs, and improve quality in the production process. However, it also poses challenges such as the displacement of workers and the need for new skills and training. The research suggests that companies that successfully navigate these challenges and embrace the opportunities presented by the Fourth Industrial Revolution are likely to gain a competitive advantage in the global economy. Overall, the research indicates that the Fourth Industrial Revolution has the potential to revolutionize the production process and drive economic growth, but it requires careful planning and management to ensure that the benefits are shared widely and equitably. The influence of

the fourth industrial revolution in improving the production process is expected to result in significant advancements in the future. With the help of advanced technologies such as artificial intelligence, the Internet of Things, and robotics, Industry 4.0 is making industrial production more efficient, flexible, and sustainable. In the future, we can expect to see even greater improvements in the production process as companies continue to adopt these technologies. For example, predictive maintenance will become more accurate and efficient, reducing downtime and increasing productivity. Robotics will become more advanced and capable of performing even more complex tasks, freeing up workers to focus on higher-level work. Artificial intelligence will continue to improve, allowing for even more sophisticated data analysis and decision-making. Additionally, Industry 4.0 is expected to lead to the development of new business models and products. For example, companies may begin to offer more personalized products and services, made possible by the use of data analytics and advanced manufacturing techniques. The use of renewable energy sources and sustainable production methods will also become more widespread, leading to a more environmentally friendly and socially responsible approach to industrial production. Overall, the influence of the fourth industrial revolution in improving the production process is expected to result in significant advancements in the future, leading to greater efficiency, flexibility, and sustainability in industrial production.

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