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DEVELOPMENT OF AUTOMATION IN THE DIRECTION OF HYPERAUTOMATION

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Abstract: Hyperautomation is an approach that companies use to quickly identify, verify and automate as many business and IT processes as possible. It includes the coordinated use of multiple technologies, tools or platforms, such as Artificial intelligence, Machine learning, Robotic process automation, Natural language processing, Integration Platform as a Service and many other solutions and tools for automating various tasks. By 2025. The hyperautomation software market is predicted to reach nearly $860 billion due to the strong need for digital transformation and automation of industrial processes. Hyperautomation is more than process automation and it is irreversible and inevitable. Everything that can be automated will be automated. It is a revolutionary way of economic development by using multiple technologies to simplify work operations and processes while achieving maximum efficiency. Hyperautomation is the present and future of technology in the business world. It represents technology as a symphony of products and platforms working in sync to achieve a common goal. In general, hyperautomation can help industrial enterprises in several aspects: improved decision–making process, optimization of workforce engagement and potential, increase of speed and dynamics of work and the possibility of combining conventional means of automation with "low/no code" platforms (for developing and programming various applications using simplified interfaces and what is important – without actually writing code). The latter trend is gaining widespread popularity in the world of mobile applications, and more recently and in industrial robotics. Today is a time when the need for autonomy and edge computing has accelerated the adoption of cloud infrastructure in companies around the world. Cloud–based platforms should play a key role in the further development of all areas of human activity. They account for 95% of new digital initiatives in the last three years. It is observed that companies that have already adopted cloud infrastructure have completely transformed their business, operational and management models.

Keywords: industrial automation, hyperautomation, autonomous production, robotics

1. INTRODUCTION

During the 1990s, several discoveries led to significant progress. Robotic process automation (RPA) systems extracted data from images and PDF files. The experiments eventually led to the first RPA software concepts in the early 2000s. RPA has driven the acceleration of automation, including the development of artificial intelligence. It wasn't long before technology firms and researchers realized that they could combine software and tools, such as AI and Business process management (BPM). The first Intelligent Automation (IA) appeared in 2018, relying heavily on RPA tools. Hyperautomation wouldn't exist if it weren't for RPA and IA. RPA, as a forerunner of IA, contributed to the emergence of hyperautomation (according to research organization Gartner). RPA only came into mass use in 2015, but the concept has roots dating back to the 1960s. Machine learning, as a branch of artificial intelligence, became a subject of interest in the 1960s, but progressed slow for about thirty years [1]. RPA and IA have grown exponentially in a few years.

The RPA industry reached $1.58 billion in 2020 and is expected to grow by more than 30% by 2027. The evolution of RPA into IA has laid the foundation for hyperautomation (as predicted by Gartner 2019). This complex system continues to evolve, with businesses, technology firms and developers finding new ways to improve existing tools [2]. Hyperautomation is the next big and significant technological jump in the field of industrial automation. It implies the purposeful and simultaneous combining and "stacking" of innovative technological solutions and platforms for the optimization of a given activity or task. The key elements of this concept are robotic process automation (RPA), which is based on human behavior in the execution of various protocol and repeatable tasks; artificial intelligence – AI, machine learning (ML), natural language processing (NLP), as well as platforms for intelligent data processing (IDP). A harmonious and intelligent finding of operational solutions (machines, robots, firmware, software, Supervisory Control and Data Acquisition (SCADA) systems, human–machine interfaces (HMI) and integrated computing technologies with informations (tools and hardware for data acquisition, storage and processing, networking, IoT (Internet of things) and IIoT (Industrial IoT) applications, etc.) is achieved in the production ecosystem. The growing popularity of the so–called "low/no–code" platforms for the development of software applications lies in the fact that these activities are available to

ISSN 1584 – 2665 (printed version); ISSN 2601 – 2332 (online); ISSN-L 1584 – 2665

practically every employee in an industrial enterprise, and not only to programmers with special qualifications. Fig. 1 shows the development road of hyperautomation [3].

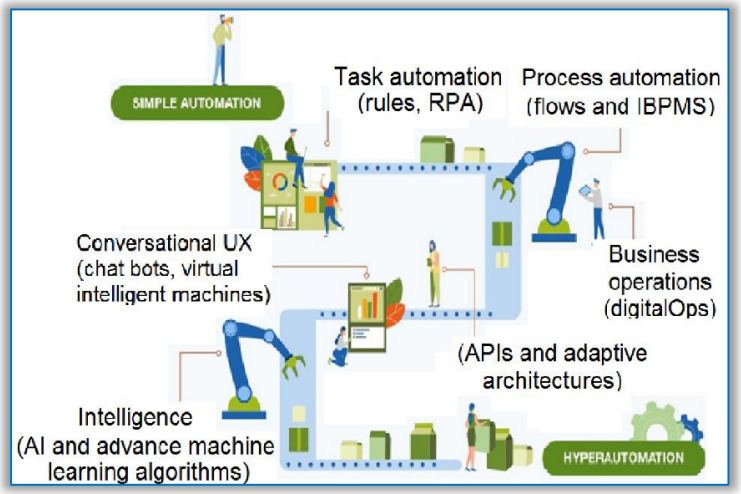

Figure 1. The road to hyperautomation (source Gartner)

Technologies for optical recognition and reading of characters are also applied. In practice, they perform electronic translation of handwritten or typed documents into machine coded text. The source of information is usually a scanned document or a digital photograph of it. IDP technology is the base in the digitization process, as the first and most important stage in it, which automates the intensive conversion of data from physical (paper) media into electronic form. Hyperautomation has the flexibility to provide customizable solutions that meet the needs of a particular enterprise or industry, driving their digital transformation. The result is a holistic process of human–machine interaction to achieve maximum autonomy.

The main difference between automation and hyperautomation is that the former seeks to improve the execution of individual tasks, e.g. by implementing a collaborative robot instead of a human at the workstation, while the other seeks to optimize the production process through a holistic approach. This is where the logical end goal of industrial automation is reached, i.e. fully autonomous production or production "with the lights off" – without the need for any operator intervention. It is convenient appropriate to make a semantic diference with the terms "automatic", "automated" and "autonomous". While the first two assume static, pre–programmed, strictly limited and one–dimensional human–driven activities, the third excludes the need for human participation in them. Technologies such as IIoT, AI, ML and data analytics tools provide increasing added value in modern industry by independently adjusting and optimizing technological processes "on the fly" – in real time. With the help of peripheral platforms, the computing capacity needed for this purpose "leaves" the data centers and is located on the periphery of industrial networks (edge computing), close to real machines and equipment. In just one decade, the concept of production "in the dark" or "with the lights off" due to the eliminated need for human presence has turned from a futuristic idea into a real operational strategy, and the first truly fully autonomous factories are already a reality in the world.

2. THE BENEFITS AND CHALLENGES OF HYPERAUTOMATION

Hyperautomation is transforming businesses by simplifying business processes, repetitive tasks and automating manual tasks. This has a number of key advantages. It enables organizations to complete tasks consistently, accurately and quickly. In turn, costs are reduced and the overall user experience is improved. Any new approach to business processes or infrastructure will present challenges, and hyperautomation is no exception. Many companies hesitate to tackle automation because of problems in acquisition and processing relevant data or due to a lack of resources with the technical skills to solve the problem. Retraining programs are available that can help organizations respond to these needs and develop an approach that is suitable for achieving their goals. Other challenges include choosing from an ever–evolving and growing product market. Intelligent automation uses techniques such as optical character recognition (OCR), AI and ML algorithms to mimic human actions and intelligence. A key component of hyperautomation, as mentioned, is RPA. It is a specialized software technology for automating repetitive tasks in business processes. It is applicable in various practical scenarios such as procurement, pricing, invoicing, bidding, data entry and troubleshooting in business systems. For this purpose, RPA bots are used that interact with the system or application in the same way as humans would, but much faster, more organized, more accurate and more reliable. The significant benefits that companies get by applying hyperautomation are shown in Figure 2.

ISSN 1584 – 2665 (printed version); ISSN 2601 – 2332 (online); ISSN-L 1584 – 2665

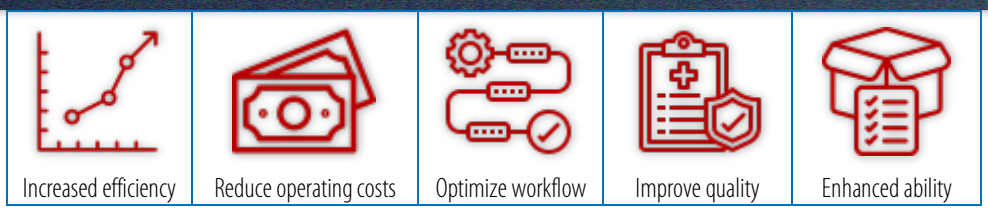

Figure 2. Advantages of hyperautomation

When describing modern production processes in the context of digitization and the fourth industrial revolution, market analysts use a specific rhetoric of prefix characteristic of the transfer of large digital data. In their reports, traders constantly talk about megatrends, gigafactories, ultra–high data transfer speeds, hyperefficiency – terms that have gained wide popularity precisely because of these prefixes used in digital technology and information exchange. Along with the development of technology and equipment in production and storage, the working environment itself also developed. The concept of smart workspaces is emerging – physical places equipped with connected sensors that provide additional functionality and continuous data flow for the operation of various automated systems integrated into buildings. Smart workstations enable remote monitoring and management of various tasks, predictive maintenance and autonomous execution of tasks even in the physical absence of the operator.

3. THE ROBOTIC PROCESS AUTOMATION AND ARTIFICAL INTELLIGENCE

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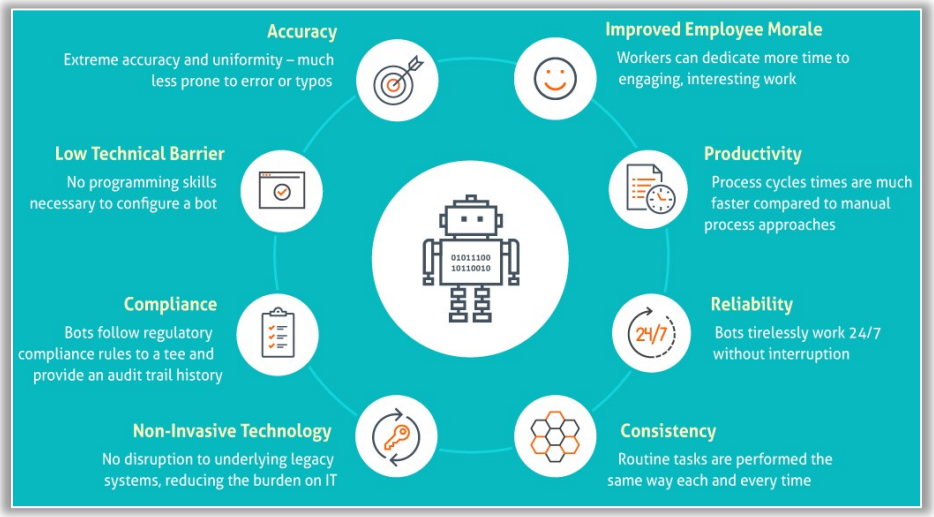

Figure 3. Robotic Process Automation in Hyperautomation function

RPA is a train that moves at breakneck speed. According to [4], the technology will reach near–universal adoption by 2025. However, just because RPA dominates the business world doesn't mean it will stop

ISSN 1584 – 2665 (printed version); ISSN 2601 – 2332 (online); ISSN-L 1584 – 2665

evolving. The world is in an exciting technological moment. The progress in the field of artificial intelligence in recent years is astounding. ChatGPT (an AI–powered language model developed by OpenAI, capable of generating text in a human–like manner based on context and past conversations). Other forms of generative artificial intelligence have captured the public consciousness. However, this technology is only one manifestation of the potential of AI. RPA is a simple but effective tool. However, the convergence of RPA and AI provides endless opportunities for innovation. Customer service using conversational artificial intelligence, analytics–driven decision making, and automated knowledge work are just a few examples of AI in RPA. As technology advances, cognitive robotic process automation will change the nature of work in ways we can hardly imagine. AI with RPA has already pushed the boundaries of automation before its future impact can be seen. Artificial intelligence seems to be advancing by leaps and experts are outdoing themselves year after year. Of course, progress has created a number of potential challenges for organizations seeking to implement new technologies. Some of the main problems related to artificial intelligence include issues of privacy and inherent biases in the systems. Since most companies do not develop their own AI technologies, they rely on experienced development teams. These teams need real–world data to build and test programs, which means there is a risk of leaking personal data or inaccurate training systems. Also, all AI systems have some ingrained biases in their algorithms. These incorrect or irregular assumptions can affect the entire system and delay or prevent the achievement of optimal efficiency. RPA is intended as a simple and uncomplicated tool, at least at the user level. It is designed to be accessible to non–technical teams. In this capacity, he executes the instructions given to him in a controlled manner. Humans need to identify these processes and direct RPA to execute commands. Of course, detailed step–by–step instructions can become insufficient due to the complexity of the system – that's why combining RPA and artificial intelligence is the future of automation. The widespread use of RPA is a testament to its usefulness. Technology has helped many businesses achieve new levels of production, efficiency and accuracy by automating once manual tasks. However, like any technology, it also has an upper limit.

4. THE ROLE OF COMMUNICATION NETWORKS

In the transition to fully autonomous factories and warehouses, the latest generations of communication networks (5G) play an essential role. They contribute to increasingly reliable mobility and connectivity of equipment. Also crucial is the importance of IoT technologies, which connect the entire range of devices – sensors, portable electronics, intelligent machines and systems into one platform in order to increase the efficiency, accuracy, productivity and profitability of business. The Internet of Things provides improved transparency of operations in smart factories, warehouses and logistics centers through centralized management and monitoring, asset tracking through the vast amount of data sent by end devices. Autonomous robots are becoming a key component of supply chains in the future and contribute to significant reductions in long–term costs, optimal utilization of workforce potential, increased productivity, improved safety, and faster order fulfillment and deliveries. as well as the automation of trivial tasks such as locating, sorting, distributing and transporting products in the warehouse. Along with autonomous robots, self–guided vehicles using radio frequencies, Light Detection and Ranging (LiDAR), scanners, bluetooth trackers, 3D machine vision cameras and smart navigation sensors are increasingly popular in digital factories and warehouses as well as portable electronic devices. (including those with augmented and virtual reality) – smart glasses, bracelets, etc. From the perspective of hyperautomation and autonomy, it is also interesting to look at the trends in industrial communication technologies that mediate this holistic approach to optimization. In order to enable the realization of truly convergent and operationally compatible networks that can simultaneously process critical and non–critical data in applications from an industrial environment, a specialized working group in the field of so–called time–sensitive networking (TSN), part of the IEEE 802.1 standardization committee, define a set of specifications for deterministic data transfer over conventional Ethernet networks. As a set of standards, the time–sensitive network concept functions more as a "toolbox" than an all–in–one solution. Users choose and combine different functions depending on the specific needs and goals of the end application. In the context of TSN technologies, it is also appropriate to mention OPC Unified Architecture (OPC UA) – an open–source IEC62541 cross–

ISSN 1584 – 2665 (printed version); ISSN 2601 – 2332 (online); ISSN-L 1584 – 2665

platform standard for exchanging data from sensors to cloud applications. Together, these two concepts promise to generally facilitate automation and hyper–automation processes through Industry 4.0 and IIoT solutions, making them more transparent and with greater added value than ever before.

5. ARTIFICIAL INTELLIGENCE, MACHINE LEARNING AND CYBER SECURITY

Artificial intelligence and machine learning, which underpin hyperautomation, are rapidly changing the face of cyber security. Cyber security threats have evolved over the years, and traditional security tools are no longer sufficient to keep up with the ever–changing threat landscape. AI and ML are now being used to analyze and identify threats in real time, helping to prevent cyber–attacks. One of the main advantages of AI and ML in cyber security is the ability to quickly discover and analyze large amounts of data. With the ever–increasing amount of data generated by end devices and networks, it is nearly impossible for security analysts to manually review and analyze all of this information [5]. This is where AI and ML come in, providing a more efficient way to analyze data and identify potential threats. They also help detect unknown and new types of attacks. Traditional security tools rely on predefined patterns to detect and prevent attacks. However, with the increasing number of new and sophisticated attacks, these traditional tools are no longer effective. AI and ML can learn to recognize new and emerging patterns, even those previously unknown, and help prevent cyber–attacks before they can cause significant damage. AI and ML can also be used to improve incident response. With the help of AI and ML, it is possible to create automated responses to incidents, reducing response time and minimizing the damage caused by an attack. In addition, AI and ML can be used to develop predictive analytics that help identify potential vulnerabilities and mitigate them before they are exploited. Despite the many benefits of AI and ML in cyber security, there are also some challenges. One of the main challenges is the lack of trained professionals who can develop and manage security systems based on AI and ML. Another challenge is the potential for AI and ML to be used for malicious purposes. As they continue to evolve, it is important to ensure that these technologies are used for good purposes and not create the conditions for cybercrime. In conclusion, the impact of AI and ML on cyber security is significant, and these technologies are playing an increasingly important role in protecting against cyber threats. With their ability to quickly discover and analyze large amounts of data, identify new types of attacks and improve incident response, AI and ML are helping to make the digital world safer [6]. However, as with any technology, there are challenges to overcome and it is important to ensure that these technologies are used ethically and for the greater good.

6. CONCLUSION

Hyperautomation is more than automating processes. It is a revolutionary way of economic development by using multiple technologies to simplify work operations and processes while achieving maximum efficiency. Hyperautomation is the present and future of technology in the business world. It represents technology as a set of products and platforms working in sync to achieve a common goal. Every technology system has its drawbacks, including hyperautomation, which means businesses must be prepared to meet the challenges. The implementation of many automation programs is at the core of hyperautomation, which means that by definition it is a complex system. Although the technologies complement each other to make everything work, it takes time and know–how, which is not easy for several reasons. First, the organization must have a comprehensive list of all business processes, which is not always available. Building a database takes time, and then additional steps are needed to determine which processes should be considered first. If there is a misunderstanding between the teams about the process or where to start, it can delay the start of implementation. Hyperautomation uses multiple products, platforms, and tools to create a balanced and efficient system for automating all possible tasks. It focuses on the process and creating a single system that works to sustain the business, which means a multi–stage implementation. A digital twin approach was developed to help companies define hyperautomation parameters. In principle, the company creates a virtual model of existing organizational processes and the way they currently function. Using information and task retrieval tools, it is possible to manipulate the virtual construction for identification purposes and experiment with different applications to see how the automation will perform in real–world conditions. The business can also identify potential problems or opportunities for further automation at each stage.

ISSN 1584 – 2665 (printed version); ISSN 2601 – 2332 (online); ISSN-L 1584 – 2665

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Note: This paper was presented at IIZS 2023 – The XIII International Conference on Industrial Engineering and Environmental Protection, organized by Department of Mechanical Engineering and Department of Environmental Protection of the Technical Faculty "Mihajlo Pupin" Zrenjanin, from the University of Novi Sad, in cooperation with partners – University Politehnica Timisoara, Faculty of Engineering, Hunedoara (ROMANIA), University "St. Kliment Ohridski", Technical Faculty, Bitola (MACEDONIA), "Aurel Vlaicu" University of Arad, Faculty Of Engineering, Arad (ROMANIA), University of East Sarajevo, Faculty of Mechanical Engineering East Sarajevo, Sarajevo (BOSNIA & HERZEGOVINA) and University of Giresun, Faculty of Engineering, Giresun (TURKEY) – in Zrenjanin, SERBIA, in 05–06 October, 2023.

ISSN 1584 – 2665 (printed version); ISSN 2601 – 2332 (online); ISSN-L 1584 – 2665
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