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IoT as a Central Disruptive Technology in the Development of Hyperconnected Business and Social Models

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Economic and social activities depend to a large extent on the technological opportunities available to the most involved users and in general to all citizens. Trends in hyperconnectivity, virtualization of computing resources, mobile communications networks, digitization and the Internet of Things (IoT) are already revolutionizing access to data, the nature of work, production methods. Health, travel, energy and food production, the environment, practically our whole life undergoes accelerated changes. This constant process is known as the digital transformation of our society, to which IoT is consistently contributing. Organizations have already begun exploring more options to take advantage of IoT's potential, accessing untapped data and using analytics that can help make decisions. With this increased efficiency, opportunities are created to reduce operational costs in many sectors. This paper examines IoT technology for a better understanding of consumer needs from the perspective of historical purchasing and decision-making models, to provide personalized services to increase revenue growth potential. With the help of IoT, organizations and even their own households can realize their efforts to focus on ensuring a safe work environment and individual and group well-being. Data processing at each stage, by segmenting networks, helps organizations control the quality of processes and activities and allows operators to take corrective action in real time. IoT can be seen as a central disruptive technology, along with Artificial Intelligence (AI) and 5G.

Keywords: Hyperconnectivity, New business models, IoT as a central disruptive technology, AI, 5G

1. Introduction

Disruptive technologies have the potential to completely change the way products are manufactured, distributed and tracked. IoT as a disruptive technology will fundamentally change supply chains and social life. But these changes will be for the better. IoT will require fewer hours of work to keep track of inventory, improving warehouse efficiency. Inventory would be expected faster, allowing companies to move more products and earn more revenue. Drones are similar in efficiency to delivery methods. 3D printing can reduce product lead times. Common trends are efficiency, lower labor costs, reduced production times and faster delivery. These key, improved performance indicators are what the supply chain industry is looking forward to.

The term IoT is used to describe the connectivity of things and is defined as a system of uniquely identifiable and connected elements (called Internet-connected elements) capable of virtual representation and virtual accessibility that leads to an Internet-like structure for remote location, detection or operation. constituent elements with real-time data. The explosion of connectivity is subtle and often not visible to many people and the business environment in which they work [10]. IoT is a system of interconnected computing devices, mechanical and digital machines, objects or people that have unique identifiers (UIDs) and the ability to transfer data over a network without the need for human-to-human or human-to-human interactions. -computer [2]. An IoT thing can be a person with a heart rate monitor implant, a machine that has built-in sensors to alert the driver when tire pressure is low, or any other natural or artificial entity that can be assigned an Internet Protocol (IP) address. and is able to transfer data over a network [27]. Increasingly, organizations in a variety of industries are using IoT to operate more efficiently, to better understand customers, to provide improved customer service, to improve decision-making, and to increase business value. IoT helps people live and work smarter, as well as gain complete control over their lives [13]. In addition to providing smart home automation devices, IoT is essential for business. IoT provides companies with a real-time analysis of how their systems work, providing information on everything from machine performance to supply chain and logistics operations. IoT enables companies to automate processes and reduce labor costs. It also reduces waste consumption and improves service delivery, making the manufacture and delivery of goods less expensive, providing transparency in customer transactions. As such, IoT is one of the most important technologies in everyday life and will continue to grow as more companies realize the potential of hyper-connected devices to stay competitive. The already huge and growing number of IoT sensors and devices poses a specific security risk for corporations and governments. IoT devices are technically unsafe. They are connected, but often do not have the processing power for basic protections, such as encryption. Some devices cause delays in providing adequate security protections. Due to the low security perception in IoT devices, IT managers often refuse to authorize their use. In many cases, the company does not own IoT devices, but they are part of machines, other devices or services. At the same time, companies rely heavily on the accuracy of IoT sensors to collect any type of data, to control vital processes and facilities, authenticating device identities, combining effective security measures in low latency IoT networks, providing resistance to various types of attacks. cyber, enabling automatic security updates, ensuring resilience and protecting data privacy. The maturation of IoT technology has the potential to change the world as we know it and will fundamentally change the business models of many companies, as well as the way consumers interact with companies. In recent years, common objects in people's lives have evolved by incorporating new data acquisition capabilities, often using sensors and control systems. The paper is structured as follows: the Introduction discusses the basic objectives of IoT as a future disruptive technology, in accordance with the new social and economic demands, and section 2 presents a series of aspects on some points of view related to the topic presented as shown in selected bibliography in relation to the existing literature. Section 3 outlines some technical features of an open IoT architecture. Section 4 discusses the impact of IoT on business and everyday life. In close connection with other technologies with which IoT can coexist functionally, in order to respond as accurately as possible to current and future economic / social demands, section 5 presents some of the possible developments of IoT.

2. Literature review

IoT presents new challenges and opportunities for companies that build business models around technology. The theories of business models developed in the first wave of innovation on the Internet are not enough to help us understand the new wave of technologies that underlie IoT [4,10]. They are based on improved processing power, hardware miniaturization and ubiquitous connectivity. Their work is valuable for new entrants to this sector, who are looking for ways to build sustainable businesses, but also for owners who need to understand how value migrates to new business models. The importance of data for IoT business models is often underestimated, with a focus on the technologies used to collect and process data [15,17]. Cloud-based business models tend to provide remote, internet-accessible platforms for customers who want to develop IoT services. Service-oriented business models are generally based on data provision and analysis, while process-oriented business models are usually addressed to industrial customers to help them optimize business processes. IoT innovations require a wide range of players and stakeholders to get involved in the various technologies that IoT encompasses [5,11]. A key issue for the development of business models resulting from their case study is the tensions that arise between these players due to different priorities and the company's business models. Their conclusion is particularly relevant for any company that builds IoT products and services in which several actors are involved, probably in most cases of IoT development. A pertinent warning for practitioners and fertile ground for researchers is that the reliance of actors from different sectors on building new platforms for IoT innovation leads to complex and often conflicting relationships [12,20]. Not only those interested in IoT projects can generate conflicts, but also the technologies themselves. New business models need to be supported for IoT products and services to reach their full potential [25].

Hyperconnectivity is expanding rapidly. Virtualization of computing resources allows traditional applications to move from the user's limited desktops to the unlimited potential cloud. The benefits of high performance computing have been brought to everyone, directly from their connected devices. Virtualization plays an important role in improving resource efficiency and increasing the reliability and security of services. IoT is considered one of the factors that facilitate a hyperconnected society. IoT is an infrastructure that connects the physical and digital worlds. In a first step, the data is collected and converted into useful data. In the second stage, the data is converted from analog to digital format. In the third stage, the IoT Edge system analyzes the data more. Data that requires more processing and does not require immediate processing will be transmitted to the data center or cloud-based systems. If technology professionals expect their investments in IoT or Artificial Intelligence (AI) to continue to provide value for many years to come, they need to know how they are inextricably linked. IoT is the detection part of transformation technology, and AI is the thinking part [29]. In the broad field of AI, machine learning is poised to have the greatest impact. It has the potential to enable rapid and intelligent decision-making either in support of or in place of human intelligence. The potential for AI for IoT is still developing. As more data accumulates on connected devices and enters AI algorithms, the effects of AI and IoT on people's lives and jobs will increase. The combination of AI and IoT will lead to a highly automated future in which a network of IoT technology and intelligent software entities work together to stimulate progress and better support decisions. IoT accumulates large amounts of data through the connectivity of the device through the Internet and AI, especially through its powerful mechanism, Machine Learning helps to assimilate and evaluate this data. Machine learning in IoT devices helps to identify patterns and detect any defects in data collection through highly advanced sensors. Unlike traditional technology, IoT and machine learning make operational forecasts tens of times faster, with increased accuracy. This is why companies that use AI technology see an increase in revenue. Hyperconnectivity, as a multitude of means of communication and interaction always active, easily accessible, with interactive information, allows connections of the most diverse, resulting in the expansion of the concept of IoT to IoE [9]. The Internet of Everything extends the concept of IoT by adding links to the most complex data, people, business processes and activities in our lives. Therefore, it encompasses other connection-based paradigms, such as IoT, Internet of People (IoP), and Industrial Internet (II). In this context, we understand IoE as a network of connections between intelligent things, people, processes and data with real-time data / information flows. Despite the huge interest in these new concepts that have the potential to radically change where we live, how we work and how we interact with each other and organizations, there is a lack of understanding of how the emergence of IoE will impact on business. Companies that manage to adapt their existing business models to new technological possibilities have considerable opportunities for innovation, being potentially highly competitive. However, IoT poses significant challenges for companies, including the development of interoperability between systems, to meet industry partners [3].

3. Features of an open IoT architecture

There are many real-world applications of the Internet of Things, ranging from consumer IoT and enterprise IoT to industrial IoT (IIoT). IoT applications span many verticals, including automobiles, telecommunications and energy [30]. In the consumer segment, for example, smart homes that are equipped with smart thermostats, smart appliances and heating, lighting and connected electronic devices can be controlled remotely via computers and smartphones. Portable devices with sensors and software can collect and analyze user data, sending messages to other technologies about users in order to make users' lives easier and more comfortable. Portable devices are used for public safety - for example, improving the response times of first responders in an emergency by providing optimized routes to a location or by tracking vital signs of construction workers or firefighters in life-threatening places. In a smart city, IoT sensors and deployments, such as smart headlights and smart meters, can help mitigate traffic, conserve energy, monitor and solve environmental problems, and improve sewerage. [30] IoT suffers from a lack of interoperability between platforms. As a result, developers are facing data silos, high costs and limited market potential. This can be likened to the pre-internet situation when competing non-interoperable network technologies existed. WoT aims to eliminate fragmentation by forming a web-based abstraction layer capable of interconnecting IoT platforms, devices, cloud services and communications standards and analysis. WoT is closely linked to the W3C's work for the Web of Data [37,38].

IoT is a general term that includes several different categories: Wireless sensor / actuator networks, Portable items connected to the Internet, Built-in low power systems, Automatic identification and data capture (AIDC), Use of mobile phones to interact with the world real (detection), Devices that connect to the Internet via Bluetooth-enabled mobile phones, Smart Homes, Connected Cars. RFID belongs to the group of technologies called Automatic Identification and Data Capture (AIDC). AIDC methods automatically identify objects, collect data about them, and enter that data directly into low-intervention computer systems. No single architecture will suit all of these areas and the requirements that each area brings. However, a modular scalable architecture that supports adding or subtracting capabilities, as well as supporting many requirements in a wide variety of use cases is inherently useful and valuable. It provides a starting point for architects who want to create IoT solutions, as well as a solid foundation for further development. A reference open architecture must cover several aspects: i) the cloud or server architecture, which allows us to monitor, manage, interact and process data on IoT devices; ii) the network model to communicate with the devices, agencies and the code on the devices themselves; iii) the requirements regarding the type of device that can support this architecture. Such an architecture is vendor-neutral and not specific to a set of technologies, although it is strongly influenced by the best open source projects and technologies. The data storage component purchased from IoT devices is very important primarily in terms of the traceability of certain devices. The stored values can be used in defining components for viewing histories, but also for different analysis and prediction algorithms. In the context of diversifying storage media (file system storage, database server solutions or cloud storage), but also the format of stored data (media content, text recordings or data from sensors) requires an analysis the evolution of platforms as well as the main types of SQL or NoSQL database servers. The development of IoT systems also requires the development of efficient communication protocols, at M2M communication level. The development of standardized protocols also involves plug-and-play options for IoT devices, which must be able to interrogate each other, understand the content of the transmitted data, be able to interpret this data in the same way. time to provide maximum resource efficiency (processing power, busy memory, low power consumption). IoT devices must also be able to operate within existing networks and allow the development of modern sensor and device networks, using the latest technological achievements capable of processing big data [1,7,29].

The bottom layer of an IoT architecture is the device layer. Devices can be of different types, but in order to be considered IoT devices, they must have some communications that attach indirectly or directly to the Internet. The communication layer supports device connectivity. There are several potential protocols for communication between devices and the cloud. The three best known potential protocols are HTTP / HTTPS, MQTT 3.1 / 3.1.1, Restricted Application Protocol. If the main communication is based on HTTP, the traditional approach for sending data to the device would be to use HTTP Polling. This is very inefficient and expensive, both in terms of network traffic and energy requirements. The modern replacement for this is the WebSocket protocol, which allows an HTTP connection to be upgraded to a full two-way connection. It then acts as a socket channel (similar to a pure TCP channel) between the server and the client. An important layer of architecture is the layer that aggregates and brokeres communications. This is an important layer for three reasons: 1) The ability to support an HTTP server and / or an MQTT broker to talk to devices; 2) Ability to aggregate and combine communications from different devices and direct communications to a specific device (possibly through a gateway); 3) The ability to link and transform data packets between different protocols, e.g. to provide HTTP-based APIs that are mediated in an MQTT message to the device. An ability is needed to create web front-ends and portals that interact with devices and the event processing layer and to create dashboards that provide views for event analysis and processing. We need to be able to interact with systems outside this network using machine-to-machine communications (APIs). These APIs need to be managed and controlled and this happens in an API management system. To build the web front-end, it is recommended to use a modular front-end architecture, such as a portal, which allows the simple and fast composition of useful UI interfaces. Of course, the open architecture also supports existing Web server technology, such as Java Servlets, PHP, Python [38]. The dashboard is a reusable system focused on creating graphs and other visualizations of data from devices and the event processing layer. Device management (DM) is provided by two components. A server-side system (device manager) communicates with the devices through various protocols and provides individual and bulk control of the devices. It also remotely manages the software and applications deployed on the device. May lock and / or wipe the device if necessary. Device Manager works with device management agents. There are many different agents for different platforms and types of devices. The final layer is the identity and access management layer.

IoT entities have a unique mechanism for tracking, recording, and observing a user's patterns and interaction with the device. Businesses use the data obtained to develop better means and to improve consumer experiences. An IoT ecosystem consists of web-enabled smart devices that use embedded systems, such as processors, sensors, and communications hardware, to collect, send, and act on the data they acquire from their environments [7]. IoT devices share the data from the sensors they collect by connecting to an IoT gateway or other edge device where the data is either sent to the cloud for analysis or analyzed locally. Sometimes these devices communicate with other related devices and act on the information they receive from each other. Devices do most of the work without human intervention, although people can interact with the devices to configure them, give them instructions, or access data. The connectivity, networks and communication protocols used with these web-based devices depend to a large extent on the IoT applications thus deployed. IoT can also use AI and machine learning to facilitate and streamline data collection processes. The Internet of Things offers many benefits to organizations. Some benefits are industry specific and others are applicable in several industries [17]. Some of the common benefits of IoT are: 1) monitoring general business processes; improving the customer experience (CX); 2) saving time and money; 3) increase employee productivity; 4) making better business decisions; 5) generating more income. IoT encourages companies to rethink the way they approach their business and provides them with the tools to improve their business strategies [14]. Sensors, for example, could be used to monitor events or changes in structural buildings, bridges and other infrastructure. This brings benefits such as cost reduction, time savings, quality of life changes and clean digital flows. Data collection is vital for the growth and development of a company. A business with an IoT strategy can use data analysis to provide a greater understanding of consumer information [26]. AI facilitates the management based on a certain type of rationality of this information.

4. IoT and new digital business models

The digital transformation is forcing companies to change their business models and adapt to the new market reality [16]. Interestingly, it is not the companies that have generated this change, but the customer. Today, customers expect relevant content about what they do anytime, anywhere, in the format and device they choose. That's why companies that understand the benefits of digitalization will not only have a real advantage over the competition, but will increase productivity and revenue, having the opportunity to turn customers into brand ambassadors by improving their experience with that business. In the current context where our interaction is limited by the pandemic, the economic consequences are expected to be very serious for many companies in different fields of activity, especially in the SME area. All this is due to the limitation of the possibilities of interaction between people. There is a period in which people will have to limit their travel to the maximum and try as much as possible to solve everything from a distance. It is clear that we are witnessing the massive digitalization of human relations with the health crisis, which will have an inevitable impact on current business models. The future will be much more digital than the past and will give a huge boost to information technology and the development of many activities in the virtual space. In this context, the way of organizing from a digital point of view becomes extremely important, as well as the digital skills of employees. It is time for managers to fully exploit the possibilities of interaction in the digital environment and, in addition, to identify new ways of action that will lead to the achievement of organizational objectives. Digital transformation is a broad term and includes the transformation of the business process, skills, activities and models. Digitization also changes the general conditions for companies, competitors make existing products and services more attractive to customers by using digital solutions. The potential for process digitization arises, for example, if existing processes can be improved or automated by adding value to employees for innovation, the use of new support systems or digital interfaces. Accordingly, companies need to adapt by identifying and exploiting this digitization potential in their own company and market in order to remain competitive. Digital transformation reveals, through analysis, the weaknesses of the processes within the company, these points becoming potential for digitization. They allow process managers and analysts to discuss the characteristics of weaknesses and develop plans to streamline each process based on big data [22]. Whether it's cost efficiency, such as moving business to the Cloud and reducing CAPEX, improving operational processes and reducing OPEX, or streamlining processes by introducing their automation, digital transformation gives you the flexibility you need to develop.

Technologies such as AI, machine learning, RPA or blockchain must be taken into account for all projects related to process digitization [3,6,8]. Both the data and the reality in the field show us that there is a huge potential for business digitization. Many companies completely lack the most basic tools, such as an up-to-date site, a professional email address, or CRM, ERP, or collaborative platforms. Regardless of the field of activity, some of the processes can be digitized and automated. There are IT solutions for all departments of an organization: administrative, production, logistics, marketing, sales, etc. Digitizing important processes in an organization, if done correctly, reduces costs, shortens delivery times for products and services, and improves quality and customer experience. The first stage in the digital transformation process is the same, regardless of the company and is the cloud strategy. You can choose in the cloud, on premises or hybrid, depending on the budget that the company has available for investment in infrastructure and security. Other important benchmarks for choosing an optimal solution are [30]: mapping existing and functional processes in the organization, integration with other systems used (eg Microsoft or Oracle, widely used), meeting current cyber security needs, and protection of personal data, development of customization possibilities. Such an implementation must aim at real-time monitoring of digitized processes, which offers the possibility to make decisions based on data and not on the intuition of managers. Another aspect to consider is the psychological nature. Many of the digitization projects have failed due to the resistance to change of employees. This is because they are seen as monitoring and coercion tools, but also because human nature in general has the characteristic of protecting itself from possible dangers. The shock caused by the crisis can be a factor that favors the adoption of these technologies and considerably increases the chances of success for the digital transformation of the organization.

The essence of a business model is to define how the company provides value to customers, attracts customers to pay for value and turns these payments into profit [18,19]. Thus, the model reflects the management's hypothesis about what their customers want, how the company can be organized to best meet those needs, to be paid for it and to make a profit. From a business model perspective, one of the important impacts for many companies is the shift from business models focused on the production and sale of physical products to business models in which the service element of their offerings becomes more significant. It opens up new potential revenue streams for producers, as well as the possibility of recurring subscription services and closer customer relationships. Therefore, IoT is a fertile ground for researching business models as researchers and practitioners try to develop frameworks and approaches that new and established companies can exploit. An important element of digital transformation is the digitization and automation of processes within the company. A major challenge is the systematic identification of the potential for digitization in business processes, depending on the company's development plans, automation needs, cost efficiency and planning of the company's resources needed to support development [21]. Any growing company must include in the business plan the use of software systems for monitoring and streamlining the business. Whether we are talking about using the company's resource planning systems - ERP, logistics management - WMS or customer relationship management, sales and service - CRM, the implementation and use of these systems will lead to considerable business improvements, staff development and efficiency, meeting needs personnel and control over the company's operating costs. For many years, these systems have been adopted by companies around the world, bringing them process improvements, low operating costs, developing innovation and gaining a competitive advantage. These transformations are achieved by combining numerous physical and digital technologies, such as AI, cloud computing, adaptive robotics, augmented reality and IoT [23,24]. Regardless of the technologies used, the main goal of digital transformation is to increase resource efficiency and productivity to increase the competitive power of companies. The era of transformation in which we live now differs from the others in that it not only offers change in the main business processes, but also reveals the concepts of smart and connected products by presenting service-based business models.

For a successful adaptation of the digital transformation process, three characteristics must be taken into account: 1) horizontal integration through value chains; 2) vertical integration and network of production systems or services; 3) end-to-end process on the entire value chain of the company. Vertical integration requires intelligent networking and digitization of business units at different hierarchical levels within the organization. Therefore, vertical integration allows, preferably, the transformation into a smart company, in an extremely flexible way and provides more personalized products and services with high levels of profitability. For example, intelligent machines create an automated ecosystem that can be dynamically subordinated to affect the production of different types of products; and a huge amount of data is processed to easily operate the manufacturing processes. On the other hand, horizontal integration achieves the creation of full value between companies to enrich the life cycle of the product or service using information systems, efficient financial management and material flow. Horizontal and vertical integration allows real-time data exchange, resource allocation productivity, coherent business units and precise planning. Finally, end-to-end technology helps product development processes by digitally integrating support technologies, taking into account customer requirements, product design, maintenance and recycling. Emerging technologies such as Big Data analysis, autonomous and adaptive robots, horizontal and vertical integration, blockchain, cloud systems and augmented reality are needed for successful adaptation [28]. The most important point is the widespread use of the Internet and alternative connections that ensure the creation of networks of dispersed devices, which help to monitor and control business remotely. As a result of industry developments, competitiveness, distributed systems such as wireless sensor networks, cloud systems, embedded systems and autonomous robots have been connected to each other through various management software solutions. Above all, the whole system must involve data analysis and various coordination tools to lead a real-time decision and autonomy for manufacturing processes and services. While building the framework, the sensor network, real-time processing tools, role-based and autonomous devices are intertwined with each other for real-time data collection on the manufacturing system and services. Edge and IoT computing fit together perfectly for several reasons. Not surprisingly, today margin calculation appears in virtually all IoT trend reports. The term edge calculation has often been used interchangeably with fog calculation. However, there are differences between fog computing and margin computing and between the exact (technological) ways in which they play a role in the IoT ecosystem, mainly in industrial IoT (IIoT). Both edge and fog computing are growing strongly for the same exact reasons: a large volume of IoT data, certainly in IIoT. This flood of IoT data occurs in the converging worlds of IT (again predominantly industrial IoT) and generally occurs as we add more IoT devices in the field of large-scale IoT projects in the industrial markets of the Industry. 4.0. Depending on the context and purpose of the project, you want the data you need quickly. Or better: you need aggregated and analyzed data, in the form of actionable intelligence, that allows you to make actions and decisions, quickly, whether or not these decisions are human. So you don't need all that data to store and analyze it in the cloud, you just want that piece of data that travels through your networks. You can imagine hundreds of scenarios where fast data is essential, from asset management , critical power issues, process optimization, predictive maintenance and predictive analytics to real-time supply chain management needs in a hyper-connected world. The speed of data and analysis is essential in many industrial IoT applications, but it is also a key element of industrial transformation and in all other areas where we are moving towards autonomous and semi-autonomous decisions made by different systems, actuators and controllers. This degree of autonomy is right at the heart of many desired results and objectives, for example, in Industry 4.0, as we move to the next stage of the third platform, which is all about autonomy. In addition to IIoT, IoT applications faced by consumers are also becoming more sophisticated and mission critical. In the first wave of IoT applications for consumers, industry and consumers are exploring interesting use cases. They are often less demanding (for example, changing the color of certain objects). However, as the IoT market matures, IoT will become the backbone of the infrastructure that supports important activities in people's daily lives. Reliability and real-time response will be essential. The Automatic Driving System (ADS) is one such example. ADS uses several advanced technologies, including multi-modal sensors, computer vision, AI and machine learning. The system performs data fusion, image analysis, mapping and predictions to determine the best action and controls for the running gear. All this must be done reliably in milliseconds without interruption.

Bandwidth and latency requirements require a powerful in-machine processing node with built-in redundancy. In addition to ADS, AI and computer vision applications will also lead to increased demand for fog computing. An intelligent IoT system does not only collect and analyze data for human consumption, it must respond to situations without human intervention. To do this, real-time AI inference is performed, using data from a large number of sensors, and then sends commands to actuators in machines, drones, or robots to perform actions. In an unsupervised environment, the AI engine also collects real-time results to evaluate the next actions to be taken. We need a hybrid fog / cloud model, in which edge processing nodes manage time-sensitive computer vision and AI interference tasks. In addition, cloud nodes manage real-time non-real-time or software functions, such as software updates, contextual information collection, and long-term big data analysis. For many embedded or mobile systems, typical Graphical Processing Units (GPUs) are far too expensive. In the last few years, companies such as Nvidia, Intel, ARM and Apple have been working hard to design integrated AI systems. Nvidia's powerful TUDRA processor with CUDA technology is currently the market leader. The Nvidia Jetson platform is widely used in smart drones and ADS vehicles. Intel is also actively investing in similar embedded AI technologies, such as the recent acquisition of Movidius with computer vision chips. Qualcomm, Mediatek, Huawei, AMD and some startups are also highlighting a fast growing market. These companies are developing neural network capabilities in their future System On Chip (SOC), which will enter the market in the next few years. Chip vendors also work closely with software developers to optimize deployments on their processors. Moreover, embedded software developers are also looking to optimize neural network architectures to ensure the right balance between complexity and accuracy requirements. The requirements are usually very different for different applications and use cases. An example is face recognition, in which accuracy and real-time requirements are very different for the access control system from photo marking applications. The difference results in differences in the order of magnitude in the processing requirements and, ultimately, the cost of the system. Individually IoT and AI are powerful technologies. Combining AI and IoT, we get AIoT - Artificial Intelligence of Things. It can think of IoT as the digital nervous system, while AI is the brain of a system.

Many non-essential outlets can be temporarily closed with minimal disruption to our lives - largely due to the emergence of online retail. However, shops that supply essential products, such as food and medicine, must remain open to meet the basic needs of local people. We can expect to see a new goal for innovative models, such as Amazon's fully automated supermarkets, which reduce the need for non-vital human interactions as we supply our homes with food and other essentials. Automation through IoT-compatible devices will continue to grow in massive fulfillment centers that send inventory to stores. Contactless payment methods will also become more widespread as we move further towards the cashless society that is expected to arrive soon, bringing with it its own challenges. Other developments in retail will include the use of RFID tags to track the movement of customers around stores. As before, they will be used to make decisions about stock placement and refueling, recording how and when customers interact with displays and products on the shelves. Retailers are already tracking products through development, warehousing and delivery to retail stores. Companies use advanced automation and robotics to pick and prepare products from warehouses, allowing for fast rolling and delivery. In the warehouses of the future, the corridors and shelves will self-organize endlessly to respond to changes in demand. Both employees and customers will be able to use data visualization to assess where custom orders are in the production and distribution process. Better route management will be achieved to accurately predict when goods will arrive, reduce time lost in transit and optimize energy consumption. IoT technology allows retailers to monitor items and equipment and ensure their stability. One of the biggest gains with IoT is the ability to forecast demand and correlate business analysis with decisions. Employees will use visual dashboards that integrate real-time historical values, predictive information and machine learning to more accurately forecast every aspect of supply chain management, from ordering raw materials to managing suppliers, inventory and pricing. Retailers will improve staff productivity, reduce price errors and synchronize prices between distribution channels. In addition, prices can be quickly updated to meet real-time demand.

Most customers are currently looking for companies that have reviewed their business practices and implemented easy-to-use interfaces, offering uninterrupted within 24 hours of the day availability and personalized services. Immediate satisfaction of needs and instant provision of solutions are the main criteria by which customers are guided when choosing one company over another. While more traditional companies cannot fully meet the demands of the modern customer, companies that take advantage of digitization have a real advantage, offering their customers exceptional digital services and experiences, in line with current times. Increasingly understanding its benefits, digitalization has become a topic that more and more companies are interested in, through services such as: 1) Implementation and configuration of CRM & HubSpot; 2) Task management services; 3) Website CRM integration services, site forms, site chatbot implementation, site integration and configuration; 4) Scheduling automation; 5) Website flow automation; 6) Online store, e-commerce store; 7) Business process automation; 8) Consultancy in business process automation, support, training and maintenance in the use of digitization tools and software [32,33,34,35,36].

From telemedicine to automated home care for the elderly and disabled, smart portable devices, sensors and connected devices will continue to change the way healthcare is provided [31]. This will include tools that use AI to detect falls or changes in regular daily routines that may alert relatives or healthcare providers that intervention may be needed. Adapting to the challenges of the Covid-19 crisis, the same technology can be used to determine whether there is a rapid deterioration in the health of people who can be protected or isolated at home. Working from home is the new normal for many of us in the information economy these days, due to security concerns around a large number of people gathering in offices and city centers. With AI-powered personal assistants, such as Alexa, now installed in many of our homes, we can expect more apps designed to help us manage our day while working remotely. This will mean smarter automated planning and scheduling tools, as well as better quality, more interactive video conferencing and virtual meeting technologies. The Microsoft Virtual Stage platform, for example, uses its Azure Kinect sensors to enable captivating, AI-based presentations that will keep us better engaged. Smart meters record the use of energy in homes and businesses so that supply can be balanced to meet peak requirements and avoid waste where it is not needed. In the coming year, we can expect an increase in resources for building digital capacity within municipal authorities to enable them to make better use of new technologies that are becoming available. This will be essential when it comes to addressing the challenges of a changing society, with security issues around public transport, downtown offices, and so on. Future platforms need to blur current interoperability differences between vertically oriented IoT platforms and mobilize third-party contributions by creating markets for IoT services and applications.

5. Conclusions

The benefits of IoT can be summed up in: the ability to access information from anywhere, at any time, on any device; improved communication between connected electronic devices; transferring data packets over a connected network saving time and money; task automation helping to improve the quality of a company's services and reducing the need for human intervention. There are also a number of disadvantages. As the number of connected devices increases and more information is shared between devices, so does the potential for confidential information to be stolen. Businesses may eventually have to deal with a massive number - perhaps even millions - of IoT devices, and collecting and managing data from all these devices will be a challenge. If there is a system error, each connected device may be affected. Because there is no international compatibility standard for IoT, it is difficult for devices from different manufacturers to communicate with each other. It is a challenge to prevent the obsolescence of technology in a hyper-connected society without interfering with the evolution of technology and business. A sustainable hyperconnected world cannot exist without addressing standardization and interoperability. The main value of a hyperconnected world is the integration of physical device data into the development of new services and data-based scenarios, such as transport, e-health, industry 4.0 or energy. By 2022, although consumers will continue to be the largest segment of the IoT (approximately 13 billion units), trans-industrial devices are expected to grow to 4.4 billion units and specific vertical devices to about 3.2 billion units. . Hyperconnectivity and IoT will increase considerably, driven by 5G, higher volume and lower cost communications infrastructure and devices. By 2025, there could be nearly 1.4 billion connections worldwide, up from about 200 million 5G connections in 2021. A hyper-connected society could raise cybersecurity challenges. New legislative instruments, such as the recent cyber security of 5G networks, are intended to regulate the development of such a trend. Quantum information science is the next frontier of the information age, to shape the long-term future of information processing. Autonomous robots, advanced 3D / 4D production and AI could lead to economic growth without current employment. A harmonized market for IoT interoperability standards and open APIs is an important condition for a free market that reduces dependencies and barriers for new businesses and SMEs. Security and privacy must be addressed as a matter of priority in the following IoT platforms. The information exchanged by IoT applications is managed by IoT platforms that will use cognitive systems with new components that address information systems, customer experience, analysis, intelligence and business systems to generate new and better services and use cases in the environment. digital business. IoT Edge integrates the functions of the smart digital network, related digital technology platforms and cloud-based application architectures, while increasing the demand for end-to-end security solutions. In addition to the use of established security technologies, it is essential to monitor the behavior of users and objects in different IoT scenarios. IoT Edge is the new frontier for security solutions that create new areas of vulnerability. New tools and remediation processes are needed to be incorporated into IoT platforms. The use of AI, collective intelligence and cognitive technologies, together with deep learning techniques to optimize IoT services in collaborative environments and spaces, create new solutions and bring huge challenges and opportunities. AI is an increasingly important factor in the development and use of IT technologies. It is important to develop IoT-based IoT applications and solutions, consumer empowerment, and take responsibility for implementing IT technologies and AI-based applications. It is already a certainty that the IoT will allow companies that choose to implement the system an unprecedented maximization of added value, given that sensors, software applications and other technologies installed in physical assets will allow their interconnection. and the rapid exchange of data with third-party devices and systems using the Internet. This reality will encourage innovation and generate an improvement in the overall efficiency of operations in many industries, starting with design and ending with so-called processing. In this context, operators who will opt for 5G technology and complete business connection in the IoT system will have the opportunity to dynamically adapt to environmental protection requirements, especially by accelerating the reduction of carbon dioxide emissions. Already the current applications are multiple and exceed the limits of imagination, if it were mentioned, plaid, only the interconnection of tennis rackets equipped with sensors, which provide the player with valuable information about the balance and the reasons why the ball is not placed on the field.

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