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FROM CONCEPT TO REALITY: UNDERSTANDING THE INTERNET OF THINGS

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Abstract: Despite numerous studies and examples, the phrase "IoT"-Internet of Things continues to be a source of confusion for individuals. The purpose of the research is to give a basic explanation of IoT. Despite the increasing usage of the term, there is currently no accepted definition or understanding of what the Internet of Things actually entails. IoT technology is increasingly expanding into practically all areas of everyday life. Today, more and more companies are starting to introduce a number of IoT-based products and services. We can say that IoT is the merging of the physical and digital worlds through the Internet. The Internet of Things will affect many different domains. Provisions for both the structure's security and users' privacy must be included in the regulatory framework. It will also be necessary to take into account any legal obstacles that might prevent the Internet of Things from being fully utilized.

Keywords: IoT, Internet of Things, mIoT.
Field: Social science, Educational technology.

1. INTRODUCTION

The term IoT (Internet of Things) first appears by Kevin Ashton in 1999. (Geng, 2017) International Telecommunication Union (ITU, 2012), now defines the Internet of Things as "a global infrastructure for the information society, enabling advanced services by connecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies" (ITU, 2012). "The origins of the term date back more than 15 years and have been attributed to the work of the Auto-ID Labs at the Massachusetts Institute of Technology (MIT) on networked radio-frequency identification (RFID) infrastructures" (Atzori et al. 2010); Mattern and Floerkemeier 2010). "RFID uses an electromagnetic field that automatically detects and wirelessly tracks an object. RFID is a vital component of the Internet of Things as it connects millions and billions of physical objects to the cyber world" (Mota, & Batista, 2013).

The Internet of Things is basically a vast network of connected objects that collect, analyze and perform tasks independently. These objects can include anything from everyday devices like smartphones, smartwatches, and home appliances to more specialized equipment used in industries, such as factory machinery and environmental monitoring systems. With the development of new technologies, primarily the development of the 5G network itself, the application of artificial intelligence and machine learning, IoT is present in everyday life, from simple smart watches to the very development of city infrastructure, so-called - smart cities. "In the near future, mostly businesses will operate on the Internet of Things. Civil society is only expected to use the Internet of Things. The IoT is envisioned as a network model to fill the gap between the cyber and the physical world" (Atzori, & Morabito, 2010).

Simply the Internet of Things (IoT) can be thought of as a superset of linking items that are uniquely recognizable by existing near field communication (NFC) protocols (ETSI 2013).

2. ADVANTAGE OF IOT

IoT (Internet of Things) offers numerous advantages that contribute to its widespread adoption and integration into various industries and everyday life. Some of the key advantages of IoT include:

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- Minimizing human effort - IoT devices communicate and interact with one another; they automate tasks, allowing us to improve the quality of corporate services while reducing the need for human interaction.
- Enhanced Efficiency – devices collect and exchange data, which enables companies to make valid decisions in a faster and simpler way.
- Improved Convenience – is reflected in the provision of numerous services from their smartphones (controlling the temperature at home, security system …).
- Data Insights and Analytics – based on the collected data, insights and patterns can be gained, which will make it easier for companies to understand customer behavior, optimize services and improve decision-making.
- Cost Savings – using IoT can reduce costs by optimizing the use of resources as well as reducing waste in industrial environments.
- Enhanced Safety and Security – by monitoring and controlling the infrastructure, the security itself can be improved against potential threats by using smart security systems for both homes and offices, as well as businesses themselves.
- Real-time Monitoring and Control – by using IoT, remote access, personal property, numerous work processes can be monitored in real time.

Sustainability and Environmental Benefits: IoT can contribute to sustainability efforts by optimizing resource consumption and promoting energy efficiency. Smart grids, for example, can help balance electricity demand and supply, reducing overall energy consumption and greenhouse gas emissions.

Personalization: IoT enables personalized experiences by tailoring services and content based on user preferences and behavior. This personalization enhances customer satisfaction and engagement.

Connectivity and Accessibility: The Internet of Things (IoT) creates a highly connected world in which people, systems, and gadgets can communicate easily with one another, making information and services more accessible.

Innovation and New Opportunities: IoT opens up new business models, services, and revenue streams. It fosters innovation and encourages entrepreneurs to develop novel solutions to address various challenges.

3. THE STATE OF IOT IN EUROPE AND THE WORLD

In 2021, the IoT market in Europe recorded a revenue of over €4.8 billion and was expected to grow to €7.8 billion by 2026. The number of IoT devices worldwide is predicted to be close to 30 billion in 2030. As a consequence/result of increased home automation with IoT, shipments of smart home devices are projected to reach 1.8 billion by 2025 (https://www.statista.com/topics/2637/internet-of-things/#topicHeader__wrapper).

„The Internet of Things (IoT) is an emerging Internet-based global information architecture that facilitates the exchange of goods and services" (Weber, 2013). The very concept of IoT is designed to connect objects around us through radio frequency identification (RFID), mobile devices, sensors, and all this through a wireless or wired network. According to (Ray, 2018) IoT represents „The integration of tiny devices known as smart objects (SO), usually battery-powered equipped with a microcontroller (MCU) and transceivers into the global Internet".

The goal of the Internet of Things is to provide an IT infrastructure that facilitates the exchange of "things" in a safe and reliable way, i.e. „its function is to overcome the gap between objects in the physical world and their representation in information systems" (Hawrylak Peter, Miskle and Cain, 2008). Any of the approximately 50,000 billion objects that exist on earth can be brought into IoT(Santucci Gerald, Paper for the International Conference on Future Trends of the Internet, From Internet of Data to Internet of Things).

The question is often asked why IoT was not developed much earlier. The answer lies in the fact that the Internet technology itself was not developed enough, and the wireless mode of operation was not widespread enough for devices to communicate more advanced. With the development of wireless networks came the rapid expansion of IoT. Globally, IoT is a very complex system for connecting things based on Internet technologies.

In the beginning, the IoT architecture was based on tools for data communication, primarily RFID - (Radio-Frequency Identification), which was used to identify, track and locate assets. RFID is a technology that uses wireless radio waves for automatic identification. RFID systems consist of a data carrier or transponder and a registration device that reads that data. The RFID tags themselves can be: active (with an integrated battery, which has an active transmitter and receiver), passive (does not have a battery) and

semi-passive (contains a battery but no transmitter)(Benghozi Pierre-Jean/Bureau and Sylvain/Massit-Follea Francoise, 2009; Hawrylak Peter, Miskle and Cain, 2008).

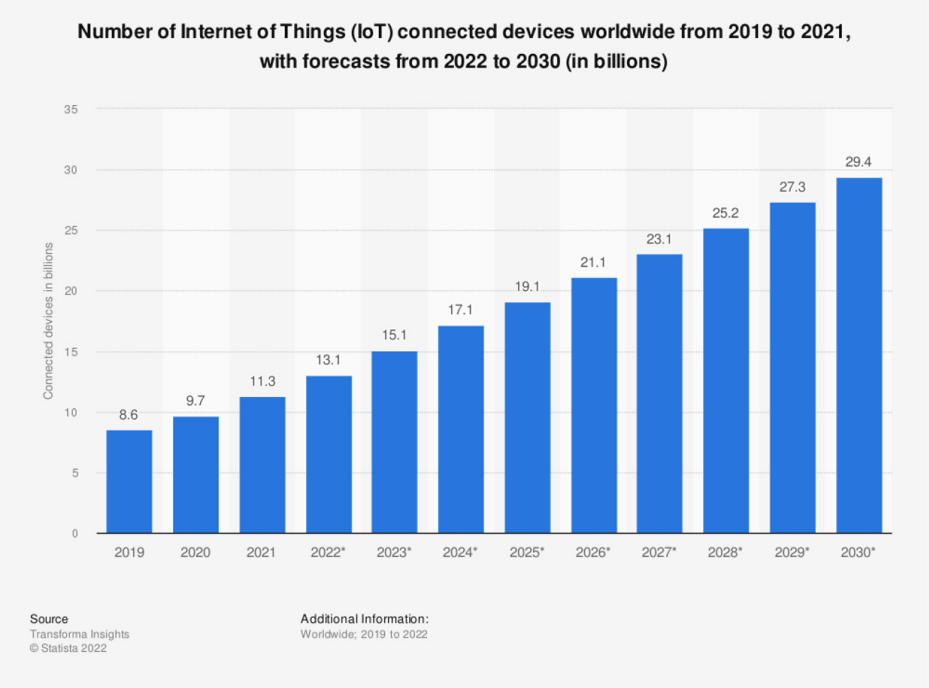

Figure 1. Number of Internet of Things (IoT) connected devices worldwide from 2019 to 2021, with forecasts from 2022 to 2030.
Source: Transforma Insights, Statista 2022.

4. DISCOVERING THE INTERNET OF THINGS (IOT) AND HOW IT AFFECTS EVERYDAY LIFE

Every day, electronics are incorporated into commonplace physical objects, creating smart devices that are now an unthinkable aspect of day-to-day life. The incorporation of electronics into physical objects has given rise to a new type of technology known as the "Internet of Things" (IoT). In general, the term refers to: (i) the global network that is created as a result of utilizing augmented Internet technologies to connect smart objects; (ii) the set of supporting technologies needed to make this vision a reality (such as RFIDs, sensors/actuators, communication machine-to-machine devices, etc.); and (iii) a collection of services and applications that make use of these technologies to create new business and market opportunities (Atzori, Iera., & Morabito, 2010; The Internet of Things, ITU Internet Reports, 2005).

Fast CPUs, big memory capacities, and miniaturization are gaining traction in numerous gadgets as nanotechnologies advance. The whole application and development of IoT is dependent on its application's security. It is inconceivable to foresee the growth of these technologies without guarantees of privacy, confidentiality, and authenticity at the system level.

The development of intelligent production systems and networked production sites is commonly referred to as Industry 4.0, and the term "smart industry" is becoming more and more popular. The idea of a "smart home" or building is becoming more and more popular these days. Examples include intelligent security systems and thermostats, smart energy applications, and smart meters for electricity, gas, and water. Smart cities are being created through the use of IoT, where solutions like real-time parking space availability monitoring and intelligent street lighting are sought after. (Atzori et al. 2010; Fleisch, 2010; Vermesan et al. 2014). Smart cities use connected devices through the Internet to perform various actions and tasks in order to save money, time and energy in their work. That communication of devices over the Internet makes those things IoT. It is anticipated that the worldwide market will grow to around $100 billion in value by 2021. According to sales volume, China and the Far East are the most significant smart home markets, accounting for 40% of all manufactured devices sold there. (https://www.statista.com/topics/2430/smart-homes/#dossierKeyfigures). It is predicted that the number of smart homes will grow and exceed the figure of 350 million to 2023(https://www.statista.com/topics/2430/smart-homes/#dossierKeyfigures).

Smart homes save money, time, and energy by utilizing linked appliances and gadgets to carry out

automated routines, tasks, and actions. Integration of different smart gadgets and devices managed by a centralized system is made possible by home automation systems.

5. CONCLUSION

With the development of new technologies, faster internet flows, there was also an increase in multimedia traffic, which initially changed the meaning of IoT in the so-called Multimedia Internet of Things (mIoT). A more modern view of IoT requires a higher bandwidth in contrast to IoT and therefore to changing the entire architecture of IoT itself. While the traditional IoT focuses on connecting physical objects and devices to the internet to enable data exchange and automation, the Multimedia IoT extends this concept to include multimedia elements such as audio, video, images, and other interactive media. By incorporating multimedia capabilities into IoT devices, users can access and interact with a wide range of media content through various connected devices. This can include smart TVs, smart speakers, smartphones, tablets, and other IoT-enabled gadgets. However, the integration of multimedia capabilities into IoT devices also presents challenges, such as increased bandwidth requirements, data processing complexity, and the need for robust security measures to protect multimedia content from unauthorized access.

Rethinking IoT design for M-IoT is necessary because multimedia applications that are bandwidth-intensive and delay-sensitive operate on constrained IoT networks. Also, M-IoT smart objects are usually resource-constrained, in terms of energy, memory, and processing power, so they are typically designed to run on batteries or solar power with only a few kilobytes of memory and limited processing power in megahertz. In contrast to IoT, M-IoT devices need more processing power, large amounts of memory, and higher bandwidth in order to evaluate and process collected multimedia data.

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