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UNIVERSITY OF ALBA IULIA

Perspective on the digitization of virtual reality

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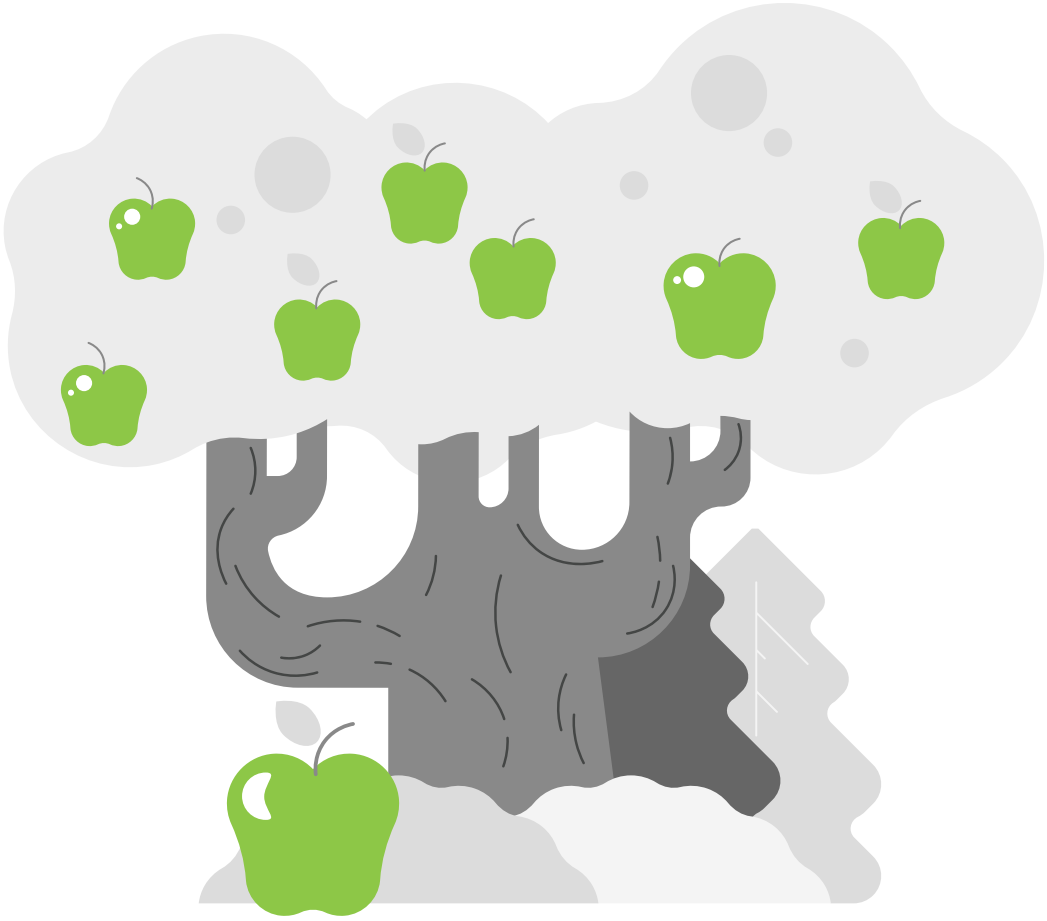

COURSE TITLE

Perspective on the digitization of virtual reality

Language of instruction: English

Name of lecturer: Lect. PhD. Eng. CIORTEA Elisabeta Mihaela

Form of instruction	Number of teaching days	Number of teaching hours per day	Form of evaluation (if any)	Certification
Lecture	1 day	.... hours per day	-	Acquired competences -

COURSE AIMS:

- **What Is the Internet of Things (IoT)?** - IoT is the network of things, with clear element identification, embedded with software intelligence, sensors, and ubiquitous connectivity to the Internet. IoT enables things or objects to exchange information with the manufacturer, operator, and/or other connected devices utilizing the telecommunications infrastructure of the Internet. It allows physical objects to be sensed and controlled remotely across the Internet, thereby creating opportunities for more direct integration between the physical world and computer-based systems and resulting in improved efficiency, accuracy, and economic benefit.
- **The Open System Interconnection Model -** The model is intended to describe and standardize the main communication functions of any telecommunication or computing system without regard to their underlying internal structure and technology. Its goal is the interoperability of diverse communication systems with standard protocols. The OSI is a conceptual model of how various components communicate in data-based networks. It uses "divide and conquer" concept to virtually break down network communication responsibilities into smaller functions, called layers, so they are easier to learn and develop. With well-defined standard interfaces between layers, OSI model supports modular engineering and multi-vendor interoperability.
- **Support for Constrained Devices** - This section will present the key requirements for IoT and their impact on each level of the protocol stack. Each layer is considered and industry efforts to meet current demands are discussed. We will also present some gaps that remain for further studies and that require future solutions.
- **Defining Fog Computing** - Cloud computing refers to a model that provides users with on-demand access to a shared pool of computing resources over a network. These resources can be quickly provisioned and released through a self-service model. One of the key features of the cloud computing model is the notion of resource pooling, where workloads are associated with multiple users. This guarantees the economy of scale of the Cloud as a computing model. Thus, essential to cloud computing is the use of network and computer virtualization technologies. Cloud computing provides features of elastic scalability, where the number of resources can be increased or decreased based on user demand.

Fog computing refers to a platform for integrated computing, storage, and network services that are highly distributed and virtualized. This platform can scale on-premises from IoT end devices and gateways to Cloud data centers but is typically located at the edge of the network. Fog is not an alternative to Cloud computing; rather the two interact synergistically to enable new types and classes of IoT applications that would otherwise not have been possible when relying on stand-alone cloud computing.

- **What Is the Blockchain?** - Many expect that blockchain technology has the potential to transform a range of different industries. Because of this, blockchain is already being used and researched by many of the leading companies in technology. While many efforts are still in their infancy, and there are many challenges to solve, it is expected that blockchain has the power to propel significant transformations in the IoT sector.

There are countless digital currencies and innovative applications being developed on top of a blockchain. The impact of these efforts will be hard to predict. In IoT, blockchains can facilitate things like M2M transactions, automated firmware updates, or even the tracking of food quality and control. Imagine cars automatically negotiating rates for parking spaces, or drones automatically reserving and paying for a landing pad. These are just a few possibilities, we explore further how the blockchain can impact the IoT domain.

COURSE CONTENTS (for each workshop):

1. Internet of Things (IoT) Overview
2. The Internet in IoT
3. IoT Requirements for Networking Protocols
4. Fog Computing
5. The Blockchain in IoT

TEACHING METHODS:

Lecture, conversation, exemplification.

LEARNING OUTCOMES:

- Defining IoT as a network of things with clear identification of elements, embedded with software intelligence, sensors, and ubiquitous Internet connectivity. IoT is powered by four main elements: sensors to collect information, identifiers to identify the source of the data, software to analyze the data, and Internet connectivity to communicate and enable notifications. The ultimate goal of IoT is to create a better environment for humanity, where the objects around us know what we like, want, and need and act accordingly without explicit instructions.
- The TCP/IP model which is the basis for the Internet. The TCP/IP protocol has two big advantages in comparison with earlier network protocols: reliability and flexibility to expand. The remarkable growth of Internet applications can be attributed to its flexible expandability model.
- The Internet Protocol (IP) was among the factors that contributed to the success of the Internet. IP provides a solid foundation for building the IoT, a number of shortcomings must be addressed to meet the specific requirements of the IoT. These requirements include support for resource-constrained devices that have very limited computing capabilities and limited power; support for massive IoT scalability; the need for deterministic networks to support real-time mission-critical applications; the requirement for light security protocols and ensuring data confidentiality; and, the requirement for application interoperability through the use of APIs and unified data semantics.
- Defining the concept of Fog computing and its relationship with Cloud computing. The various IoT requirements that drive the need for fog have been covered. The prerequisites and enabling technologies for Fog play an important role in virtualization technologies, network mobility technologies, orchestration, and data management technologies.
- Blockchain is expanding into new industries every day and has the potential to propel the IoT forward. This potential is largely due to the technology's foundation in cryptography and the mechanisms implemented. Blockchain features key features such as decentralization, security, and trust - all important aspects of IoT solutions. A few use cases in M2M, energy management, supply chain management, healthcare, retail, and transportation paint a picture of a rapidly emerging technology in various industries. Finally, it is important to consider the challenges facing blockchain, such as scalability, privacy, and anonymity. Technology presents many new possibilities that are just beginning to gain ground.

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA (if any): -

RECOMMENDED READING (English language only):

1. Ciortea Elisabeta Mihaela, „Analysis of manufacturing systems modeling by petri nets", ACTA UNIVERSITATIS APULENSIS, Mathematics-Informatics, No.11/2005, ISSN 1582-5329
2. Ciortea Elisabeta Mihaela, „Aspect regarding the types of process control systems", ACTA UNIVERSITATIS APULENSIS, Mathematics-Informatics, No.8/2004, ISSN 1582-5329
3. Ciortea Elisabeta Mihaela, „The study for transport in flexible cells", 6^{TH} International Conference of phd Students, 12-18 August 2007, Miskolc, ISBN 978-963-661-779-0
4. Ciortea Elisabeta Mihaela, Morar Liviu, „Analysis of the influence of the transportation system in increasing the performances of the production system", ACTA UNIVERSITATIS CIBINIENSIS, Vol. LII, Technical Series, Sibiu, 2005

5. Ciortea E M 2019 Manufacturing analysis with discrete events using IoT platform, Modern Technologies in Industrial Engineering VII, (ModTech2019), IOP Conf. Series: Materials Science and Engineering 591 (2019) 012008
6. Ciortea E M 2017 Prototyping manufacturing in the cloud, IOP Conf. Series: Materials Science and Engineering 227 (2017) 012028
7. Ciortea E M 2019 The cloud manufacturing – technology of the future, ANNALS of Faculty Engineering Hunedoara – International Journal of Engineering, Tome XVII [2019] | Fascicule 4 [November]
8. Ciortea Elisabeta Mihaela 2016, Intelligent system of coordination and control for manufacturing, IOP Conference Series-Materials Science and Engineering Volume: 145 Article Number: 022008 Published doi:10.1088/issn.1757-899X Online ISSN: 1757-899X
9. Ciortea Elisabeta Mihaela 2017, Prototyping manufacturing in the cloud, IOP Conf. Series: Materials Science and Engineering 227 - 012028, doi: 10.1088 / 1757-899X / 227/1/012028
10. Ciortea Elisabeta Mihaela 2016, Intelligent system of coordination and control for manufacturing, IOP Conference Series-Materials Science and Engineering Volume: 145 Article Number: 022008 Published doi:10.1088/issn.1757-899X Online ISSN: 1757-899X
11. Ammar R., Samer S., 2019, „Internet of Things From Hype to Reality, The Road to Digitization", ISBN 978-3-319-99516-8 (eBook) Springer, https://doi.org/10.1007/978-3-319-99516-8
12. Cheol-Ho Hong, Blesson Varghese, 2018, „Resource Management in Fog/Edge Computing: A Survey", arXiv:1810.00305v1 [cs.DC] 30 Sep 2018
13. Tiago M. Fernández-Caramés , Paula Fraga-Lamas, 2018, "A Review on the Use of Blockchain for the Internet of Things", *Digital Object Identifier 10.1109/ACCESS.2018.2842685*