IITU MetaUniversity: creation of the digital twin for higher education in Kazakhstan[⋆]

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Abstract

MetaUniversity is a concept that redefines education by integrating emerging technologies such as XR into a flexible and inclusive learning ecosystem. It provides students with personalized interdisciplinary opportunities, emphasizing critical thinking, innovation, and accessibility. Virtual avatars reflect the unique characteristics of students, promoting cultural diversity, equity, and collaboration in a global learning environment. MetaUniversity creates a digital twin of the institution, streamlining processes and enabling innovative approaches to learning. By addressing contemporary challenges and labor market demands, MetaUniversity prepares students for success in the evolving world.

Keywords

virtual reality, digital twin, education, adaptive learning

1. Introduction

The concept of a university in the Metaverse represents a future view of education, suggesting the existence of innovative teaching methods and content development. The Metaverse includes advanced artificial intelligence technologies through the emerging convergence of augmented reality, virtual reality and mixed reality, cloud computing methods, blockchain and 5G/6G wireless networks [1].

With the development and availability of virtual reality, the approach to obtaining higher education has begun to change. This is evidenced by the launch of the Meta Immersive Learning program, for which Mark Zuckerberg's Meta company has allocated $ 150 million [2]. One of the goals of this program is to create 10 Metaverse campuses, and VictoryXR was brought in to implement it, which together with Meta uses the Quest 2 virtual reality headset. The list of 10 Metaverse campuses using the Quest 2 virtual reality headset includes such educational institutions as UMGC, Dominguez Hills, Alabama A&M University, West Virginia University, University of Kansas, Morehouse College, Fisk University, St. Ambrose University, Southwestern Oregon Community College, New Mexico State University, South Dakota State University, Inspired EDU, American High School and Northern Illinois University [3].

2. Digital twins and metaverse in higher education

In the era of rapid technological transformations, the concept of "University" is changing. Now it is no longer a classic educational institution that trains specialists in fundamental and applied sciences. A modern university is an educational, scientific and practical complex that offers students access to laboratories, practice and knowledge bases. With the development of immersive

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technologies in the world, there is a shift of the "University" to a virtual or meta-space - i.e. a web platform that offers students and organizations a platform for communication, knowledge sharing and achieving interdisciplinary academic goals [4]. Thus, educational institutions, uniting, offer students the opportunity to access educational resources from any university / library they need, and students studying at one educational institution can take courses at other universities and colleges. All this makes education more accessible, advanced and independent. Today, virtual universities provide access to higher education remotely using software or web platforms. Prominent representatives of the virtual university are:

1. The University of Maryland (UMGC, USA) [5] is a leader in the field of distance learning. Education is conducted entirely online or in a hybrid form. Courses include arts and humanities, social sciences, business, management, computing, technology, and education.
2. The African Virtual University (AVU) [6], founded in 1997 by the World Bank, provides higher education programs remotely, which are implemented using software. Its goal is to provide access to education to that part of the population that does not have the physical opportunity to visit the campus.
3. Syrian Virtual University (SVU) [7]. The university was founded in 2002, and includes the faculties of information systems and telecommunications, business administration and humanities.
4. Pakistan Virtual University (VU of Pakistan) [8]. The university was founded in 2002 and is located in Punjab. It is a public university that offers undergraduate, graduate, and doctoral programs.
5. National Distance Education University (UNED, Spain) [9] is the largest public university in Spain, which has been committed to universalizing quality higher education through an online and blended learning model for 50 years.
6. Michigan Virtual (USA) [10], founded in 1998 and with 120,000 students, the university is dedicated to advancing education through digital learning, research, innovation, policy, and partnerships.
7. CUAHSI Virtual University (CVU, USA) [11] is a unique multi-institutional, one-semester graduate course consisting of a diverse set of 4-week modules on specialized hydrological topics. CVU aims to increase the depth of graduate course offerings at universities across the country and to facilitate networking within the hydrological community.
8. The Bavarian Virtual University (BVU, Germany) [12], a network of 33 universities in Bavaria, promotes and coordinates the development and implementation of online courses at Bavarian universities. The network finances, promotes and supports the development of digital learning and, in particular, supports the exchange and use at the inter-university level.
9. The Hong Kong Virtual University (HKVU) [13] is a joint project funded by the UGC Restructuring and Cooperation Fund. The aim of this programme is to provide a networked virtual campus to connect local higher education institutions and to provide students with a wider choice of subjects and greater flexibility in their studies.

In the age of rapid technological advancements, universities are transforming from traditional institutions into comprehensive educational, scientific, and practical hubs. This shift is fueled by immersive technologies that move education into virtual or meta-spaces, offering students and organizations platforms for collaboration, interdisciplinary knowledge exchange, and global access to resources.

3. IITU METAVERSE CONCEPT DEVELOPMENT

New generations of students require a more interactive and engaging learning format. At the same time, the traditional university model with an emphasis on theoretical knowledge is gradually giving way to systems focused on practical skills, interdisciplinarity and flexibility.

The development of artificial intelligence, virtual and augmented reality, blockchain technologies and machine learning, in turn, has shown that they have enormous potential to change the approach to the educational process. In this regard, the International Information Technology University (IITU, Almaty, Kazakhstan) came up with the idea of creating an ecosystem in which learning would be integrated with business processes, scientific research and immersive technologies. Among them are digital laboratory work, which is primarily focused on an individual user, a student who is able to work at his own pace and depending on his needs. At the same time, the system responds precisely depending on his/her initial data and parameters.

Metauniversity concept represents a cutting-edge approach to education, deeply enriched by the principle of inclusivity. It ensures that students from diverse backgrounds have access to unique opportunities for in-depth, multidisciplinary learning, tailored to their individual needs and abilities. The inclusive dimension of the Metauniversity project has been detailed in recent research by [14], who explore how such ecosystems can eliminate barriers to education and provide equitable access for diverse learner groups.

The relevance of Metauniversity lies in its ability to respond to the evolving needs of the labor market and society as a whole. By integrating the latest technologies and methodologies into its educational processes, Metauniversity increases the effectiveness and attractiveness of its programs for students. This adaptability, combined with a commitment to versatility and diversified development, positions Metauniversity as a key element of the modern educational ecosystem.

The concept is based on the idea that modern education should be flexible, combining several areas at once: IT, economics, ecology, scientific research, etc. This allows us to train specialists who are able to solve complex and non-standard problems. Thus, Metauniversity project was created, which in its digital form has become not just an educational institution, but a full-fledged ecosystem in which students, scientists, business and technology work together. Figure 1 shows a diagram describing the concept.
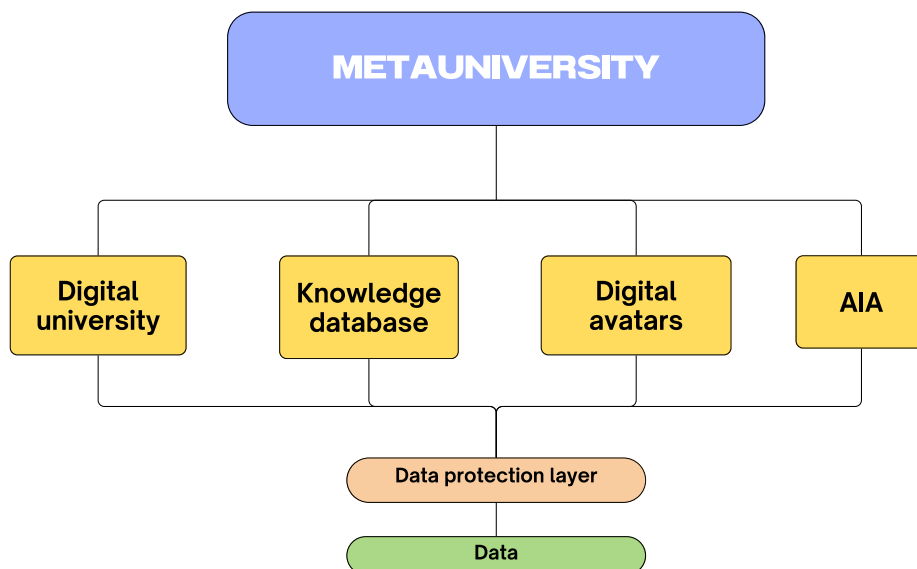

Figure 1: Metauniversity concept

The diagram consists of four blocks, each representing a key area of work:

1. Digital University: digital copy of the university including the building as well navigation and interaction within;
2. Knowledge database: source of the learning materials in many forms including virtual laboratory works and gamified learning materials;
3. Digital avatars: feature that helps to create a fully personalized avatar representing student's perception and needs;
4. AIA: intelligent agent that helps student work and navigate within the virtual copy of the university.

At the basic level of Metauniversity there is a data protection layer and data layer itself which is a workforce of the whole project.

A standout feature of Metauniversity is its AIA software agent – an innovative tool that leverages advanced artificial intelligence to provide personalized support to students, faculty, and staff. This intelligent assistant enhances the learning experience by offering tailored guidance, managing administrative tasks, and facilitating seamless interactions within the educational environment.

Metauniversity provides each user with the ability to create and customize their own avatar. This feature allows for the diversity of students' physical and cultural characteristics to be taken into account, ensuring inclusion and equality. Students can choose various parameters for their avatars, including physical characteristics, clothing and accessories, as well as functional capabilities, allowing for the creation of an avatar that most accurately reflects the individual characteristics of each user. This personalization helps create a comfortable and supportive learning environment where everyone can feel involved and valued.

Metauniversity provides equal opportunities for participation, regardless of physical abilities or geographic location. This is especially important for students with disabilities who may face barriers in a traditional learning environment. The ability to reflect cultural and ethnic characteristics through avatars promotes respect and understanding of cultural diversity among students, which creates a more tolerant and harmonious learning environment. Moreover, as shown by [15], developing communicative language competence in future IT specialists is crucial for success in interdisciplinary and multicultural digital environments. The integration of such competence into digital platforms like Metauniversity strengthens students' readiness for collaborative and globalized workspaces. The virtual environment allows for the adaptation of learning materials and interfaces to the individual needs of each student, which increases the overall accessibility and effectiveness of learning. An inclusive approach to creating avatars also promotes social interaction and collaboration between students. Virtual avatars allow students to get to know each other more easily and establish social connections, which is an important element in the learning process. In Metauniversity, students can participate in virtual group projects, discuss learning topics and exchange ideas in real time. Personalized avatars help create a sense of presence and reality, which makes interaction more natural and productive. Organizing virtual events such as lectures, seminars and informal meetings helps strengthen social connections and develop students' communication skills. Teachers and mentors can interact more effectively with students, taking into account their individual characteristics and needs, which allows for a more personalized and supportive educational process. By adopting inclusive and adaptive principles, Metauniversity becomes a space where students are not only educated but also inspired to collaborate across disciplines, think critically, and innovate. This approach nurtures a culture of lifelong learning and prepares students to address the challenges of tomorrow with confidence and creativity.

4. Conclusion

Digitalization in Kazakhstan has affected absolutely all areas. A striking example of the integration of new technologies into education is the use of special training systems. The state is actively investing in the development of this area, primarily by allocating budget funds. The presented project fully meets the problems of accessibility of education, which is expressed in the demand for

such solutions among the new generation of students. This article described the concept of Metauniversity, created at IITU, Almaty. The main goal of this project is to create a digital twin of the university that will enable the administration to track real-time processes within the institution, assist instructors in developing new educational materials and approaches, and offer students the opportunity to experiment with and learn through immersive technologies in a virtual environment.

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Declaration on Generative AI

The author(s) have not employed any Generative AI tools.

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