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The Metaverse: A Descriptive Journey into the Digital Frontier

Skanda Suresh[1]; Sudarshan Sridhar[2]; Ranjith V[3]; Savitha T.[4]
Assistant Professor Dept. of CSE[3,4]
RNS Institute of Technology, Bangalore

Abstract:- The concept of the metaverse has garnered con- siderable interest in recent years, serving as a virtual environ- ment where real-time interaction takes place. This concept was popularized by Neal Stephenson's 1992 novel "Snow Crash." This paper delves into the various potential applications of the metaverse in fields such as entertainment, education, and commerce. We investigate how the metaverse offers immersive experiences by combining the physical and digital realms, thereby revolutionizing storytelling, learning, and commerce. Addition- ally, we address the challenges and considerations associated with the development and implementation of the metaverse, underscoring the significance of responsible governance and equitable access in shaping its future societal impact.

Keywords:- *Metaverse, Virtual Reality, Augmented Reality, Digital Environment, Cybersecurity, Accessibility, User Experi- Ence, Immersive Technology, Online Collaboration, Digital Inno- Vation*

I. INTRODUCTION

The term "metaverse" was first introduced by Neal Stephen- son in his influential science fiction book "Snow Crash" and denotes a digital realm where people can engage with one another and virtual surroundings instantaneously. Over time, the idea of the metaverse has evolved from its fictional beginnings to become a significant topic of conversation and investigation in technology and society.

The metaverse is essentially a shared virtual realm that goes beyond any single platform or application, connecting a vast network of immersive experiences. Within this metaverse, users can explore virtual landscapes, interact with others, and take part in various activities such as entertainment, education, commerce, and collaboration.

The metaverse distinguishes itself by seamlessly blending the physical and digital realms, enabling users to participate in activities that were previously unimaginable in an immersive environment. Utilizing virtual reality (VR), augmented reality (AR), and digital networking technologies, the metaverse has the capability to revolutionize our interactions with technology and our perception of the world.

The metaverse's development and growth bring both thrilling prospects and intimidating obstacles for society. In one respect, the metaverse provides fresh opportunities for imagination, interaction, and networking, enabling people to engage with virtual realms and cooperate with others world- wide. Nonetheless, the metaverse also prompts significant inquiries regarding privacy, security, and digital rights, along with apprehensions about its potential influence on social interactions and human conduct.

This paper aims to thoroughly explore the diverse aspects of the metaverse, including its different uses, consequences, and possibilities. We will investigate how the metaverse is transforming our perception of reality and redefining human experiences, from entertainment and education to commerce and community-building. Furthermore, we will address the difficulties and factors to be taken into account in the creation and adoption of the metaverse, emphasizing the importance of careful and ethical management in determining its future direction.

The introduction of the metaverse is bringing about a significant transformation in how we interact with technology and the digital world. This new platform provides immersive and interactive experiences and has the potential to lead us into a new era of digital connectivity and exploration, bringing about profound societal change. It is important to carefully consider the implications of the metaverse and strive to create an inclusive and fair virtual environment for everyone in order to fully unlock its potential.

II. PROBLEM STATEMENT

During the initial phases of the metaverse, a significant challenge is to ensure that all users have fair access while maintaining strong security measures. This complex issue entails making sure that people from various backgrounds can actively engage in virtual experiences without facing obstacles, all the while protecting their personal information, privacy, and online safety from potential threats. Finding a middle ground between inclusivity and security in the metaverse requires comprehensive approaches that tackle technological, socioeconomic, and regulatory hurdles in order

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to create a safe and inclusive environment for everyone.

III. OBJECTIVE

- In the quest to conquer the challenge of attaining fair access and strong security in the metaverse, the main goal is to devise thorough tactics and execute efficient measures that find a middle ground between inclusiveness and security. This encompasses:
- Improving Accessibility: The aim is to guarantee that people from various backgrounds, including individuals with disabilities, low-income households, and rural communities, have fair access to virtual environments within the metaverse. This involves addressing barriers like cost, digital literacy, and infrastructure limitations to encourage inclusiveness and engagement for all users.
- Enhancing Security Measures: The goal is to enforce strong security protocols and encryption methods to secure user data, communications, and transactions within the meta- verse. This entails establishing uniform security standards, access controls, and data protection policies to defend against data breaches, identity theft, and cyber threats.
- Advocating Digital Literacy and Online Safety: The aim is to equip users with the knowledge and abilities to navigate virtual environments safely and responsibly. This encompasses offering educational and awareness initiatives on subjects such as privacy preservation, best practices in cybersecurity, and identifying and reporting online harassment and abuse.
- Encouraging Cooperation and Involvement of Stake- holders: The goal is to promote cooperation among technol- ogy firms, policymakers, regulators, civil society groups, and community stakeholders to establish and implement fair and comprehensive policies and procedures within the metaverse. This includes advocating for openness, responsibility, and communication to address the various needs and interests of all parties involved.
- Through accomplishing these aims, the objective is to establish a metaverse that is available, all-encompassing, and protected for all users, allowing them to fully engage in virtual experiences while protecting their privacy, data, and online welfare.

IV. METHODOLOGY

- Achieving a balance between inclusivity and security in the metaverse entails developing comprehensive strategies and implementing effective measures to address the challenge of ensuring equitable access and robust security. This requires:
- Guaranteeing Equitable Access: The aim is to make sure that people from various backgrounds, including those with disabilities, low-income households, and rural communities, have fair access to virtual environments within the metaverse. This involves tackling obstacles such as affordability, digital literacy, and infrastructure limitations to foster inclusivity and engagement for all users.
- Enhancing Security Measures: Our goal is to put in place strong security protocols and encryption methods that will ensure the protection of user data, communications, and transactions in the metaverse. This will include creating standardized security guidelines, access controls, and data protection policies to prevent data breaches, identity theft, and cyber threats.
- Advocating for Digital Literacy and Online Safety: Our aim is to equip users with the knowledge and abilities to navigate virtual environments in a safe and responsible manner. This involves offering educational programs and pro- moting awareness about privacy protection, best practices in cybersecurity, and the identification and reporting of online harassment and abuse.
- Encouraging Cooperation and Involvement of Stakehold- ers: The goal is to encourage cooperation among technology firms, policymakers, regulators, non-governmental organiza- tions, and local community participants to establish and im- plement fair and comprehensive policies and procedures within the metaverse. This includes advocating for openness, respon- sibility, and discussion to tackle the diverse requirements and issues of all stakeholders.

By attaining these goals, the objective is to establish a metaverse that is available, comprehensive, and protected for all users, allowing them to engage fully in virtual experiences while protecting their privacy, information, and online welfare.

V. FUNDAMENTAL REQUIREMENTS

In order to achieve equitable access and strong security in the metaverse, it is important to address several essential requirements for a comprehensive and effective approach:

- Technological Infrastructure: It is crucial to guarantee that the technological infrastructure of the metaverse is capable of accommodating accessibility features and implementing strong security measures. This might include the creation of interoperable standards, protocols, and APIs to enable smooth integration of accessibility and security features throughout virtual environments and platforms.
- Policy and Regulation: Clear and enforceable policies and regulations should be established to support accessibility and security in the metaverse. This involves creating legal frameworks, industry standards, and regulatory guidelines that require the incorporation of accessibility features and security measures. Non-compliance should be met with penalties.

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- User Education and Awareness: Comprehensive education and awareness initiatives should be provided to educate users about the significance of accessibility and security in the metaverse. This includes increasing understanding of common risks and vulnerabilities, as well as instructing users on the best methods for safeguarding their personal information, privacy, and online well-being.
- Encourage cooperation among stakeholders from different backgrounds, such as technology firms, policymakers, regulators, advocacy groups, and community organizations. This entails establishing forums for discussion, cooperation, and knowledge exchange to create comprehensive and fair solutions that cater to the diverse needs and concerns of all stakeholders.
- Ensure that virtual environments, applications, and content in the metaverse are designed and created with accessi- bility considerations in mind. This includes incorporating uni-versal design principles, accessibility standards, and usability guidelines to guarantee accessibility for people of all abilities.
- Building Security into the Design: Ensure that security features and mechanisms are incorporated into the structure and planning of virtual environments in the metaverse. This involves integrating encryption, authentication, access control, and data protection measures to protect user data, communica- tions, and transactions from unauthorized access and misuse.
- Oversight and Assessment: Put in place systems for overseeing and evaluating the effectiveness of accessibility and security measures in the metaverse. This involves gathering data, analyzing patterns, and assessing results to pinpoint areas of success and areas needing improvement. Regular audits and evaluations can help guarantee that accessibility and security requirements are being fulfilled and upheld over time.

These basic needs must be met so that stakeholders can collaborate in developing an inclusive metaverse.

VI. NON FUNCTIONAL REQUIREMENTS

To ensure fair access and robust security in the metaverse, it is crucial to fulfill diverse non-functional requirements to ensure the effectiveness, dependability, and user-friendliness of solutions. The following are key non-functional requirements to consider:

- Performance: It is crucial to make sure that the system performance and user experience are not significantly affected by the implementation of accessibility features and security measures within the metaverse. Virtual environments should remain responsive and interactive, even when these features are activated.
- Scalability: Create solutions with the ability to expand and accommodate the growing user base and increasing complexity of virtual environments within the metaverse. Adapt- ability and scalability of security measures should be seamless to keep pace with the evolving metaverse over time.
- Reliability: Guarantee the dependability of accessibility and security features within the metaverse to uphold user trust and confidence. Virtual environments should be able to withstand disruptions, failures, and cyber attacks, ensuring users with a steady and uniform experience.
- Make sure the interfaces in the metaverse are easy to use and friendly to users, focusing on accessibility and security features. Users should find it effortless to navigate through the system, adjust settings, and personalize accessibility and security options according to their specific requirements and choices.
- Guarantee that the metaverse is compatible with a variety of devices, platforms, and assistive technologies to enhance accessibility and security for all users. Virtual environments should be accessible and secure on different operating systems, web browsers, and devices, such as desktops, mobile devices, and virtual reality headsets.
- Establish interoperability among different virtual environments and platforms in the metaverse to allow smooth communication, cooperation, and engagement. Make sure that accessibility and security features can work with third-party applications, tools, and services for easy integration.
- Ensure that the metaverse complies with relevant accessibility and security laws, regulations, and industry standards. The virtual environments should meet accessibility standards like WCAG (Web Content Accessibility Guidelines) and secu- rity standards such as ISO 27001 to uphold legal compliance and regulatory requirements.
- Resilience: Develop solutions that can withstand cyber threats, data breaches, and other types of digital attacks. Integrate security measures like encryption, intrusion detec- tion, and disaster recovery to reduce risks and guarantee the durability of accessibility and security features in the metaverse.

The efficient, trustworthy, and user-friendly accessibility and security measures in the metaverse can be ensured by address- ing these non-functional requirements, ultimately establishing a virtual environment that is accessible, inclusive, and safe for all users.

VII. IMPLEMENTATION

Achieving fairness and strong security in the metaverse necessitates a comprehensive approach that integrates diverse methods and technologies. Here's a broad outline of how to execute the problem statement:

- Establishment of Accessibility Standards and Guidelines: Engage in collaboration with stakeholders to establish exten- sive accessibility standards and guidelines for virtual environ- ments in the metaverse. These standards

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should encompass a wide spectrum of accessibility requirements, encompassing visual, auditory, motor, and cognitive impairments, and offer clear direction on designing and implementing accessible features and interfaces.

- Blend Design and Development Procedures with Accessibility Characteristics: Make sure that the design and devel- opment of virtual environments, applications, and content in the metaverse include accessibility considerations. This entails integrating universal design principles, accessibility standards, and usability guidelines from the start of the development process to ensure that virtual experiences are accessible to individuals of all abilities.
- Enforce Security Measures and Protocols: Put in place strong security measures and protocols to protect user data, communications, and transactions in the metaverse. This en- tails incorporating encryption, authentication, access control, and data protection mechanisms to prevent data breaches, identity theft, and cyber threats. Also, establish secure coding practices and regularly conduct security audits and assess- ments to identify and address vulnerabilities.
- Promote Digital Literacy and Online Safety: Provide educational and awareness programs to empower individuals with the knowledge and skills necessary to operate safely and responsibly in online environments. Offer workshops, seminars, and educational resources that address topics such as protecting privacy, adhering to cybersecurity best practices, and recognizing and reporting online harassment and abuse.
- Enhance User Interface and Experience Design: Cre- ate easy-to-use and intuitive interfaces for accessibility and security functions in the metaverse. Users need to be able to effortlessly navigate, adjust, and personalize accessibility options and security settings to suit their specific requirements and choices. Furthermore, give importance to design principles that enhance user experience to guarantee that virtual settings are captivating, immersive, and pleasurable for all users.
- Establish Regulatory Frameworks and Compliance Mechanisms: Establish regulatory frameworks and mechanisms for compliance to guarantee that virtual environments in the metaverse conform to accessibility and security-related legal and regulatory mandates. This involves creating standards organizations, regulatory bodies, and certification initiatives to ensure adherence to applicable laws, regulations, and industry norms.
- Foster Collaboration and Stakeholder Engagement: Encourage technology companies, policymakers, regulators, ad- vocacy groups, and community organizations to work together to create and execute fair and inclusive solutions in the metaverse. Establish spaces for discussions, teamwork, and exchanging information to tackle the varied needs and issues of all involved parties and foster transparency, responsibility, and solidarity.
- Monitor and Evaluate Implementation: Establish systems for overseeing and assessing the execution of accessibility and security measures in the metaverse. Gather data, track results, and evaluate the efficiency of tactics and interventions to pin- point successful areas and areas needing enhancement. Utilize input from users and stakeholders to continually improve and adjust implementation endeavors.
- Develop Assistive Technologies and Tools: Thinking about investing in the development of assistive technologies and tools to enhance accessibility in the metaverse could be beneficial. These tools might include screen readers, voice recognition software, and alternative input devices to assist individuals with disabilities in navigating virtual environments and interacting with digital content more effectively. Addi- tionally, exploring cutting-edge technologies such as haptic feedback devices and brain-computer interfaces is worthwhile as they offer fresh possibilities for improving accessibility in virtual environments.
- Enable Accessibility and Security Across Platforms: In order to ensure maximum accessibility and security for all users, it is crucial to guarantee that accessibility and security features in the metaverse work well across various platforms such as desktop computers, mobile devices, and virtual re- ality headsets. Achieving this goal necessitates collaboration among technology firms to establish interoperable standards and protocols for integrating these features seamlessly.
- Promote Industry Cooperation and Creativity: Foster collaboration and innovation in the tech sector to propel progress in accessibility and security within the metaverse. Cultivate partnerships among tech firms, research institutions, and non-profits to create inventive solutions and technologies that tackle the distinct challenges and advantages of virtual environments. Back initiatives like hackathons, innovation challenges, and open-source projects that encourage collab- oration and the exchange of knowledge among stakeholders.
- Foster User-Centric Design and Co-Creation: Embrace a design and development approach that prioritizes the require- ments and choices of users within the metaverse. Involve users as co-creators and partners in shaping virtual environments by seeking their feedback, perspectives, and recommendations to guarantee that accessibility and security features suit their wide-ranging needs and preferences. Execute user testing and usability research to pinpoint obstacles and difficulties encountered by users and refine design solutions as necessary.
- Funding Research and Development: Provide funding for research and development projects aimed at improving accessibility and security in the metaverse. Back academic research, industry partnerships, and government-funded pro- grams that seek to develop new technologies, approaches, and standards for enhancing accessibility and security in virtual spaces. Encourage collaborative

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research across different disci- plines, bringing together specialists from areas including com- puter science, human-computer interaction, psychology, and accessibility studies to address intricate issues and promote innovation.

- Advocating for Ethical Design and Responsible Inno- vation: Championing the integration of ethical design prin- ciples and responsible innovation practices in the metaverse to guarantee that accessibility and security considerations are incorporated at all stages of the design and development process. Suggesting that tech companies adopt ethical design frameworks like Privacy by Design and Inclusive Design, which give priority to user privacy, data protection, and acces- sibility right from the start of product development. Backing the enforcement of policies and regulations that encourage responsible innovation and require tech companies to uphold ethical standards and best practices.
- Engage with Diverse Communities and User Groups: Collaborate with a range of communities and user groups to guarantee that accessibility and security solutions in the metaverse are fair and inclusive for everyone. Work alongside disability advocacy organizations, community groups, and marginalized communities to gain insight into their specific requirements, obstacles, and focal points, and integrate their viewpoints into the creation and implementation of acces- sibility and security measures. Cultivate a welcoming and inclusive atmosphere in the metaverse that values diversity and encourages equal engagement and representation for all users.

A. Assessment Using Statistical Sampling

Utilize statistical sampling techniques to conduct a needs assessment and identify the specific accessibility and security requirements of users within the metaverse. Employ formulas such as the sample size calculation formula to determine the appropriate sample size for the survey or interviews based on the population size and desired confidence level.

➢ *This is an Explanation of the Operation:*

- Utilize the formula for calculating sample size *n* in a population to conduct a assessment:

$$n = \frac{Z^2 \cdot p \cdot (1-p)}{E^2}$$

Where:

- Z is the Z-score corresponding to the desired confidence level - p is the estimated proportion of the population with a particular accessibility or security need.
- E is the desired margin of error where The number of occurrences in the dataset is indicated by m.

B. Development of Accessibility and Security Standards

Utilize mathematical modeling methods to establish thor- ough accessibility and security benchmarks for virtual environ- ments within the metaverse. Employ equations like regression analysis to pinpoint the primary factors that affect accessibil- ity and security, and create predictive models to gauge the potential effects of various interventions and policies.

➢ *This is an Explanation of the Operation:*

- Apply linear programming to maximize accessibility while minimizing resource constraints:

Maximize $Z = c1x1 + c2x2 + \ldots + cnxn$

Subject to:
$a11x1 + a12x2 + \ldots + a1nxn \leq b1$ $a21x1 + a22x2 + \ldots + a2nxn \leq b2$.
$am1x1 + am2x2 + \ldots + amnxn \leq bm$ $x1, x2, \ldots, xn \geq 0$

Where:
Z is the objective function to be maximized - c1, c2, . . . , cn are the coefficients of the decision variables
- aij are the coefficients of the constraints - b1, b2, . . . , bm are the right-hand sides of the constraints - x1, x2, . . . , xn are the decision variables representing the design param- eters

VIII. ADVANTAGES

- Inclusive Digital Environment: The project gives top priority to accessibility, aiming to make sure that individuals with disabilities can enter virtual spaces in the metaverse, thus promoting inclusivity and ensuring equal participation for all users.
- Enhanced User Engagement: Increasing accessibility and security in the metaverse boosts user trust and confidence, leading to higher engagement, participation, and retention rates.
- Mitigation of Legal and Reputational Risks: Ensuring adherence to accessibility and security standards can reduce the legal and reputational risks linked to non-compliance and security breaches.
- Market Differentiation: The project stands out from com- petitors by investing in accessibility and security, establishing itself as a frontrunner in the industry and drawing in users who prioritize inclusive and secure digital experiences.
- Positive Social Impact: Promoting digital equity, diver- sity, and social justice in the digital realm leads to positive social outcomes and contributes to creating an inclusive and secure metaverse.

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- Technological Innovation: The development of new tools, technologies, and practices is encouraged by the project to drive technological innovation and improve accessibility and security in virtual environments.
- Economic Opportunities: The expansion of the user base, the attraction of investments, and the stimulation of innovation and entrepreneurship in the digital economy are all results of a metaverse that is both more accessible and secure.
- Empowerment of Marginalized Communities: Empowering marginalized communities with improved accessibility allows them to engage more effectively in digital society, amplifying their voices and enhancing their presence in virtual spaces.
- Long-Term Sustainability: Ensuring the long-term sustainability and resilience of the metaverse involves integrating accessibility and security into its core, thus safeguarding its viability and success in the future.
- Alignment with Ethical Values: The project aligns with societal expectations and ethical standards by prioritizing accessibility and security, which reflects values such as inclusivity, fairness, and respect for user privacy and dignity.

IX. LIMITATION

➢ *Implementing a Project to Ensure Fair Access and Strong Security in the Metaverse has many Benefits, but it also Brings Some Limitations:*

- Technical Complexity: Implementing accessibility and security measures in the metaverse can pose technical com- plexities, necessitating proficiency in software development, cryptography, and user interface design.
- Resource Intensiveness: Dealing with accessibility and security obstacles in the metaverse might demand substantial time, human resources, and financial commitment, creating difficulties for smaller entities or initiatives operating with restricted budgets.
- Interoperability Issues: It can be difficult to ensure that accessibility and security features are compatible and inter- operable across various virtual environments and platforms in the metaverse, particularly in decentralized or fragmented ecosystems.
- User Adoption Barriers: Even with attempts to enhance accessibility and security, specific user demographics might encounter obstacles to adopting technology because of issues like limited awareness, digital skills, or technology access.
- Regulatory and Compliance Challenges: Navigating the complex legal and regulatory requirements about accessibility and security in various jurisdictions may necessitate continu- ous monitoring and adaptation to ensure compliance.
- Potential Trade-offs: Finding the right balance between accessibility and security needs while also taking into account performance, usability, and innovation may entail making compromises that necessitate careful thought and involvement of stakeholders.
- Evolution of Threat Landscape: Continuous monitoring and adjustment of security measures are necessary to combat emerging risks and challenges posed by the constantly chang- ing landscape of cybersecurity threats and vulnerabilities.
- Resistance to Change: Introducing fresh accessibility and security protocols in the metaverse could encounter opposition from individuals, developers, or other parties who are used to current procedures or hesitant to embrace change.
- Limited Scope: The efforts to enhance accessibility and security within the metaverse are important, but they might not completely tackle the wider concerns surrounding digital inclusion, privacy, and equity in the digital world.
- Unintended Consequences: Specific accessibility or security measures, when implemented, may inadvertently create new challenges or risks for certain user groups, or lead to unintended consequences that need to be approached with care.

X. CONCLUSION

In summary, working on a project to ensure fair access and strong security in the metaverse comes with various advan- tages and difficulties. Enhancing accessibility and security in virtual environments offers benefits such as greater inclusivity, user involvement, and market competitiveness. However, there are also obstacles to consider, such as technical intricacies, resource requirements, and regulatory hurdles that must be tackled.

In light of these challenges, it is essential to stress the importance of prioritizing accessibility and security within the metaverse. Allocating resources to projects that improve the accessibility of virtual environments for individuals with disabilities and guarantee the safety of all users can create a digital realm that is inclusive, trustworthy, and resilient. This not only enhances user satisfaction and competitive positioning but also promotes positive social effects, economic opportunities, and technological progress.

It will be essential for all involved parties to cooperate, think innovatively, and adapt in order to address the evolving needs and challenges of the metaverse. By working together to overcome technical, regulatory, and adoption hurdles, we can establish a metaverse that reflects our shared values of inclusivity, privacy, and security, ultimately unleashing the full potential of digital technology to empower individuals, communities, and society as a whole.

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We also show our gratitude to the various communities and user groups that provided valuable perspectives, feedback, and assistance throughout the project. Their viewpoints and contributions have helped us ensure that our endeavors are all-encompassing, user-oriented, and attuned to the needs of all parties involved.

In addition, we express our gratitude to our partners, collaborators, and sponsors for their generous support and cooperation. Through our joint efforts, we have effectively utilized our combined knowledge, resources, and connections to tackle intricate challenges and promote positive transformation in the metaverse.

In conclusion, we appreciate the users and participants who have embraced our accessibility and security initiatives and contributed to the ongoing success of the project. Your involvement, input, and support are vital in achieving our goal of creating a metaverse that is accessible, inclusive, and secure for everyone.

REFERENCES

[1]. World Wide Web Consortium (W3C). (n.d.). Web Content Accessibility Guidelines (WCAG) Overview. Retrieved from https://www.w3.org/WAI/standards-guidelines/wcag/

[2]. United Nations. (2015). Transforming our world: the 2030 Agenda for Sustainable Development. Retrieved from https://sustainabledevelopment.un.org/post2015/transformingourworld

[3]. Nielsen Norman Group. (n.d.). Usability 101: Introduction to Us- ability. Retrieved from https://www.nngroup.com/articles/usability-101-introduction-to-usability/

[4]. World Economic Forum. (2020). Advancing Digital Inclu- sion in the Fourth Industrial Revolution. Retrieved from https://www.weforum.org/reports/advancing-digital-inclusion-in-the- fourth-industrial-revolution

[5]. European Commission. (2020). Digital Strategy for the European Data Strategy. Retrieved from https://digital-strategy.ec.europa.eu/en/library/digital-strategy

[6]. Gupta, A., Bhatnagar, V. (2017). Accessible Internet of Things (IoT): An Overview. International Journal of Computer Applications, 158(4), 31-36.

[7]. Dillenbourg, P., Elen, J., Clarebout, G. (2009). Learning Sciences: Theories and Research Programs. Springer Science Business Media.