

Preface

There isn't a single industry that does not employ augmented reality (AR) or virtual reality (VR) in some way. This technology's applicability has already spanned a wide range of industries. It will soon infiltrate regions that no one could have predicted. Technology behemoths are already putting money, effort, and time into AR/VR integration. As this technology advances and expands, it is vital that everyone understands the numerous uses of AR and VR, as well as their entire potential. This book of research on "Application of Virtual Reality (VR) and Augmented (AR) in Industry 5.0" reveals new and inventive aspects of technology, as well as how they might aid in increasing economic efficiency and efficacy for improved production. It is an excellent resource for researchers, academics, politicians, business executives, corporations, and students, as it covers a wide range of issues. Numerous applications of AR and VR that improve industrial skills and decision-making are gaining traction. The exponential growth of AR-enabling technology boosts support for Industry 5.0 service enhancement. Meanwhile, in many industry-wide advances and real-time applications, practical difficulties of AR and VR play a key role in building cognitive tools and analytics.

The influence of AR/VR on artificial intelligence (AI) appears to be set as significant. The next generation of AR/VR gadgets will deliver customized, accessible, and well-designed experiences. However, more effort is needed before these technologies become broadly used, which is addressed in this book via multiple chapters under Industry 5.0, as future AR/VR gadgets will give customized, accessible, and well-designed experiences. In this new normal, AR and VR are gaining traction. People's access to the metaverse – the next generation of the internet – will be aided by AR/VR. As hardware devices are more inexpensive, a few groundbreaking use cases, including gaming, fitness, and social, have seen early market acceptance. This book is written in a reader-friendly manner, with a significant material that has been thoroughly examined, allowing for simple comprehension of the subject. The book gives readers with resources, allowing them to conduct more in-depth research. The case studies will present a tried-and-true method for resolving common challenges in the field of study. The reader will be able to assimilate the material briefly, thanks to the essential concepts and simplified substances of the chapters.

This book reveals new and innovative features of AR/VR and how it can help in promoting sustainability among various sectors for raising economic efficiency at both microlevel and macrolevel and provides a deeper understanding of the relevant aspects of AI impacting efficacy for better output. It is an ideal resource for researchers, academicians, policymakers, business professionals, companies, and students. Numerous practical aspects of AR/VR that enhance industry skills as well as decision-making are gaining momentum. This book is a solid step forward and will be of great use for the people in corporate, business professionals, sociology, political science, public administration, mass media and communication, information system, development studies, as well to the business studies. The models discussed in the book will have a huge replication and

practice potential across the world, and the field is one of the most important growing fields across the globe. On the other hand, this book will serve as an excellent reference source to the practitioners working in the field of stakeholders and their strategies.

Secondly, this book is laid out in a reader-friendly format where important information duly analyzed is highlighted, thus facilitating easy understanding of the content. The book provides resources to the readers, thus providing an opportunity for further detailed studies. The case studies will provide a tried and tested approach to the resolution of typical problems in the area of study. The key concepts and summarized content of the chapters will enable the reader to absorb contents at glance.

It talks about the following enlisted chapters:

Chapter 1 talks about the application of AR and VR for supply chain: a macro-perspective approach. Post-COVID-19, global manufacturers' attention has suddenly shifted toward supply chain networks to enhance their efficiency and effectiveness. This necessitated redesigning and incorporating novel viewpoints into the service and production processes. Manufacturing has undergone a new industrial shift with the introduction of Industry 4.0, which uses cutting-edge technologies to enhance all aspects of operations and the supply chain. VR knowledge permits customers to interrelate with and immerse themselves in a computer-generated situation, recreate the actual world, or create an unreal world. The goal of this chapter is to investigate the existing literature, available data, and concepts to provide future research directions to help academicians and managers systematically understand the various applications and growth of AR and VR in managing the supply chain.

Chapter 2 talks about an intelligent traffic control system using machine learning techniques. The ever-increasing traffic jams in urban areas makes it necessary to make use of cutting-edge technology and equipment in order to advance the state of the art in terms of traffic control. The currently available solutions, like time visitors or human control, are not adequate to alleviate the severity of this crisis. The findings of this investigation have led to the proposal of a system for the control of traffic that makes use of canny edge detection and digital image processing to determine, in real time, the number of vehicles present. The above imposing traffic control advanced technologies offer significant advantages over the existing systems in real time, transportation management, robotization, reliability, and efficiency. In addition, the complete process of digital image acquisition, edge recognition, as well as green signal assignment is demonstrated with accurate blueprints, and the final outcome are stated by hardware. All of this is done with four separate photographs of various traffic scenarios.

Chapter 3 talks about proficient implementation toward detection of thyroid nodules for AR and VR environment through deep learning methodologies. A disease that commonly exists on a global scale is thyroid nodule. It is identified by unusual thyroid tissue development. Radiologists sometimes may not notice minor elements of an ultrasound image, resulting in an incorrect diagnosis. To help physicians and radiologists to better diagnose, several deep learning (DL)-based models which can accurately classify

the nodules as benign and malignant have been implemented. After performing a comparative study of several DL-based models implemented with different classification algorithms on an open-source data set, it has been found that Inception Net V3 gave the best accuracy (~96%), F_1 score (0.957), sensitivity (0.917), and so on. A simple and easy-to-use graphical user interface has been implemented.

Chapter 4 talks about the convergence of AR and VR with IoT in manufacturing and their novel usage in IoT. Augmented reality is an interactive experience of a real-world environment where the objects that reside in the real world are enhanced and superimposed by computer-generated information. When AR and VR technology is combined with IOT, there are endless use cases and industries which benefit from this convergence. AR/VR + IOT can be used to display a machine's performance in real time, using sensors we can get the real-time data of an object, that data can be superimposed and shown to the user in AR or VR. This benefits the manufacturing or service industries to know about the status of the machine or a section visually, which helps in finishing the tasks sooner than conventional methods of working. AR + IOT is more suited for fixing day-to-day operations. VR + IOT is suited for training the employees on a given situation or virtual training of a machinery. This chapter explains how combining AR and IOT can increase the productivity, and how VR and IOT can help in reducing the training time of employees. Finally, touching upon the data we extract out of this convergence of AR/VR and IOT which helps the companies to get a meaningful insight of their operations and further optimize their production.

Chapter 5 talks about the proficiency of metaverse using VR for industry and user's perspective. Amid the widespread scenario, the world of web has seen a gigantic climb within the advancing and digitizing world. The paradigm of the digital world is just beginning to take shape and reality as a metaverse. It is still emerging, and many key components have started to take shape and are a major part of almost every field. This chapter presents an effort to showcase the ecosystem and elements which metaverse consists of. It examines the capabilities and application of the existing virtual worlds. Every tech-giant and field have begun to implement VR to come up with positive innovative results. Therefore, we discuss economical and industrial impact and negative aspects of implementing metaverse.

Chapter 6 talks about the retailing and e-commerce riding on technology. Today's world and economy are driven by technology and technology-savvy people across all sectors. This chapter gives the reader idea about the use of AR and VR in the e-commerce and retail sectors. The retail industry has grown considerably over the last two decades with the advent of e-commerce. It is no longer just a "purchasing" activity-based industry. Instead, it has become an "interactive" industry that provides customers with a "shopping experience." Shortly, AR and VR could be critical factors in establishing customer engagement and product promotion. The Indian retail business is close to \$1 trillion in size. Some were secular developments, whereas the Covid-19 tailwind helped others. As a result, the old-world order of organized retail, the value of location and scale, and the power of shelf space are all up for grabs.

Some upcoming advances (supported by tech innovations) are VR, AR, robots, facial recognition, and 3D printing. They are showing their presence. As a result, retail has become more transformative.

Chapter 7 talks about the inclusive education through AR and VR in India. With the advancement of technology, the education imparting scenario also changed drastically. This study lays the framework to understand how far AR and VR have contributed to inclusive edification in India. The sample for this research was collected through nonprobabilities sampling, precisely through the convenient sampling technique. The findings of the study conclude that with the help of AR and VR there were transformations in the education system, leading to inclusive education by improved learning, improved motivation for study, enhanced students engagement, authentic learning opportunity, better communication, and learning opportunity.

Chapter 8 talks about exploring practical use-cases of AR using photogrammetry and other 3D reconstruction tools in the metaverse. In today's world, people rely more and more on mobile apps to do their day-to-day activities, like checking their Instagram feed and online shopping from websites like Amazon and Flipkart. People depend on WhatsApp and Instagram stories to communicate with local businesses and leverage the said platforms for online advertising. Using Google Maps to find their way when they travel and finding out the immediate road and traffic conditions with digital banners around the road has obviously led to a boom in advertising and marketing. Thus, the proposed framework in this chapter would be a new kind of system that may develop a socio-meta platform powered by AR and other technologies like photogrammetry and LiDAR.

Chapter 9 talks about an empirical analysis of conspicuous consumption for luxury cosmetic products via AR technology concerning India's workforce. Status and conspicuous purchasing pattern help in developing links between customers with certain products and brands toward establishing status. AR allows consumers to virtually try goods and provide a "try before you buy" experience while shopping online. Within the national boundaries of a culturally diverse India, this study sought to examine the homogeneity of the luxury industry. The study aimed to decipher the behavioral pattern of the workforce in India in terms of conspicuous purchase intentions for luxury cosmetic products with the assistance of AR-driven technology, emphasizing brand antecedents and psychology.

Chapter 10 talks about the application of VR and AR technologies to boost technical capabilities for constructive effective learning in education for a performing virtual ecosystem: a design-thinking approach. This chapter introspects into the use of the technical capabilities of VR and AR to boost constructive learning in the domain of effective education. It examines a model approach for instructional and developmental design for creating a virtual educational ecosystem. It creates a team for participation employing VR/AR technology to combat the obstacles in ease of learning and assessing its feasibility of performance. The study has employed an exploratory study with critical literature review in a mixed method approach. It engaged the

method for a deeper understanding of the constructivism learning theory applied to the VR technologies for better knowledge.

Chapter 11 talks about the role of AR and VR in sports. Computer-generated reality and expanded truth are part of comparative studies of HMDs. The two advances use high-goal shows and following sensors to show stereoscopic pictures that change sufficiently to the client's head. In VR, the client sees the virtual climate. It preferably shuts out impacts from this present truth to amplify inundation. The increased fact utilizes cloudy presentations. It overlays virtual articles inside reality impeccably. The client cannot recognize genuine and virtual items while employing an expanded reality headset. The mix of AR and principal component vision is applications. It includes game diversion applications. Enlisting the AR and PC vision innovation into sports diversion applications gives novel open doors and new difficulties. The work is a survey article discussing various contributions.

Chapter 12 talks about space traffic management: a simulation-based educational app for learners. Due to the swift creation of human-centric applications and technologies, educational and training programs are progressively transforming toward newer ecosystems of modernization through the adoption of AR and VR technologies. Simulations and gamifications in engineering education and training could play a huge role in imparting knowledge with entertainment and amusement, thereby bringing in positive and effortless understanding of concepts among students. The game helps in stimulating strategic understanding among players by providing them an invigorating environment consisting of animations, graphics, sound effects, and music. This chapter reports the inception of this game prototype with the mathematical theory related to its creation.

Chapter 13 talks about the integration of VR in the e-learning environment. In our ever-changing world, learning is an essential part of everyone's daily routine. The traditional approach to education relies on students applying what they have learned from textbooks and professors in the classroom to real-world circumstances. The use of cutting-edge technology in teaching and learning techniques is critical in today's digital world. Information and communication technology is a major focus for universities. They are important scientific instruments with the potential to have an impact on how people learn and teach science. Three-dimensional VR interfaces give an experience via e-learning activities, software games, and simulated labs. Using VR, users may see, modify, and interact with computer systems and massive amounts of data. The term "visualization" refers to a computer's ability to provide the user with sensory inputs such as visual, aural, or any other combination of these. E-learning may benefit from the realistic virtual environments that VR and web technologies can create.

Chapter 14 talks about the resurgence of AR and VR in construction: past, present, and future directions. For a long time, AR and VR have been used in gaming and entertainment. However, construction is turning to AR and VR in an increasing number of applications, so it is not the only place where these technologies are gaining traction. The most current developments allow complete teams to plan a project meticulously,

from enhancing safety to creating intricate designs and choosing the best materials for the job. In addition, project managers can accurately convey their vision to stakeholders since VR and AR make construction projects come to life. The study examines how AR and VR can be used more frequently in the construction industry. The objectives are to determine the amount of knowledge about AR hardware and software, look into AR application areas, and spot construction companies lagging. The study explores how AR and VR might be used in the building process.

Thus, this book intends to give a quality publication with unique insights and methods of application for current scholars and users. This book offers a great overview of how AR and VR transforms organizations and organizes innovation management in Industry 4.0.