



Creating Training Capacity With Digital Twins

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EXECUTIVE SUMMARY

The global workforce is facing a major shortage of skilled workers. Companies in various industries are in search of effective strategies to train the next generation of employees. One of the most promising solutions for this problem is digital twinning.

In this white paper, we explore the potential benefits of integrating digital twinning technology with AI and how this innovative approach can effectively address the growing problem of skills shortage across different industries, such as aviation.

This paper highlights the potential of digital twins as the latest and most innovative technology that has the power to transform workplace training. Similar to simulations, digital twins are virtual replicas of pre-existing assets in the physical world, and the paper explores how they can revolutionize the training process. Beyond the powers of basic simulations, digital twins utilize IoT (Internet of Things) sensors and trained AI to allow for accurate data collection and analysis.

This white paper also investigates how data collection strategies give digital twins the ability to emulate the physical mechanism's past, present, and predicted future performance, as well as make insights as to what changes must be made to improve output and functionality. Digital twins will play a crucial role in strengthening the workforce of every industry, ranging from healthcare and manufacturing to aviation and beyond.

This white paper also discusses how our company, Illumia Labs, utilizes AI avatar instructors that act as digital twins of experts in any desired field. Virtual instructors have the ability to act as trainers around the clock, delivering lessons, administering assessments, and providing real-time feedback anytime and anywhere.

Illumia utilizes AI-powered action-based training, enriched with expert-level data that is integrated through digital twin and IoT sensor technology. These innovative AI-powered training methods, which are carried out in a virtual setting, act as digital replicas of traditional training scenarios. Our digital twinning technology makes the delivery of training more effective and efficient, expanding training capacity without taking away from the quality of the training.

In conclusion, the paper highlights how digital twinning technology can enable companies to improve the overall training experience and produce highly skilled workers, ultimately contributing to the resolution of the pressing issue of worker shortage.





INTRODUCTION

Digital twinning is one of the most significant technological advancements to emerge in recent times. While some of us might be familiar with simulation technologies, and at first glance they may look similar, they are not the same thing. A simulation typically lacks a counterpart in the physical world that is linked to or constructed using data from IoT sensors, digital devices, actual physical equipment, systems, operations, or even human beings. To put it simply, there is no data sharing between the physical object and the digital replica. If a change is made to the physical model, it does not affect the corresponding digital model.

On the other hand, digital twins are distinct in that any modifications made to the physical entity, as well as the data obtained during its operation, are utilized to inform and update the digital replica. This enables users to engage with and examine the studied mechanism, while also contributing to its continuous refinement and evolution, as well as developing predictive models for performance enhancement.

Advanced versions of digital twins utilize real-time data, computer-aided design, machine learning, and AI reasoning to fully synchronize with its physical version.

In today's era where most organizations lack adequate training resources to address the shortage of skilled workers, digital twinning offers a cutting-edge solution that promises a brighter future for every industry. By leveraging digital twinning technology, organizations can elevate their training capabilities and bridge the gap between the demand and supply of skilled workers.

With the help of AI-enhanced digital twin instructors, companies can produce a higher number of skilled, successful employees at faster rates. Digital training allows training capacity to expand past the limits of traditional training by providing 24/7 virtual training that can train a heightened amount of people at one time.

Not only does digital twinning make training more efficient and cost-effective, it does it without losing training quality. By leveraging the expertise and performance data of industry professionals to train AI instructors, companies can provide their employees with top-quality instruction and an unparalleled training experience.

Digital twins provide faster, safer, cheaper, and smarter training solutions that have the power to greatly impact the training capacity issues that many industries face today.

BACKGROUND

Although the term is just being popularized in recent times, digital twin concepts have been around since the 1970's, originating with NASA's Apollo Program¹. NASA was the first to create complete emulations of spacecraft, on Earth, that worked in correlation with spacecraft orbiting Earth or traveling farther into the galaxy. However, NASA utilized identical physical systems locally, rather than

modelling digital replicas, as the technologies were not available yet.

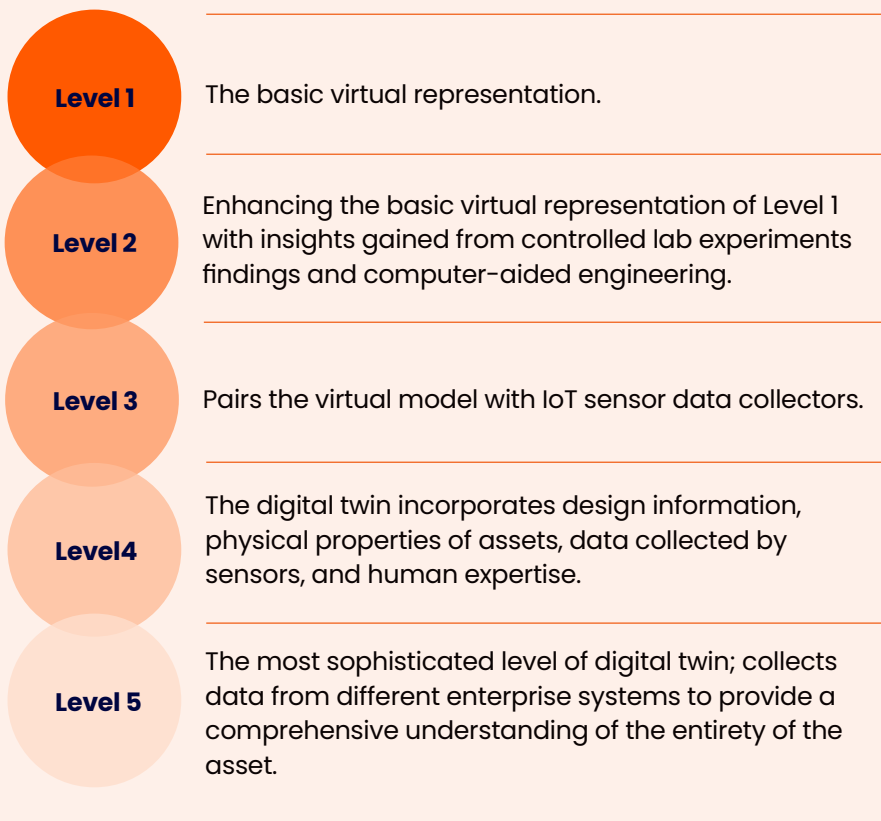
In more modern times, digital twinning can be identified in commonly used functions such as email (digitalization of human communication) and online maps and guidance (digitalization of everyday things).





Looking ahead, digital twinning is poised to play a pivotal role in social media as it represents the digitalization of human connections and networks. Although not a new concept, the evolution of digital twinning technology has unlocked its potential for use in industry training applications.

The key advancement of digital twins is its precise and efficient flow of information. There are five levels, each associated with their own unique data analysis methods:



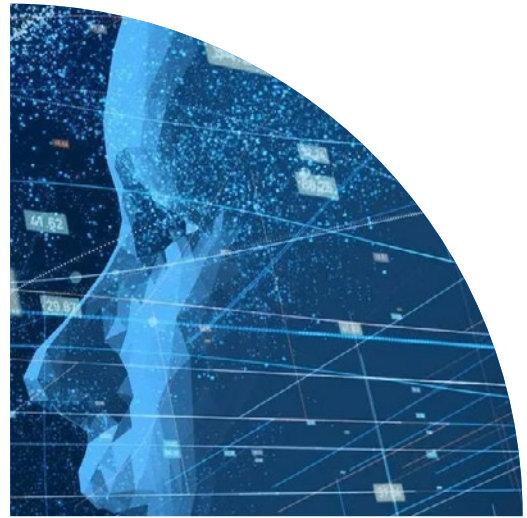
From Level 3 and beyond, the digital twin truly demonstrates its capabilities as IoT sensors and digital devices are strategically placed on the physical system to collect and store data, which is then replicated in the virtual counterpart for study and analysis. This analysis also gives the twinned system the ability to make predictions and insights on the asset's future functionality, which can be applied to the physical version.

By leveraging an AI-enhanced database system, a digital twin has the capability to

generate recommendations for improving performance that can be applied to the corresponding physical system.

Digital twins apply AI technology to improve accuracy and efficiency of real-life processes. This bidirectional, cyclical flow of information allows the physical system to receive continuous improvements for better performance, while the digital twin is able to constantly enhance its own analytical, diagnostic abilities.





AI AVATAR-LED TRAINING: INTRODUCING ILLUMIA LABS

Conversant Chat Bot

Illumia Labs's virtual training platform, Illumia Labs incorporates digital twin technology, enabling us to develop customized virtual tutors and instructors that emulate real-life instructors, facilitating a familiar learning experience for students.

An instance of our AI Avatar is provided for each user, allowing them 24/7 access to an expert level tutor or mentor, much like an apprentice would. Additionally, as a conversant chat bot, it delivers the lessons in a manner that enhances the course content. They are also able to answer all questions fielded by the user, enabling the candidate to achieve a higher level of success, all without the need for human instructor resources. These AI Enhanced Avatar trainers provide students with real-time feedback and assessment in whatever subject they are learning. Our virtual AI trainer collects and uses data in a similar manner to the bidirectional flow of information seen in digital twins.

To enhance the teaching effectiveness of our AI, we meticulously gather the requisite data from real-world phenomena and established

knowledge. Our team of programmers and subject matter experts meticulously curate this data for the digital tutor's learning. Furthermore, we constantly collect behavioural and performance data as the AI trainer engages with students, enabling us to refine and improve its teaching abilities. This data is collected, curated and analyzed and is used in various areas, such as:

- > Improving the methods used for screening and selecting.
- > Developing models to predict student future performance based on student progress.
- > Adapting the AI's teaching strategies to suit the individual student's best learning style.

Our conversational chatbot fosters adaptive learning strategies to enhance the learning experience. The Illumia Labs AI avatar trainers change learning methods based on the student's needs and behavioural patterns. By implementing this practice, not only can training standards be improved, but training time can also be reduced, leading to a faster training output. Ultimately, this contributes to the creation of greater training capacity.





Creating Training Capacity

The accessibility of virtual trainers also serves as a solution to the shortage of instructors available to teach in various industries, particularly aviation.

In Illumia Labs, students have 24/7 access to multiple instances of expert virtual instructors. These virtual instructors have the ability to

provide instant feedback, assessments, corrections, and gather valuable data for both individuals and organizations. This will remove the need for human instructors up to an advanced level of training, thus creating immense capacity for organisations to increase training throughput as well as to allow leadership to focus on higher order training policies.

Training in a virtual environment with AI enhanced, expert level digital twin instructors allow students to have access to efficient, adaptive, and engaging training anytime and anywhere.

AI-Led Action-Based Training

In the aviation courses we offer, our team of aviation experts utilizes IoT sensors to fly the training profiles, thereby developing benchmark flight data at an expert level.

The IoT sensors are physical devices or objects that are embedded with sensors, software, and network connectivity to enable them to collect and exchange data over the internet. The sensor data collected through the physical flight patterns is analyzed and used to sharpen the fidelity and accuracy of the virtual version of the course. This data is used

to train the AI Agent to operate as a virtual instructor, guiding the trainee along all the required flight maneuvers and attainment of skills.

While the student engages in the necessary flight patterns, the AI-enhanced digital twin instructor effectively trains them through flight demonstrations, performance supervision, and coaching of training repetition. This approach effectively develops the trainee's muscle memory. Digital twin technology makes it easier for us to benchmark and relay data from real-life course activity into Illumia Labs.





Addressing a Widening Knowledge Gap

Looming on the horizon is a serious labour shortage in the global skilled workforce, with a widening gap between the number of open job positions and the limited availability of qualified individuals to fill them. The ratio of job vacancies and hireable employees has been trending downwards in various industries including manufacturing, healthcare, and hospitality². The healthcare industry is projected to need 10 million more healthcare workers to meet the needs of the growing population³. The aviation industry as well, is in need of a significant influx in workers, by as much as 480,000 new technicians and 350,000 pilots by 2026⁴.

A major force in this equation is the generational shift⁵ that is occurring as baby boomers make a mass exit into retirement⁴, with not enough young workers qualified to replace them. Those of this older generation, who pioneered and dominated their respective industries, are taking their knowledge with them, leaving behind a widening knowledge gap⁶. Industries are now left in desperate need of bridging this gap and properly educating and training the younger generations⁷.

Digital twinning technology will be a critical component in the complete training life-cycle of the next generation work force the help of AI avatars trained by experts in any desired industry, AI-enhanced digital twin trainers will make effective, efficient, and professional training exceedingly more accessible.

As the AI instructors are available 24/7 and are able to train more students at one time compared to a human instructor, AI avatar-led training maximizes training capacity a great deal. With a greater capacity, companies that utilize AI-enhanced digital twin training will be able to contribute an increased number of skilled workers into the workforce.



Furthermore, by collecting and storing all training data, industry standards, and general knowledge, digital twinning strategies create a virtual hub of knowledge for any organization and industry. This accumulation of information, along with the expertly trained capabilities of AI avatar trainers and AI-enhanced digital twin technology will bridge the gap, providing sustainable modes of knowledge transfer and training.

The digital twin trainers' ability to precisely replicate traditional training processes in the real world results in highly accurate data collection from students. This data is valid for use in meeting accreditation or licensing requirements set by industry regulators.

Student performance information, including procedural efficiency, scores, feedback, and other metrics, can be re-integrated into any sort of learning management system, where it can be applied to the certification process of the future professionals.

Conversational AI, which utilizes avatar-led and action-based instruction, not only effectively builds the skills and knowledge needed for the next generation of workers, but also provides comprehensive training that enables trainees to demonstrate their competency and officially enter the workforce.





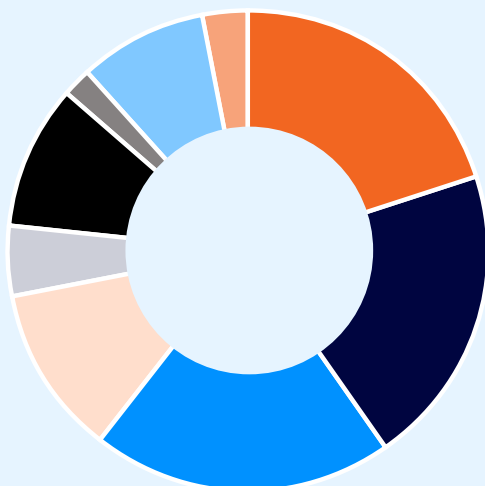
THE CURRENT SITUATION

As the technology behind digital twin continues to advance and gain popularity, the digital twin market is becoming increasingly attractive.

As industries continue to seek innovative ways to stay ahead of the curve, the adoption of digital twinning is becoming increasingly common. With its ability to improve efficiency, increase productivity, and reduce costs, it's

no wonder that more and more organizations are turning to this cutting-edge technology to enhance their methodologies in order to remain competitive.

Industry analysts predict that the market will rise from \$11.51B in 2023 to as much as \$137.67B by 2027, representing a CAGR of 42.6%. In the current rising domination of digital twin technology, the sectors that are predicted to



Global Digital Twin Market Share, By End-User, 2021

- Aerospace & Defence
- Energy & Utilities
- Automotive & Transportation
- Home & Commercial
- Manufacturing
- IT & Telecom
- Healthcare
- Others
- Retail

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be the largest market drivers are healthcare, manufacturing, urban planning, and utilities.

Presently, digital twins are being created for the design, production, and maintenance of high value equipment in these fields, such as airplanes, buildings, windmills, power-generation plants, medical images, and more⁹. The main use of digital twinning today is to improve the processes and operations of these industries through the virtual replication and data collection of physical entities such as previously mentioned.





WHAT THE FUTURE HOLDS

At Illumia Labs, we envision a sustainable future where quality training is accessible to everyone, everywhere in the world.

Utilizing digital twin technology, companies in every industry will be able to address and solve labour shortages and curate and manage a knowledge hub that can ensure knowledge, skills and best practices are retained within the organisation for the benefit of future generations, ensuring future skill-gaps will cease to arise. Illumia Labs is dedicated to empowering both current and future generations of workers by providing accessible, adaptive, and high-quality competency-based training.

Another potential development in the future is the enhancement of human digital twinning¹⁰, where industry leaders are exploring ways to create virtual counterparts of real humans in cyberspace.

This further advancement in digital twinning technology has enriched the operational and training efficiency for various industries, as the human experience can be included in the data collection and analysis process. For example, in virtual training products such as our training platform, Illumia Labs, human digital twins are being formed into virtual, AI-enhanced trainers that are able to provide high quality training in a virtual space.

Our human digital twins benchmark information at an expert level, acting as a key solution in closing the knowledge gap that is driving the worker shortage. Human digital twinning will be a supplement to the training capacity revolution that digital twin technology will facilitate.



CONCLUSION

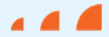
Digital twinning technology has the potential to revolutionize the operational capabilities of any system and process. Through its efficient and precise modes of data collection, analytics, and diagnostics, digital twins are leading the way in creating smart, sustainable mechanisms that will shape the future.

Every industry can benefit from the advantages of this technology by using it to create more qualified and skilled employees, therefore solving the problem of a declining workforce. Digital twinning will make the

training process more efficient and effective, causing the feat of rebuilding the workforce to be an easier mountain to climb.

At Illumia Labs, we have applied digital twin concepts into our digital learning platform. Through Illumia Labs, companies can deliver standardized and effective training, making use of our digital twin data collection and prediction strategies. With this knowledge on the power of digital twinning, we hope to provide the most accurate and adaptable virtual training in the market.





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The logo for illumia labs, featuring the word "illumia" in white and "labs" in orange, with a small orange graphic element above the "i" in "illumia".

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