Research Paper | E-ISSN NO : 2455-295X | VOLUME : 9 | ISSUE : 6 | SPECIAL ISSUE JUNE-2023

DIGITAL TWIN AN TAXONOMIC DESIGN

DR.KEERTHI B S ASSOCIATE PROFESSOR, SCHOOL OF MANAGEMENT, SRI VENKATESWARA GROUP OF INSTITUTIONS.

ABSTRACT:

KEYWORDS:

INTRODUCTION

The digital revolution continuously gives rise to new words that quickly come to be recognized as clichés and iconic phrases. Terms like "cloud computing," "platforms," "big data," "smart cities," "machine learning," "artificial intelligence (of the "weak" variety), and others have been developed in the last ten years to explain recent trends in computation and communication that are accelerating society's automation. The 'digital twin' is the most recent term to be added to this set of clichés. Although it was first used almost 20 years ago, it has only recently gained widespread acceptance as digital infrastructure becomes more and more integrated into our communities, cities, and businesses. This paper might help the reader with the profound knowledge on digital twin technology.

DIGITAL SIMULATION MODEL- A REPLICA

Once informed with such data, the virtual model can be used to run simulations, study performance issues and generate possible improvements, all with the goal of generating valuable insights—which can then be applied back to the original physical object. These sensors capture data on a range of performance indicators of the physical device, including energy output, temperature, surroundings, and more. A digital twin is a virtual model designed to accurately reflect a physical object. A digital twin is a virtual representation of a physical object that is designed to be accurate. Virtual twin is a model which can be used to accurately replicate the physical object. A Digital Twin is a Virtual Representation Model which accurately reproduces the object. These sensors provide data on a variety of physical objects' operational characteristics, including energy output, temperature, environmental conditions, and more (Zhao et al. 2019).

Despite the benefits that digital twins provide, not every company or every product made needs to employ them. Not all objects are intricate enough to require the continuous and intensive influx of sensor data that digital twins demand. Additionally, it is not always advantageous financially to devote a considerable amount of resources to the development of a digital twin.

PROJECTS FROM THE USE OF DIGITAL MODELS:

Projects that are physically large Buildings, bridges, and other complicated structures subject to severe engineering requirements. Mechanically challenging tasks Auto mobiles, jet turbines, and aircraft. Digital twins can aid in the improvement of efficiency in complex machinery and massive engines. Electrical equipment This comprises both power generation and transmission mechanisms.

Projects in manufacturing Digital twins thrive in streamlining process efficiency, as seen in industrial settings with co-functioning machine systems. As a result, the industries that benefit the most from digital twins are those that deal with large-scale products or projects:

- Engineering (systems)
- Automobile manufacturing
- Aircraft production
- Railcar design
- Building construction
- Manufacturing
- Power utilities

While digital twins are currently in use across many industries, the fast increasing digital twin industry suggests that demand for digital twins will continue to rise for some time. The global digital twins market is expected to reach USD 73.5 billion by 2027 in 2022. The use of end-to-end digital twins lets owner/operators reduce equipment downtime while upping production.

APPLICATIONS USED IN DIGITAL TWINS AS COMPREHENSIVELY

POWER-GENERATION EQUIPMENT

Large engines—including jet engines, locomotive engines and power-generation turbines—benefit tremendously from the use of digital twins, especially for helping to establish timeframes for regularly needed maintenance.

STRUCTURES AND THEIR SYSTEMS

Big physical structures, such as large buildings or offshore drilling platforms, can be improved through digital twins, particularly during their design. Also useful in designing the systems operating within those structures, such as HVAC systems. Zhao et al. 2019

MANUFACTURING OPERATIONS

Since digital twins are meant to mirror a product's entire lifecycle, it's not surprising that digital twins have become ubiquitous in all stages of manufacturing (Petrova-Antonova and Ilieva 2019), guiding products from design to finished product, and all steps in between.

HEALTHCARE SERVICES

Just as products can be profiled through the use of digital twins, so can patients receiving healthcare services. The same type system of sensor-generated data can be used to track a variety of health indicators and generate key insights. (Chhetri et al. 2019; Zhang et al. 2019)

AUTOMOTIVE INDUSTRY

Cars represent many types of complex, co-functioning systems, and digital twins are used extensively in auto design, both to improve vehicle performance and increase the efficiency surrounding their production.

URBAN PLANNING

Civil engineers and others involved in urban planning activities are aided significantly by the use of digital twins, which can show 3D and 4D spatial data in real time and also incorporate augmented reality systems into built environments.

FUTURE PERSPECTIVE OF DIGITAL TWIN TECHNOLOGY:

A fundamental change to existing operating models is clearly happening. A digital reinvention is occurring in asset-intensive an industry that is changing operating models in a disruptive way, requiring an integrated physical plus digital view of assets, equipment, facilities and processes. Digital twins are a vital part of that realignment.

The future of digital twins is nearly limitless, due to the fact that increasing amounts of cognitive power are constantly being devoted to their use. So digital twins are constantly learning new skills and capabilities, which means they can continue to generate the insights needed to make products better and processes more efficient.

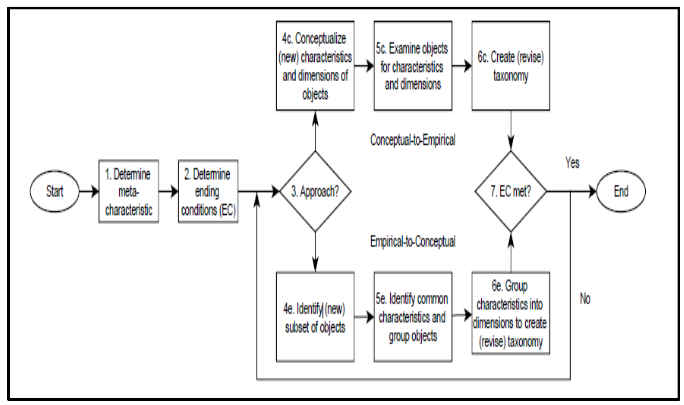
There is little doubt that current operational paradigms are undergoing a major transformation. Asset-intensive businesses are experiencing a disruptive digital reinvention that is redefining operating models and necessitating an integrated physical plus digital view of assets, equipment, buildings, and processes. A crucial component of that realignment is digital twins.

Due to the ongoing allocation of more and more cognitive resources to their utilization, the potential of digital twins is almost endless. Digital twins are able to continue to produce the insights required to improve goods and streamline operations since they are always acquiring new knowledge and abilities.

A growing amount of data is produced as a result of the ongoing advancement of information and communication technology and the development of Internet of Things applications.

Due to their goal of bridging the physical and digital worlds by offering digital representations of tangible items, digital twins provide a possible solution to these problems (Zhao et al. 2019).

It is similar to the idea of having one thing mimic the effects of another in that an identical space capsule was kept on Earth to emulate the behaviour of the capsule in space. However, the spacecraft on Earth was a real, physical object, not a computer simulation. Therefore, this does not explain how a real thing is connected to its digital representation.



A bi-directional data link makes up a typical Digital Twin. It processes data and is connected physically to its analogue in the actual world. A human-machine interaction is present in the digital twin, which is a replica of a physical system that is exact in every way. In addition, we establish that a machine-to-machine interface is as crucial. The Digital Twin handles both unprocessed and preprocessed data and is updated continuously. Despite being advised to develop the Digital Twin before the physical system is in place, it is frequently done after the physical counterpart has been created. It gathers data automatically from a variety of sources. The use of these traits provides guidance for the second Research Objective (RO2) and establishes the framework for classifying the definitions provided by Glaessgen and Stargel (2012). Grieves (2014 & 2017), Tao et al. (2018), Individual definitions clearly match to the most often used qualities. However, there are certain limitations to this study. While we attempted to be as impartial as possible in our research, subjective effects cannot be ruled out. Subjective effects have a role, particularly when determining the meta-characteristic and building the utilized dimensions. Our search was limited to ACM Digital, AIS e-Library, IEEE Xplore, JSTOR, and Science Direct databases. Nonetheless, our taxonomy provides a solid foundation for a deeper understanding of Digital Twins.

CONCLUSION

In conclusion the way we create, manage, and maintain physical systems including structures, infrastructure, and industrial machinery has been revolutionized by digital twin technology. Engineers and operators may model and optimize these systems' performance prior to installation by building a digital duplicate of them, which results in cost savings, increased productivity, and less downtime. In the future, it is anticipated that the usage of digital twins will extend across a variety of sectors, boosting efficiency and enabling more environmentally friendly and productive procedures.

The goal of bridging the physical and digital is to create a seamless integration between the physical world and the digital world. This can be achieved through the use of technology such as sensors, wearables, and connected devices, which can collect data from the physical world and transfer it into the digital world for analysis and interaction. The aim is to provide a more personalized and efficient user experience, and to improve the overall effectiveness of systems and processes. This can be applied to various fields such as healthcare, retail, manufacturing, and transportation.

REFERENCES

1. Bostrom N (2003) Are you living in a computer simulation? Philosophical Quarterly 53: 243–255.

2. Basso, B., Antle, J., (2020). Digital agriculture to design sustainable agricultural systems. Nat. Sustain. 3 (4), 254–256. https://doi.org/10.1038/s41893-020-0510-0. ISSN 2398-9629.

3. Chhetri, S. R., Faezi, S., Canedo, A., and Faruque, M. A. A. (2019). "QUILT," in Proceedings of the International Conference on Internet of Things Design and Implementation - IoTDI '19, O.Landsiedel and K. Nahrstedt (eds.), Montreal, Canada, New York, USA: ACM Press, pp. 237-248.

4. Digital_Twin_White_Paper_Dr_Grieves.pdf (2002, accessed 3 August 2018).

5. Kurth, R., Tehel, R., P¨aßler, T., Putz, M., Wehmeyer, K., Kraft, C., Schwarze, H., 2019. Forming 4.0: Smart machine components applied as a hybrid plain bearing and a tool clamping system. Procedia Manuf. 27, 65–71.

6. Lohtander, M., Garcia, E., Lanz, M., Volotinen, J., Ratava, J., Kaakkunen, J., 2018. Micro Manufacturing Unit - Creating Digital Twin Objects with Common Engineering Software. In: Procedia Manufacturing, vol. 17. Elsevier B.V., pp. 468–475.

7. Petrova-Antonova, D., and Ilieva, S. 2019. "Methodological Framework for Digital Transition and Performance Assessment of Smart Cities," in 2019 4th International Conference on Smart and Sustainable Technologies (SpliTech), Split, Croatia: FESB, University of Split, pp. 1-6.

8. Zhao, G., Cao, X., Xiao, W., Zhu, Y., and Cheng, K. 2019. "Digital Twin for NC Machining Using Complete Process Information Expressed by STEP-NC Standard," in Proceedings of the 2019 4th International Conference on Automation, Control and Robotics Engineering - CACRE2019, New York, USA: ACM Press, pp. 1-6.