# DIGITAL TWINS: FROM PHYSICAL TO VIRTUAL REALITY

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***Abstract:*** *Industrial companies are realizing that for development they require to develop innovative new business models, optimize their operations, improve lagging productivity. connectivity with ubiquitous network, affordable data storage and analytics, computing, and Sensor capabilities are creating opportunities for companies so that they can collect their data and connect their assets. Progress in machine learning, analytics, models is building more chances for better insights. But ,there many industrial companies operating without a platform, underestimate the complexity of connecting the physical and digital worlds, operating without any proper approach or methodology . There is a need of a new way for building apps that can be optimized for understanding physical assets .Digital twins is a technology that build the bridge from the physical world to the digital world by providing understanding of each unique asset over time.* .

***Key Words:*** *Ubiquitous, Innovative, Analytics, Insights.*

## 1. INTRODUCTION:

The digital-twin is a concept that is based on three things. These are-A real space where a physical product exist ,A virtual space where a virtual product exist, the connection of information and data that ties the real and virtual products together.

## 2. CONCEPT OF DIGITAL TWIN:

The Concept of Digital Twin model is shown in Figure 1. This model contains three main parts: 1) Existence of physical products in Real Space, b) Existence of virtual products in Virtual Space, and c) the connections of information and data that ties the real and virtual products together. By using the concept of digital twins it is possible to create lightweight versions of the virtual model. So these light-weight models permits simulation products to simulate and visualize complex systems in real-time:-

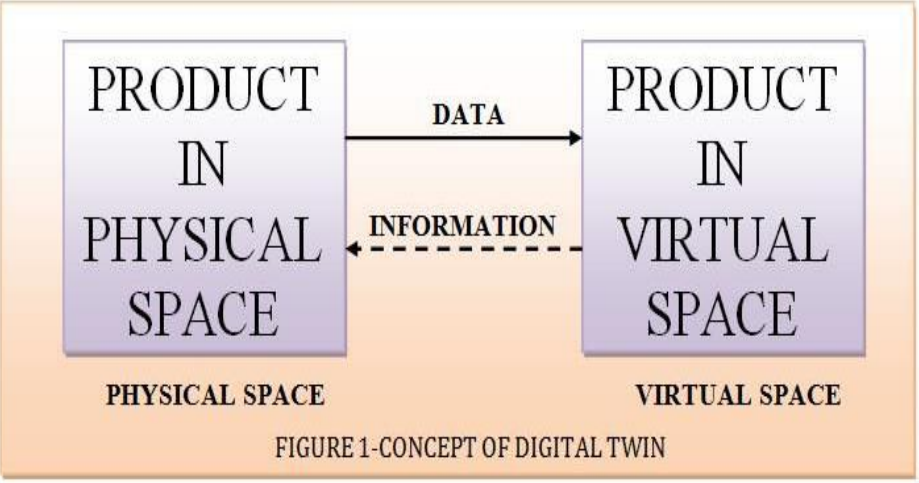


FIGURE 1-CONCEPT OF DIGITAL TWIN

## 3. REQUIREMENTS FOR DIGITAL TWIN:

For connecting the physical and virtual products, one possible way is to have a Unified Repository that will help to link the two products together.[1] In this way, Both tools for physical collection and tools for virtual development would populate the Unified Repository. This would help to enable the two-way connection between physical and the virtual product. On the virtual tool side, one can identify these characteristics like torque requirements, measurements for hardness, dimensions, tolerances etc., and place a tag that will be unique in the virtual model which would act as a placeholder of data for the physical product that actually exist. [2]These tags can be used to create the Unique Repository. [3]In this way a model with lightweight can be created with the help of tags and characteristics of tags and geometrical location can also be created.[4] On the physical side, all of these tags can be incorporated into the manufacturing execution system in the Process creation's Bill at the process step where they will

be captured.[5] Whenever the processes will completed, the manufacturing execution system will produce the captured characteristic to the Unique Repository.[6] The finishing step will be to incorporate this into the factory simulation. This will turn the simulation of factory into a replication of factory application. Instead of simulating what should be going on in the factory, the application will be replicate what actually was going on in the factory at each step on each product. [7]The application of factory replication will be in constant communication with the Unique Repository, by picking up the latest data from real production and displaying this data in the virtual factory.[8] In this way users will be able to see what actually was going on in the factory and view the characteristics of actual product.

## 4. USE CASES OF DIGITAL TWIN:

There are various use cases of Digital Twin. The capability of digital twin supports three powerful tools of tool kit of the human knowledge. [9] The name of these three tools are: A. Conceptualization, B. Comparison, and C. Collaboration-:

**A. Conceptualization**: Humans do not process information like computers. But, they conceptualize the problem by looking at a situation. Humans can conceptualize the situation and take in all the data about the situation in which they are interested by seeing in their mind's eye from various aspects. While humans can do the same by just looking at various reports, number tables and other type of symbolic information .In this whole process their highest bandwidth and most powerful input device is their visual sight. What presently going on is that they take visual information and reduce the information to symbols of letters and numbers, after that they re-conceptualize it visually. [10]In this process, we lose lots of information due to introduction of inefficiencies in time. The capability of digital twin permits to eliminate the steps directly which are not efficient .By decreasing the information and translating it from the visual information to symbolic information after that back all this to visually conceptual information and check the situation .With the help of digital twin a common perspective can be build. One can check both the virtual product information and physical product information, simultaneously. Instead of looking at a report of factory performance By looking at simulations of digital twin one can see the progress of the physical product like where it is moving and information about the physical product characteristics. One can see the actual trend lines and the products in the virtual factory. One can select tagged products and see the actual parameters and designed parameters simultaneously.

**B. Comparison:** The another tool that is used by humans for determine situations is comparison. Comparison is used for determining the difference between desired and actual results. After that we tries to eliminate that difference. Comparison is a powerful and intellectual tools. When we have completely different physical product information and virtual product information, then we still can do comparison. But, it is inefficient, because we have to look at information of the physical product and then we have to find the information of corresponding virtual product and we tries to work on the differences. With the help of digital twin model, one can view the various ideal characteristic like tolerance for the ideal measurement, the type and range of products to determine where we want to be. With the help of digital twin model we can set ideal and actual trend lines. Digital twin model also permits us to make the comparisons and adjust the operations of future.

**C. Collaboration:** In order to bring more intelligence the third powerful tool that is used by humans is collaboration with each other with better problem solving, innovation to situations and more variability of perspectives. A shared conceptualization is offered by digital twin model. With the help of digital twin, one can look at any type of physical product at any type of stage in the factory and we can extend capability of virtual products across multiple factories. In this way individuals can monitor how their factory is doing against other factories of the world. By using this concept it become easier to identify one factory and to control not only in that factory, but the solution related to any problem can immediately be implemented and transferred in all other factories across the globe. By using digital twin concept, same virtual window can be used for associating everyone with not only one but with other factories across globe also. With the help of digital twin we can see the actual characteristics, the various achieved key characteristics, and the gap between the actual and desired.

## 5. ACKNOWLEDGEMENT:

During this research paper, I have put my best efforts for completing this research paper. I hope that this research paper will be helpful for the future authors who want to do further research related to Digital Twin.

## 6. CONCLUSION:

This is extremely powerful concept of digital twin capability which has conceptualization, comparison, and collaboration capability that frees us from the realm of physical world and we can switch to realm of virtual world where physical location is not relevant and there is a common visualization for humans across the globe, those are engaged in comparisons and identifies the difference between actual and desired results, and collaborate together. In future, the concept of digital twin will become more helpful for humans.

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