International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 04 | April - 2023 Impact Factor: 8.176 ISSN: 2582-3930

Implementation of Digital Twin in Construction Industry.

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Abstract - The idea of digital twins, which are virtual representations of physical assets, systems, and processes, has found favor in the construction sector. By giving real-time information on project status, spotting possible issues, and streamlining construction procedures, digital twins provide a valuable tool for managing complicated construction projects. This essay examines the advantages and drawbacks of using digital twin technology in the building sector. The study emphasizes the value of data management, the requirement for experienced employees to manage and maintain the digital twin, and the integration of various data sources. The report also analyses how digital twins have the potential to revolutionize the construction sector by better project delivery, increasing safety, and lowering costs.

Key Words: Virtual Replica, Digital Twin, Real-Time information Optimization, Data Management, BIM.

1.Introduction

A Digital twin is a representation or digital copy of an object, person, process, system, device, or location. Digital twin technology can be used to copy a variety of objects, including humans, cars, and aeroplane engines. The virtual representation or digital duplicate of a building model created by a construction business is known as the "digital twin" of the actual building. Construction is one of the most information-intensive businesses, thus information must be easily accessible, precise, full, timely, and presented in a way that the recipient can understand it. The whole project lifespan of a construction project, from conceptual planning through decommissioning, generates enormous amounts of data. The success of the construction project relies greatly on the management of flow of information and the ability to process the sheer volume of data and extract relevant insights.

2. Digital Twin

- Due to the volume or complexity of newly completed building projects increasing, operational safety and daily management effectiveness are becoming more crucial than ever.
- Difficulties result from both static and dynamic factors: huge public buildings frequently have hundreds of rooms, each with specific use requirements.
- Managing precisely is a tricky puzzle to solve.

Additionally, there are several embedded mechanical and electrical systems, including ventilation, air conditioning, lighting, weak current, water supply and drainage, and lift systems.

- Even for experienced workers, to repair and maintain these systems is not far from tedious. The main challenge is managing the people in the house the most probability factor of all, such as visitor behaviors or staff collaboration for different tasks.
- For Example, Hospital buildings have not only common difficulties as public buildings but also have unique characteristics of the medical industry. There are unique systems in hospitals such as the medical sewage system, medical gas system, pneumatic logistics system, etc. There should be a hospital space which should strictly divided into public, medicine, clinical, surgery areas, and other special technical regions.
- BIM (Building Information Modelling) is one of the most advanced and promising theories when it comes to managing problems with huge hospital facilities. Facility managers can retrieve, examine, and process different types of data using a unified software interface with the help of BIM, which offers a graphic platform with 3D building entities. BIM-based facilities management, energy management, and safety management have all had some documented success.

3.Building information Modelling

Despite BIM's successes, there are still three key issues with building operation management, particularly for major hospital buildings:

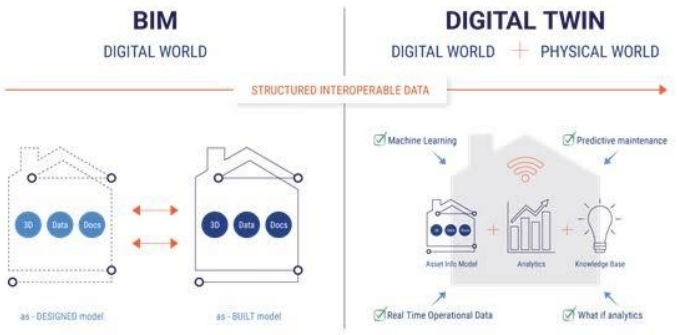
1. Real-world building displays that are continuously updated are absent from current software platforms. For instance, a sudden influx of individuals at a hospital's entrance is risky and needs to be notified right once. On existing platforms, the majority of the building data is pre-imported and then left alone. Managers are unable to view the most current status as they see fit.

2. The collection of digital data from multiple sources still presents challenges. There are around 20 systems in a hospital that could be sources of dynamic data. Hardware components, user interfaces, and data formats vary from system to system. Additionally, sensor data might amass quite quickly. Data transformation techniques and the storage of such a large volume of data both require improvement.

3. Typical BIM solutions don't focus on mass analysis, but rather on exploring or verifying business data using a 3D model. To close this gap, adopting an offline database analysis would be inefficient in terms of timely feedback methods. Advanced data analysis work is therefore needed to provide timely decision-making recommendations.

Difference between BIM and Digital Technology

The key distinction between Digital Twin and BIM is that whereas BIM is used for design and construction visualization rather than operations and maintenance, Digital Twin concentrates on how humans interact with built environments.



Objectives:

- To Integrate Real-Time data from built asset with its Digital Representation to create insights across the Project Life cycle.
- To enable more effective design and research.
- To create simulations that can find and predict how actually the product or process will work.

A virtual representation of the facility that is now under construction is called a "construction digital twin." (as shown in Figure).

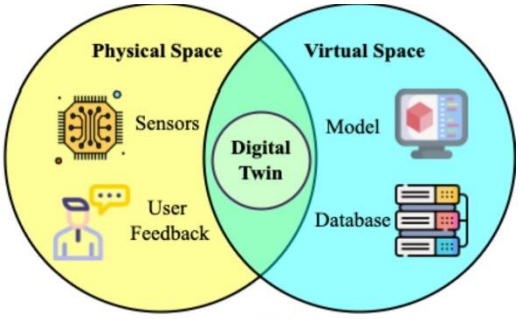


Figure 1 Digital Twin Paradigm

The idea of a Construction Digital Twin was made possible by earlier studies that analyzed and emphasized the difficulties and requirements for the varied BIM applications during the construction stage.

Studies have also shown how useful digital twins could be for tracking construction progress.

Framework:

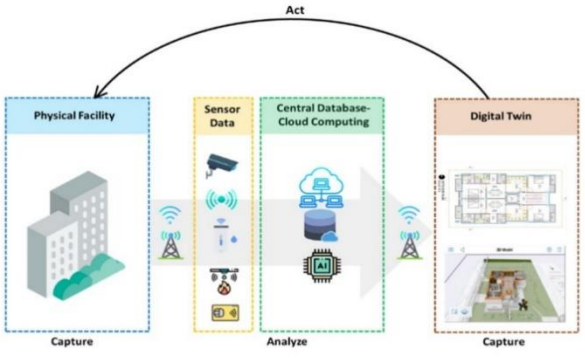
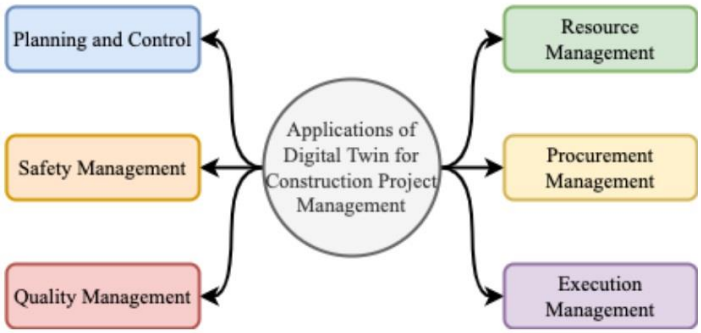


Figure 2: Framework for the implementation of Digital Twin in construction

Classifying Digital in Construction Management:

This article uses the widely used PMI-PMBOK project management framework to categorize the potential applications of digital twin for construction project management. (shown in Figure)



The PMBOK framework, which encompasses all the crucial procedures needed for building under the following six categories, was created with assistance from several project management experts. The following subsections discuss the corresponding applications.

Conclusion:

Digital twin technology has a significant potential to make it possible for building processes to be digitalized, which is becoming important for effective project management. The cost of creating digital twins has been coming down as technology advances. They are anticipated to become a widely utilized tool for project management and scheduling building projects. Making correct and timely judgements can be made easier with the use of a digital twin for construction management. They offer the following benefits:

1. Improved Productivity and Collaboration

2. Optimized Asset Performance and Sustainability

3. Performing Simulation and Scenario analysis

4. Real-time Data Management

5. Enhanced Operational Performance

6. Efficient Supply and Demand Chain

7. Reduced Construction and Operational costs

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