Review Paper on Digitalization of The Built Environment In India And Complementary Technologies

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Abstract- *Digitalization can connect communities and structures throughout their lifecycles. Transformational for democratization and carbon reduction the transition from the industrial to the information ages is already taking place. India's distinct regional context must be taken into account to maximize the benefits of digitization. Digitalization can be revolutionary in achieving decarbonization and democratization by connecting structures and communities throughout their lifecycles. The transition from the industrial to the information ages is already taking place. India's distinct regional context must be taken into account to maximize the benefits of digitization. The pandemic has effortlessly destroyed daily life, including the ways in which we work, commute, communicate, live, and use structures. As a result of the digital network, there is now some semblance of normalcy instead of a complete socioeconomic collapse. We can now move from isolation to inclusion thanks to digital technology. During the COVID lockdown, information technology (IT) was used by 94% of micro, small, and medium-sized businesses (MSMEs).*

Keywords- Digitalization economic, building lifecycle, building management systems.

I. INTRODUCTION

Digitization is the process of gathering data from smart devices at various frequency and granularity levels. The appropriate volume and velocity, for instance from advanced metering infrastructure, charging stations for electric vehicles, renewable energy production, weather stations, etc., complemented with occupant feedback/surveys.

Digital transformation, or the ability to derive information through analysis, visualization, and actionability, such as benchmarking and anomaly detection to promote energy efficiency or decarbonize the energy sector.

The democratization of digital access to equally unlock social and commercial benefits, notably in India's informal and fragmented construction industry. This could open up prospects for upskilling while also seamlessly ensuring income and livelihood improvement, for example, through mobile-based cash transactions for services (skilled/semi-skilled) accessed.

II. CYBER-PHYSICAL COMPLEMENTARY TECHNOLOGIES

These are some of the cyber-physical complementary technologies used in construction industry: -

2.1 Drone Technology

Drones. You've observed them and got to hear about them everywhere. Drones have a wide range of uses, including in the field of building, whether flying through a room or recording unusual aerial imagery. Drones have emerged as one of the most alluring building innovations in recent years. Drone use in the industry has increased by 239% year over year, more than in any other business sector. They are a useful tool with advantages ranging from remote monitoring to on-site safety thanks to their aerial vantage point and data gathering capabilities. The advantages of drone technology have particularly transformed the whole project life cycle, from project idea to project closeout. Drone photography is used to scope out projects, monitor construction progress, and deliver real-time information. Drone use in construction will increase dramatically as the sector develops and projects get more complicated. Continue reading to find out more about how these cutting-edge gadgets are changing business.

2.2 **Autonomous Vehicles**

However, the use of autonomous cars in the construction sector is unlikely to encounter quite the same amount of restriction and is set for widespread acceptance in the near future. The first commercial uses of this technology are being seen in 2018, with San Francisco-based Built Robotics having introduced their autonomous track loader

(ATL) in October 2017. Caterpillar has moreover already installed more than 100 autonomous haul vehicles in mines all across the world. ATLs and other autonomous vehicles on construction sites are able to do various straightforward but time-consuming or hazardous activities like foundation hole drilling by utilising a combination of LIDAR sensors, inertial measurement units (IMUs), and global positioning system (GPS) technologies.ATLs and other autonomous vehicles will first be employed to complete relatively straightforward jobs; more difficult operations, including excavating around underground power wires or truck loading, would require human interaction. Although there may be less need for human involvement as technology's capabilities advance.

2.3 **3D Laser Scanning**

The use of lasers to capture and quantify precise features and dimensions of any physical item or activity is known as 3D laser scanning. As 3D laser scanning accurately locates and gathers data on the physical features, it may also be utilised for documentation and inspection of existing buildings.

The modern technology is currently being utilised by the building business. The time has changed, and we are now assisting our clients in maximising efficiency and streamlining the building and construction process by using modern technology. You may increase accuracy, data quality, and the efficiency of your present operations by using 3D laser scanners and laser scanning technologies to digitise real-world data quickly and accurately.

2.4 **Radio Tracking Devices in Operation**

A stationary sensor receiver, one or more transmitter marker tags on one or more objects to be tracked inside a capture zone, at least one stationary reference tag transmitter, and a processing system for processing the received signals make up a radio frequency (RF) motion capture system. Each tag sends out a short burst of spread-spectrum RF waves. A general sync code and a tag-specific identifying code are both included in the sent signals. The processing system can precisely detect the location of each tag as it goes through the capture zone without the requirement to synchronise clocks between sensors and tags by computing double differences of pseudo ranges. The technique is suitable for moving RF matches.

2.5 **Geographic Information System (GIS)**

GIS, or geographic information system, is a tool for analysing and displaying geographically referenced data that integrates data, technology, software, and GPS. A data processing system called a geographic information system (GIS) may gather, examine, and show geographic data. Civil engineering has advanced significantly. Geographic information systems are one sort of technology that helps contemporary civil engineers (GIS). Engineers may gather and evaluate geographic data using GIS. Digital geographic maps may then be used to visualize the data in layered fashion. Software called a GIS (geographic information system) analysis, records, and modifies geographic data so that it may be displayed in relation to other data. It may be used in many different industries to gather data on everything from logistics to the environment.

2.6 **Automated Pre-Fabrication**

Prefabrication is the process of creating structures or its parts away from the actual construction site. Construction firms will move the finished structure to its destination, where they will finish setting it up and handing over the buildings to their new owners. Because off-site built pieces produce less waste than typical building materials, this approach removes the need for them. Prefabrication lowers the cost of labour and materials since the raw materials are constructed off-site and transported partially completed.Prefabrication is controversial since it was once a low-mass development technique. In the building business, prefabrication is becoming more and more important, although it is more important in commercial construction. However, because prefabricated concrete and steel parts are produced in large quantities and then transported to construction sites, civil engineers employ prefabrication the most.

2.7 **Predictive Maintenance**

In order to predict when an asset failure will occur, predictive maintenance (PdM), a proactive maintenance approach, employs real-time asset data (gathered through sensors), past performance data, and sophisticated analytics. Predictive maintenance software uses data gathered by condition-monitoring equipment during normal operation to compare real-time data against known measures and forecast asset failure. These sophisticated formulae are referred to as algorithms. Innovative technology, like artificial intelligence and machine learning, may also be used in advanced PdM procedures (AI). Because of PdM, maintenance tasks may be planned and completed with little downtime before an asset is anticipated to fail.

2.8 **Automation andRobotics in Construction**

Traditional building techniques are all known to be labour-intensive and carried out in extremely tumultuous and hazardous settings. Additionally, issues with the erratic labour force supply and rising labour prices continue to crop up every day in the construction sector. Engineers have thus added automation and robotics to their building sites to reduce reliance on people and boost productivity.The automation of the design process, computer-aided design, construction scheduling, project management, cost estimating, planning, etc., as well as other aspects of construction are now commonplace.Robotics and automation have a lot of potential in the construction industry. The whole construction life cycle, from the initial design through building maintenance and control to final building disassembly or demolition, might be touched upon. But from one building phase to another, there are big differences in how much automation and robotics systems are used.

2.9**3D Printing (On Site/Off Site)**

When businesses or projects use computer-controlled procedures to progressively layer materials to form three-dimensional objects, this is known as 3D printing in the construction industry. 3D printers can be used to produce components off-site for later assembly or to build whole buildings on-site. The printer produces the construction on a platform using materials like cement, plastic, or liquid metals after receiving dimensions from a software programme. With the help of a machine that builds and assembles buildings, 3D printing in construction has the potential to replace certain manual labour. This may be a more economical, practical, and ecologically responsible method of building new structures. You may determine whether the technology might help you boost client happiness and expedite operations by learning about the advantages of 3D printing in the construction industry.

2.10 **Augmented Reality**

Augmented reality (AR) has shown its worth in several industries and shown that it can be used for purposes other than gaming and entertainment. As a result, a 77% CAGR is anticipated for the AR/VR industry from 2019 to 2023. With the use of augmented reality, retailers are improving the online buying experience by letting customers see what a product (such a piece of furniture or appliance) would look like in their own space. AR is being utilised in the medical field to mimic surgeries or see organs. To increase accuracy and results, surgeons can utilise augmented reality to show 3D images of a patient's anatomy.AR is also creating a stir in the building sector. When used effectively, augmented reality may increase your chances of winning contracts, foster teamwork, and even increase safety. Understanding the capabilities and use cases of augmented reality is essential for utilizing it in the construction industry. And this is the subject that will be covered in this post. You may read more about the present and potential uses of augmented reality in building below. Additionally, you'll witness instances of businesses utilizing augmented reality, giving your ideas for your own initiatives.

III. BENEFITS OF DIGITALIZATION

Through value creation that is unlike anything else and gives stakeholders more influence, digital transformation helps the built environment become more democratic and low-carbon.

By addressing the next level of intelligence made available by information and communications technologies including sensors, connected devices, networks, and data analytics, digitalization co-creates solutions for a zero-carbon future.On a practical level, this improves benchmarking, benefits of savings persistence and grid, capital purchase options, and opens up new markets and financing options. For instance, it is predicted that 8.8 billion metric tonnes of CO_2 emissions in the energy industry might be avoided by 2025, adding $418 billion in additional economic value.

IV. CONCLUSIONS

By 2050, we want to have a built environment that is zero carbon in order to promote equitable wellness and resilience.

Zero carbon equates to zero energy and zero emissions. To enable short-term early wins (2022-2025), medium-term (2025-2035), and longer-term routes, the following section outlines 10 major proposals along the three drives, Decarbonize, Democratize, and Digitalize (2035-2050). To realize the transformative vision, each stakeholder can set and direct short-, medium-, and long-term objectives utilizing their respective levers of influence: R&D, technology, human capital, regulatory/policy, and economic investment.

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