Research on the Application of AI Artificial Intelligence Technology in Intelligent Buildings

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Abstract: *This study aims to reveal the application of artificial intelligence, and determine the opportunities and challenges of artificial intelligence application in the construction industry, and proposes the design of applying artificial intelligence technology, which provides a research basis for future smart city design and development. Additionally, AI applications in construction are pointed to in this study, and the study provides insights into key applications of AI for construction-specific challenges.*

Keywords: *Artificial intelligence; Intelligent building; Construction industry; Opportunities and challenges*

1. Introduction

Artificial intelligence (AI) is one of the most important artificial intelligence technologies, the adoption of which can help increase automation and provide better competitive advantages [1]. The construction industry, one of the least digitized industries in the world, faces many challenges that hinder its growth compared to other industries such as manufacturing [2]. The main idea of a smart city system is to create an information space containing working data of controlled objects (thermoelectric counters, elevators, electronic equipment, technical safety equipment, etc.) [3]. "Smart cities" are innovations in organizing economics (various forms of cooperation between governments, governments, private construction companies and public organizations) and finance (financial models in digital services). Its main fields are mechatronics, information technology, software and telecommunications, personalizing the production and consumption of resources, facilitating the process of intellectualist management of all spheres of life, including the development of "smart cities" and "smart buildings". The development goals of smart cities and smart buildings are sustainability and energy efficiency. The modern scientific concept of smart city development is closely connected with the development of digital economy, Internet, digitization and biotechnology, and the deep integration of virtual space and urban environment. The development of building technology, housing, engineering and transportation infrastructure has blurred the boundaries between urban and rural quality of life, and the term "smart city" is now applied not only to cities but also to administrative areas, but in "smart cities" "Smart Buildings".

2. Application of artificial intelligence in construction industry

2.1. Application trends of artificial intelligence

More than 60% of the research on the application of artificial intelligence in the field of construction was completed in the past ten years [4]. In the construction industry, IoT is already being combined with artificial intelligence in many ways. Since the concept of "comfortable working and living" requires different characteristics from different consumers, it is necessary to provide flexible housing systems, digitization, thereby developing the concept of "smart city", unifying smart buildings into "smart buildings", and Meets energy efficiency and environmental standards.

Modern architectural trends not only establish individual housing needs, satisfying production and social functions, but also establish a comfortable living environment for self-realization as an individual's development. This requires a rethinking of approaches to planning, design and construction goals, with an emphasis on meeting the diverse and changing requirements of buildings and buildings, their masterplans, their environment and their aesthetic character. For example, the Fourth Industrial

Revolution has brought about significant process improvements, cost efficiencies, reduced production times, improved safety, and helped companies achieve their sustainability goals. However, despite the challenges of AI, the construction industry has yet to reap any significant benefits from AI.

The current situation of the construction industry, the availability of housing, information technology and communication and the analysis of the criteria for compliance with the "Smart City" are analyzed. It is understood that the development of technology and artificial intelligence technology, modern methods of construction, automation and management of property facilities, can guarantee the development of the territory with the standards of "smart buildings" and "smart cities". Urban environment, "smart buildings" at the level of quality of life indicators as elements of "smart cities". Here's an intelligent building classifier that evaluates a building's level of intelligence based on its knowledge cost. The cost of improving the intelligence and energy efficiency of residential buildings is assessed. Whether it's a single-room home or a multi-story apartment building, the cost of energy efficiency is not paid back over the lifetime of the systems and equipment. Reducing energy and water consumption guarantees neither a reasonable economic cost nor a return on state subsidy tariffs.

2.2. Future opportunities of artificial intelligence

In order to develop artificial intelligence technology, with the development of capital construction market relations and the development of competitive relations, it is necessary to develop methods for evaluating the competitiveness of construction organizations [5]. The position determination in the construction construction business ranking shows competitive strengths and weaknesses and allows effective management decisions and formulation of construction business development strategies. It is impossible to develop construction organization, introduce new technologies, use new building materials, expand industry, because the only factor that determines competitiveness is price. The price index is no longer a decisive characteristic of the contractor selected by the contractor to perform the task. Among other things, the client evaluated the management, financial, organizational and technical characteristics of the construction business. From the application areas, current status and future potential opportunities of artificial intelligence in the construction industry, subfields are identified with relevant latest applications and potential opportunities for construction-specific issues, under value-driven services, evaluation and scheduling, construction site analysis, Create job opportunies. Intelligent buildings that will supply power, heating, hot water, cooling, ventilation, fire protection, fire extinguishing and monitoring of strain status, information control and communication, control and management of auxiliary services, system monitoring and management of intelligent building structures.

Architecture and BIM technology are key. Digital transformation includes not only the use of new mobile digital technologies, but also the process of transforming an organization into a new way of thinking and working. This shift includes a change in management style, adopting new business models to improve the organization's building techniques and quality. Resource and waste optimization. Due to continuous and rapid development, more and more construction and demolition waste is generated every year. These construction activities have adverse impacts on the environment, nature and human resources across the globe. Therefore, the construction of "smart buildings" as elements, the present economic conditions can be seen as increasing the comfort of the knowledge environment and calling for cost reduction. Reducing the resources consumed by homes and cities does not provide economic benefits for buildings, systems and equipment. AI technologies allow for more efficient use of resources, more efficient organization of public services, waste disposal and reduction of accidents. Simultaneously increased costs and energy savings that are currently not paid for over the regulatory period of a single equipment service should be considered costs of creating comfort and environmental conditions. Construction site analysis. The development direction of the population center is "smart city". The level of development of a "smart city" is determined by a series of indicators covering all aspects of human life, including energy, housing, telecommunications, water supply, and roads and other urban environmental areas. From an economic point of view, urban environments require increased capital costs to implement efficiencies, automation and management. The higher the knowledge level of a building, the more expensive it will be to build it. Smart cities should aim at a new quality of life. Efficiency at the detached house level is mainly determined by energy savings, heat and electricity, and water consumption savings. Visualized data and predictive analytics for active project control on construction sites provide the rationale. In operation, smart cities cost less than maintaining utility networks and city housing funds. The continuous development of artificial intelligence technology, construction technology, equipment performance improvement, as well as automation system efficiency is aimed at dealing with the problem of paying for individual buildings

and cities.

3. Challenges and opportunities for the application of artificial intelligence in the construction industry

To further strengthen knowledge in this area, key challenges must be identified and discussed. Emerging trends, challenges, and openings for artificial intelligence in the construction industry.

3.1. Intelligent buildings improve the quality of life

As we all know, the construction industry is one of the least digitized industries. In the field of construction, innovative technologies represented by digital technology, green technology and Internet technology have produced major changes to different national economies and the overall construction industry. Disposing of waste is very important when digital technology is used, resources such as heat, electricity, water are used efficiently to reduce damage to nature, new "green technologies" include installing solar cells instead of heating which produces harmful emissions device. Reduce emissions, waste generation, natural resources and environmental benefits, improve the quality of human living environment, reduce the operating costs of construction enterprises, and improve the efficiency of resource use in construction enterprises and organizations. The competitive advantage in meeting the specific needs of customers is not only reflected in the high-value features of construction products, but also at the level of production organization. However, it is not noted that the methods used are limited. This is a special focus on the economics, management and consumers of construction business competitiveness. This implies a close link between economic, organizational and technical indicators governing the competitiveness of consumers and building construction companies. This in turn drives management decisions with the goal of achieving the objectives within the stipulated time and at the lowest possible cost. Competition in the construction market arises when a large number of products with similar consumer characteristics are available. Through the improvement of production technology and technology, the use of scientific and technological achievements and modern construction technology, reduce production costs, thereby improving production quality.

3.2. Intelligent buildings improve work safety

Despite AI's ability to enhance security and detect intrusions, the bottom line is that the safety of construction workers could be compromised. When the expansion of economic growth is slowed by the increase in construction jobs through artificial intelligence technologies, the key focus of the development is to improve the efficiency of the construction industry process. In the local market, the introduction of artificial intelligence has seen greater implementation in building smart homes. Furthermore, further research is needed in this area, especially in technologies emerging in architectural research, such as computer vision and robotics. The existence of "intelligent building" systems must be considered within the context and scope of the theory of reliability of technical systems. But the development of artificial intelligence technology and control systems has increased the complexity and maintenance difficulties of buildings. A global infrastructure for smart buildings by establishing connections between physical or virtual things based on existing and developing compatible artificial intelligence technologies. The use of ICT in the construction business is to help executives achieve their goals. Construction sites are mostly remote and lack electricity, telecommunications and internet connectivity. At the heart of the idea of building automated buildings is the need to manage both the environment and the users, because without intervention, situations can spiral out of control and unacceptable conditions can emerge. In smart buildings, technology is used to serve users rather than dominate them. This approach is very different from what was done in the beginning of "smart buildings", when the most "smart" buildings were considered the most advanced.

3.3. Working capital of intelligent buildings

With the development of artificial intelligence technology, many organizations have the opportunity to system and automate construction enterprises, which is one of the most important tasks to be automated using ICT. Consider using artificial intelligence technology to control receivables as one of the criteria for evaluating the competitiveness of construction business entities. Receivables control algorithm provided by artificial intelligence technology Therefore, the main task of managing this asset can be called automatic arrangement of financial monitoring customer payment discipline, using

artificial intelligence technology to improve the competitiveness of construction enterprises to increase the speed of rotation. Major breakthroughs have been made in the development of artificial intelligence technologies, including construction, education and educational technology, enabling the automation of many processes to improve the quality and efficiency of work. In this regard, fewer resources can be used, thereby reducing costs and increasing the speed of work. In addition, technology can easily store more information while maintaining integrity. Information is immediately available when needed, can be analyzed, not only past trends can be studied but also future trends can be predicted and can aid in the decision-making process. Improve the competitiveness of construction enterprises by increasing the recovery speed of working capital. This technique is a practical material used by organizations and has been tested in existing construction enterprises. With the introduction of controlling accounts receivable, construction businesses gain a managed production process that controls working capital, thus maintaining current payment discipline. All measures to control the collection of accounts receivable are aimed at minimizing costs and increasing the company's competitive advantage. The use of artificial intelligence technology in construction business accounting organizations is to help managers achieve their goals. Many construction companies face the problem of receivables with long-term working capital. The main challenge is to manage funds through information technology and improve the competitiveness of construction companies by improving the return on working capital. The technology is material for practical application by organizations and has been tested after implementing ICT for receivables control in existing construction businesses. All receivables control activities are focused on reducing costs and improving the company's competitive advantage.

4. Conclusion

As an innovative way to increase productivity and solve challenges, AI is expected to have a huge impact on the way of work of multiple industries. The construction industry faces productivity problems and myriad other challenges that could potentially be solved by AI. As more data is generated during the life cycle of buildings and other digital technologies become available, AI has the ability to leverage this data and the capabilities of leveraging other technologies to improve the construction process.

The application fields, advantages, limitations and benefits of artificial intelligence applied to each sub-field of architecture are summarized. The study shows that whilst some AI technologies are already being used in architectural research, recent advances in these technologies have been significantly improved, and the adoption of more powerful recent AI technologies has been in a relatively slow pace. For example, the use of deep learning has the potential to give more accurate predictions than traditional machine learning techniques.

In addition, this study identifies and discusses further opportunities and open research questions for architectural AI research. While the application of AI is gradually increasing, other emerging trends such as BIM, the Internet of Things, quantum computing, augmented reality, cybersecurity and blockchain further strengthen its relevance.This study provides researchers and practitioners with a useful source of information on relevant AI applications and research in the construction industry.

In modern artificial intelligence, architecture no longer requires just a building project, but a model of all the necessary information for a building. It is a virtual replica of a building with geometric and technical characteristics of construction, materials and equipment. Artificial intelligence technology has made the design of buildings, blocks, and even urban areas dozens of times faster, making construction easier and safer. AI technologies can improve the efficiency of smart buildings. This article analyzes the construction enterprise management system, considering its application in the construction industry, the use of construction codes, standards, artificial intelligence technologies and new management methods is especially important. Interaction of construction market players through information systems enables them to develop high-quality management strategies. In today's world, with the continuous development and deepening of information in the construction field, the requirements for the design, construction and maintenance of basic building facilities are constantly increasing. In this regard, information models for building design play an important role.

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