Application of BIM and GIS Technology in Urban and Rural Planning

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Abstract. For a long time, geographic information system (GIS) technology has been widely used in urban and rural planning. This paper first analyzes the background of urban and rural planning, introduces the concept of building information (BIM), and puts forward the building information model. Then the application of mobile off-line GIS is studied, and the characteristics of mobile GIS are known. Secondly, the concept of urban-rural integration is put forward, and two functions of urban-rural planning are found: macro-control means and public interest protection. Finally, the application of information technology in urban and rural planning management shows that the disposable income of urban and rural residents increases year by year, and the fastest growth in 2020 is 120 million yuan.

Keywords: BIM Technology, GIS Technology, Urban and Rural Planning, Spatial Control

1. Introduction

With the continuous progress information technology has become an indispensable part of our life. With the rapid development and construction of modern cities, the management of residential planning is moving forward slowly. The current management of residential planning still takes the plane drawing information as the main way of examination and approval supervision for individual projects. However, CAD, JPG files or text forms all have the problems of single information, low information exchange efficiency and limited expression ability. It can massive information analysis, multiple index verification and quantitative evaluation of human livable factors of new era projects.

With the continuous development of Internet technology, many experts have studied urban and rural planning. For example, some domestic teams have studied the key technologies of dynamic maintenance of urban and rural planning data of mobile GIS. Combined with regional urban and rural information system, it has unique characteristics in application requirements, data structure, technical structure and so on. By adjusting the number of hidden nodes and learning rate, used to calculate the weight. Combined with the case introduction, the paper puts forward its own views on the impact on the practice of planners, the misunderstanding in the planning, the obstacles in the research and future development of big data [1]. Some experts have studied the planning, design and evaluation of eco industrial park under the concept of circular symbiosis, and elaborated the accessible geo software. In order to enrich the this paper introduces the method of combining the generated geographic
information with other formats of geographic data (such as DEM, grid layer, vector layer, etc.). In terms of infrastructure construction, it is planned to strengthen the development and utilization of new energy, establish solid waste recycling and reclaimed water recycling projects in the park, and establish information technology sharing platform in the park. According to the planning and design of eco industrial park, we should strengthen the application of building energy saving and emission reduction technology in the park architectural design. This paper introduces the application of GIS and VR technology in urban planning, and puts forward a new architecture of 3D urban planning system. This paper introduces the function of each module, especially combined with the urban planning projects in China, puts forward the development direction of Digital City Technology in urban planning. Aiming at the late evaluation of eco industrial park planning, this paper puts forward the AHP fuzzy comprehensive evaluation method of eco industrial park comprehensive evaluation, constructs the comprehensive evaluation index system of eco industrial park, and obtains the fuzzy comprehensive evaluation results of Industrial Park [2]. Based on the theory of green infrastructure, planning of rural green space system in Jiaozuo suburb. Based on the research of green infrastructure theory and the construction of rural green space system at home and abroad, this paper makes multi criteria analysis in IDRISI GIS software package, and evaluates the development suitability of four land use types according to the appropriate measurement and weight standards. The virtual 3D city model based on citygml management can provide comprehensive information as a higher level service. This method shows how the city data of different scales, different fields and different shareholders can be seamlessly integrated on the visualization level, and how to establish corresponding services. Comprehensive building scale model and city scale model are adopted in route planning. This method is a mixed model of rough to fine path planning, which provides detailed path from room to room through outdoor road network. Then, four suitability maps are used for multi-objective land allocation to determine the best location of each land use type. The decision-making process needs seven consecutive steps, which will be discussed and applied in detail in the case study [3]. Although urban and rural planning research has made a lot of achievements, there are still some deficiencies in the application of Bim and GIS technology in urban and rural planning.

In order to study the application of Bim and GIS technology in urban and rural planning, this paper studies Mobile GIS technology, BIM Technology and urban and rural planning. The results show that mobile GIS technology is conducive to urban and rural planning.

2. Method

2.1. BIM Technology, Mobile GIS Technology and Urban Rural Planning

2.1.1. BIM Technology
BIM has a wide comprehensive range, which can be described from the following three points. First and foremost, it is undeniable that BIM is the result or intelligent digital expression of construction projects. Second, BIM is a collaborative process that can be used to maintain continuity and authenticity. It covers business driven, automated process capabilities and open information standards. Third, BIM is a project life cycle management tool, which can well understand information exchange, workflow and procedures, and can use repeatable, verifiable, clear and sustainable development information for the whole life cycle of construction projects.

2.1.2. Building information model
Building information model (BIM) is a three-dimensional model based on the information of construction engineering. It has the advantages of whole life cycle, information sharing and collaborative operation. BIM, with its advantages of information and intelligence, has attracted extensive attention in various fields of architecture, and has been developed rapidly. The government at home and abroad has also issued a large number of policies to promote and support BIM. The emergence of BIM brings us planning management. As the latest information architecture, building
information model technology, after years of continuous improvement by experts in design, management, construction and other fields, is setting off an information revolution in the construction industry with the advantages of information integrity, information coordination, information sharing, information interaction and operation visualization.

2.2. Mobile GIS Technology

2.2.1. Mobile GIS technology. Due to the limitations of mobile devices, compared with PC system, the function of mobile GIS system is relatively simple [4]. The current research mainly focuses on cloud GIS, cross platform and other technologies [5]. The existing mobile GIS data acquisition system only considers the changes of the elements themselves, and does not consider the changes of the topological relationship with the surrounding elements [6]. Therefore, generally speaking, the mobile terminal sends processing requests to the server, the server performs complex calculations, and then the server returns the processing results to the mobile terminal, thus solving the problem of weak processing capacity of the mobile terminal [7]. However, compared with wired network, wireless network has smaller bandwidth and lower network transmission speed, which is not suitable for transmitting a large amount of data [8].

2.2.2. Application of mobile offline GIS. Offline GIS is based on BIM and ArcGIS 10. Offline data includes two parts, one is vector data, including distribution network data and navigation data. Database server is a service center that provides various spatial and business data storage, management, processing, maintenance and update for mobile GIS application system. It is the data base and important support to realize the function of mobile GIS. Mobile GIS database can provide mobile application data, store and manage GIS spatial data and spatial related thematic data database, and support user query, search, analysis, mobile computing, positioning application and other related services.

2.2.3. Characteristics of mobile GIS. The characteristics of mobile GIS include: (1) one of the important characteristics of distributed data source mobile GIS is strong mobility. Any single data source can not meet the needs of users. Mobile GIS data source of distributed solve the problem source. (2) When the network signal is unstable, the mobile GIS terminal will actively or passively disconnect the communication with the server. In this loose condition, mobile GIS needs to be able to re connect to the server under different conditions and run independently. (3) Because mobile terminals access server resources through the remote network, data is easy to be invaded and the reliability is poor. There are a series of security risks in mobile GIS. Mobile GIS database is still GIS database in essence. But it expands the function and application of traditional GIS database, enhances the processing ability and service application design of mobile computing based on spatial data, and provides data request service. Through real-time and uninterrupted geographic data interaction with intelligent mobile device terminals, spatial correlation mobile information service is provided.

2.3. Urban and rural planning

2.3.1. Urban rural integration. Urban rural integration is the urbanization process of urban-rural integration and industrial transformation and upgrading [9]. Urbanization is a process of urban-rural integration. Cities, especially big cities, radiation and driving, and promote the gradual realization of rural urbanization in various fields and in all directions [10]. The process of urbanization is more the process of population demand and labor regional transfer brought about by the transformation of regional economic structure and industrial upgrading in the process of industrialization [11]. The process of urban and rural overall planning is also an important aspect of overall planning, integration and promotion of industrialization, information construction and agricultural modernization. New urbanization provides labor supply and consumption market for industrialization construction, and
industrialization construction provides products and energy for urbanization development. Information construction provides information technology support for efficient and economical society. Agricultural modernization is the guarantee of agricultural products and labor demand in the process of urbanization. As an important part of the four modernizations, new urbanization needs to coordinate with other construction contents to form a good situation of common development.

2.3.2. The role of urban and rural planning. Urban and rural planning has the following functions: (1) macro control means. Under the condition of market economy, the development of urban and rural construction depends on the operation but the simple market mechanism will lead to "market failure". At this time, the government needs to intervene in the market. Urban and rural planning can regulate the use and allocation of urban and rural land space resources, intervene in the market behavior in the development of urban and rural construction, and ensure the healthy and orderly development of urban and rural economy and society. We should protect the public interest. Urban and rural planning through the analysis of social, economic and natural environment, combined with the future development arrangement, from the perspective of social needs for comprehensive deployment of all kinds of public facilities, and through the arrangement of land and space use to provide the basis for the realization of public interests, through development regulation and other comprehensive control means to protect public interests from damage.

2.3.3. Application of information technology in urban and rural planning management. When computers were first popularized in European and American countries, the informatization of administrative work began. In the early days, however, it was only used for the electronic storage of approved text. Until the emergence of geographic information system (GIS), the real informatization has just started. At the end of 1990s, European countries represented by the United Kingdom began to widely use GIS as the main mapping and approval tool of planning management. At the end of the 20th century, American urban planning management information system has made great progress. Through the comprehensive evaluation and analysis of the suitability of construction land, environmental quality, public facilities and equipment configuration by using GIS, the planning management technology is more professional and efficient in informatization. The planning management information system based on geographic information system (GIS) and office automation technology (OA) has been formally established in foreign countries. By 2010, IBM has put forward the concept of "smart city", which makes urban and rural planning management information have a new goal and direction. Smart city is to integrate the components and core functions of a city through information technology innovation, intelligently respond to the needs of people's livelihood, business, public security, environmental protection and other activities, optimize city service and management, and create a better city life.

3. Experience

3.1. Experimental Object Extraction
With the rapid development of building information model technology, BIM software with different specialties and functions emerge in an endless stream. As a representative software, each project in the software is a database, which contains all the design information such as the three-dimensional model of the building, design view, engineering quantity, construction drawing, etc. These data information are interrelated and change one information. The whole model can be updated synchronously, which can not only reduce the design error, avoid the error information, but also reduce the cost It can design efficiency, which is very conducive to project management.

3.2. Experimental Analysis
The purpose of choosing building information model technology to build management platform is to make use of the characteristics of its life cycle, so that professionals at different stages can share data
and information, so as to achieve the purpose of collaborative work. The architecture platform takes information technology as the core and can accommodate the collaborative work of multi-disciplinary analysis. Its basic structure is as follows: ① the data layer stores all the information of the whole life cycle of the building, which is enough to support the design work of various disciplines. Only in this way can the building information model really realize information sharing. ② The data layer should be able to store the data information of multiple projects. As BIM Technology is facing massive building information processing, the data layer should be able to carry all the data first, so as to open up a way for building information sharing. ③ As the bottom layer of BIM Technology, database is the basis of BIM Technology. In order to reduce errors, avoid waste and exchange transfer, the same standard must be established. At present, the International Finance Corporation (IFC) standard is widely used.

4. Discussion

4.1. Population Size Prediction of Heine Town Driven by New Urbanization

During the planning period, development and construction of the central village, improve the scale and function, and optimize the hierarchical scale structure of the town. Build necessary infrastructure and social service facilities to meet the needs of infrastructure and modern life, and promote intensive management. As Donga village and new countryside are located in the reserved land for long-term urban development, the existing scale of village land will be maintained at the end of the planning period, and the development will not be expanded. In the future, we can consider adjusting administrative villages and further reducing administrative villages and villages in combination with villagers' wishes. Some small natural villages are relocated or merged into the surrounding reserved villages and towns, as shown in Table 1.

| level           | Village name | Current population size in 19 years (人) | Population size at the end of the planning period (人) |
|-----------------|--------------|----------------------------------------|------------------------------------------------------|
| town            | Town         | 47378                                  | 58564                                                |
| Central Village | Village A    | 37544                                  | 46783                                                |
| Grassroots Village | Village B    | 34784                                  | 45672                                                |
|                 | Village C    | 37846                                  | 39532                                                |
|                 | Village D    | 38796                                  | 48674                                                |

According to the relevant data of the National Statistical Yearbook, there are 47378 people in the town in 19 years; 37544 people in a village in 19 years; 34784 people in B village in 19 years; 37846 people in C Village in 19 years; 38796 people in D village in 19 years. At the end of the town planning period, the population size is 58564; at the end of the village a planning period, the population size is 46783; at the end of the village B planning period, the population size is 45672; at the end of the village C planning period, the population size is 39532; at the end of the village D planning period, the population size is 48674. The results are shown in Figure 1.
It can be seen from the above that the population size at the end of the town planning period is 58564, 11186 more than that of the town in 19 years; the population size at the end of the planning period of village a in central village is 9239 more than that of the town in 19 years.

4.2. Population Mobility Between Urban and Rural Areas is Restricted
The registered residence registered residence system in 1958 stipulates that without the approval of the city public security department, the rural household registration can not be transferred from the rural areas to the city, and the city household registration can not be moved back to the countryside. The city and countryside separated registered residence system has limited the reasonable flow of population, impeded the transfer of surplus rural labor to the cities, impeded the free flow and reasonable allocation of production factors between urban and rural areas, reduced the output and benefits of economic input, and made the labor force of agriculture lose a lot of labor, and the labor force was hard to raise, resulting in farmers’ income lagging far behind the city, as shown in Table 2.

**Table 2.** Disposable income of urban and rural residents in 2016-2020(unit: 10000 yuan)

| particular year | 2016 | 2017 | 2018 | 2019 | 2020 |
|-----------------|------|------|------|------|------|
| Urban residents | 36246| 54123| 67483| 79543| 87295|

According to the relevant data of the National Statistical Yearbook, the disposable income of urban residents was 362.46 million yuan in 2016, and that of rural residents was 346.18 million yuan in 2016; the disposable income of urban residents was 541.23 million yuan in 2017, and that of rural residents was 458.73 million yuan in 2017. The results are shown in Figure 2.
It can be seen from the above that the disposable income of urban residents and rural residents increases with the year, and the fastest growth is 123.48 million yuan in 2020.

5. Conclusion
With the acceleration of the process of modern urbanization, the goal of building smart city, ecological city and low-carbon city has been put forward, and the work of urban and rural planning department is becoming more and more difficult. In recent years, with the development and BIM Technology, it provides a strong advantage for enterprise decision-making. Urban and rural planning workers study the micro environment management system based on BIM Technology, and apply it to the case, which has certain reference significance. Urban and rural built-up area expansion has obvious spatial differentiation, and high-speed expansion is mainly concentrated in urban areas. The fractal dimension of regional urban area increases gradually, which means that the overall structure of urban area is more and more complex. Due to the lack of reasonable planning and management, the change of rural land use is irregular. The main driving forces of urban built-up area expansion are construction, economic development, population growth, transportation, natural environment, policy guidance and urban planning. Using GIS information technology and design structure matrix to integrate and manage professional resources can improve the level of engineering, planning, design and quality management, and simplify knowledge management and innovation management.

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