Urban planning and design strategy based on ArcGIS and application method

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Abstract. GIS is a spatial information system combining geography, cartography, remote sensing and computer science, which is widely used in different fields. As a computer system, GIS can input, store, query, analyze and display geographic data. In the 1980s, GIS gradually began to be applied in the field of urban planning. This kind of digital technology meets people's requirement for regional geographic environment visualization. At the same time, the development of the network has also provided help for the popularization and development of this technology, making the dissemination and sharing of data possible. Nowadays, as an important technology, GIS has been widely used in all fields of urban planning and has gradually become an indispensable part. Arcgis as GIS platform building and applications will be treated as big data analysis and data visualization as an important part of planning, implementation of the software data correlation of traditional urban planning, break traditional design and drawing mode, through the spatial analysis function to generate new information, make decisions and solve problems efficiently, and make a prediction to the development of future city. Through the introduction of Arcgis data organization structure, CAD data loading, mapping and modeling under Arcgis platform and Arcgis spatial analysis function, this paper discusses how to use Arcgis platform to realize the application of urban planning and design.

1 Planning strategy based on ArcGIS

1.1 Background

With the continuous development of cities, various kinds of information in cities are complex and changeable, and the traditional methods of collecting and processing information manually are no longer suitable for all kinds of research on urban development today.

The sheer volume and complexity of the data is also one of the obstacles to these studies. The analysis and processing of big data and data visualization also affect all aspects of urban planning.

Traditional project planning focuses on drawing, which is not conducive to the analysis and presentation of information data, and is not suitable for the current information explosion.

1.2 Introduction of ArcGIS

The data visualization, management database and powerful data analysis function of GIS (Geographic Information System) provide a powerful way for urban planning information management and planning problem solving.

ArcGIS is a platform for GIS construction and application, which can release geographic information for use by people in different fields all over the world.

ArcGIS is composed of a variety of tools and software programs that provide USERS with GIS functions.

- Any GIS task, from simple to complex, can be accomplished through coordinated invocation of the application interface, including mapping, geographic analysis, data editing, data management, visualization, and spatial processing.

1.3 Urban planning strategies based on ArcGIS

There is no analysis platform for urban spatial planning. The rise of cloud computing and big data makes the information space model of design and planning quantified.

It no longer regards beautiful drawing as an important element of design and planning, but regards information data analysis as an important link, which reflects that project design and planning pay more attention to the research on reality.

ArcGIS integrates space and information, and can also be associated with the data and mapping methods of traditional mapping, which provides a better way for design planning.

To form the technical support system under database management, the traditional cartographic data should be transformed into GIS data and become a database with information.

ArcGIS can support multidisciplinary participation in planning and design, understand the basic knowledge of non-majors, search for the most basic data, and form basic

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concepts and knowledge structures.

2 ArcGIS data organization structure

Most urban planning spatial data management is realized through CAD and Excel. However, the data of the two are not compatible, which results in the inefficiency of information retrieval and analysis in practical application and can not be updated timely.

The urban planning database established by ArcGIS adopts a unified standard format to establish the association between various attribute data.

The application of GIS need not reflect all aspects of the real world, but should actively extract elements that are useful for research and analysis.

Therefore, element extraction of GIS should be accurate and efficient, and redundant and miscellaneous elements should be filtered out, so as to form a clear understanding of the whole planning project.

The data types supported by ArcGIS are vector, raster and TIN.

2.1 Vector data

Vector data is accurate, but difficult to quantify. Shapefile is a format for storing geometric location and attribute information of geographical elements.

It is a common format and can be represented by points, lines or surfaces.

2.1.1 The point is the coordinate point of the space, and generally corresponds to the layout planning of each land use.

2.1.2 A line is a line segment composed of multiple coordinate points, generally corresponding to each traffic artery and pipeline.

2.1.3 Surface is a polygon composed of line segments, which generally corresponds to the land layout and attribute planning of a larger area.

These points, lines, and surfaces constitute the spatial properties of the data. The data of the database is managed hierarchically according to the points, lines and planes of the urban planning.

2.2 Raster data

Raster data is composed of pixel units organized by a grid, and each pixel contains information. Grids can be overlaid with data for analysis.

A point is a pixel, the smallest unit of a grid. Lines and faces are made up of pixels. Raster data represent plot planning with a large number of pixels.

After the establishment of spatial data, each attribute information can be attached to it to represent the data such as floor area ratio, building area and green land rate.

2.3 TIN

TIN is a digital representation of surface morphology in irregular triangulation and is mainly used for terrain creation. Vector data and raster data have their advantages and disadvantages.

3 CAD data loading

The traditional tools for urban planning drawing and presentation are AutoCAD, SketchUp, PS, AI and other software. AutoCAD is a drawing software commonly used in urban planning.

The traditional design and mapping process highlights the process of drawing, ignoring the analysis and thinking of all elements of the project, and is no longer suitable for the complex and diverse information within the city and the development of urban uncertainty.

The application of cloud computing and big data carries out quantitative research on various urban problems, and replaces the traditional design and mapping mode through the visual expression of urban problems research.

Therefore, in the use of software, the transformation from AutoCAD to ArcGIS can be realized.

CAD format is the common format of AutoCAD output. To achieve transformation, THE CAD data should be exported to Shapefile data and transformed into GIS data that can be analyzed directly.

The traditional AutoCAD method of manually measuring the quantity, area and other data has some problems, such as low accuracy and low efficiency, but the application of GIS has improved these problems. The transformed layers can merge and intersect.

- It with database technology as support, hierarchical processing while under construction in library, which is based on the nature of the data classification and properties of the same or similar merge together, to form a data layer, so that we can analyze the graphic data and attribute data and index measurement, to a large extent reduce the physical labor of the planning and design personnel.

The application of GIS provides a reasonable basis for the analysis of urban planning status and improvement of planning results.

Geographic database is the core of GIS. Geographic databases are typically used to store and manage key base layer data used in GIS.

These centrally managed data can be symbolized, presented, processed and released in various ways in ArcGIS maps.

4 Mapping and modeling under ArcGIS platform

GIS is not a professional mapping software for urban planning. However, with the development of GIS, the mapping function of ArcGIS is becoming more and more perfect and more people use it.

4.1 ArcMap

In ArcGIS, ArcMap is the main module for map data processing.

- Perform input and edit of all task map data, including geospatial data, tabular attribute data space elements and attribute factor query space analysis and map making.

Urban planning involves a lot of natural environment and artificial environment information. ArcGIS is rich in compatible data types, which can integrate data from different sources and in different formats, making data and attribute analysis more convenient and efficient.

ArcMap has a powerful spatial analysis function, which provides a strong guarantee for the formulation of urban planning schemes.

The integrated and modular setting environment for ArcMap display, editing, and mapping greatly improves planning efficiency and allows visual data and information to be widely presented.

4.2 3D modeling

3D modeling can use 3D Max software to build the basic building model, and then use ArcGIS combined with vector data to build the ground model, and match the two to complete THE 3D modeling.

- In the high-version ArcGIS, by embedding many 3D shapes and related tools, 3D perspective and cross-analysis of ground objects in 3D space can be easily achieved.

3D model and 3D analysis can help to create and display more intuitive browsing effect of urban planning, meet multi-dimensional spatial analysis, and facilitate the formulation and implementation of decision-making.

ArcGIS also has many auxiliary mapping and modeling tools, and with the continuous maturity of GIS, ArcGIS is making more and more contributions to urban planning.

5 ArcGIS analysis function

Spatial analysis is one of the most important functions in GIS. Spatial analysis processes input data, and generates new information through statistics, calculation and sorting.

Through spatial analysis, unknown patterns and relationships can be discovered.

ArcGIS contains spatial analysis module, network analysis module, 3D analysis module, etc., and a variety of tools and operation methods meet the requirements of various data analysis.

- These modules of ArcGIS can be used to carry out spatial analysis operation in the environment of raster data and vector data integration. Through analysis, the correlation information and general rules between spatial data are explored, so as to solve various spatial problems.

The development of urban space is not carried out in a single linear way, but with the passage of time, the features in the space are miscellaneous and changeable under the action of various elements.

Faced with complex and constantly updated spatial data and attributes, ArcGIS is able to acquire and process

data information quickly and efficiently, and solve problems timely.

Compared with traditional analysis tools, ArcGIS can conduct scientific quantitative analysis on data, form an intuitive analysis model, and enhance the accuracy of future urban spatial development prediction.

At the same time, the results of inspection and analysis can be published on the network in a timely manner and provided to a variety of users.

5.1 ArcGIS network analysis tool

ArcGIS network analysis tool is one of ArcGIS analysis functions and plays an important role in facing the problem of urban planning path selection.

- Network analysis theory is the basis of the operational research and graph theory, it from the perspective of operational research to study, plan as a whole, planning a project, with characteristics of network topology to arrange all the elements of running make its can give full play to the role so as to achieve the expected goals, such as the shortest path's location, the reasonable distribution of the resources, address matching the query, etc.

ArcGIS network analysis tool can calculate and determine the distance between two locations. This distance is not the distance between two points on the plane, but the distance on the real road network in the process of site selection.

Therefore, the network analysis tool is suitable for the analysis of traffic network, pipeline layout and their planning and movement in the network in urban planning.

ArcGIS network analysis tool can realize the shortest path comparison measurement, which plays a great role in path selection.

5.2 3D analysis function of ArcGIS

3D analysis of ArcGIS is also a commonly used function in ArcGIS analysis function, which can present better results than planar graph for the needs of terrain and geomorphology simulation and road linear optimization.

The 3D analysis extension module of ArcGIS can simulate and analyze topographic DEM modeling, so as to simulate engineering problems such as earthwork calculation, as well as predict and evaluate unknown natural disasters.

Compared with the traditional planar two-dimensional static display, the three-dimensional display is more intuitive.

The 3D analysis function of ArcGIS can be used for dynamic simulation, which is more conducive to a comprehensive understanding and control of the operation mechanism of the scheme, so as to promote the formulation and implementation of decisions.

The 3D analysis function of ArcGIS enables planning decisions to be adjusted more quickly and effectively with the actual situation of application, so as to solve new problems in time.

In addition to network analysis and 3D analysis, ArcGIS also has other practical analysis tools.

As the core function of GIS, the extraction and analysis of spatial information provides support for the formulation and development of various planning work, making information analysis more rational and objective.

With the development of GIS technology, the analysis function of ArcGIS will become more and more powerful and gradually penetrate into the whole process of urban planning.

6 Conclusion

The increase of the number of cities and the continuous improvement of the urbanization level lead to the ever-changing urban landscape.

Under the influence of many unpredictable factors, urban planning and the implementation of the work are faced with complex difficulties and pressures.

Many urban planning work does not play a perfect prediction role, and then the planning work is inconsistent with the actual development situation, resulting in the final planning has not been effectively implemented.

In addition, urban planning is an overall planning science, with the participation of people from different fields such as government, planners and ordinary citizens. It is a space art in order to maintain the order of urban life.

Urban planning needs more appropriate technical support. In accordance with the requirements of engineering and environment, a sound spatial development strategy should be formulated to ensure the orderly construction and development of the city.

ArcGIS platform is used to realize the planning and design method, which satisfies the characteristics of systematic and strong regional urban planning, scientifically foresees the future development direction of urban space, and reasonably achieves the detection and evaluation of environment.

The appearance and use of ArcGIS also indirectly changed people's thinking on mapping and planning strategies. Instead of being limited to the measurement standard of making exquisite mapping, ArcGIS proposed different thinking modes and ideas for planning.

At the same time, mapping under ArcGIS platform can be published on the Internet, and can be freely enlarged and shrunk in mobile devices for dynamic presentation and sharing.

With the continuous development of GIS technology, ArcGIS will be more and more widely applicable and gradually become an indispensable part of urban planning.

ACKNOWLEDGMENTS

Through study and paper writing, I have overcome many difficulties and gained a wealth of knowledge. More importantly, I have a better understanding of myself.

Urban planning and ArcGIS are both extensive fields. Due to my lack of knowledge, the depth of this paper is obviously insufficient.

Thanks to my teachers and classmates who helped me during my study. In particular, I would like to think of my advisor, who has given me valuable advice on topic selection, recommendation of relevant materials, framing,

final paper determination and paper writing.

I would also like to thank my parents who have been encouraging and supporting me behind, making me full of confidence and courage for my study and life.

Finally, in order to live up to their own and everyone's expectations, for the time we study and live together, I offer this immature paper.

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