GIS technology integration design based on university culture resource

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Abstract

3-D GIS technology has become the hot research in current GIS realm. It is applied in various industries. This paper constructed open and interactive 3-D data campus based on Sketch Up applying ArsGIS 3-D space platform and combining traditional information management system and 3-D GIS technology. We integrated various system resource management modules in campus and fulfilled an open campus project, which has strong inquiry and space analysis function. We turned 3-D model data into ArcGIS supportable format and imparted it into digital campus development structure. Browsing system of multi-detail and multi-level scene is also applied. Finally, we constructed a lively 3-D digital campus culture design that has interaction form.

Keywords: GIS technology, open type, interaction type, mutual integration

1 Introduction

Digital campus of GIS technology is generally modelled as real campus [6]. It is constructed with the principle of computer network technology, visualization technology and information integration technology. It is not limited by time and space and can collect and manage various culture resource at any time in LAN for efficient deploy and powerful control. This kind of integration design is good to the improvement of informatization scientific research system of campus, implement and perfect of various measurement of school and planning and decision of campus scientization. Therefore, integration of university culture resource is needed an effective management system to allocate resource.

Foreign university pay high attention on campus informatization development construction. Switzerland allocated 30 million Swiss franc approved by both houses of the Swiss confederation to the state Swiss University to encourage campus informatization construction and construct information technology website of higher education [1]. America is always carrying out policy of rapid development of visual information technology after formulating National Information Infrastructure. In recent years, educational management system of America has witnessed great changes. Many building facilities, office affairs and graphic technology centre in campus are all informationized. Resource is integrated in it, which achieved objective of high efficiency [2]. Compared to abroad, digital campus design of our country still has gap. However, some excellent digital campus platform is constructed with the constant emphasis from Ministry of Education. Chang Hong et al proposed in Goal, Content and Strategy of Digital Campus Construction under the Macro Digital Background [3] that education informatization pulling the development of modern education has become the strategy of current education growth. They also thought that construction of digital campus construction is the construction goal, content and strategy under macro digital age background. Ma Tian et al [4] realized a set of 3-D visual campus system based on 3DMax and OSG in 3-D Visual Campus System Design Realization of Lintong Campus of Xi'an Science & Technology University. They proposed independent roaming collision detection method to realize automatic positioning by 3-D modelling of the whole campus. Liu Xinyu [5] took GIS as platform on overall design, content construction design, system function design and interfacial design. He studied GIS and map service based on web and realized campus map service prototype in campus GIS map service system design of Kunming Science & Engineering University.

2 ArcGIS introduction

ArcGIS is the most advanced GIS software developed by a series of perfect progress integrating multiaspect computer mainstream technology by American Environment System Research Institute (ESRI). ArcGIs is widely applied in world GIS realm [11].

2.1 INTRODUCTION OF ARCGIS SYSTEM

There is a set of complete GIS application external member in GIS frame covered in ArcGIS. Development group can provide GIS flushbonading application technology. In addition, there are also ArcGIS Server,

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ArcIMS, ArcGIS Engine and ArcGIS Desktop applied in enterprise.

2.2 ArcGIS ENGINE

Flushbonading GIS can be flexibly used to construct new application procedure in GIS procedure developing process. ArcGIS Engine can also be used to extend specific application procedure of other industries and derived to user. Development tool is shown in Table 1.

TABLE 1 Overview of ArcGIS Engine development tool

ArcGIS Engine development tool		overview
kit	ArcGIS Engine Developer Kit	Provide a series of tools and resources used for comprehensively developing customization application procedure for developer
	ArcGIS Engine Runtime	Provide core component and extended module needed for operating ArcGIS Engine for users
toolbar	Comprehensive and dynamic GIS edit tool	Tools such as translation, rotation, zoom, browsing, analysis and selection are dragged and dropped into customized application to realize interaction function of system.
Object category gallery model	ArcGIS Engine component gallery	Basic service, data access, map expression, development component and extended function
3-D extended controls	SceneControl	Used for 3-D scene and 3-D analysis display with small data size and can realize visualization mutual scene and 3-D surface analysis on GIS data
	GlobeControl	Can realize browsing and query on large space topography, 3-D grid and huge amount of vector data

3 3-D digital campus overall design based on GIS technology

Design philosophy of this paper is based on data model of university campus geographic space. We use GIS technology to develop 3-D digital campus by space management and information analysis ability to realize integration of space information cultural resource of university campus.

3.1 DESIGN THOUGHT AND TECHNOLOGY ROUTE OF DIGITAL CAMPUS

First, we need to install SketchUp ESRI control [10] to add SketchUp toolbar into relative procedure of ArcGIS to realize a real visualization 3-D digital campus model in construction of digital campus model, as shown in Figure.1. We constructed a technology route through data preparation, data processing, 3-D modelling and system development at earlier stage, as shown in Figure 2.
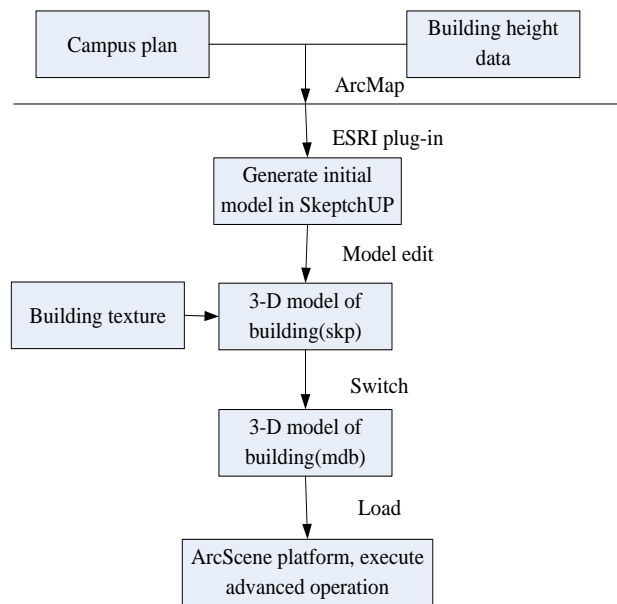
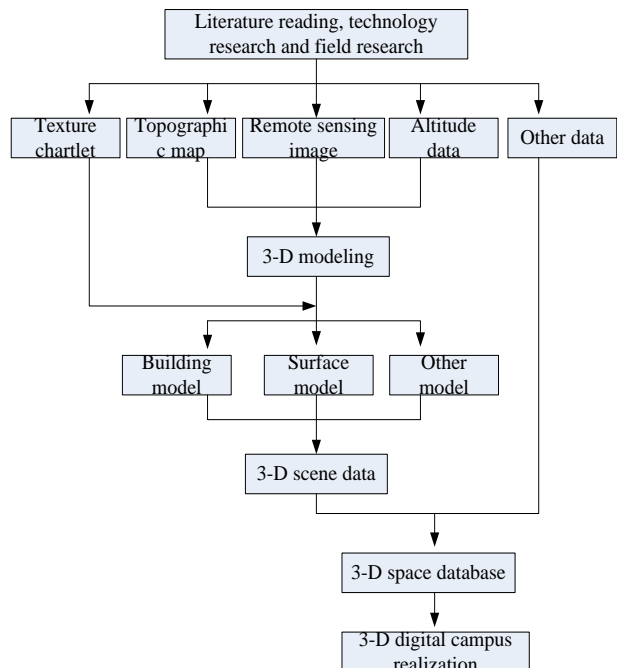FIGURE 1 Procedure diagram of 3-D campus construction

FIGURE 2 Technology route of 3-D digital campus construction

3.2 DIGITAL CAMPUS SYSTEM FUNCTION DESIGN

3-D digital campus design first need 3-D scene modelling including topography with shrink actual ratio, building, playground, road, river, etc. Second, we should construct a 3-D roaming system for realizing roaming browsing and flying browsing in the process of 3-D campus browsing. At last, we should realize information query and information analysis function so that users can do interaction functional operation.

3-D digital campus system can be divided into four system module, that is, scene browsing module,

information query module, space analysis module and measurement statistics module, as shown in Figure 3.
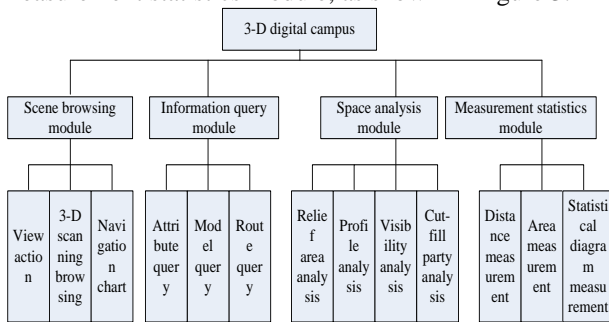

FIGURE 3 System module function diagram

Scene browsing module includes view action. It is used for browsing 3-D scene by perspective switching and can be moved and zoomed for omnibearing observation. 3-D browsing, that is, some function of route browsing, combining with navigation chart has navigation function for the moving direction and position of users. Information query module includes attribute query. It is one of 3-D campus basic function and can be used for effective searching of building, college information, hot event, news, etc. Model query can rapidly found relative building, road, river, etc. Route query can provide the shortest distance and walking time estimation between two places. Module function in space analysis module can make the whole system possess enough advantage on space analysis applying space analysis ability in ArcGIS technology. Users can develop various space analysis functions by tools on control board. Distance, area and statistical figure in measurement statistical module are stored in form of database. If users have need then it can conduct modification order.

3.3 DATABASE STRUCTURE DESIGN

Development of digital campus system constructed by GIS technology need various types of data. Attribute data and space data are two main data types. Attribute data includes information of teacher and student, course notice information and building attribute information. They are stored according to types for flexible processing ability of system, which can combine campus entity object and data of database. We can achieve goal of resource integration by using ArcGIS technology for space data controlling and database software for attribute data controlling [9]. Database structure figure is shown in Figure 4.
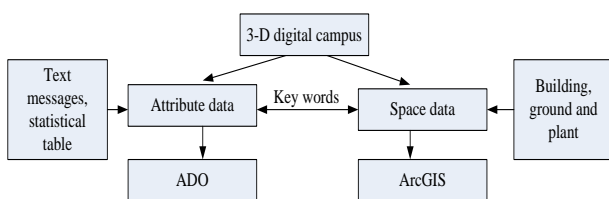

FIGURE 4 Database structure figures

Geodatabase is to integrate and describe data that needed to be processed according to certain model framework and GIS technology based on DBMS [8]. This kind of thought and behaviour can more directly present the real world. Data storage characteristics of GIS technology are hierarchical storage. Geodatabase applies hierarchical mode to use space data and attribute data in specific data storage. Structural representation of geospatial data model on 3-D model file is shown in Figure 5.
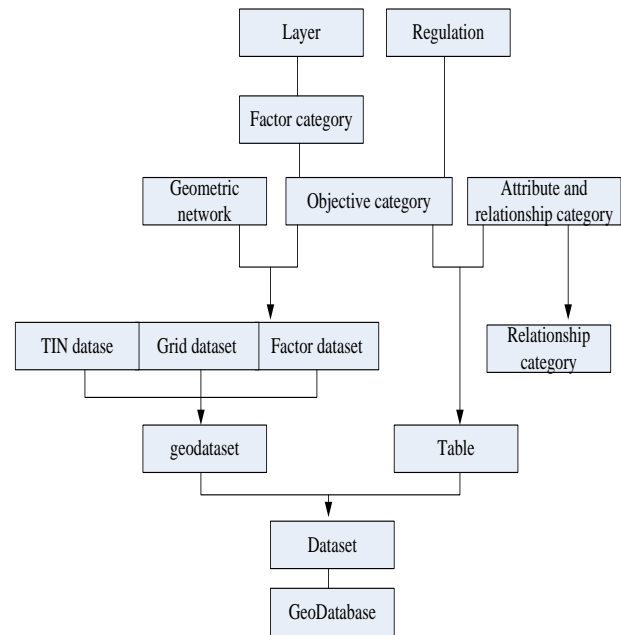

FIGURE 5 Sketch map of Geodatabase organization structure

System database integrates and manages lots of space data information and attribute data information adopting practical multiline relationship distribution database system SQLServere2005 and stable GIS space data engine ArcSDE.

3.4 SPACE AND ATTRIBUTE DATABASE DESIGN

According to the high-resolution remote sensing image [7] and campus cultural environment and geographical environment, space data and attribute data are conducted hierarchical management based on space feature. It includes environment layer such as plant, river, road, land, etc., building layer such as Ball Park, teaching building, dormitory, street, infrastructure, etc., label layer such as name, direction, tendency, distance, etc., and information layer such as college information, teacher information, class information, student information, news notice, etc. We should set up attribute table and add relative data into SQL Server. Table 2 is excerpts of attribute table of database. Of course, we can apply space analysis means of ArcGIS technology to process and distribute relative message segment.

TABLE 2 Part information of attribute database

Classification of information table	Field name	Field type	Field length	Remark
Student	Sno	Int	10	Major key
	Sname	Char	10	
	Ssex	Char	2	
	Sage	Int	20	
Department	Dno	Int	10	Foreign key
Class	Cno	Int	10	Foreign key
Building	Bno	Int	10	Major key
	Bname	Char	10	
	Bnum	Int	50	
	Barea	Int	10000	
	Bdate	date	10	

scientific and rapid campus cultural resource framework and promote the stable development of university campus. This paper comprehensively studied overall process of digital campus construction in view of system design thought, development route of technical route, functional module design, system structural database design, space database design and attribute database design. It mainly discussed realization of interaction pattern in 3-D digital campus interaction pattern with SketchUp software technology and ArcGIS software technology and creatively proposed hierarchical management form of applying space database and attribute database, which provides a solid foundation for integration of university cultural information resource.

4 Conclusion

This system developed and designed 3-D digital campus with the help of space data analysis and information resource analysis of GIS technology in purpose of integration of campus human geography resource. It aimed to show real and vivid campus culture, plan out

Acknowledgment

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