THE STUDY ON THE TECHNIQUE OF THE 3D GIS MODELING BASED ON THE DIGITAL PHOTOGRAMMETRY

Zhou Li, Sun Jia-long, Li Wei-xiao, Bai He, Chen Wei-wei

Spatial information science Faculty，HuaiHai Institute of Technology ,Lianyungang 222001,China

Commission III, WG/4

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ABSTRACT:

With the rapid development of applications in 3D GIS, the defects in 2D GIS, which is no intuitive feelings, no convenient to manage the space object and no certainty to express the information and so on, are more obvious. 3D GIS can recover geographical environment. Every points in 3D models have their true coordinates, so they can express terrain features in intuitive way and realize the management and analysis of 3D visualization.As the 3D modeling is currently built the structure as a whole independent entity and managed the whole entity-oriented to establish databases, it can not resolve properly the object-oriented classification to achieve the management and analysis of spatial information, limited the function of 3D GIS applications. This paper discusses the object-oriented 3D modeling technique to use existing digital photogrammetry software platform for secondary development. The text includes: the object-oriented concept of 3D modeling; the 3D GIS modeling technology based on digital photogrammetry; the Digital Campus examples of 3D modeling over the current Digital Campus space modeling, using the methods of divide entities and management-oriented data modeling to combine the 3D model of the campus and the database management objectives, achieve the 3D model of the campus on the school's Information Management Services Digital and inquiry friendly the accurate information.

1. INSTRUCTION

With the rapid development of research of 3D GIS in city area, the defects in 2D GIS become more and more obvious: basing on abstract symbol, no according with the 3D spatial characters in geography and cognition rules, failing to give intuitive feelings. So, the research of 3D GIS modeling has become a major hot spot. In computer, 3D data model is regarded as a tool to express the 3D objects in reality. The convenient information of 3D campus fails to contact the inter locale in campus construction which cause no certainty in expressing data and incommodity in inquiring. However, object-oriented 3D data managing system makes up the limit of conventional 2D GIS, provides strong function of analysis, visualization, and science calculation in data of real 3D GIS, and makes inquiring the spatial information and managing the database of property possible. The paper discusses mainly how to make use of the mode of 3D model directly to show the way of management in campus, make the users themselves feel in the real inter special locale of campus constructions, inquire the information of campus management at any time and at any place, and realize the target of sight-seeing on screen and particular management.

2. THE IDEA OF MANAGEMENT-ORIENTED 3D MODEL

Real digital 3D management system of campus is different from the perspective 3D, which can realize the real emergence of local scene. The arbitrary spatial points constructed in 3D environment have real 3D spatial coordinates which can express directly the spatial data in the solid way, realize the cascade and visualization of data of features in terrain and figure, make the management and analysis of 3D visualization of spatial information possible.

Nowadays, in view of imperfection of 3D soft in our country, it is better way to design mathematical model and database rather than develop further the soft developed to realize the inquiring of data on the base of 3D campus model.

But, current 3D modeling usually regards the whole construction as a single entity, constitutes a database on the base of the whole entity in which people fail to inquire the data separately and the quantity of data inquired is limited.

> The data can not be inquired because of regarding the whole construction as a single entity when modeling.
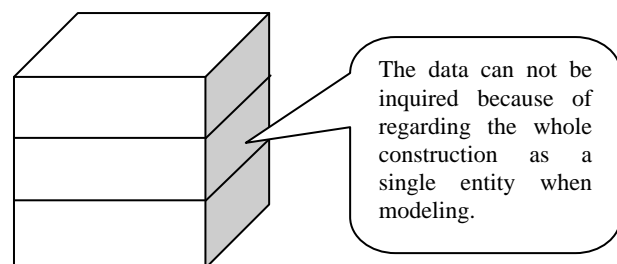
Fig 1 Sketch of constitution of database on the whole entity

Unattached construction entity model is inquired by means of whole in the system, so the result of modeling influences directly the effect of inquiring of information in the system. In order to know well more particularly the information of target of construction, it is very necessary to consider the character of mode of construction. For example, when different floors in the mode are stuck by users, the color of the floor is altered as well as different information (the character of the floor (office building, teaching building, lab building and so on) rooms of the floor, instruments in the floor) is known by users. Above information can be obtained by means of technical

delaminating for the special construction management by the time of modeling (method of special entity)to realize the target of constituting database particularly. Also, it is possible to constitute different unit modes on the base of floors.

It can be showed in a figure as follow:

> The information of the room on the floor elected can also be inquired.

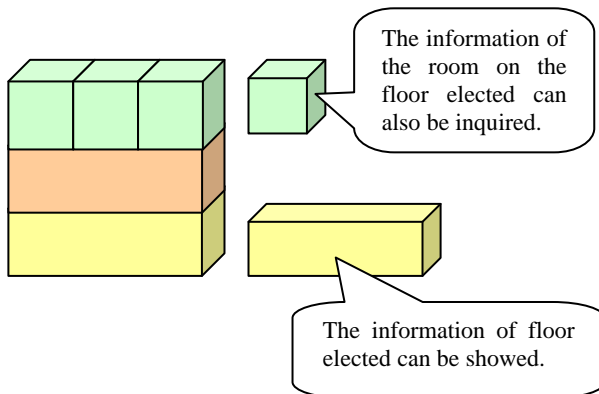> The information of floor elected can be showed.

Fig 2 Sketch of building the database on the base of unit model

As to database, which can be constituted according to different needs and the only thing done is to choose the different databases contacted so as to inquire reciprocally in practical application.

3. REALIZATION OF MANAGEMENT-ORIENTED OF 3D MODELING

The research is carried through on the base of JX-3D, a 3D virtue reality system soft developed by China Siwei Surveying & Mapping Technology Company, which is operated by the following major process.

Detail process is showed as follows:

(1) Open CAD file, the base map in CAD of Huaihai Institute of Technology (HHIT) is showed, the process of MF-MIDout then is load in CAD.

(2) Open the SupernatureGIS, stick the option of transmitting image of vein on the menu of editing, transmit the image of HHIT collected under foot by JX4 into SupernatureGIS, input the geodetic coordinates, adjust the parameters of skimming.

(3) Transmit the data of house mode(a data of vector collected by JX4—HHIT*.ASC), load the data of house mode, transmit the mode of house in HHIT—hhit*.house.

(4) Constitute TIN: create new rectangle in CAD, assign the restraint of height between (0, 0, 0) and (0, 0, 5), reserve the file of figure as file of dxf of 12th edition. Read the file of dxf. Obtain the file from the option of triangulation network of terrain on the menu of file. Delete the construction elected in the base map, Establish new construction figure in CAD. One important point should be indicated: describing the rectangular to a counterclockwise direction to choose the joint.

(5) Transmit the cvrc into CAD to edit the type of data, and code the arc elected. Transmit outvr to gain the data of 3D, the spatial model will be showed in the soft of Supernature. However it is only the first floor, the second and the third floor have to be erected on the base of the first floor. In view of the outer figure of construction elected only is rectangular which is so easy that the 10th construction model will have to be chosen when input the code of house. The value of height of the first floor is the average value of dividing the practical height of the whole construction into three equal parts. The new model, which will divide one building into three parts and lead to the change of the numbers of ID and database correlated, is different from the former model.

Obtain the terrain data	Obtain the image of photography of ground	Obtain the data of 3D modeling	Photograph the texture of surface of the building

Edit the data

Build the 3D entity	Build the database of information

Model separately for the main body of building

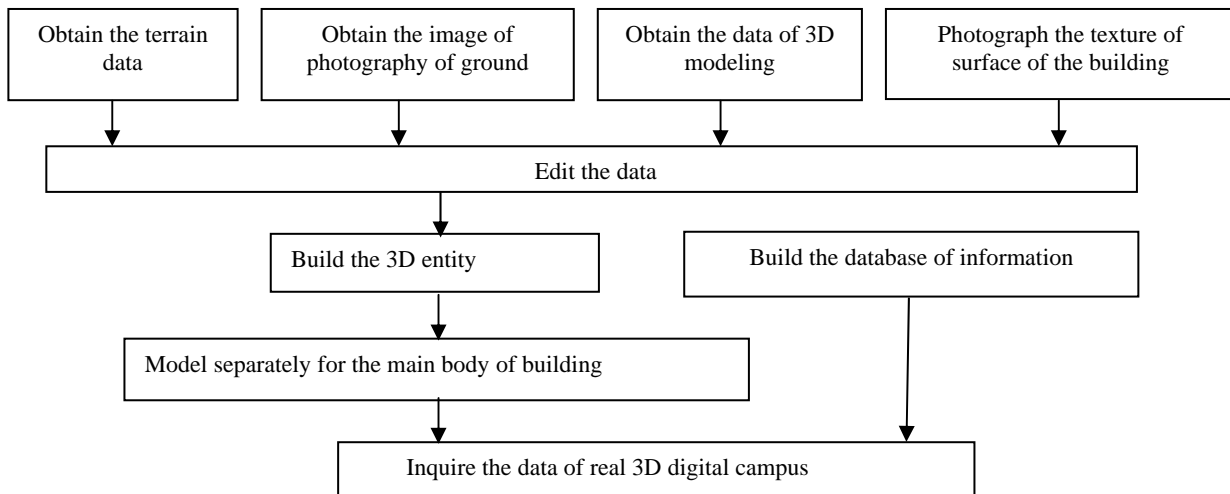| Inquire the data of real 3D digital campus |
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Fig 3. Flow chart of management-oriented of 3D modelling

Build model by means of dividing the construction into several parts: firstly, calculate the average value of height according to the actual height of the construction and the number of floors needed; Then, the major work for building the first floor is, according to the ordinary method of modeling for a house, to code 10 for the house, elect counterclockwise the culminations of rectangle and return clockwise to constitute the roof in CAD since the construction elected is a regular cuboid which leads to return at the last culmination of bottom of the construction. The height of the first floor should be entered into the model on the base of the calculated mean value which indicates the 3D model of the first floor can be showed in the 3D interface.

Next for the second floor. The process of operating is alike to the first floor. Difference lies in the change of geographical coordinates: the Z value of four culminations of the foot of the build is as much as the double Z value of the first. Therefore,

the volume of the built model is not changed, but Z value changed when the model is built on the first floor. Last, for the third floor, the method is same as the above process, excluding the changed Z value. After building the third floor, the outer figure of the building is mainly determined. However it will have to be done to combine the building since three floors are various unattached and need to combine them a entity. The particular operating is made as follow: pitch on the three floors which are chosen in virtue of the right mouse button with pulling a rectangle, stick the editing command in the main menu to combine the targets of construction in order to incorporate the different parts of building.

To inquire the various kind of information in 3D model is the most major purpose of constructing the digital campus since the database is connected with the built 3D model. Real digital campus can come true with the connection between the 3D model and the powerful searching function.

Due to the target of experiment is to show the information of related floors through sticking the floor, the numbers of ID will have to be distribute the different floors to contact with the attribute data, lead 3D landscape to be endued more contents.

So in terms of vary needs we build separately the information database of instruments (including the information about the mode and number of computer, total station, theodilite, level, rod, tripod and so on), information database of teacher(including the information about name, age, rank, teaching class, contact method and so on), database of class affair(including number of student, monitor and contact method, syllabus, information of student in special class and so on), information database of classroom(including various kinds of classroom(ordinary classroom, lab, office), the teacher and the class at any time). Then build data sheet of class(including number, monitor and contact method, syllabus(time and classroom)) in the classroom; Build the information sheet of instrument in lab and information database of teacher at office to come assorting summary true rather than repetition of equal information in order to inquire more much information. The only thing done to bring bilateral inquiring into effect is to choose the relevant database on the stuck target in terms of the need of user in application.
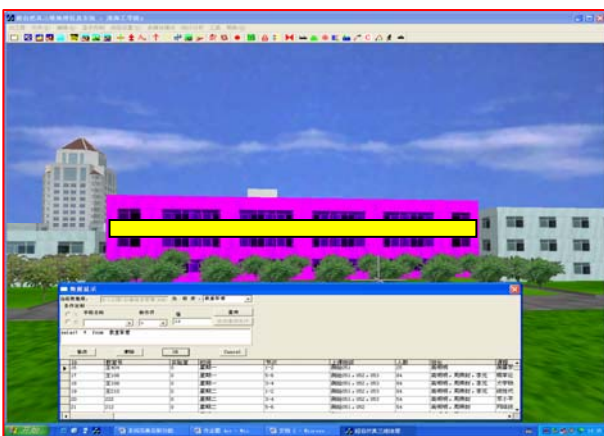
Result figure is showed as following:

Fig 4 Sketch for inquiring the management-oriented of 3D modelling

4. TRANSMITTAL AND FURTHER INFORMATION

By testing, it has been brought into effect to sight-see in the campus of 3D in light of the elected route. Those who are not familiar with the campus arrangement also can skim through the campus in virtual space on the base of 3D campus as well as know well the relation between building and teaching. Meanwhile by combining construction model and database, it can also be realized for bilateral inquiring for the base situation of the stuck construction on the base of the model, for the character of the classroom in the chosen by sticking the right mouse button, for the arrangement of teaching in the ordinary classroom, teacher and contact method, teaching class(including the monitor and contact method), for the instruments in labs and so on. Even though the user who can not distinguish the direction can also find the destination, who hardly knows the establishments of software and hardware can be familiar with the information on the base of platform, so the target of "know all by sticking a button" comes indeed true. It must become more and more popular for the 3D digital campus in the development of digital campus, which will be the best choice of many universities who are made up of several parts or have large area, more building, complex arrangement, to establish digital campus.

This paper puts stress on discussing the inquiring for detail information of entity, however nowadays it is very difficult to skim in 3D model through the material inside of entity which will need more much time and great effort to deal with.

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