Three-Dimensional Decision Support Platform of Yellow River Based on GIS Data

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ABSTRACT--- ***In the paper, we introduce the key technology of the three-dimensional ice decision support platform, and the each function of the subsystem of the decision support platform are also presented, through related the analysis and simulation, the three-dimensional decision support platform of Yellow River can be applied in the actual ice monitoring and analysis, and it will do help in the ice-broken and reducing the disaster of flood.***

Keywords— Three-Dimensional, Decision Support Platform, GIS Data, System

1. INTRODUCTION

With the rapid development of modern information technology, and the modernization of water conservancy and water information, digital water conservancy technology has been used in the water conservancy[1-3]. Geographic Information System (GIS), Remote Sensing (RS), image processing, network communication, management of database, Virtual Reality (VR) and other modern high and new technology will be applied to the construction of water conservancy, and it is the inevitable trend of water conservancy development[4-6].

According to the actual needs of Yellow River ice flood warning and emergency handling work in the Inner Mongolia Autonomous Region if China, we propose the decision support research of three-dimensional platform, which is combined with ice equipment and related research work. The aims of the 3-D spatial decision support platform of the Yellow River in Inner Mongolia part is ice prevention and providing the support decision for the emergency treatment, provide technology supports for flood warning and command decision management platform.

2. SYSTEM DESIGN AND FUNCTION

2.1 Data collection and collation

Data are mainly includes:

1.The high resolution image data and DEM data. Among them, DEM is the precision of 1:10000 ,and involves the Yellow River segment data, image data is image data of the Yellow River section with the accuracy of 15m.

2.the Yellow River river cross-section data, including the terrain data, surveying and mapping of the Yellow River yellow broken yellow broken section data, and the line data of main channel shown as Figure.1.

3. The data of road, villages and towns, villages, bridges and other data, such as river contour data, high data etc..

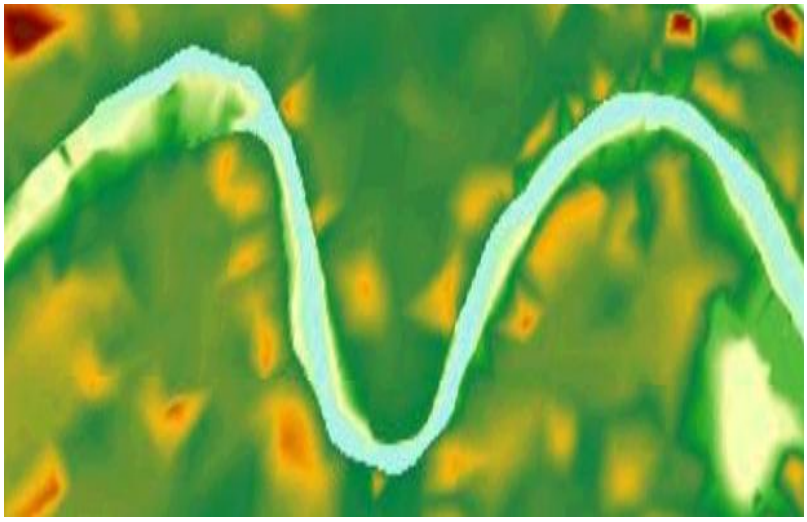

Figure 1: Surveying and mapping data of river cross section

2.2 Establishment of 3-D scene

Using the 3-D geographic information technology, the establishment of the Yellow River in Baotou section of three-dimensional digital scene image data and topographic data based on 3D scene is realized, and the translation, rotation, flight, navigation and scene storage function are also realized.

The Yellow River ice three-dimensional decision support platform should have the rich basic geographic information and reservoir thematic information. In order to achieve the better display effect, the classification of the system information. Different scopes of vision and different scales of 3-D scene, will leads to the different information and content of exhibition. The function of system can switch between different scenes quickly.

In order to realize the display of 3-D scene and water conservancy engineering distribution, system should provide automatic flight function, and it can be set along the certain route with the certain angle and height in the flight, and it also have the timely adjustment function of depression angle and flight height .

The 3-D scene can be looked as a whole system, in the process of building the hierarchical design, basic principle of stratification that the each layer is relatively independent, any layer depends only on the layer below itself. Hierarchical partition of the system will do benefits to the realization and logic design of the system. According to the system design idea, the system can be divided into many subsystems from top to bottom layer, i.e., the application layer, system service layer, data access layer, and data layer, etc which is shown as Figure.2.

Figure 2: High resolution of DEM and image data

2.3 Analysis function of 3-D scene

In the 3-D platform as shown in the Figure.3and Figure.4, the location function of three-dimensional scene in the longitude and latitude, the query of distance between any two points in real-time, statistical calculation of area of 3-D scene analysis function are both realized.

Figure 3: Query of longitude, latitude, elevation

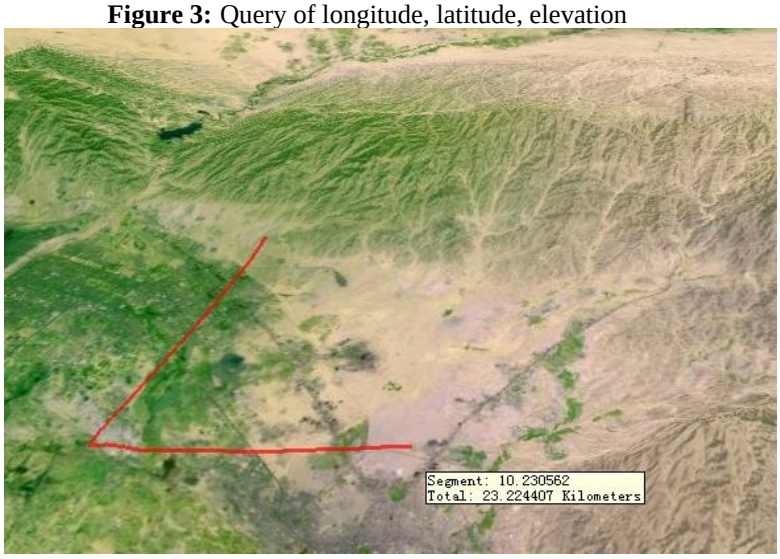

Figure 4: Measurement of distance

2.4 Query function of information

The Yellow River large section information, stream channel positioning display function can be realized in the system just shown as Figure.5 and Figure.6.

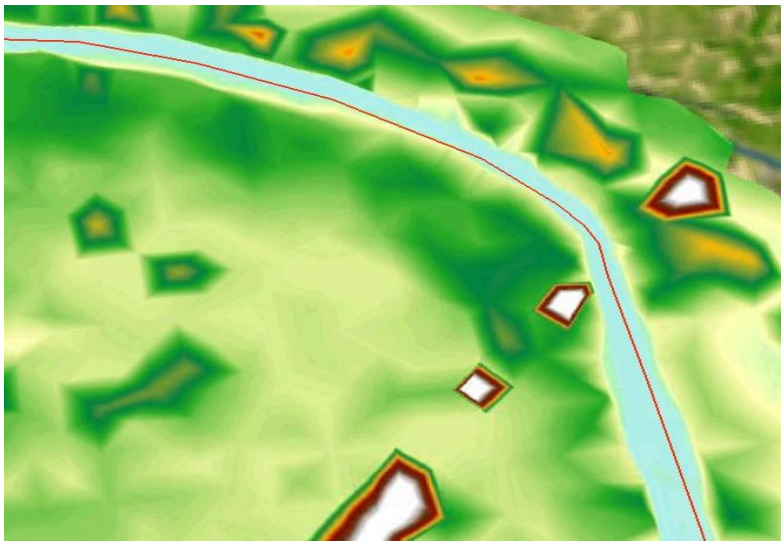

Figure 5: Data of main channel

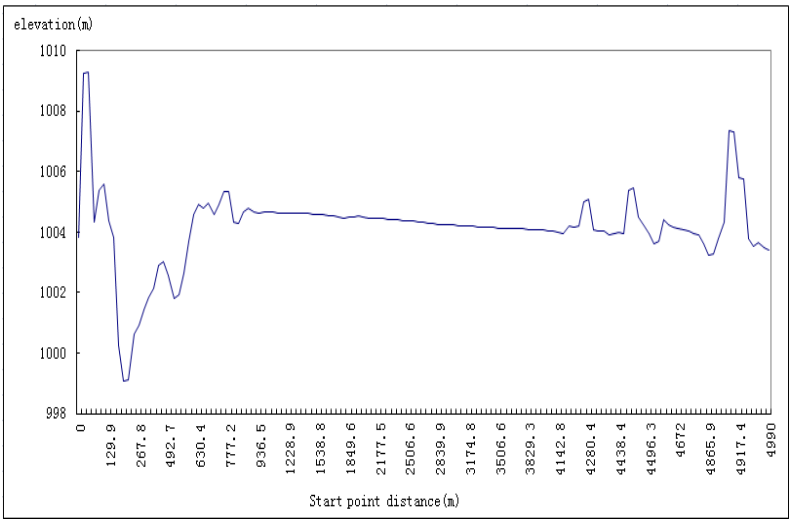

Figure 6: Query cross section data

The system can simulation the situation of the dam-break flood, the analysis of the submergence depth and submerged area can be realized. Through the water level setting of dam-break flood, and outlines the range, the system will calculate the depth of submergence of flood and inundation area automatically which as indicated in Figure.7.

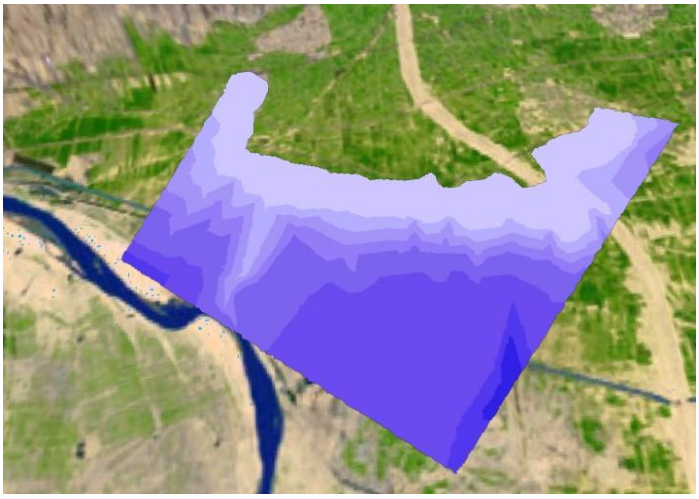

Figure 7: Analysis dam-break flood inundation

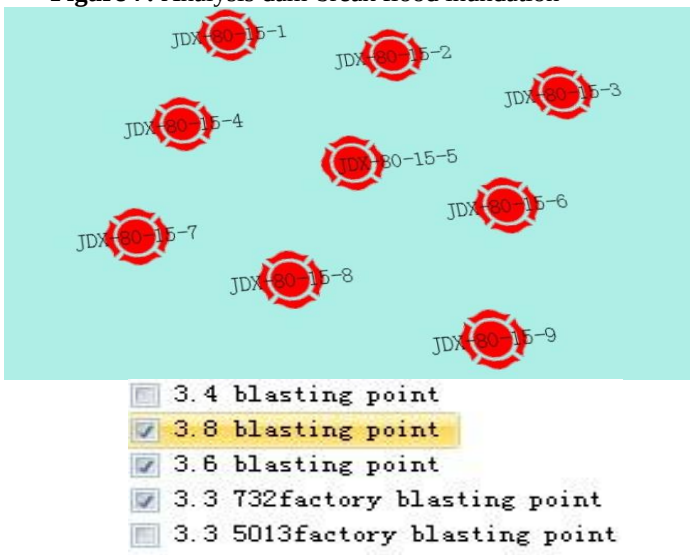

Figure 8: Classification query blasting according to layer

2.5 Query function of blasting point information

In the system, query and display of blasting point information, including blasting, blasting point number and position can be realized. The classification of the blasting points can be according to the blasting date or other methods.

In 3-D scene implementation of blasting process display, through clicking on the blow-up point in the system, the details of the blasting, blasting parameters can be obtained, the parameters include blasting environment parameters, charge properties, charge layout, blasting effect and other processes.

3. DEVELOPMENT OF PLATFORM INTERFACE

According to the ice command control system needs in the subsystem of geographic information, we should provide the support for accessing and processing the spatial data. The three-dimensional decision support platform of Yellow River can provides us two interfaces, one is the spatial data access interface; another is the development interface.

Spatial data access interface can be finished through the ArcSDE, in order to ensure the three-dimensional decision support of platform Yellow Rive can obtain spatial data as required, including vector data (such as rivers, roads, embankments, raster data (such as DEM), remote sensing image).

The system adopts the ArcGIS series software, which not only can provide the development of interface, but also for the development of this system at the same time. It can also provide the twice development of interface for future applications, and ensure that the three-dimensional decision support platform of Yellow River can be expanded according to different needs or different application.

4. CONCLUSION

This system adopt database technology and web development technologies, according to the actual work needs, we build the melting ice flood of Yellow River monitoring data reported to management system based on B/S structure, which can provide the dynamic melting ice flood information in real time. And its examination and approval, information management and query functions mainly include the basic information module, information module, information management module and system maintenance module, meet ice on information reporting, query, management, and intuitive display of the objective requirements. 3-D display system can present monitoring information in real-time and store information in the database data; 3-D display system will bring convenient for the decision support.

5. ACKNOWLEDGEMENT

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6. REFERENCES

[1] [Zhao Jieming ;Zhang Shuyu; Li Xingmin THE USE OF NOAA METEOROLOGICAL SATELLITE DATA IN FLOOD MONITORING IN SHAANXI PROVINCE[J]. JOURNAL OF CATASTROPHOLOGY,12(2):18-22,1997.
[2] ZHAO Shou-gang,CHANG Xiang-qian1,PAN Shu. Reliability analysis of seepage stability on standard dyke of Yellow River[J]. Chinese Journal of Geotechnical Engineering, 29(5):684-688,2007.
[3] GUO Yong-xin,WANG Tao,YANG Kai-lin. Design and development of decision support system for ice regime forecast of Ningxia-Inner Mongolia reach of Yellow River[J]. Water Resources and Hydropower Engineering, 36:67-73, 2005.
[4] JIANG Ren-gui,XIE Jian-cang,LI Jian-xun. Research and application of 3D Early Warning Monitoring Platform for flood prevention[J]. Journal of Hydraulic Engineering, 46(6):749-755, 2012.
[5] JIN Hong-chang, WANG Tie-qiang, ZHU Qing-li. Study on Electronic Sand Table System of the East Route of the South-to-North Water Diversion[J]. 5(2):38-37,2007.
[6] HUANG Guofeng,YUAN Ximin,LIU Yuanyuan. Construction of 3-D electronic sand table system for flood control and ice-jam flood prevention in Ningxia[J]. Water Resources and Hydropower Engineering, 42(12):84-87,2011.