WebGIS System of Kunming Public Drainage Pump Station

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Abstract. Drainage system is the main artery and vein of urban life, and is an important municipal infrastructure for the survival and development of a city. The drainage pumping station is an indispensable part of the drainage project and a hydraulic hub for the normal operation of the urban drainage system. With the rapid development of social economy in Kunming city, the city scale and population increase sharply, Kunming city drainage system, especially drainage pumping station is also facing great pressure and challenge. Aiming at the problems existing in the operation and management of drainage pumping station, a management system of Kunming drainage pumping station based on WebGIS is built to realize the information and scientific management and analysis of a large amount of data. Efficient utilization of pump station operation data; fast access to pumping station information according to different attribute requirements; using statistical chart to better show the situation of Kunming drainage pumping station; use measurement functions to plan pumping stations. The application of this system not only greatly improves the data utilization rate, but also can obtain information quickly and efficiently manage information.

1. Introduction

With the continuous acceleration of urban construction, the aging problem of more and more rainwater pumping stations and sewage pumping stations has become increasingly serious, affecting their use in flood season [1]. Therefore, the planning, construction, operation and scientific management of urban drainage pumping station are the important guarantee for the safe operation of modern cities.

In recent years, Kunming city construction develops rapidly, the city appearance changes with each passing day, has made the remarkable achievement. With the rapid increase of city size and population, the drainage pumping station in Kunming is also facing great pressure and challenge [2]. At present, Kunming municipal drainage pumping station construction planning standard is low, the management means is backward, the management efficiency is low, there are many hidden dangers, the energy consumption is high, pumping station information management level lags far behind the domestic developed cities. The information of urban drainage system and drainage pumping station has a typical spatial distribution characteristic. Because of the lack of spatial data processing ability, the traditional management information system (MIS) is difficult to store and manage the spatial and temporal information of drainage pumping station quickly[3], accurately and efficiently. Geographic Information System, namely GIS (Geographic Information System) technology and RS (Remote Sensing) technology, provides a powerful tool for the information and scientific of urban drainage pumping station [4]. GIS is a spatial information system to describe spatial data, which is a kind of spatial information system to collect, store, manage, analyse and describe the whole or part of the earth's surface and the spatial geographical distribution of the data. Users can use GIS to effectively manage spatial database, process and process spatial data, and realize data visualization. WebGIS (Web Geographic Information System) is a kind of product that combines GIS technology and Internet technology. It can...
publish and apply spatial data through the Internet, and realize the sharing and management of spatial data. Therefore, WebGIS technology is very suitable for distributed storage and management of spatial data of drainage pumping stations [5].

In this paper, based on the census data of drainage pumping stations, through ArcGIS Online data set show on the map, public drainage pumping station integrated information system based on WebGIS based in Kunming, Kunming municipal drainage pumping station data scientific, information management, to improve the water environment and pollution of the city management to provide comprehensive and accurate data and the basis of scientific decision support. Relying on this system, it can realize the rapid, efficient and accurate visual query of data, the statistical chart view, provide data analysis function, and can provide a better scheme for the decision-making plan. By using modern information technology, GIS technology and computer network technology, the traditional management mode and management means are transformed, and the monitoring and evaluation information system of urban drainage pumping station with network and spatial visualization is established, so as to realize the scientific and informational management and analysis of Kunming drainage pumping station.

2. Overall system design

2.1. System goals

- Establish a platform that integrates the basic information management of drainage pumping station, the operation analysis of drainage pumping station, and the collaborative management of multi-unit and multi-personnel, and realize the feasibility analysis of the basic information and multi-dimensional analysis of drainage pumping station by multi-unit and multi-professional personnel.
- Use the existing WebGIS technology to realize the graphical interaction of drainage pumping station information on the Internet.
- Provide data analysis function to conduct multi-dimensional analysis on the future development of drainage pumping stations, so as to provide effective support for the establishment, maintenance and prediction of drainage pumping stations.

2.2. Introduction to development technology

2.2.1. WebGIS. In order to realize spatial data sharing and interoperation, geospatial data is published and applied through the Internet. WebGIS client uses Web browsers. WebGIS is a new technology that uses Internet technology to expand and improve GIS. It can use multi-host and multi-database for distributed deployment, and realize interconnection through Internet/Intranet. It is a browser/server (B/S) structure [6].

2.2.2. ArcGIS Online. ArcGIS Online contains worldwide base maps, map data, applications, configurable application templates and GIS tools and APIs for developers to create Web maps, publish GIS services, share maps, data and applications, and manage an organization's content and multiple users [7].

2.2.3. ArcGIS Web AppBuilder. ArcGIS Web AppBuilder is an intuitive WYSIWYG (what you see is what you get) application that can be used to build 2D and 3D Web applications. It includes powerful tools for configuring fully functional HTML applications. With ArcGIS Web AppBuilder, users can create HTML/JavaScript applications that can run on all devices [8].

2.3. System framework

The purpose of the system is to manage the comprehensive information of the drainage pumping station more efficiently, provide various visual information displays, and facilitate the inquiry and use of
personnel from various departments and related professionals. The system mainly relies on ArcGIS Online to realize the WebGIS system platform. The block diagram architecture is shown in Figure 1.

Figure 1. System framework

The client supports mobile phone and PC services, and the system can realize the use conditions of multi-terminal, cross-browser and cross-mobile system [9]. The HTTP protocol is used to communicate between the client and the server, and with the support of the database, the multi-functional application of the system is realized [10].

3. Main functions of the system

The system relies on ArcGIS Online as a development tool, developed based on WebGIS public drainage pump system. The functions of the system mainly include basic geographic location query, query the corresponding drainage pump station information according to different attributes, design statistical charts according to different attributes, display the attribute table of all drainage pump stations at the bottom of the page, and measure the distance between pumping stations, and many more. The project overview is shown in Figure 2.

Figure 2. System overview
3.1. Location of drainage pumping station
Based on WebGIS, the system can provide basic positioning query to realize map zoom in, zoom out and positioning. The query results include information such as the name of the pumping station, latitude and longitude, and the approximate location of the drainage pumping station. The comprehensive information of each attribute of the pumping station is displayed in the form of a pop-up window. The pump station information can be obtained more quickly and conveniently. The location query information is shown in Figure 3.

Figure 3. Location query

3.2. Property query pump station information
According to the specific attributes, the corresponding drainage pump station information is inquired. The query conditions for attribute query mainly include pump station name, pump station code, pump station category, pump station subcategory, and pump station area. The query results include the name of the pumping station, latitude and longitude, and the approximate location of the drainage pumping station. The attribute query is shown in Figure 4.

Figure 4. Property query
3.3. Statistical chart

According to the attribute category, the statistical chart mainly includes the columnar table of the major categories of the pumping station, the statistical pie chart of the facility status, and the statistical pie chart of the operation status. Through the statistical chart, you can understand the general situation of the pumping station, and display it on the map in the form of a heat map, which intuitively reflects the statistical data of the pumping station. The operating pie chart is shown in Figure 5.

Figure 5. Operating pie chart

3.4. Property sheet management

There is a pull-up arrow at the bottom of the system page. Click to display the attribute table of the drainage pump station on the map. Various basic operations can be performed in the attribute table. You can also choose to view the corresponding information of the pump station in the attribute table in the lower right corner of the pop-up window of the pump station. The attribute table management is shown in Figure 6.

Figure 6. Property Management Table
3.5. Range measurement
Range measurement includes the measurement of area, distance and location, and the location distance is measured by positioning.

3.6. Simple data analysis
Relying on the pump station information, based on the rich widget functions of ArcGIS Web AppBuilder, it can provide simple data analysis, including finding point clustering, planning a route, and selecting the best set point, etc. This function provides support for the user's decision-making.

4. Conclusions
This paper designs and implements the Kunming public drainage pumping station system based on WebGIS. The system relies on the comprehensive information of each drainage pumping station and utilizes the existing development technology to realize the functions of positioning, query, and statistical charts. Utilizing the cross-platform and cross-browser features of WebGIS makes the use of the system more convenient and faster. In summary, the realization of the Kunming public drainage pumping station system can reduce the workload of the staff of the drainage pumping station, make the work more efficient, and provide support for scientific decision-making.

Although, the system can provide visual query of public drainage pumping stations. However, the data displayed by this system is manually processed and then stored in the database for release, and there is a certain deviation. Therefore, the system needs to continue to be improved in order to better serve the management and planning of the Kunming drainage pumping station.

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