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Application of Garden Plant Data Query and Analysis System Based on Big Data

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Abstract: *With the popularity of the Internet, big data technology has gradually attracted attention and has been widely used in various fields. Therefore, the proportion of garden plant data query system in the domestic market is gradually increasing, and garden plant research has also become a new scientific research direction. Garden plants play a huge role in garden construction. For this reason, this article has done research on the application of garden plant data system based on big data technology. This article mainly analyzes the garden plant data through investigation method, system analysis method, experimental investigation method, etc., designs the corresponding query system and conducts experiments. The survey results show that 89.7% of the citizens are in favor of the construction of gardens. Therefore, based on big data, improving the functional structure of the garden data query system is conducive to the development of garden design.*

Keywords: *Big Data; Garden Plants; Data Management; Query Analysis System*

1. Introduction

Plants play a significant role in garden design. Plants are the main theme of garden planning and landscape design. The existing garden plant database has functions that cannot fully meet the requirements of professionals. For example, the plant database has problems such as not detailed information for garden applications in the data, the database can only be queried and browsed, and the data update is slow. Undoubtedly, it is of practical significance to develop a "garden plant data query and analysis system" that has a friendly interface, practical functions, detailed data, and a certain amount of intelligent analysis capabilities that can be used conveniently by designers.

There are not a few researches on garden plant data query system based on big data. For example, Zhang Y proposed that in the current management of garden plants, it is urgent to apply modern information technology to realize the information management of garden plants [1]. In order to make plant collection more useful in garden environments with weak network signals, Zhao Dan proposed a new method that combines plant identification with distributed location information, and designed a corresponding method based on Bayesian estimation to analyze diseases and unknown parts of plants. He designed and implemented a mobile application system, and used distributed location information to speed up the recognition speed [2]. Some scholars say that garden plants are the most important part of the garden landscape. In order to facilitate management, many garden plant database systems have been designed. It combines database technology with algorithm knowledge, and through the auxiliary processing of some image software, establishes an information data and intelligent analysis system [3].

The main content of this paper is the application of big data in garden plants, expounds the principles of system development, understands the related technologies of system development, explains the process of system development in detail, uses related algorithms to construct data information and the overall design of the system.

2. Garden Plant Data Query and Analysis System

2.1 The Application of Big Data in Garden Plants

Nowadays, a wave of informatization characterized by computers and other technologies is sweeping the world. Therefore, in the construction of gardens, computers and databases have become

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the two major contributions to garden design [4-5].

(1) The application of computer-aided design in gardens

Computer-aided design is widely used in drawing drawings. It greatly improves the efficiency of garden design and reduces the designer's workload. Some auxiliary design software has also appeared in the work of garden plant configuration. Computers can intelligently provide garden designers with plant information, pictures and related materials for easy query and use.

(2) Application of database technology in gardens

Database technology is a data management technology whose purpose is to derive useful information from a large amount of data as a basis for decision-making. The role of the database in garden design is to store some detailed information in the design such as garden plants, and to provide data support for users to search and browse garden information and construction [6-7].

2.2 Principles of System Development

The system exists as a unified whole. Therefore, in the system design, it is necessary to consider from the perspective of the entire system, and the data collection of the system must be counted and shared globally. At the same time, the system should realize the organic connection between the application information of garden plants in the design.

(1) Modular design

Each module shields its own program design and only provides a low-complexity interactive interface to the outside world. The data transfer between modules is realized through the interface. Maintain maximum independence between functional modules. The scale of each functional module is moderate. While realizing componentized software design, it improves the flexibility of system modification and upgrade and ensures the survivability of the system [8-9].

(2) Practicality

The system interface and system content should be concise and clear in expression, so that users can obtain the information they want in the shortest time.

(3) Scalability

The system is required to have good openness. This requires that the system can be expanded and functionally perfected for the successors.

(4) Unity and simplicity

All control names of the front-end query subsystem of the garden plant data query and analysis system are compiled according to: control type abbreviation + purpose; all sub-segments in the back-end database of the garden plant data query and analysis system are made in the form of "function abbreviation + number" Encoding to minimize the number of characters in the field name.

(5) Reliability

The design of the system should fully consider the integrity, consistency and validity of the data. For example, deletion of data is prohibited when the data is quoted from outside.

2.3 Technical Methods of System Development

(1) The core idea of the program

The plant configuration in garden landscape design not only needs to pay attention to the adaptability of plants to the environment, but also consider the diversity of the various types of plants configured in the landscape. Generally, the configuration of garden plants is based on the designer’s personal experience or related books and materials. Therefore, it is necessary to develop a set of analysis systems that apply design experience and theory to the configuration of garden plants through certain mathematical models and algorithms to make the process of plant configuration more Scientificity and feasibility. Because the environmental factors and ornamental characteristics of plants and regions are different and uncertain, the system uses fuzzy mathematical models to determine the environmental fitness of plants and the landscape richness of plant populations in the plant configuration table [10].

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(2) Programming core technology

1) SQL language, used to access data and query, update and manage relational database systems;

2) API calls to reduce programming tasks;

3) ActiveX controls, embedded in the container host application;

4) Network update and upload data, connect to network server through HT2TP protocol to obtain update information.

2.4 System Development Process

Software development and maintenance are carried out with engineering ideas and principles, so as to ensure the progress of software development and software reliability [11-12]. The software life cycle can be divided into the following stages:

Software planning: conduct feasibility analysis of software, estimate development cost, etc.

Demand analysis: understand the needs of users and solve the problem of "what to do";

Software analysis: analyze the problems to be solved and propose the best solution;

Coding: According to the results of software analysis, use a certain programming language to implement;

Test: After coding, use a lot of data to test to find out the hidden errors;

Maintenance: After the software is delivered to the user, the software needs to continue to be modified in accordance with the changes in the user's needs.

2.5 Construction of Data Information

(1) Classification method of plant data

There are many algorithms and models for solving classification problems. Among many algorithms, the Adaboost algorithm has a good feature of "feature selection", which can filter out features that are only valuable for classification from a large number of features.

The prediction model G (m) of the Adaboost algorithm is an additive model of multiple g (m), and the prediction process is as formula (1)

$$\mathrm{b}_{G(\mathrm{m})} = sign(G(m)) = sign(\sum_{v=1}^{\delta} \pi_v g_v(m)) \quad (1)$$

Input sample set $\{(a_{\mathrm{u}}, b_u) \mid \mathrm{u} = 1,2,...,\mathrm{M}\}$, and a_{u} is the feature vector of the sample, b_u is the corresponding class label. The number of samples is M=M++M-.

Initialize the weight wu of the sample au according to formula (2):

$$w_u = \left\{ \begin{matrix} \frac{1}{2M^+}, b_{\mathrm{u}} = 1 \\ \frac{1}{2M^-}, b_{\mathrm{u}} = -1 \end{matrix} \right\} \quad (2)$$

2.6 System Design

(1) System frame design

The system framework briefly includes three aspects: user interface, data engine, and database, as shown in Figure 1: Calculate the weight of the weak classifier: $\psi_g = In\frac{1-\tau_g}{\tau_g}$, and normalized sample weight.

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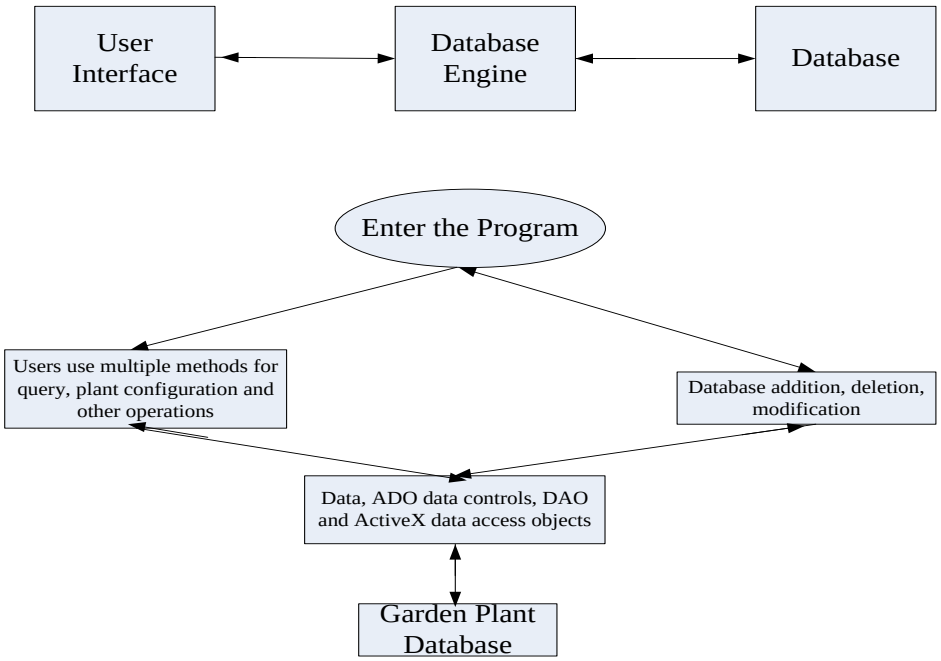

Figure 1: System structure and the principle of system working

(2) System database design

The core database of the system adopts a relational database. Compared with other models, relational databases have the advantages of easier understanding, easier use, and simpler maintenance. The general SQL language makes it very convenient to operate relational databases.

(3) System structure design

The system is composed of six modules, namely browsing, query, analysis, output, management and help. The details are shown in Figure 2:

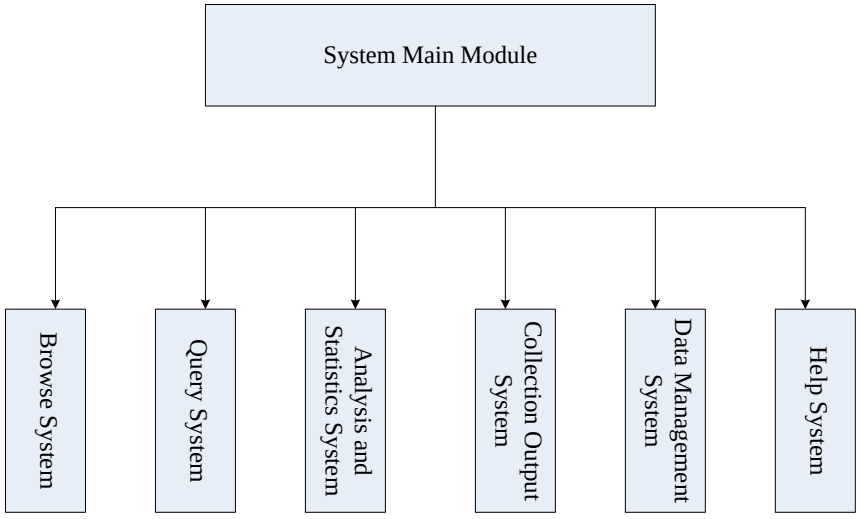

Figure 2: System structure design

3. The Realization of the System

3.1 Data Collection and Sorting

The collection of data is divided into two parts: text data and design materials. The design materials are mainly for the documents related to garden design and drawing. After the data collection is completed, the Access database system is used to systematically classify the collected data to establish

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a basic database.

3.2 Interface Design

The system adopts standard windows operation interface. The software is divided into four parts, and all modules are displayed in the main operating window area through sub-forms.

3.3 Function Realization

(1)Browsing system. Including classification browsing, searching for plant information according to plant taxonomy credits; feature browsing, tree browsing according to the different morphological characteristics of plants in garden applications; plant browsing, according to the pronunciation order of plant names in Chinese List all plants in the database; browse diseases and insects, browse plant diseases and insect pests information, pictures and have the search function.

(2) Inquiry system. Inquiries are divided into professional inquiries and advanced inquiries. Professional query is based on basic information, botanical characteristics, humanistic characteristics, environmental factors, etc. to search. Advanced query is a user-defined query, you can write code to search according to your own needs.

(3) Analysis system. The analysis system is mainly manifested in habitat analysis and comprehensive analysis. Habitat analysis is the analysis of the living environment of plants such as soil, air, temperature, precipitation, and light. Comprehensive analysis is the data analysis of the richness of the garden plant configuration and the landscape effect.

(4) Collection output. Include a list of specific plants.

(5) Data management. The data management module can add, modify, and maintain database information, and can synchronously add data to the network server to update software data.

4. Plant Information for Garden Design

Garden design can also be called plant landscaping technology under normal circumstances. Plant landscaping is generally based on the types and appearance of natural trees, shrubs, herbs and other plant communities, through a certain artistic structure, combined with colors, lines, etc. to design, forming a series of beautiful scenery lines. Table 1 shows the requirements of three different vegetation landscapes on soil, temperature, water, light, etc., and the specific conditions of whether they are affected by pests:

Table 1: The external growth environment of different vegetation

	Soil	Temperature	Moisture	Illumination	Pests
Natural trees	Lax Requirements	Warm or High Temperature	Damp	dark	√
Shrubs	Lax Requirements	Cool	Dry	Plenty of Light	√
Herbs	Lax Requirements	Warm	Moist	Lax Requirements	√

As shown in Table 1, natural trees have higher requirements for temperature, them like high temperature and warmth, and them like humidity, so they are suitable for growing in a dark environment. Shrubs like to be cool, dry, and have plenty of light. Herbs need a warm, humid environment and do not require high light. Moreover, the three plant species do not have high requirements on the soil, and they can grow if they are suitable, and they are all afraid of the influence of insect pests.

Different vegetation has different requirements for the external environment. Therefore, the design of garden landscape should also consider the different conditions of vegetation. Therefore, the rational configuration of the plant landscape is the basis for realizing the ecological functions of the garden. The following aspects should be considered when designing a garden:

(1) Give full play to the comprehensive role of garden plants. It not only has the function of beautifying the environment, but also brings economic benefits.

(2) Handle the inter-species relationship well. Familiar with the growth environment of various trees, and design the distribution of vegetation in districts.

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(3) The artistry of vegetation landscaping. Different gardens have different ideas. It is necessary to make good use of color matching, plant forms, etc., to maintain consistency with the garden theme.

5. Conclusion

In the garden design, plant selection and configuration mainly consider the ornamental characteristics of plants and their adaptability to the environment. In order to facilitate the query, in the context of big data, it is necessary to design a garden plant data query and analysis system. The system designed in this paper has 5 functions. The first is to browse various basic information, the second is to inquire about your own individual needs, the third is to analyze the habitat of vegetation, the fourth is to collect plant charts, and the fifth is to manage plant data. Through the secondary development of AutoCAD, this database system is combined with AutoCAD to digitize the information on the location, variety, quantity, specification, growth and other aspects of plants planted in urban gardens and green spaces. Doing so can not only query plant-related information, but also visually display the current status of urban green spaces. This system can provide a convenient and efficient platform for urban green space management, and provide comprehensive and intuitive statistical data and reference basis for urban green space planning, construction, and maintenance.

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