Deploy on extranet based on CAWS Anywhere Server Volunteer meteorological observation station

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Abstract: *The CAWSAnyWhere Server2013 unified data collection platform for regional automatic stations can be compatible with various types of automatic weather station equipment from various manufacturers, and is suitable for the central station operation management software of voluntary meteorological observation stations.CAWSAnyWhere Server2013 is used to deploy voluntary meteorological observation stations on the Internet to realize unified data receiving and processing of automatic weather stations.Users of all industries can obtain and query real-time and historical observation data more easily by installing and applying the application software of the central station.The installation, setting and commissioning of the central station and the application software of CAWSAnyWhere Server2013 require the close cooperation of technical personnel of meteorological equipment support, network management and manufacturers.Through the analysis of examples, it is proposed that the technical key points of CAWSAnyWhere Server2013 deployment of voluntary meteorological observation stations on the Internet include: DTU debugging of collector, software configuration and debugging of central station, database environment configuration, network environment configuration, application terminal software development and application, etc.*

Keywords: *Volunteer meteorological observation station, CAWSAnyWhere Server, Automatic weather station, Observation data*

1. Introduction

In recent years, with the in-depth development of professional meteorological services, related industries have put forward more personalized, refined and real-time requirements for meteorological observation data[1]In order to promote the rapid development of voluntary meteorological observation stations, meteorological departments urgently need to improve the management norms and technical support for the development and construction of voluntary meteorological observation stations[2].The voluntary meteorological observation station is an important part of the integrated meteorological observation system.

At present, there is little research on the data collection and processing system technology of voluntary meteorological observation stations in China. The central station software of CAWSAnyWhere Server is mainly deployed and applied in provincial and municipal meteorological service Intranet.Wang Guibin et al[3]It is found that the central station software CAWS AnyWhere Server 2013 can run stably in Windows 7 with lower maintenance cost.As an attempt of voluntary meteorological observation station operation management mode, Huayun Shengda (Beijing) Meteorological Science and Technology Co., LTD. (abbreviation: The regional automatic Station Unified Data collection platform software (CAWSAnyWhere Server2013) can receive and transmit data of voluntary meteorological observation stations on the Internet, which can break through the restrictions of network security and data control of meteorological departments, and realize the integration and sharing of socialized meteorological observation resources. It is of great significance for enhancing the enthusiasm of related industries to participate in meteorological observation, increasing the supply of public meteorological services and improving the level of public meteorological services.

1.1 Introduction of unified data collection platform and terminal application platform of regional automatic station

The Unified Data collection platform for Regional automatic stations (CAWSAnyWhere Server 2013) can be compatible with existing manufacturers of automatic weather station equipment, various types of

observation stations, and various types of business network systems, and is suitable for the central station operation management software of voluntary meteorological observation stations[4].CAWSAnyWhere Server 2013 can realize the comprehensive and multi-channel collection, processing and fusion application of various meteorological data.Through various means of communication, complete the whole network data collection, processing, storage, application, analysis, display functions;To realize the communication network control, data integrated application and external service in a cascading way;Data is uploaded and reported in real time, applications are shared horizontally, and control flow and status flow are interconnected.

As the terminal application platform of CAWSAnyWhere Server, CAWSAnyWhere Plus 2013 can realize the comprehensive application of data of automatic meteorological observation station network.The platform and CAWSAnyWhere Server carry out data transmission through the Internet to realize the query, display, analysis and processing functions of real-time data and historical data.

2. System design and development

2.1 System Structure

After the automatic weather station and CAWSAnyWhere Server 2013 central station software receive data normally after installation and debugging, the CAWSAnyWhere Plus 2013 application terminal can be installed on the user's computer in the LAN to realize the user's query, display and application of observation data.

Since the data of voluntary meteorological observation station is mainly for users outside the LAN, and the CAWSAnyWhere Plus 2013 application terminal is mainly for users inside the LAN, Beihai Meteorological Bureau develops the application software on its own based on users' needs to access the database of the central station through public IP and port number. Real-time acquisition of observation data and processing, to provide users with more friendly data display, query and analysis applications.The system structure is shown in Figure 1.
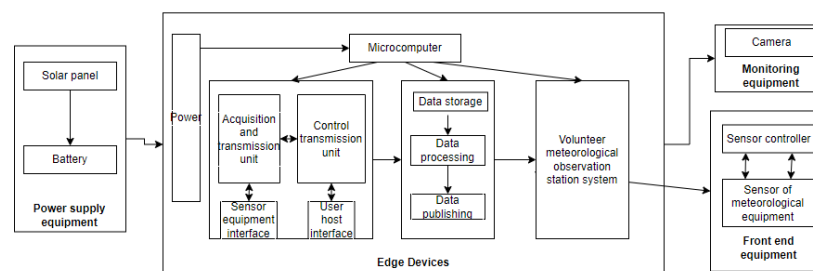

Figure 1: System structure

2.2 Software Design

The application software uses the Spring boot framework + Vue framework to develop the solar weather station observation system that integrates the meteorological Internet of Things platform. The system has realized meteorological data management, user management, and large visual screen management module, etc. The functions of meteorological information equipment have been designed, and the database system of the system platform has been designed and developed. Build a data service platform with good function expansion and public service support[5].

2.3 Software Development

2.3.1 Visualizing large-screen interface

Display meteorological data uploaded via various information sensing devices that receive real-time monitoring of physical models from CAWSAnyWhere Server2013.The main components include the equipment location map module in the middle, outdoor real-time meteorological environment monitoring module, weather forecast module, meteorological video module, temperature and humidity trend chart module, and rolling equipment list module.See Figure 2 below.
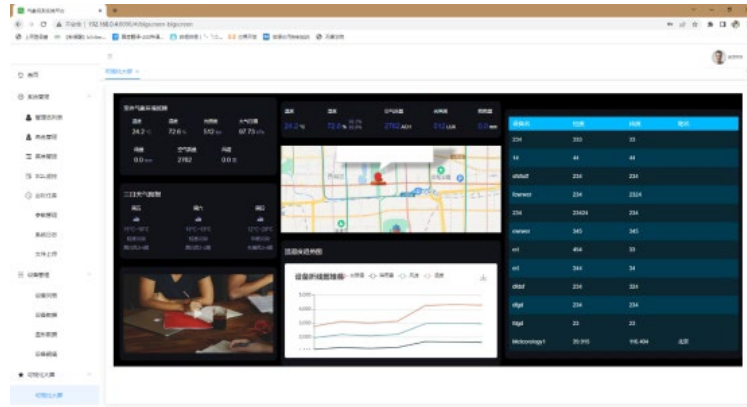
Figure 2: Large screen visualization interface

2.3.2 Role Management Page

The system can be divided into administrator, ordinary user and developer three authority modules, ordinary user and developer module to achieve the scheduled task, device management, data function management, file upload, early warning management and other functions.Administrator module to achieve the function is to enjoy the above basic functions but also to achieve user management and role management functions.The role management module is shown in Figure 3 below.
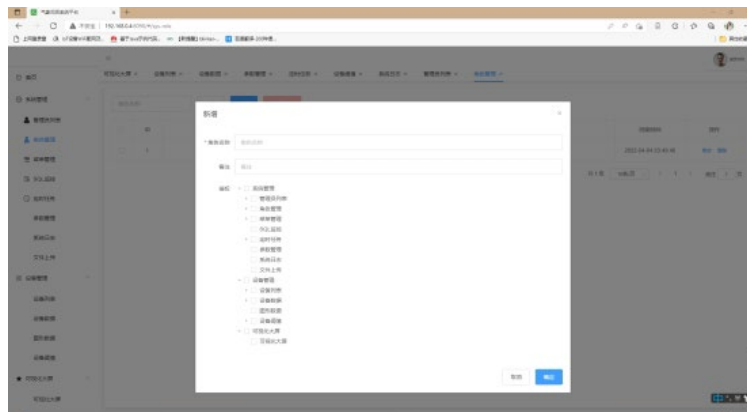

Figure 3: Role management interface

2.3.3 GUI

No matter on any platform, meteorological data monitoring and analysis is a daily task for users and administrators. Therefore, this meteorological observation system also provides the function of graphical data interface, which can classify and calculate the data needed by users and obtain the data results or data renderings that users want.The graphical data interface is shown in Figure 4 below.
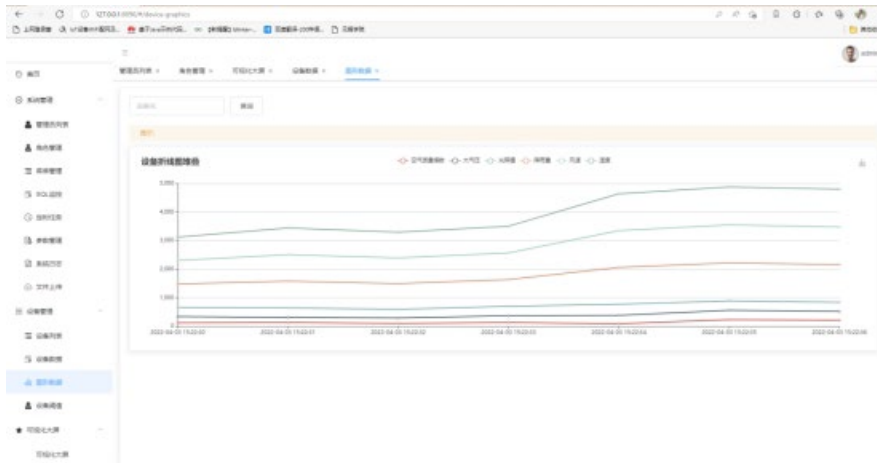

Figure 4: Graphical data interface

2.3.4 Cloud Computing platform

The cloud computing platform combines a variety of algorithms, including Apriori algorithm and K-means algorithm in big data mining technology, to carry out intelligent analysis of the environmental factors in the deployment location of the equipment cluster. The essence of the analysis is to find out the strong correlation between the environment and meteorological factors in the monitoring location of the equipment, and establish matching modeling and self-modification support degree according to the strong correlation. Relying on the cloud computing technology in the cloud computing platform, the data collected by the perception layer of the Internet of Things can be effectively analyzed and concluded in a very short period of time to assist technicians to make correct decisions in a short period of time[6].

2.4 Implementation of personalized functions

2.4.1 Function of Apriori

The voluntary observation system provides the function of big data mining, which selects at least three factors for processing in a selected period of time and excavates the strong association rule between the factors. The data time can be selected in the last three days. The data comes from the hourly ground data of the voluntary observation meteorological station in Beihai City, Guangxi Province. Air temperature (marked as AT), precipitation (marked as PP), wind speed (marked as WS), wind direction (marked as WD), humidity (marked as HM) and air pressure (marked as AP) constitute the thing set I of a single excavation project, namely I={AT,PP,WS,WD,HM,AP} then a record at each moment, namely a subset of I, For a transaction Ti.

2.4.2 User Rights Functions

The voluntary observation system platform strictly divides the identities and permissions of administrators and developers.Because the system involves local scientific research data, involving a large number of local first-hand basic meteorological information, therefore, even the administrator user does not open all the permissions.For example, the administrator's own account and other administrator account information cannot perform any permission operations.To prevent administrator users from endangering or damaging local meteorological data, do not delete administrator logs when viewing logs.To prevent external intruders from maliciously tampering with basic data and obtaining information such as device addresses through administrator accounts, you are not allowed to register accounts of common social users.The user permissions is shown in Figure 5 below.
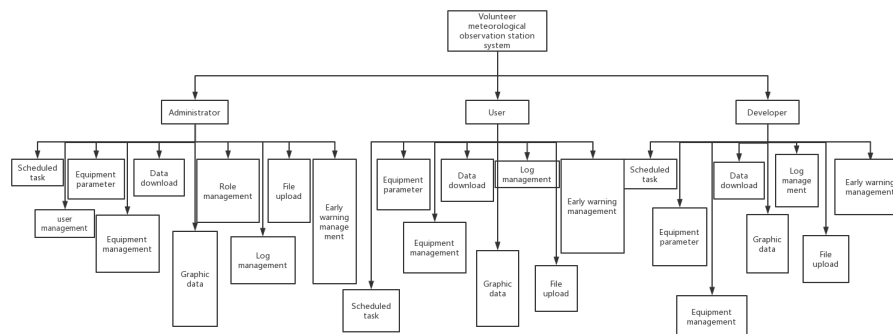

Figure 5: User permissions

2.4.3 File Upload Function

The system platform supports the transmission of meteorological data to the cloud disk of the cloud for storage, using the cloud disk interface of three different platforms of the system, namely: Qiniuyun, Ali Cloud and Tencent Cloud.Data can be stored in the desired place anytime and anywhere. Therefore, the file upload function module has the following two characteristics: (1) High efficiency, without tedious operations directly on the web page to meet your needs.(2) Practicality, enterprise users can customize the interface required by their cloud disk according to their own needs.

The upload function adopts personalized upload mode and supports drag upload. You don't have to worry about finding the file path any more. It is fast and convenient.Figure 6 shows the cloud storage configuration.
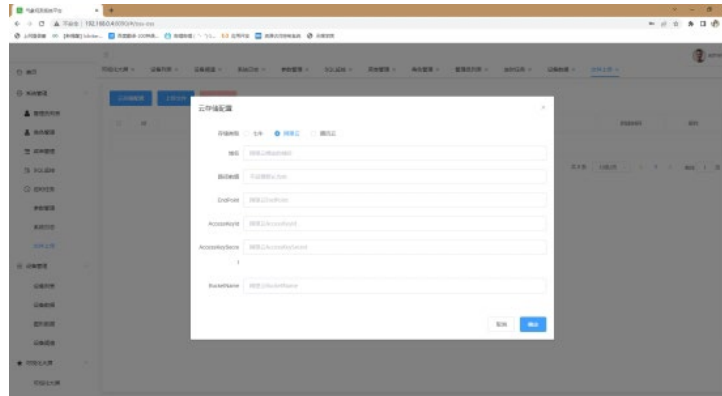
Figure 6: Cloud storage configuration

2.5 Data Storage and Database Management System

Log in to the database as the administrator and create the database space Volws in the database.Database Volws has 9 tables: weather, device, threshold, sys_user, schedule_job, sys_config, and sys_role, respectively. Role Management information table), sys_captcha (CAPTCHA data table), sys_log (System log data table).The following defines the field name, field type, description, and remarks for each table.

2.5.1 Meteorological Data Information Table

The meteorological data information table in the database is the key data table of the entire software system, which is also the most frequently used data table and occupies the largest memory. It records and displays the data collected by the underlying equipment from Ali Cloud platform.The data list includes serial number, device identity, Value, data type, unit, Remarks name, device name, and threshold record.As shown in Table 1.

Table 1: Meteorological Data Information Table (weather)

The serial number	Field name	Field Type	instructions	note
1	Id	Varchar (255)	Data Serial number	Primary key, not null
2	Identifier	Varchar (255)	Device Identity	
3	Value	Varchar (255)	Specific Data	
4	DataType	Varchar (255)	Data type	
5	Time	Datetime	time	
6	Unit	Varchar (255)	Unit of parameter	
7	Name	Varchar (255)	Parameter Name	
8	Create_time	Datetime	Data reception time	
9	Device_name	Varchar (255)	Name of the owning device	
10	threshold	Varchar (255)	Threshold condition	

3. Installation and setup -- Taking Beihai Volunteer Meteorological Observation Station as an example

3.1 Installation Environment

(1) Hardware environment: The current mainstream configuration of commercial desktop computer (the main frequency is more than 2.4G, memory is more than 2G, hard disk is more than 120G), with external fixed IP address and port number.

(2) Software environment: operating system Windows 10 Education Edition;Database Microsoft SQL Server2008 R2

3.2 Software Parameter Settings

According to the Installation Instructions of Unified Data Collection Platform Software and Database of Regional Automatic Station provided by Huayun Shengda and the software installation and setting method proposed by Wang Guibin et al. [4], the database was correctly installed, the database with the name of CAWSAnyWhereServer was established in the database, and the stored procedure file was executed in the query analyzer.After installing CAWSAnyWhere Server 2013 and map package, configure software parameters by following the steps below.

(1) Central station parameter setting.General Settings, data collection Settings, database Settings and other Settings;

(2) Sub-station Settings.Add classification, add sub-stations, set basic parameters and set communication parameters.

(3) Data macro Settings.Set the hour and minute macros;

(4) Database configuration.Generate database tables.

3.3 Application Information

After the automatic weather station and CAWSAnyWhere Server 2013 central station software receive data normally after installation and debugging, the CAWSAnyWhere Plus 2013 application terminal can be installed on the user's computer in the LAN to realize the user's query, display and application of observation data.

Since the data of voluntary meteorological observation station is mainly for users outside the LAN, and the CAWSAnyWhere Plus 2013 application terminal is mainly for users inside the LAN, Beihai Meteorological Bureau develops the application software on its own based on users' needs to access the database of the central station through public IP and port number. Real-time acquisition of observation data and processing, to provide users with more friendly data display, query and analysis applications.

4. Summary and Outlook

In order to realize the practical application of the forecast products developed in this study, all kinds of seamless and refined professional meteorological service products are visualized and released on the Internet, and a fully functional meteorological service wechat public account information release and support system is developed to meet the needs of meteorological service information release to the Marine economic industry.Developed the following characteristics, and finally built a good function expansion, public service support data service platform.

1) Live weather information.Provide real-time observation data such as wind direction, wind speed, rainfall, temperature, visibility, and relative humidity every 30 minutes by using graphs, tables, and words. Set thresholds of meteorological elements based on users' location and requirements, and automatically push live weather alarm information to users.

2) Sudden severe convective weather information.(1) Provide 0-2 hours approaching precipitation forecast and rainfall advance warning service based on any location points;(2) Provide automatic identification and reminder service of storm generation and elimination based on any location point;(3) Provide automatic production and push of 0-2 hours of severe convective weather approaching warning information based on any location points, and release severe convective weather warnings such as thunderstorms and gales, short-term heavy precipitation and hail;(4) To provide the potential (probability) forecast of three types of severe convective weather such as lightning, short-time heavy precipitation, thunderstorm and gales based on any location point for 3 hours in the next 4 days.

3) Wechat App of Beihai Volunteer Meteorological Observation Station.(1) Provide the display chart of each observation element at the minute level and the hour level;(2) Provide a chart to query the changes of the observed data in the past 24 hours;(3) Provide the function of assigning user query management rights.

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