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Epidemic Management System based on SpringBoot and Oriented for Echarts

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Abstract

If there is no epidemic website, there are too many scattered data, coarse data granularity, lack of historical dimension data, and lack of structured data. With this epidemic management system, we can observe and understand the epidemic situation more intuitively. As a powerful open source visualization library, Echarts has the advantages of multi-source, mass nature, wide openness and strong integration. This project is based on SpringBoot technology and an epidemic management system developed for Echarts. The system is divided into two modules, introducing the domestic and foreign epidemics respectively. The integration of epidemic information and data can make people better grasp the epidemic trend and intuitively feel the epidemic data.

Keywords

Echarts; SpringBoot; Data Visualization; Real-time Monitoring.

1. Introduction

This system is based on the current domestic social form of Corona Virus Disease 2019 (COVID-19, hereinafter referred to as "COVID-19"). People need to frequently pay close attention to regional epidemic information, information on medium-high risk areas, and national epidemic prevention and control policies, etc. However, these operations or access to information are often not unified, and people need to frequently travel to and from various channels, pay attention to all kinds of information, to achieve their own goals.

This system is to solve the above problems, the access to information and operation are unified in a system, simplify the user operation, more comprehensive and real-time access to epidemic related data, more intuitive statistics and predict epidemic information, people in a system can meet their needs, without time-consuming effort to various platforms for operation.

2. Development Environment and Technology Introduction

This system is a B/S three-layer architecture framework system based on SpringBoot, namely: view layer, service layer, and persistent layer. The technical selection of the three-layer architecture of the system is roughly illustrated as follows:

(1) SpringBoot Frame: Spring Boot is a new framework provided by the Pivotal team, and is designed to simplify the initial setup and development of the new Spring application. The framework is configured in a specific way, so that developers no longer need to define boilerplate configurations. Belongs to the current most popular java development backend framework.

(2) Apache Shiro: Apache Shiro is a powerful and easy-to-use Java security framework with authentication, access authorization, data encryption, and session management to protect any application.

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(3) Layui: The layui is an open-source Web UI solution, with its own classic modular specification, and following the native HTML/CSS/JS development approach, often suitable for the rapid development of web interfaces.layui is different from the front-end framework based on the bottom layer of MVVM. It is more oriented to the back-end developers. There is no need to get involved in the front-end tools, just face the browser itself, and make all the required elements and interaction.

(4) ECharts: ECharts is a JavaScript-based data visualization graph library, providing intuitive, vivid, interactive, and customizable data visualization charts.

The development environment is JDK1.8, the development tools use Intelli J IDEA, Navicat, and the program language includes html, css, Java Script, java.

(5) HttpClient: When using crawlers to grab packages online, httpClient provides us with an efficient, up-to-date, and feature-rich client-side programming toolkit that supports the HTTP protocol.

(6) Fastjson: Fastjson is a high-performance well-functional JSON library written in Java language. It uses a "supposed ordered fast match" algorithm to improve the JSON Parse performance to the extreme, and is currently the fastest JSON library in the Java language. The Fastjson interface is simple and easy to use, and it has been widely used in various application scenarios, such as cache serialization, protocol interaction, Web output, Android client, and so on.

3. System Module Description

The overall architecture of the epidemic management system based on the SpringBoot framework is shown in Fig:

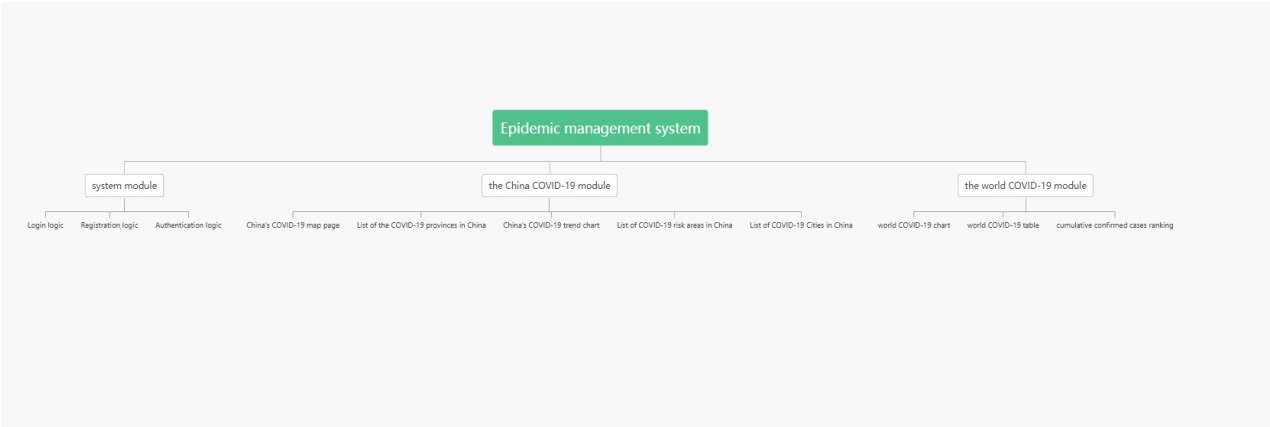

Figure 1. System overall structure diagram

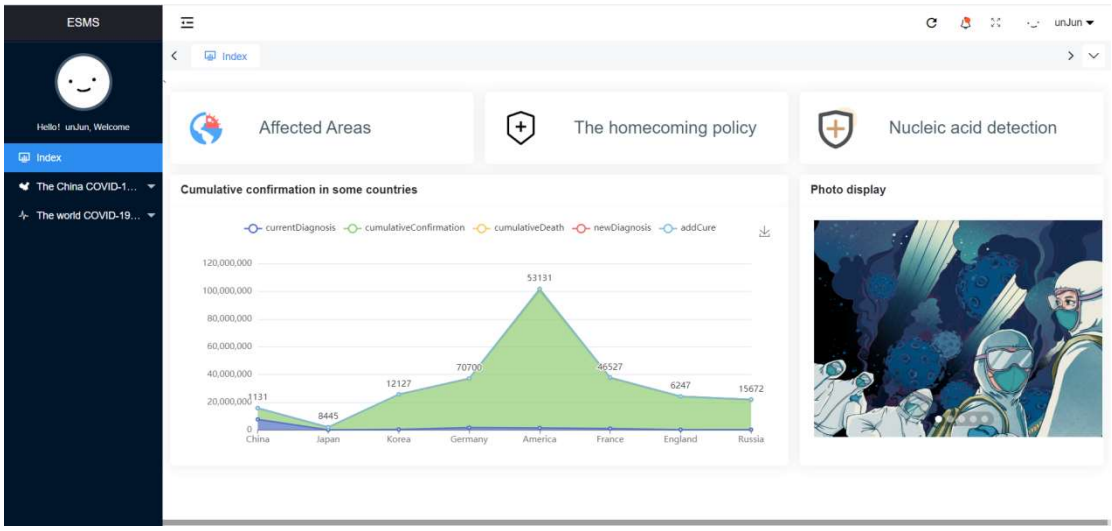

Figure 2. System overall effect display diagram

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The main functional modules of the system include the system login,registration module,the China COVID-19 module and the World COVID-19 module.

4. System Function Design and Implementation

According to the above system function design and process, to realize the functions in the interface.Grab the data from the Internet, process the event data, and then store it to the database, use the SpringBoot framework to build a web page, and realize the following functions.

4.1 Database Design and Implementation

This system uses the Mysql database to realize the data persistence layer, and uses the Navicat for visual management. There are 6 tables. Each database table information is detailed in Table 1.

Table 1. Database table information

sequence	table	annotation
1	china_province_city_epi	A table of data on COVID-19 in China
2	china_daily_epi	A table of storing daily COVID-19 data in China
3	china_risk_area_epi	A table storing data on high-school and low-risk areas in China
4	china_news_epi	A table of storing COVID-19 news data about China
5	global_country_epi	A table of storing world COVID-19 data
6	user	A table that stores all of the user information

4.2 Implementation of the Login and Authentication Logic

(1) Login: When the user logs in, the system sends the information entered by the user back to the back end, uses the salt encryption method to verify the returned password and generate token, and calls Subject. login (token) method to log in, which will be automatically entrusted to SecurityManager. SecurityManager entrusts the authentication to Authenticator, which sends the corresponding token to Realm to get the authentication information from Realm. If no success message is returned, throwing an exception means that the authentication has failed.

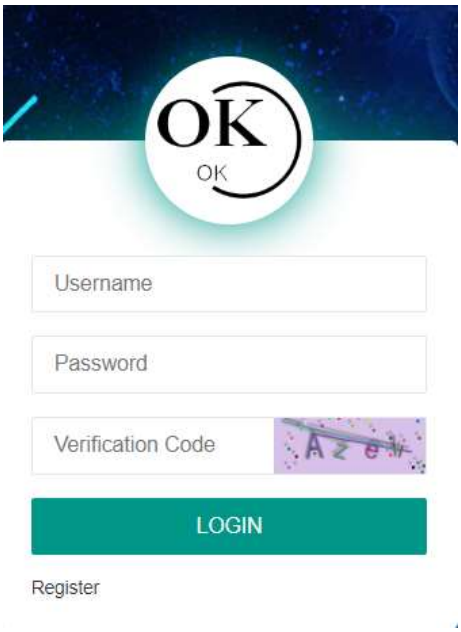

Figure 3. Login function implementation diagram

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(2) Authentication: The authentication is mainly Shiro processing, the user to configure the user current status and access resource permission relationship. For example, when the user is not authenticated, it is not allowed to access the system resource.

4.3 Introduction to the Front-end Design of the China COVID-19 Module

The China epidemic module includes five sub-pages: China's COVID-19 map page, List of the COVID-19 provinces in China, China's COVID-19 trend chart,List of COVID-19 risk areas in China,List of COVID-19 Cities in China.

Figure 4. China's COVID-19 module chart

(1) China's COVID-19 map： This interface displays the current epidemic situation data information in the form of a national and provincial map. Users can hover their cursor to different provinces to query the existing confirmed disease data information in different provinces.On the right side of the interface is the latest news and information of the epidemic.

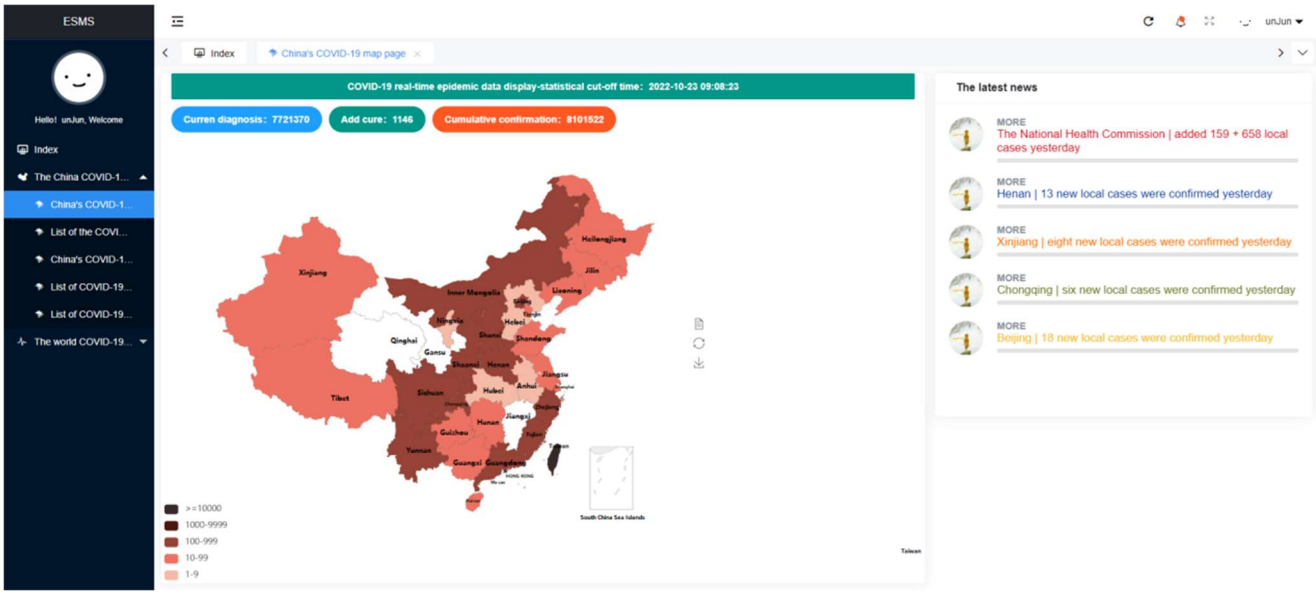

Figure 5. China's COVID-19 map

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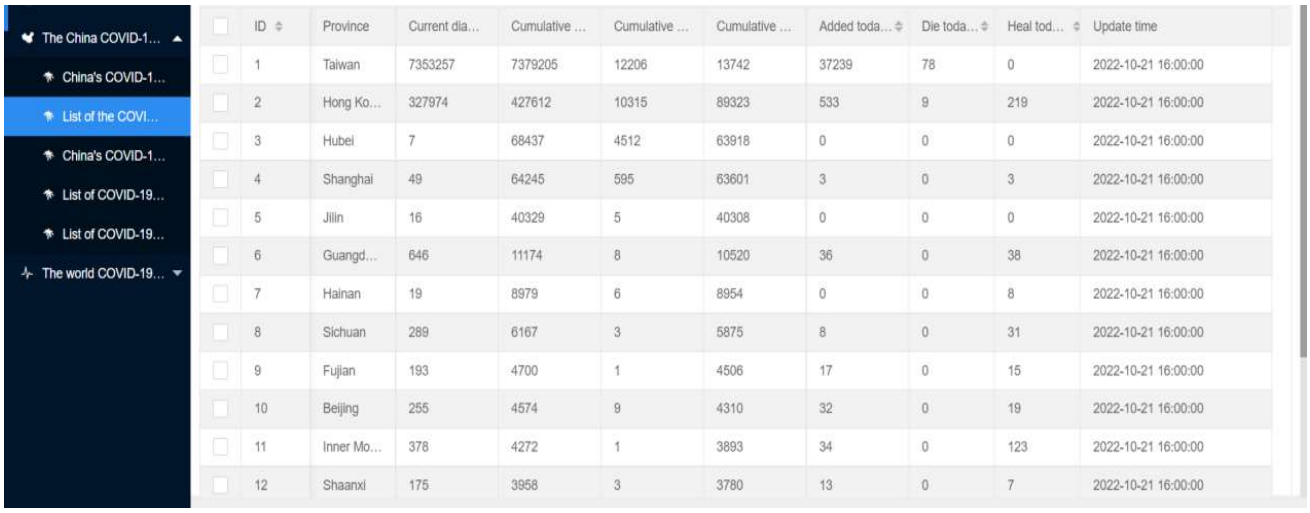
(2) List of the COVID-19 provinces in China: This interface shows the epidemic information in different provinces in China. Users can search the information of provinces to check through the search box. At the same time, you can also export and print the data of the list.



ID	Province	Current dia...	Cumulative ...	Cumulative ...	Cumulative ...	Added toda...	Die toda...	Heal tod...	Update time
1	Taiwan	7353257	7379205	12206	13742	37239	78	0	2022-10-21 16:00:00
2	Hong Ko...	327974	427612	10315	89323	533	9	219	2022-10-21 16:00:00
3	Hubei	7	68437	4512	63918	0	0	0	2022-10-21 16:00:00
4	Shanghai	49	64245	595	63601	3	0	3	2022-10-21 16:00:00
5	Jilin	16	40329	5	40308	0	0	0	2022-10-21 16:00:00
6	Guangd...	646	11174	8	10520	36	0	38	2022-10-21 16:00:00
7	Hainan	19	8979	6	8954	0	0	8	2022-10-21 16:00:00
8	Sichuan	289	6167	3	5875	8	0	31	2022-10-21 16:00:00
9	Fujian	193	4700	1	4506	17	0	15	2022-10-21 16:00:00
10	Beijing	255	4574	9	4310	32	0	19	2022-10-21 16:00:00
11	Inner Mo...	378	4272	1	3893	34	0	123	2022-10-21 16:00:00
12	Shaanxi	175	3958	3	3780	13	0	7	2022-10-21 16:00:00

Figure 6. List of COVID-19 provinces in China

(3) China's COVID-19 trend chart: This interface shows the changing trend of domestic epidemic data in recent years. Users can clearly see the trend of domestic epidemic data in the last ten days through the legend.

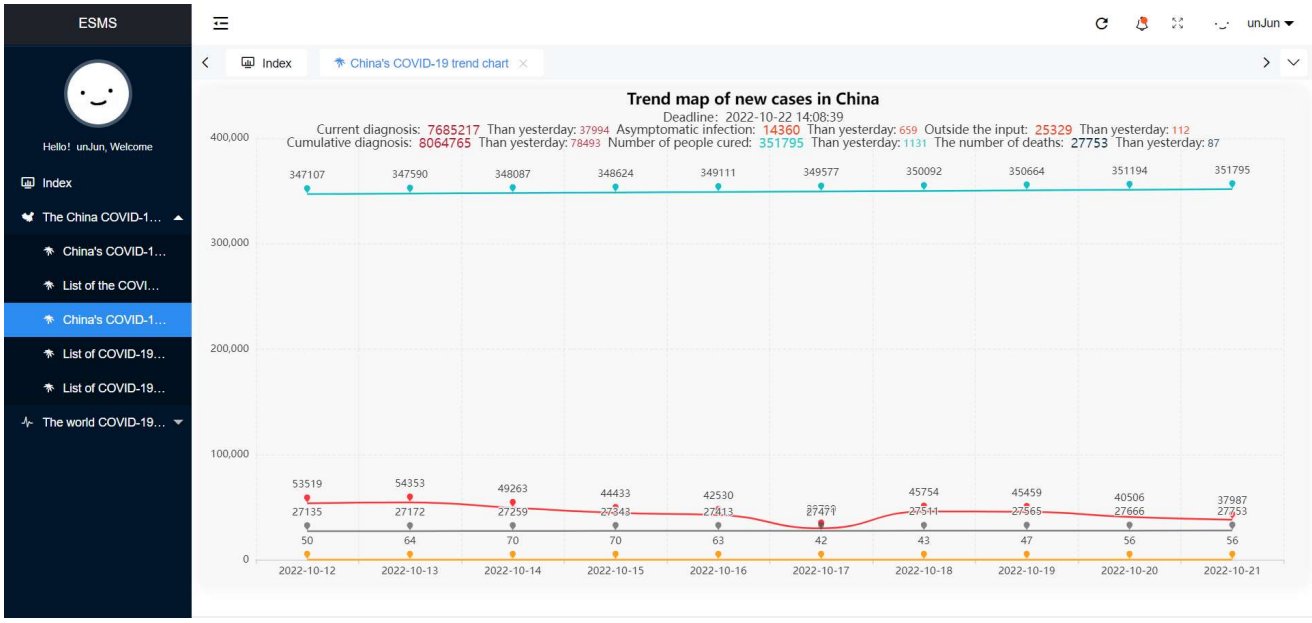


Figure 7. A COVID-19 trend chart in China

(4) List of COVID-19 risk areas in China: This interface shows the risk area table of various provincial cities in China, and users can search for different provincial cities through the search box. At the same time, you can also export lists, print and other operations. The search is a fuzzy search, through keywords can query multiple information. It can also be sorted according to the number of epidemic data to facilitate users to watch and compare.

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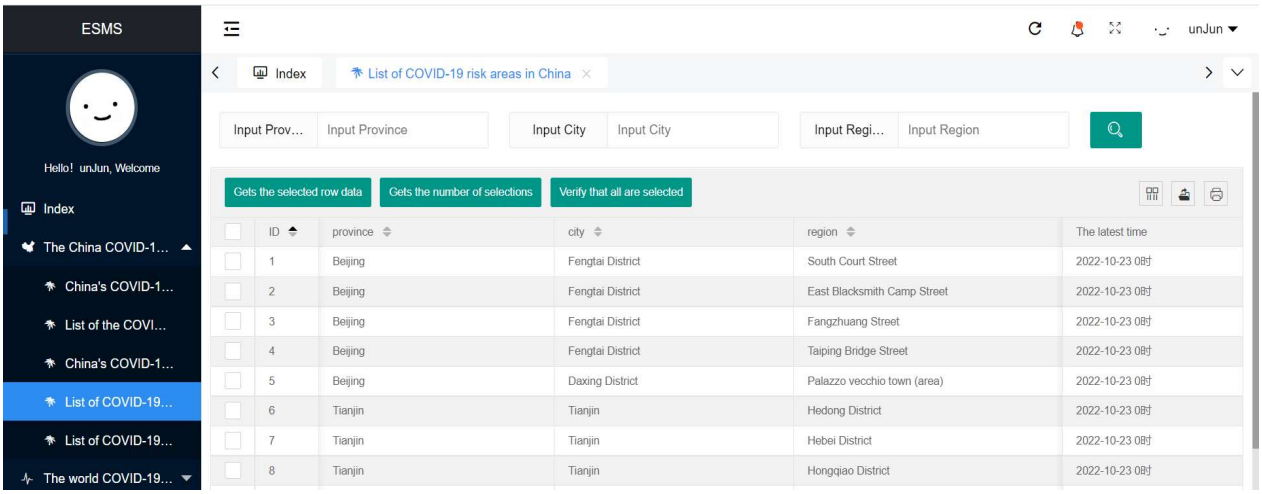

Figure 8. List of COVID-19 risk areas in China

(5) List of COVID-19 Cities in China： The interface shows data on COVID-19 in cities across China.

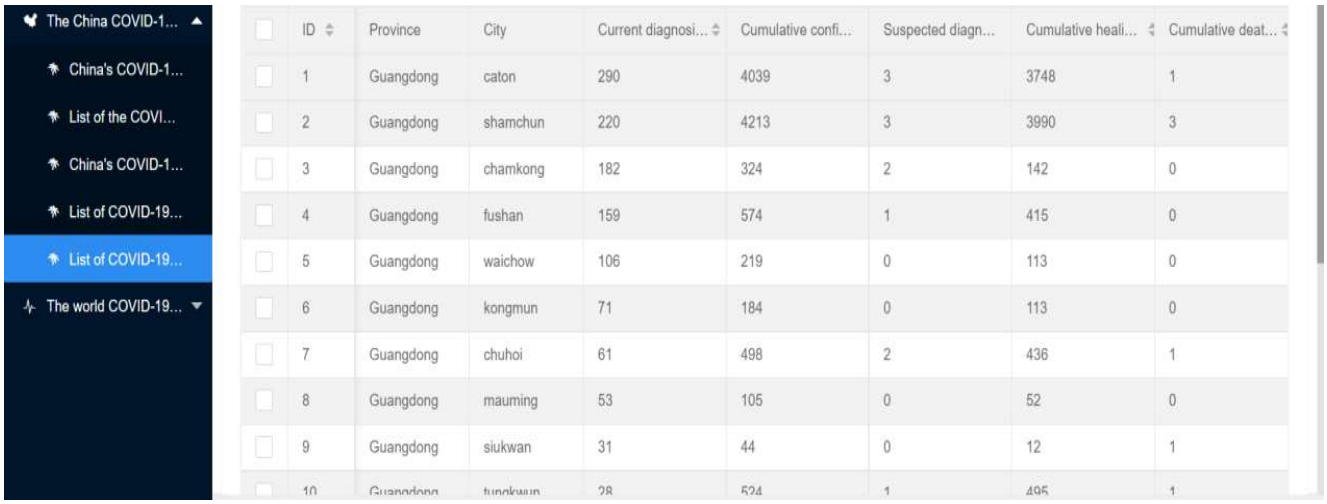

Figure 9. List of COVID-19 Cities in China

4.4 Introduction to the Front-end Design of the World COVID-19 Module

The world outbreak menu includes three sub-menus: world COVID-19 chart, world COVID-19 table and cumulative confirmed cases ranking.

Figure 10. World COVID-19 Module chart

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(1) World COVID-19 chart: The interface displays information about the epidemic in various countries around the world. Users can hover their cursor above different countries to view the current number of confirmed cases in different countries, as well as perform the image exporting of the legends.

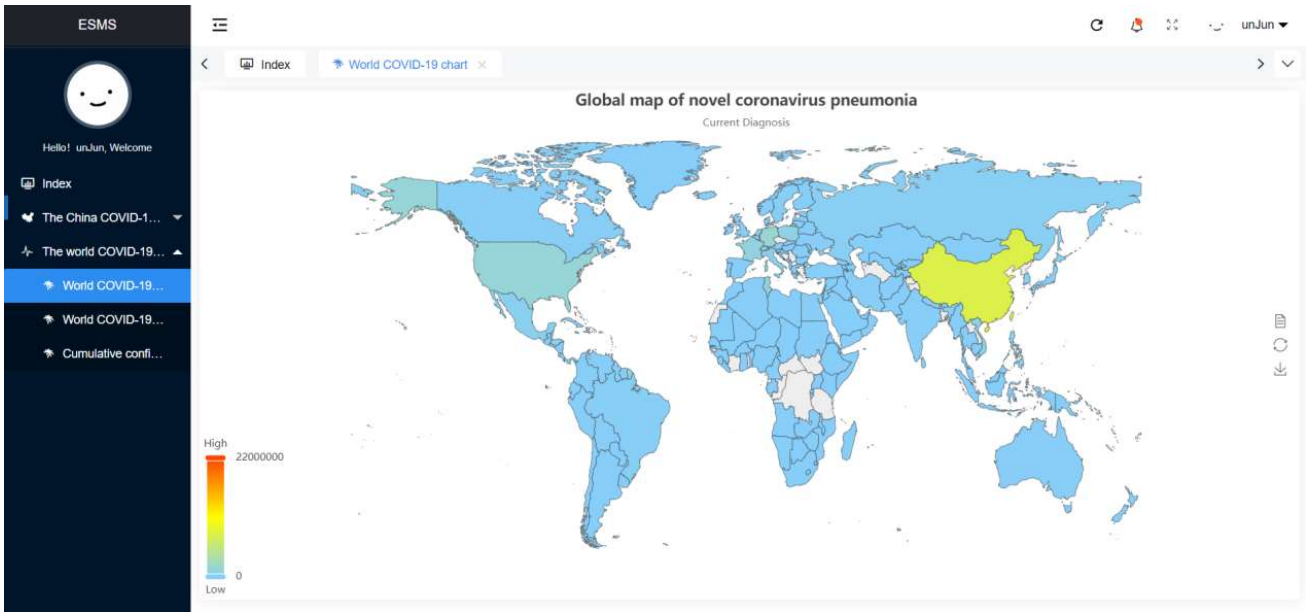
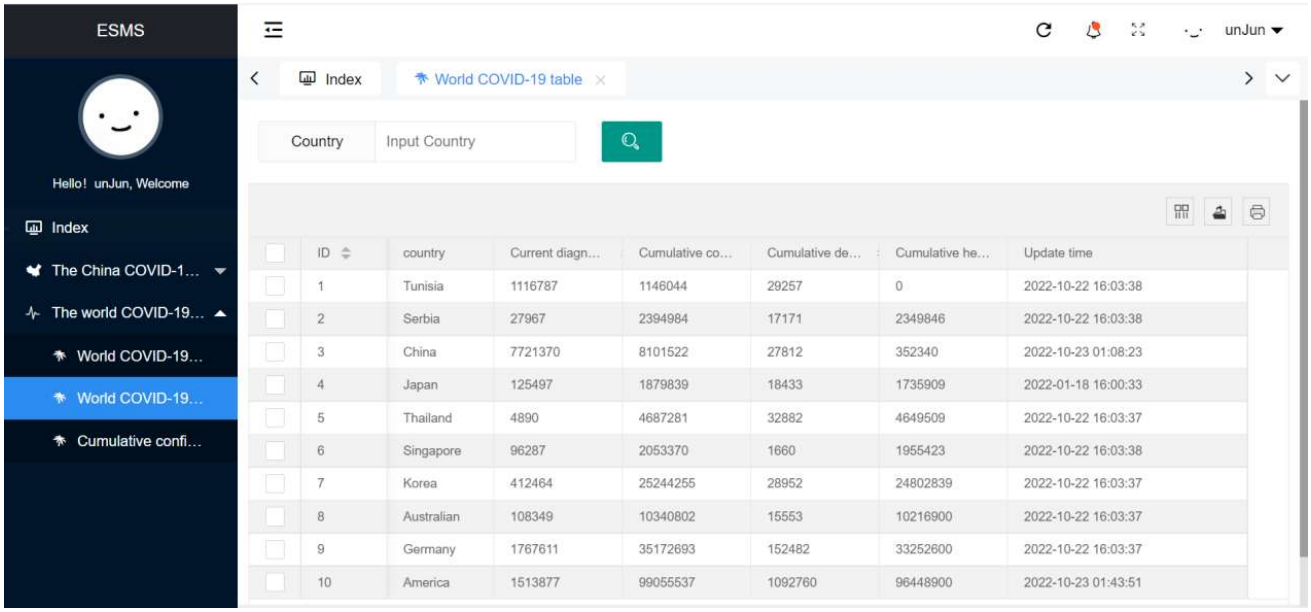


Figure 11. World COVID-19 Module chart

(2) World COVID-19 table: The interface displays the detailed epidemic information of different countries in detail in the form of a list, and users can search the epidemic information of different countries through the search box. Users can also export, print the list data and other operations.



ID	country	Current diagn...	Cumulative co...	Cumulative de...	Cumulative he...	Update time
1	Tunisia	1116787	1146044	29257	0	2022-10-22 16:03:38
2	Serbia	27967	2394984	17171	2349846	2022-10-22 16:03:38
3	China	7721370	8101522	27812	352340	2022-10-23 01:08:23
4	Japan	125497	1879839	18433	1735909	2022-01-18 16:00:33
5	Thailand	4890	4687281	32882	4649509	2022-10-22 16:03:37
6	Singapore	96287	2053370	1660	1955423	2022-10-22 16:03:38
7	Korea	412464	25244255	28952	24802839	2022-10-22 16:03:37
8	Australian	108349	10340802	15553	10216900	2022-10-22 16:03:37
9	Germany	1767611	35172693	152482	33252600	2022-10-22 16:03:37
10	America	1513877	99055537	1092760	96448900	2022-10-23 01:43:51

Figure 12. World COVID-19 Module chart

(3) Cumulative confirmed cases ranking: This interface shows the top 10 countries with cumulative COVID-19 cases.

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Figure 13. Cumulative diagnosis ranking is top10

4.5 Back-end Design

(1) Controller: This system has designed ChinaEpiControlle for managing the China epidemic module business, GlobalEpiController for managing the world epidemic module business, SystemController for managing the business of the login registration module, and UserController for the business of processing user information.

(2) Entity: This system establishes the corresponding entity classes based on the database table. Through the Lombok Java library, no getter or not need to write eques methods for the class, and the log variables can be automated.

(3) Service: This system inherits the SpringBoot native ServiceImpl and IService implementation methods in the implementation. The service layer file corresponding to the entity class and the login interface are defined.

(4) Mapper: This system inherits BaseMapper in the mapper layer, uses native database operations and is not used. The xml file does on the sql operation method to define.

(5) Utils: This system creates DataUtil classes for use to obtain COVID-19 data, uses HttpClient technology to access the epidemic data interface, analyzes the JSON data format through Fastjson, and stores the data into the database.Create the UpdateData class, which is to update COVID-19 outbreak data in real time based on the timing tasks of SpringBoot technology.

(6) Config: The system is configured with MybatisPlusConfig for paging of tables and ShiroConfig for login authentication management.

5. Implementation and Optimization Process

The implementation of the project is based on the five basic processes of project management, namely: project start, project planning, project execution, project monitoring, and project closing.

(1) Project start: At the beginning of the project, the requirements of the project are first defined, and the goals of the project are determined. That is, epidemic management projects that will achieve the goals of being available and accessible for everyone.

(2) Project planning: that is, to make the project creation plan, further clarify the needs, and do the basic design of the project table structure, project framework, project display effect (UI diagram), the implementation process design of the project, etc.

(3) Project execution: After all the plans are completed, the project is written in the second phase of the design implementation process.

(4) Project monitoring: in each stage of the project is completed, the project will be tested to see whether the logic meets the requirements, whether there are loopholes, etc. If there is a problem, it will go back to rewrite it.

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(5) Project closing: Write the project document.

6. Application and Promotion of the Value

The project was developed and implemented in the current global spread of the epidemic. The prevention and control of the epidemic are closely related to everyone. So the value of creating when applied can be analyzed as follows:

(1) Wide applicable population: As the epidemic is spreading, everyone in the world cannot get rid of the impact of the epidemic. So the applicable population range can basically cover most of the country's people.

(2) High demand and utilization rate: With the continuous occurrence of epidemics, people need to directly or indirectly obtain the data related to the system in order to deal with the epidemic and prevent and control the epidemic, so the utilization rate is very high.

(3) Facilitated people's life: Now in the epidemic prevention and control, everyone needs to pay attention to the epidemic information, pay attention to the epidemic situation, and pay attention to the policies related to the epidemic. This project can basically meet the needs of most personnel.

(4) The system obtains information that is simple and intuitive: the project uses a lot of lists and line charts to show the data, making the data display more intuitive.

(5) Easy to use: the system deploys the server, users only need to access the web page, do not need to download the app program, it is very convenient to use.

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