

# Design and Application of Visualization Function of Meteorological Environment Information Based on Android Mobile Terminal

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**Abstract.** Meteorological Environment information is characterized by professional, efficient, real-time, accurate, and three-dimensional. Its characteristics result in meteorological environment information data based on real-time information and display restrictions on the web side. Therefore, obtaining applicable weather information services is affected. Android-based mobile terminals use GPS technology to carry out the design of meteorological environment information visualization function is of great significance. Combining meteorological environment information with GPS location information data, logic processes such as acquisition, transformation, integration, and data superposition, by directly extracting the method of demanding meteorological environment information, displaying weather information corresponding to the specified location information that meets the actual needs of the user on the Android mobile terminal Provide meteorological environment information in accordance with meteorological environment information standards as required by the World Meteorological Organization. Users using Android mobile terminals can make corresponding preventive measures based on this meteorological environment information to reduce personal and property losses caused by lack of meteorological environment information and extreme weather conditions.

**Keywords:** Meteorological environment information; Visualization function; Android mobile terminal; Real-time display.

## 1. Introduction

At present, China's maritime department provides navigational users with marine meteorological environment information limited to a separate operating system and lacks effective geographic location information support. Therefore, the greater the coverage of meteorological environment information, the lower its accuracy, the accuracy of weather information for service users and timeliness is not ideal. In order to solve this situation, this paper adopts mobile internet thinking, adopts Android mobile terminal platform, adopts GPS satellite positioning technology and meteorological environment information collection, mining and editing technology fusion, and designs the design and application of meteorological environment information visualization function. Based on the mature and commonly used GPS location information function, the meteorological environment information is integrated with



the GPS location information data, and the information coverage technology is used to display the meteorological environment information in the client's jurisdiction according to the user's demand and displayed on the Android terminal system. Users can accurately grasp the meteorological environment information in the designated area, so as to take corresponding measures in time.

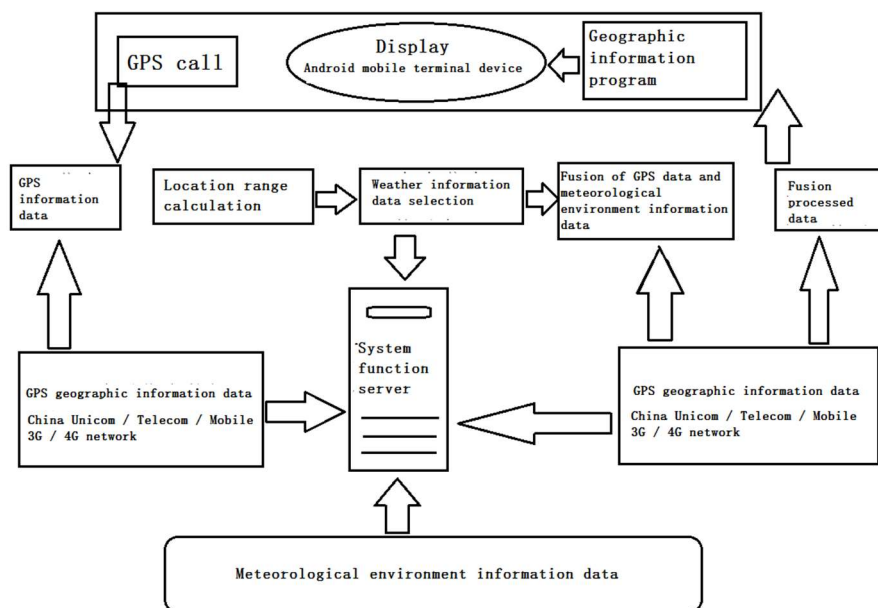
## 2. Functional architecture design

The design idea of the overall architecture of this function is based on the complete GPS location information, and displays the meteorological environment information that the user urgently needs on the mobile terminal based on the Android platform. The implementation of this function is divided into 3 steps:

Step 1: Mobile terminal development based on Android operating system, its core includes GPS location information call, geographic information API call and weather information data display;

Step 2: Integration, integration and format conversion processing of GPS location information data and meteorological environment information data;

Step 3: The configuration of the function server side and the acquisition of the weather information database (weather information data, GPS location information data, geographic information data, etc.). The above three steps constitute the overall structure of the system function, this paper can be divided into three layers of model [2] namely business application layer, data processing layer, basic data acquisition and server configuration layer, architecture design diagram, as shown in Figure 1.

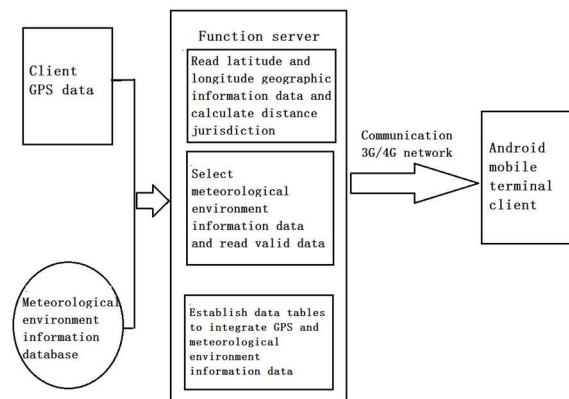


**Figure 1.** Overall architecture design

## 3. Server design

### 3.1. server functional structure design

The server side is the core of processing data. The main function is responsible for reading, data exchange and data format conversion of various types of data. It mainly involves three types of data: geographic information data, meteorological environment information data, and GPS positioning data. The first type of data is realized by the server through the API interface, and the latter two types of data are directly obtained from the server, and the function design as shown in Figure 2.



**Figure 2.** Server functional structure design

### 3.2. Server functional data flow design

As can be seen from Figure 2, the server has GPS data and weather information data flowing in, and the two merge and flow out. In the process of data inflow, the server database data and meteorological environment information data are directly interconnected through the maritime private network and registered in the weather information database management platform. The database data is managed and transmitted in real time by the meteorological environment information system, which is time-sensitive and accurate. The server database system first accepts the GPS location information transmitted by the client [3], and then queries the weather information database according to the latitude and longitude conditions in the location information, and reads and satisfies the meteorological environment information data satisfying the conditions for format conversion and storage [4] for the weather information of the client shows the system call.

### 3.3. Server functional key technologies

The server is responsible for publishing the running function program and processing the various types of data in the above data stream. It is an important part of this function. The core of the server is the processing of data, including: latitude and longitude, distance conversion, data screening and data. The format is converted in four parts.

After receiving the latitude and longitude values of the user sent by the client, the server uses the value as the center to display the meteorological environment information of the surrounding jurisdiction with a radius of 50 kilometers. Therefore, it is necessary to calculate and convert the latitude and longitude data and the geographic information distance data. The calculation method of the latitude and longitude data and the geographical information distance on the earth is that the positional distance formula of the two points A and B passing through the latitude and longitude on the earth is [5]:

$$C = \sin(MLatA)\sin(MLatB)\cos(MLonA - MLonB) + \cos(MLatA)\cos(MLatB) \quad \text{Distance} = R \arccos(C) \text{Pi}/180. \quad (1)$$

The system function program will request the anchor point as the point A. When the latitude and longitude of the point A is known, the latitude and longitude coordinates of the requesting meteorological environment information are taken as variables into the above formula function, and "Distance" is the distance range, and the if is judged within the range of Distance. The data is read as follows:

```

FOR(INT I=0; I<LoDataLength; I++)//LoData (Longitude for the requested weather
                                information)
{FOR(INT W=0; W<LaDataLength; W++)//LaData (For the requested weather information
                                latitude)
    IF(DISTANCE<=50);
    STRINGLO=LoData[I]; // (Reading longitude)
    STRINGA=LaData[W]; // (Reading latitude)
    ....
    SELECT SLOPE, ALTITUDE FORM (Data table name) WHERE LONGITUDE='LoData[I]'
    AND LATITUDE='LaData[W]' AND DATETIME="" // (Read weather information on latitude,
                                longitude and time [6])
}

```

The function program is written using the Spring MVC architecture. The digital query field is returned directly through service [7-8], and the scattered field is returned without corresponding rules, because the client uses a fast series of data streams. Therefore, in order to better match the API data of the geographic information of the client, the server function program merges and formats the GPS location information and the service return weather information database.

The fusion of data conversion and format conversion is a separate and interrelated process. Different data is needed in calling the geographic information API, and corresponding fields are provided according to user requirements, the system program will establish the data table, and the GPS geographic information data and service form a new integrated meteorological environment information data source. For the client to read the data source faster, the server uses the efficient and easy to parse JSON structure data [9] to interact with the client. JSON data is a data type that can construct a data structure according to user requirements, and is therefore a fast data structure data type. The JSON data structure in this function program is constructed as follows:

```

{'LONGITUDE': '125.5', 'LATITUDE': '125.5', 'INTENSITY': '14.719', 'HEIGHT': '
1.125', 'DATE': 'yyyy/mm/dd', 'TIME': 'H: MM: SS', 'CATEGORY': '0'}

```

The fields are the longitude, latitude, intensity, height, date, and coverage area type identifiers. 0 in CATEGORY represents updated weather information, and 1 represents original weather information. This function customizes the latest weather information to be marked to cover the original information, and the client of the user terminal selects according to the CATEGORY value. The server adds and converts the meteorological environment information data that meets the conditions according to the location information and the time information of the client by the method of the list one by one. The method and format are:

```

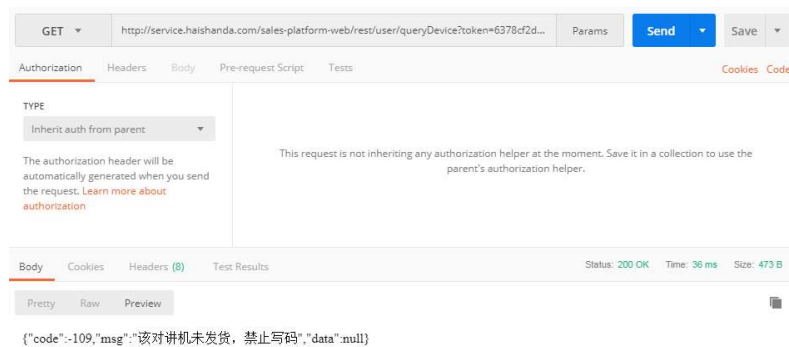
List<WEATHER>TLists=new ArrayList<WEATHER> ();
TLists.add(NEW WEATHER("111.100", "112.45", "14.719", "yyyy/mm/dd", "H: MM: SS",
"0"))

```

When all the data that meets the requirements is added to the list, the conversion of the data format is completed.

### 3.4. Server function implementation

After the server completes the above functions, the basic data processing is completed. Start the program and enter the local server address on the browser to get the JSON data obtained and processed by the server is shown as Figure 3.

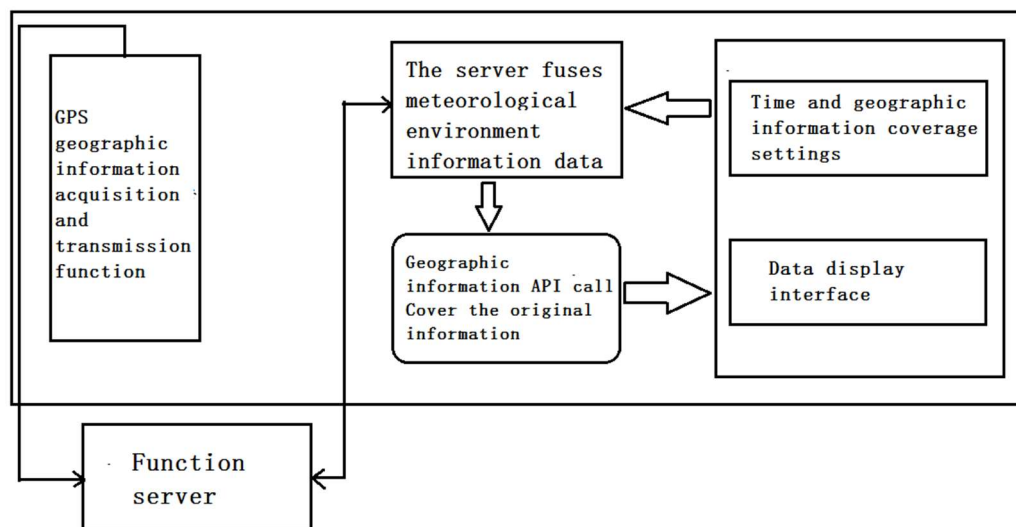


**Figure 3.** Server data processing effect

## 4. Android mobile terminal design

### 4.1 Functional architecture design of mobile terminals

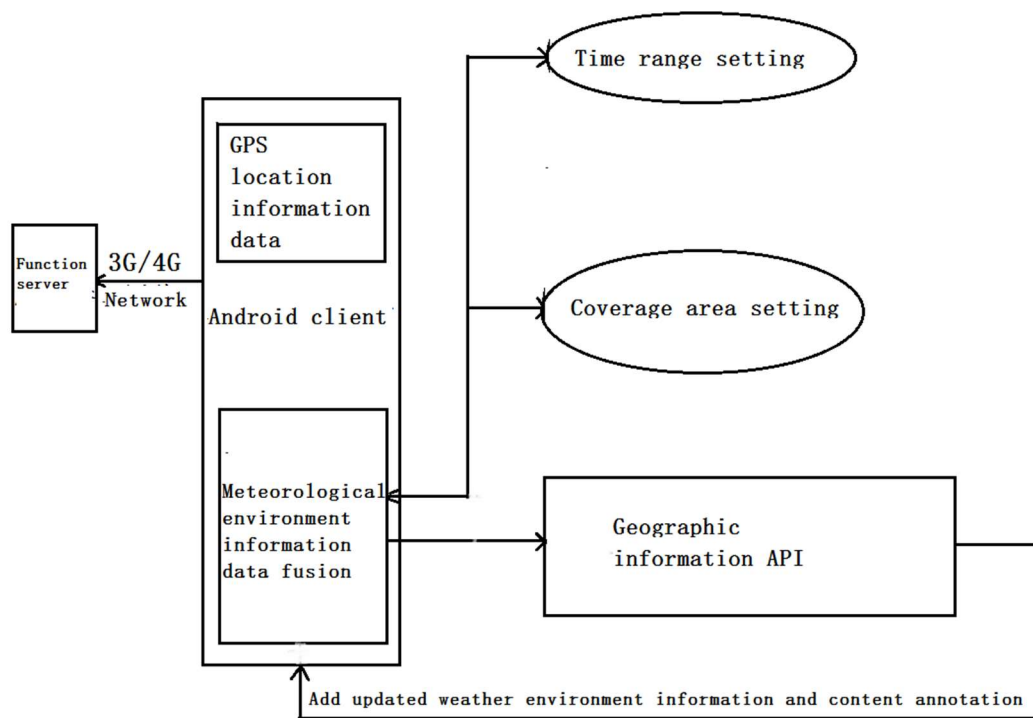
As the display terminal, the client is also the top layer of the system architecture. The functional architecture is divided into the foreground and the background, the foreground is the display interface, and the background is the running program and database system developed based on the Android platform. The front desk is responsible for display and setting functions. The background mainly implements functions such as function module call and location information data transmission of GPS location information, geographic information API data call and update weather map addition. The functional architecture is shown in Figure 4.



**Figure 4.** Client functional architecture design

### 4.2 Mobile terminal data flow design

The data stream includes a GPS location information data stream and a weather information data stream. The client meteorological environment information data obtains corresponding meteorological environment information data on the server through the user's selection of time and geographic information range [10-11], then calls the geographic information API data, adds custom updated weather information data, and realizes the merged meteorological environment information. Data visualization shows that the specific data flow is shown in Figure 5.



**Figure 5.** Client data flow design

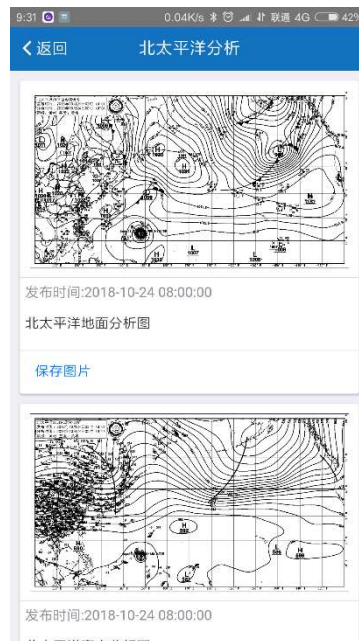
#### 4.3 Mobile client key technology

In the process of displaying mobile client data, time information, geographic information, jurisdiction area interchange, client's geographic information and server data interaction are the design priorities. In order to achieve the goal of convenient use, the design drop-down option at the top of the meteorological environment information selection interface [12-14] of the jurisdiction is used to set the weather information of the time and the designated area in this way, as shown in Figure 6.

After the client function daemon is initialized, the default time is the current time and the geographical location information at this time, and the meteorological environment information of the geographical location information at this time. When the user update time or geographical location information changes, the client will make a link request to the server through HTTP, and after the interconnection is established, the terminal user's time information and location information are submitted. When the server receives the time data and the latitude and longitude position information data for query integration data table, and returns the structure data to the client in JSON format, the meteorological environment information of the client reloads the corresponding data and initializes the weather information data [15-17]. At this point, there is a Map class in the API interface of the location information, which contains a variety of methods to support the development of this location information. The overlay method is used to add updated weather information, and the method customizes the meteorological environment information designed by the function to update meteorological environment information of the weather. At the same time, the updated geographic information and weather information are used to cover the meteorological environment information data in the original JSON data. After the weather information is initialized, the client function is updated at the same time. The display effect is shown in Figure 7.



**Figure 6.** Client query conditions



**Figure 7.** Client function display effect



**Figure 8.** function actual application effect

## 5. Verification and testing

On October 24, 2018, the Shanghai Communication Center (Shanghai Coast Radio) of the Donghai Navigation Safety Administration of the Ministry of Transport (MOT) released weather information. At the same time, from the function program display is shown in Figure 8, through the receiving system of the Shanghai Communication Center (Shanghai Coast Radio) in Shanghai, the terminal display is normal, and compared with the PC web page, the timeliness is stronger and the effect is clearer. It can be seen that this function compensates for the delay in the traditional weather information update mode, and improves the user's ability to obtain meteorological environment information.

## 6. Conclusion

Based on the key technology of meteorological environment information visualization function design of Android mobile terminal, this paper realizes the real-time data of meteorological environment information received and displayed through mobile terminal equipment, which makes up for the shortage of traditional meteorological environment information receiving terminal to receive meteorological environment information data only through web page display. It provides a practical technical support platform for the fusion and processing of meteorological environment information data and GPS location information data based on Android platform. With the strong demand for mobile platform meteorological environment information, this function will be continuously improved and updated to better serve users and provide more efficient and accurate weather information.

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