

Original Article

The QR Code Intelligent Positioning System of the LBS Cloud Platform in the Internet of Things Environment

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ABSTRACT

Aiming at the problems of long positioning time and poor positioning accuracy in traditional positioning systems, a WeChat applet QR code area positioning system based on the LBS cloud platform is proposed and designed. The overall architecture of the system is divided into three parts: LBS cloud service, central data processing, and QR code positioning terminal for small programs. The hardware is designed from the server-side module, processor and positioning module to provide a basis for system construction. In the software design, the WeChat applet QR code area image is collected, the image edge features are enhanced and filtered, the positioning target is determined according to the processed image edge features, and the WeChat applet QR code area positioning system design is completed. The experimental results show that the positioning time of the system is equivalent to 50% of the traditional system, and the positioning accuracy is always maintained above 99.5%, which has significant advantages.

Keywords: QR Code Area; Positioning System; LBS Cloud Platform; Image Acquisition; Edge Feature Processing; Simulation Experiment

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Preface

The WeChat Mini Program is a new way to connect users and services launched by Tencent. It can be quickly and conveniently obtained in WeChat. Users do not need to download and install any APP to obtain the services they need, and The WeChat applet is rich in features and has an excellent user experience^[1-3]. Among them, the two-dimensional code technology can meet the increasing demand of users for the amount of information, so it has been widely used in various fields. In the two-dimensional code recognition process, the positioning technology of the two-dimensional code area is mainly used. Currently, LBS cloud platform (location-based services) and other platforms are often used for information positioning, and some good research results have been achieved.

In view of the problems in the above-mentioned research, a two-dimensional code intelligent positioning system of the LBS cloud platform under the Internet of Things environment is proposed and designed. The experimental verification results show that the system takes a short time to locate, and has high positioning accuracy and good performance.

1. Design of WeChat Mini Program QR Code Area Positioning System

1.1 Overall system architecture

It can be seen that the system is mainly composed of three parts: LBS

cloud service, central data processing, and QR code positioning terminal of the mini program. In the LBS cloud service process, a location sensor is set up to collect the QR code area information. The central data processing part is mainly coordinated by the database, web server and processor. The database is responsible for processing system data, the web server is responsible for receiving LBS cloud service information, and for sending information to the client, the processor is responsible for processing data information. In the QR code positioning terminal part of the Mini Program, the WeChat server receives system data, and then accurately locates the QR code area, so that the information published by the Mini Program can be obtained and displayed on the mobile user interface.

1.2 System hardware design

The server-side modules mainly include sensors and data storage, as well as information compression and unpacking modules. The flowchart is shown in **Figure 1**. When receiving a request from a customer, the QR code area is located, and the server is the tool that needs to be used. The server is set up on the network, and connects to the outside world by specifying the IP address and port number. The sensor is used to collect the information of the QR code area^[7,8]. Due to the format application and the problem of the data volume, the server provides a standard data format, compresses and unpacks the collected data, and transmits the final data to the data storage, lay the foundation for the positioning of the QR code area.

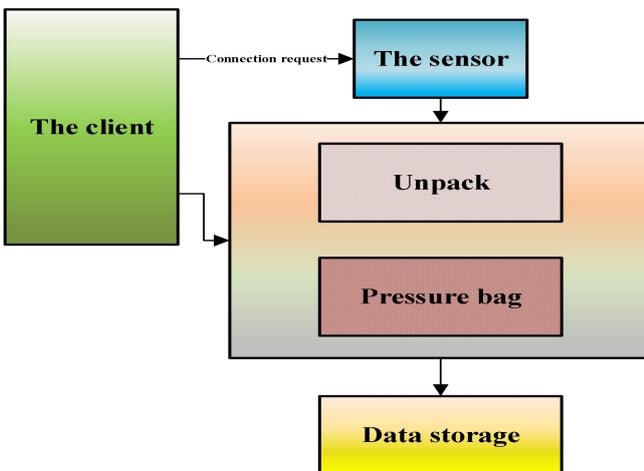


Figure 1. Server-side module.

1.3 System software design

In the process of locating the QR code area of the WeChat applet, first collect the edge image of the QR code area, enhance the edge features of the image, and perform filtering processing, and then determine the location target area based on the edge features of the QR code image.

Suppose the edge feature of the original two-dimensional code area image is E , then:

$$E = \{mean(L(X) + std(L(X)))\} \quad (1)$$

Where: $mean(L(X))$ is the mean value of the matrix elements; $std(L(X))$ is the standard deviation of the matrix elements.

Assuming that the signal variance value of the image is $\sigma^2(i, j)$, after Wiener filtering is performed on the image of the noisy two-dimensional code area, the obtained enhancement result can be expressed as:

$$S(i, j) = E \frac{\sigma^2(i, j)}{\sigma^2(i, j) + N(i, j)} y(i, j) \quad (2)$$

Where: $S(i, j)$ represents the enhanced image; $y(i, j)$ represents the wavelet coefficients generated by the noisy image under wavelet decomposition.

According to the above filtered image, the target area of the two-dimensional code positioning can be obtained, which is expressed as:

$$W(i, j) = S(i, j)(1 + \beta) \quad (3)$$

In the formula: $W(i, j)$ represents the two-dimensional code positioning target area; β represents the image positioning coefficient.

According to the calculation process of the above-mentioned two-dimensional code target area positioning, the two-dimensional code area positioning of the WeChat applet can be completed.

2. Experimental Results and Analysis

2.1 Experimental environment

In order to fully verify the performance of the system in this paper, a simulation experiment analysis is carried out. Use 100 two-dimensional code images with a pixel size of 720×480 for testing. The back-end server model used by the system is Dell PowerEdge R720, Intel $\text{\textcircled{R}}$ Xeon $\text{\textcircled{R}}$ processor with 32 cores and 64 GB memory,

and the server's operating system is Windows 10. The system uses Microsoft SQLServer 2008 as the backend database. Based on the above-mentioned experimental environment and parameter settings, the system in this paper is compared with the traditional system. The performance indicators are: positioning time and positioning accuracy.

2.2 Comparison of time-consuming positioning

In order to verify the superior performance of the system in this paper, the time-consuming positioning of the system in this paper and the system in literature^[5] are compared, and the result is shown in Figure 2.

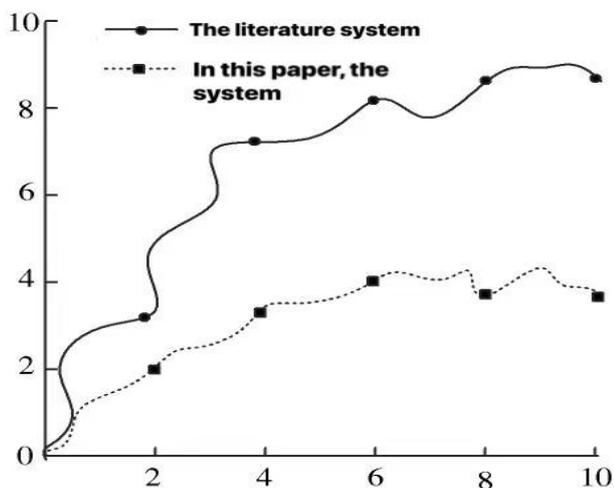


Figure 2. Comparison of time-consuming positioning.

According to Figure 2, the positioning time-consuming trend of the system in this paper and the system in literature^[5] are basically the same, and both gradually increase with the passage of data recording time, but the system in this paper is always lower than the system in literature^[5], and there are big differences. Within 10 minutes of data recording time, the average positioning time of the system in this paper is about 3 minutes, and the average positioning time of the system in literature^[5] is about 6 minutes, which is equivalent to twice that of the system in this paper. Superiority. This is because in the process of system hardware design, multiple core processors are used to process data in parallel, thereby improving the efficiency of system data processing, thereby saving time-consuming positioning.

3. Conclusion

During the use of WeChat Mini Programs, the QR code area positioning technology is widely

used, bringing great convenience to users. This paper proposes and designs a WeChat applet QR code area positioning system based on the LBS cloud platform, and makes a specific description from both hardware and software aspects, and completes the design of the WeChat applet QR code area positioning system. Experimental results show that the system can quickly complete the accurate positioning of the QR code area and has good application performance.

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