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Research Article

Using the Internet of Things E-Government Platform to Optimize the Administrative Management Mode

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This paper builds an intelligent E-Government platform based on the Internet of Things. It adopts a three-layer architecture model, including the government collection layer, the government network layer, and the government application layer. By making full use of data technology and information technology, government services can be realized in real-time perception, efficient operation, scientific decision-making, active service, and intelligent supervision and can be open and collaborative, so as to provide the public with better quality and more efficient and more responsive government services. In addition, this paper has realized optimization in the aspects of government service mode, Internet of Things application mode, and database structure. Through the use of big data technology, the government service information will be digitized and integrated, and through the data sharing and exchange platform, the government information resources will be intercommunicated and shared across departments, levels, and regions. The application mode has been upgraded. Compared with the traditional E-Government, the government has made a qualitative leap in the degree of automation of control, the intelligence of service and decision, the remote support ability, and the space-time scope that government can control. The distributed management mode of the SQL Server is adopted to realize the exchange of requested data and process the data content, which can greatly improve the working efficiency of the system. Finally, through testing, the government affairs management system has good stability; there is no congestion and delay when multiple users access the system, so the response speed and efficiency of the system basically meet the requirements.

1. Introduction

With the development of Internet technology, information technology has penetrated into all fields; the Internet of Things is a symbol of human progress of science and technology; the Internet of Things has deepened administrative management beginning with the E-Government; and the Internet of Things has fused government services to promote the administration towards an intelligent and digital antiwar direction and optimize the government affairs service mode. It is conducive to improving the efficiency of government services. Driven by the development of information technology, government departments are encouraged to develop and reform their office forms comprehensively. In the new era, it is an important direction for government departments to fully realize the development of smart government affairs in the process of innovation and development, and it is also an important organizational force to promote the development of social modernization and optimize the network structure. The continuous penetration and development of information technology in social, political, and cultural fields, coupled with the development and application of technologies such as big data and cloud computing, promotes the constant transformation of information acquisition and resource application methods such as virtual platforms and network media in the development of smart cities. The smart government service mode has gradually entered the field of modern development and has been widely valued by all walks of life.

Zaoui pointed out that E-Government came into being with the emergence of the Internet, and E-Government provided good conditions and technical support for the government to build a service-oriented government [1]. Rotta et al.
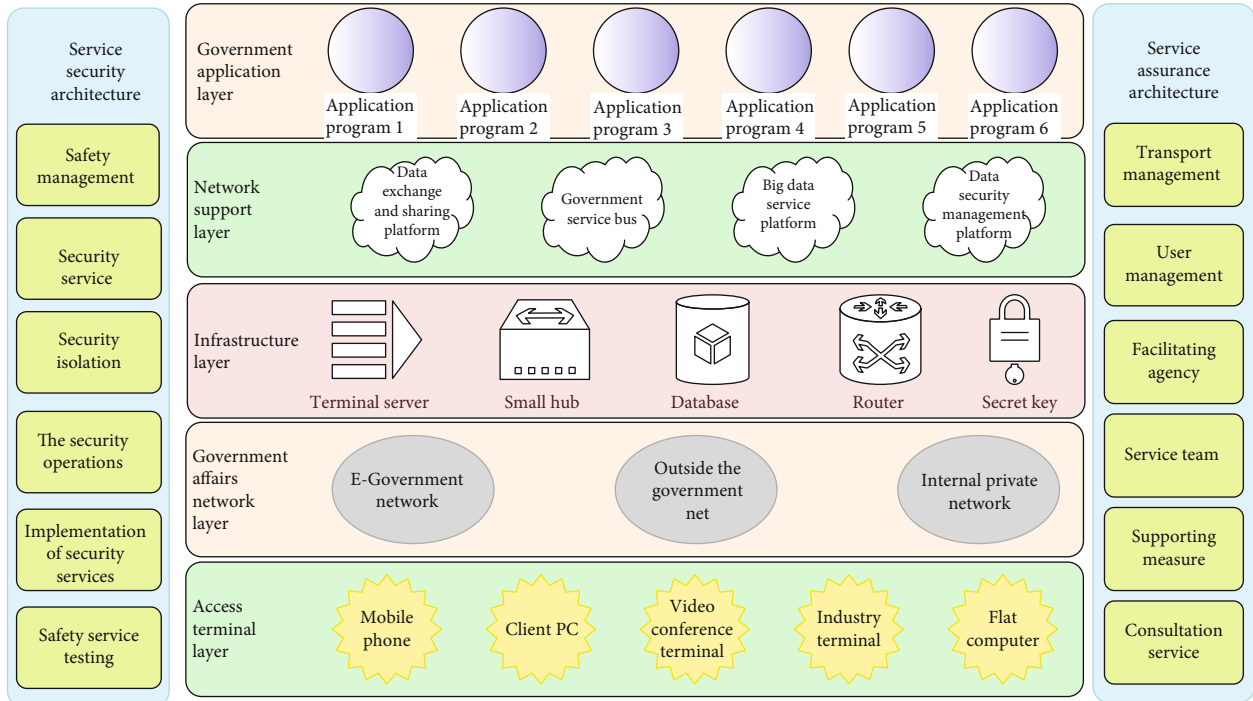
Figure 1: The overall framework of IOT government affairs.

put forward combining the electronic government affairs and service government in the new period and further put forward that the combination of E-Government and service-oriented government is not to be on the basis of the existing E-Government enhancing its maturity but to make the government implement the new changes and build a high quality of service and service of low cost of new service patterns [2]. Saxena discussed the architecture of the E-Government system and its network platform structure, which provided the theoretical basis and technical support for the government to construct an E-Government system [3]. Zhang proposed a new method combining AJAX and the J2EE platform, which was successfully applied in the practical application demonstration of E-Government [4]. Tikkanen et al. put forward the idea of developing a general E-Government platform to quickly build the E-Government application system of various urban management departments and to form the "digital city" application of various professions [5]. Alhawawsha and Panchenko proposed an E-Government platform architecture based on network technology and designed a typical hierarchical grid system conceptual structure [6]. Al-Mushayt proposed the E-Government security platform model based on cloud computing in the era of big data. This platform supports the E-Government service mode, meets the security requirements of E-Government, adapts to the background of big data environment, and supports the operation mechanism of cloud computing [7].

These new theoretical achievements based on modern information technology, especially the Internet of Things technology, provide conditions for the construction of new service models. "Internet+government services" applies the latest achievements of Internet development to government services, improving service efficiency and service quality.

Generally speaking, the research in relevant fields is relatively mature, but with the continued development of the Internet, the use of Internet of Things technology to carry out administrative management exists. However, with the development of new Internet technologies such as big data in recent years, it has become a technical problem that needs to be solved to reduce the pressure on the server, improve the response speed of the system, reduce the waiting time of users, and realize the sharing and intercommunication of information and data.

2. Establish an E-Government Platform

2.1. The Overall Architecture Design of IOT Government Affairs. According to the characteristics of the main architecture of the three-tier Internet of Things, the main architecture of the E-Government Internet of Things can also be divided into the government collection layer, the government network layer, and the government application layer. The auxiliary architecture includes the service security architecture, service assurance architecture, and access terminal layer [8], as shown in Figure 1:

The division of the two network platforms, namely, the Intranet of government affairs and the extra of government affairs. Government Intranet is an internal office network platform established through dedicated lines. Intranet and extra of government affairs are physically isolated, and limited data exchange and resource sharing can be carried out with extra through a firewall [9].

(1) *Government affairs collection layer*: in all places that need supervision or monitoring, use RFID technology, sensing technology, global positioning technology,

video technology, and an intelligent terminal to carry out all kinds of real-time data collection, data capture and identification, and event monitoring. Grassroot monitoring equipment is used to collect data sources, and conversion processing and collection are carried out according to unified technical standards [10]. When it comes to government affairs, intelligent terminals need to be installed for monitoring, traceability tracking and monitoring, and remote health check and medical care services. Through such monitoring and service of people, things, and things on land, sea, and in the whole space and time, combined with powerful cloud computing, cloud storage, and Internet of Things technology, intelligent processing can be carried out

(2) *Government affairs network layer*: process the data and event information collected at the grassroot level and use the Internet of Things, communication network, and transmission technology of the Internet, including the Internet of Things management centre and information centre to process the massive information intelligently. That is to say, the network layer should be capable of both network transmission and information collection processing. For the security of government internal data, the network processing layer will distinguish the government external network and internal network [11]. The basic level information collection, terminal installation, and network layer data transmission are the key infrastructure for the IOT government to become a universal service

In the Internet of Things environment, through the Internet of Things, communication network, Internet, and the ability to distinguish between the government's external network and internal network, the internal network and the external network have strong firewall isolation protection and can filter and exchange data [12]. The national- or city-level Internet of Things management centre will control and intelligently process the grassroot monitoring data and send it to the Internet of Things government affairs platform.

(3) The government affairs application layer provides a platform entrance for various government affairs applications to interact and communicate with civil servants and handle business. Civil servants can conduct information inquiry and monitoring, transaction processing, data analysis, and collaborative work with experts and can optimize the government affairs process, for the intelligent handling of government affairs and the handling of all kinds of emergencies to provide decision-making support [13]. The core functions of the application layer are the Internet of Things government affairs application platform, government affairs service and interaction, and integrated office and resource sharing between government affairs. The grassroot monitoring information is acquired through the Internet of Things environment and processed and fed back according to the unified standard and platform, so as to realize

the all-around and all-weather tracking service and control of people and things

2.2. Design Objectives. Based on the accumulated system management experience and successful implementation cases, the system with business capability was successfully designed and developed after fully investigating the market [14]. The specific functional modules of the system are based on the work needs of users and the penetrability and convenience of the system, and its specific structure is shown in Figure 2.

2.3. Document Management Function Design. System operation and media communication is the core role of the document in administrative processing, workflow is the basis of document management of the business process, and the main work is based on the unit for document management decisions and processing document approval and the way of processing to complete the unit, send and receive the document, examine and approve, and apply for related events and other business processing [15]. The structure and function of the document management subsystem are shown in Figure 3. (1) The functions of receiving management include the following aspects: receiving, planning, reading, and inquiring; (2) the main functions of publishing management include the following: drafting, reviewing, finalizing, and issuing; and (3) document filing includes the following: file management.

3. Optimizing the Platform

3.1. Adopt an Intelligent Government Service Model. The intelligent government service mode uses data technology and information technology to realize the immediate perception, efficient operation, scientific decision-making, active servicing, intelligent supervision, and open collaboration of government service, to provide the public with better quality, more efficient, and more responsive government services, thus bringing the public a sense of convenience, security, experience, and happiness.

Under the intelligent government service mode, the government service presents the characteristics of a more perfect service and more intelligent and more open information. To be specific, firstly, the intelligent government service mode can realize the seamless connection between the online service hall and the physical hall and online and offline government service matters. Government services have been gradually transferred to online platforms, the proportion of offline business matters has been significantly reduced, and the public can apply for, inquire, and consult business matters online at all hours of the day. Intelligent government services can be fully online, covering education, medical care, housing, health, public safety, transportation services, employment, and other service areas [16]. All these services can be handled in the whole process on this platform. That is to say, under the smart government service model, the public can handle the services within the scope of government services online at any time and any place. Secondly, under the intelligent government service mode, the government service caters to the public demand. In order to provide
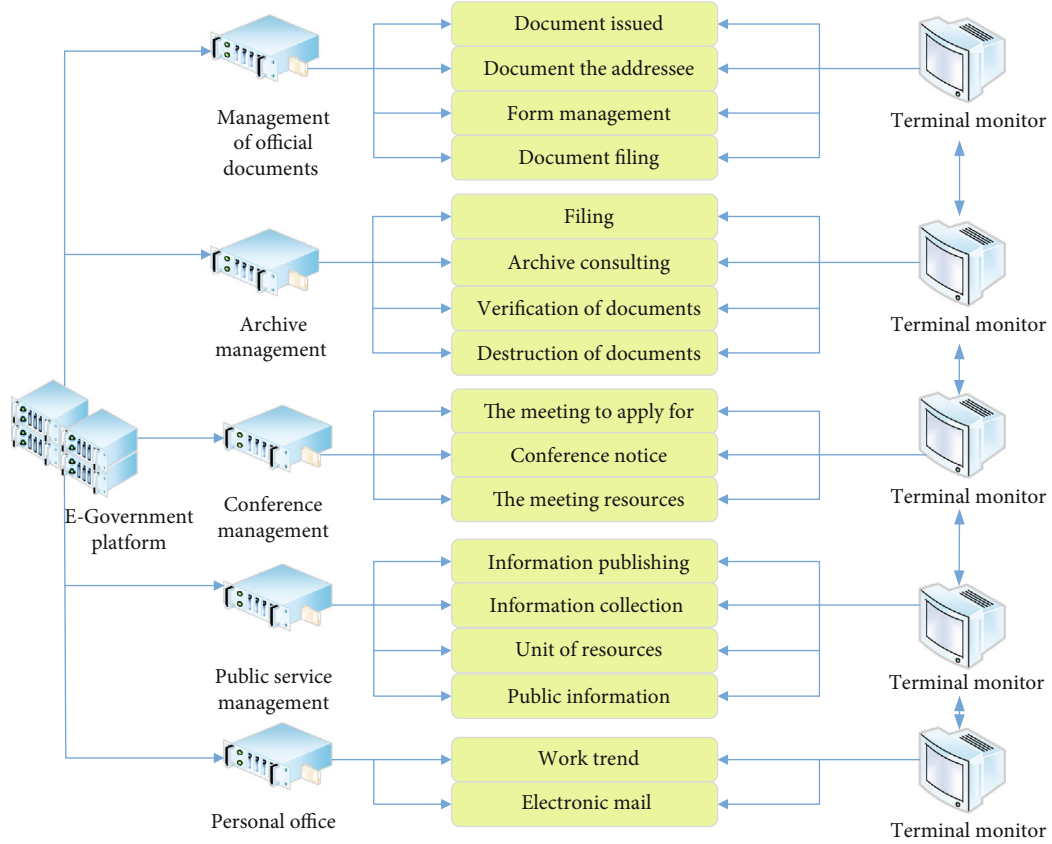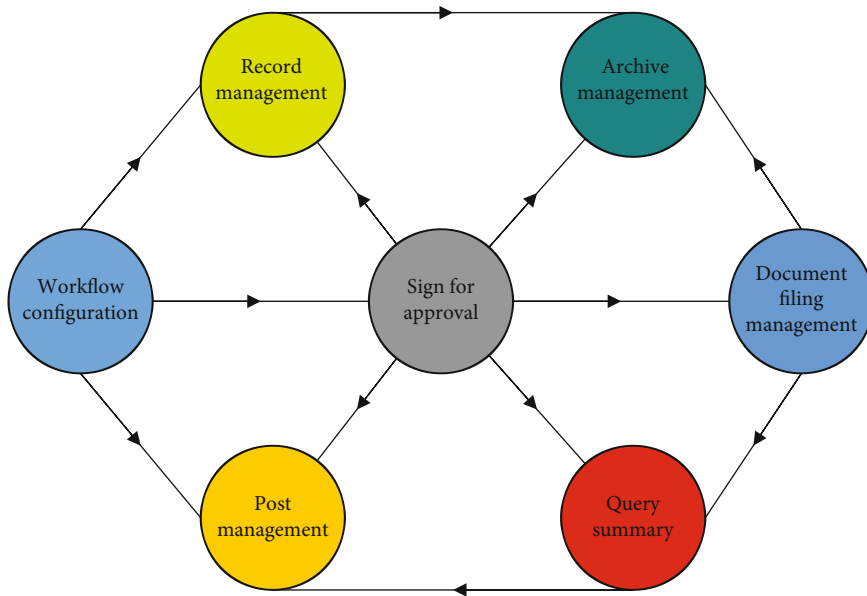
Figure 2: System function module diagram.

Figure 3: Document management structure chart.

refined and personalized services, the service content and service process can be organized according to the thinking mode and behaviour habit of users, so that the online handling of service matters can be accepted and mastered more quickly and easily. Under the intelligent government service model, more attention is paid to positive interaction, timely and

accurate sensing of the diversified needs of the public, finding personalized demands, implementing effective interaction, giving targeted feedback, realizing benign interaction, and promoting the wisdom of government service. At the same time, in this mode, the subjective initiative will be maximized, and an important reference basis for effective decision-making
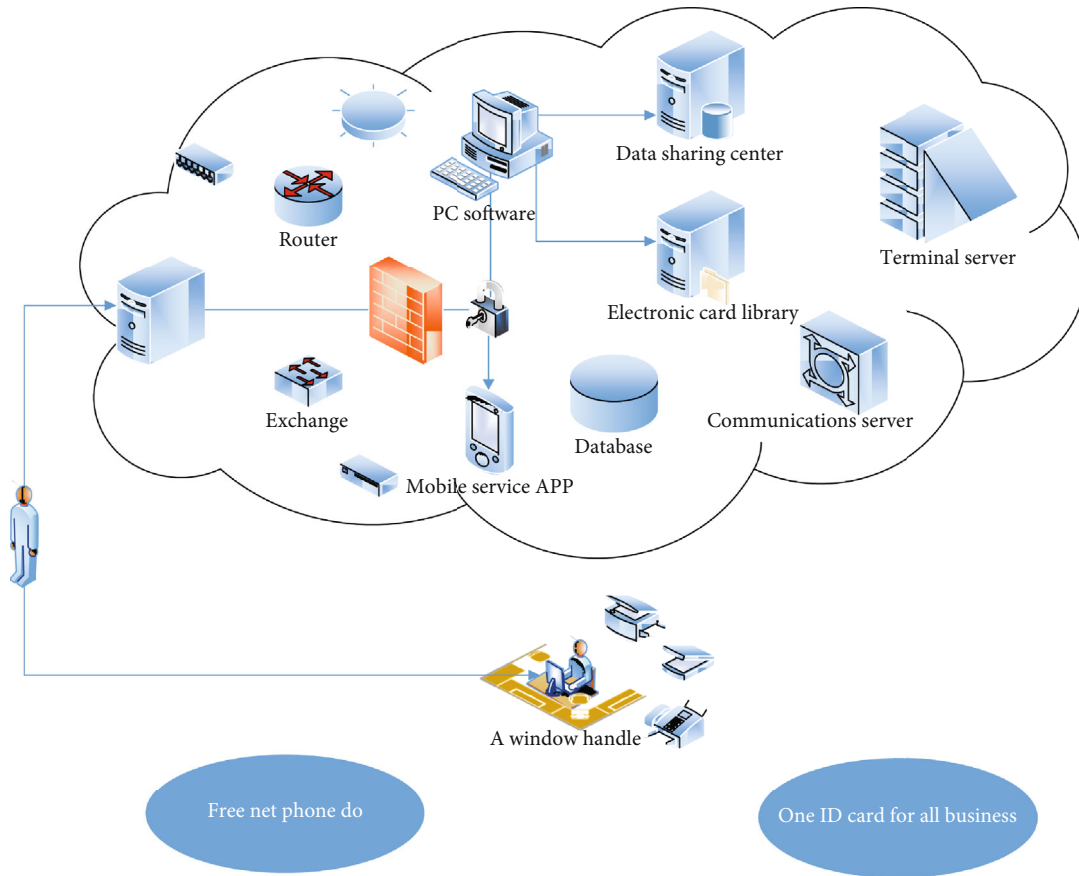
FIGURE 4: Intelligent government service model.

can be proposed with the help of the intelligent government affairs platform, so as to promote the government decision-making to provide more intelligent services. Moreover, under the smart government service mode, information sharing and business collaboration can be realized, and data and information can be disclosed to the whole society. Through the use of big data technology, the information of government services will be digitized and integrated. Through the data sharing and exchange platform, the information resources of government affairs will be shared, and "data running" will be realized in government services. Under the intelligent government service mode, as shown in Figure 4, the government service will be fully implemented with the No. 1 application, one window acceptance, and one network access.

3.2. Optimize the Government Internet of Things Application Model. The business process of E-Government has a qualitative leap with the traditional business process, the application connection is strengthened, and all the resources are integrated, so as to provide services to the public in a unified E-Government platform and improve the efficiency of administration [17–19]. Social staff access the integrated service resources through the network. Compared with the traditional government affairs, the application mode of E-Government and IOT government affairs has the following advantages: (1) the public information can be obtained through the network; (2) the way to serve the public is elec-

tronic and via the network and takes the way of Internet interaction; (3) procurement can also be electronic and net-worked; and (4) a government affairs knowledge base is established based on the Internet, which shares information and resources among departments and works together.

IOT government affairs are transformed and upgraded on the basis of traditional E-Government affairs. Compared with traditional E-Government affairs, IOT government affairs have made a qualitative leap in the degree of automation of management and control, the intelligence of service and decision-making, the remote support ability, and the space-time range that government affairs can control. In the aspect of finding problems in advance, they have the ability to take the initiative and timely and early intervention to solve problems; in terms of communication and coordination, they can interact and give feedback in real time. In terms of dealing with problems, it has the ability of quick decision-making and accurate and intelligent processing [20–23]. In terms of after-the-fact tracking of services and decisions, the government will have the ability to achieve comprehensive intelligent decision-making and intelligent service delivery.

By referring to the application modes of the Internet of Things in various industries and the business characteristics of E-Government, the government affairs under the Internet of Things environment are divided into five major government affairs modes. See Figure 5 for the analysis of their application modes.
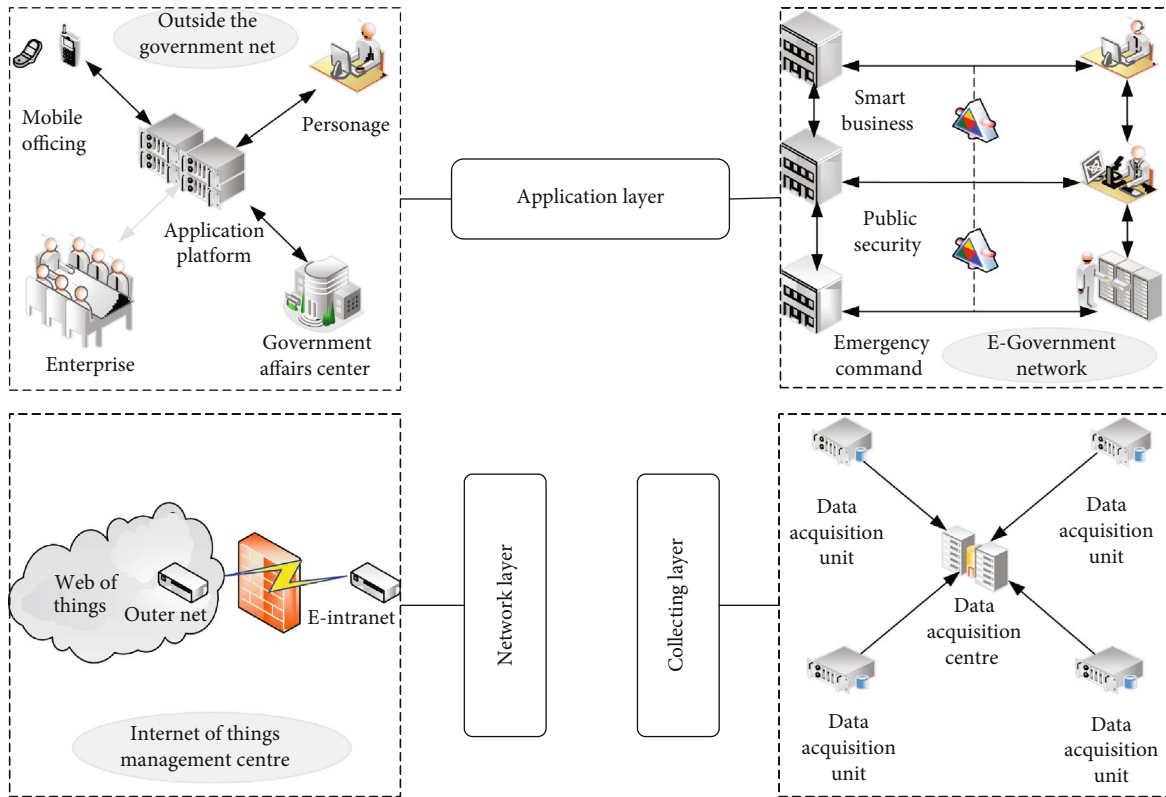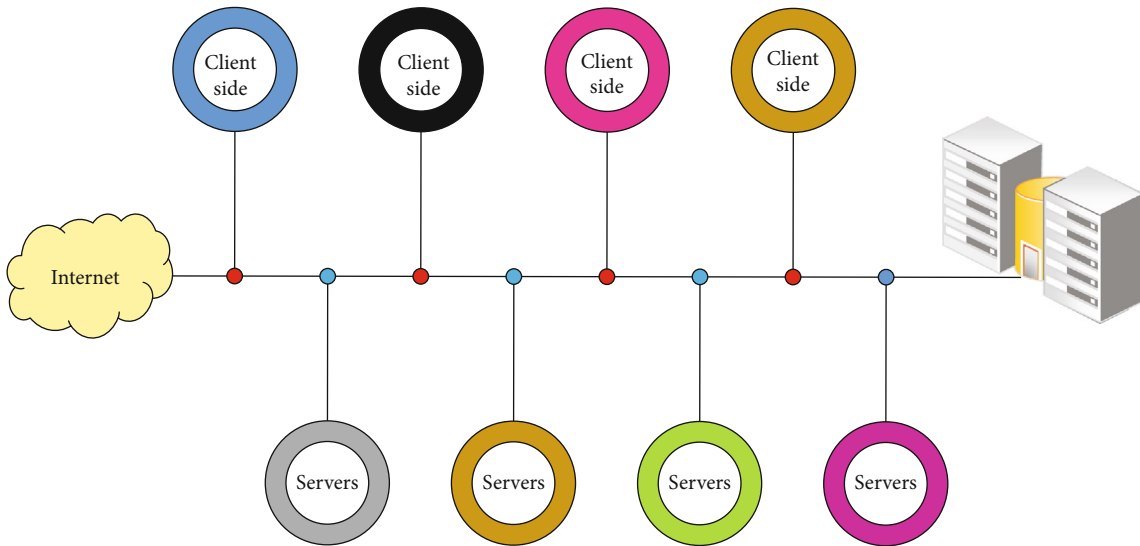
FIGURE 5: IOT government application model.

FIGURE 6: SQL Server distributed management.

3.3. Adopt the New Distributed Database Structure. Summing up the current situation and development of computer and Internet of Things, the distributed architecture will be a mainstream mode of software system development in the future [24, 25]. And the SQL Server just supports the distributed database processing mode, and because the client of the SQL Server can request data exchange to multiple SQL Server servers and process data content, it can greatly improve the efficiency of the system [26–28]. The SQL Server distributed management pattern is shown in Figure 6.

4. Optimization Test of Intelligent Government Affairs System

4.1. System Test Environment. The ordered test environment should be provided to the information system, and the

TABLE 1: Test configuration list.

|			
Server side	Application server	Hardware environment	Xeon E5620 coat-core processor,16 G RAM, 2 TB disk
		Operating system	Windows
	Database server	Hardware environment	Intel Xeon E5-2620 v3 2.4 GHz
		Operating system	SQL Server
	Network	Broadband	40M
Client side	PC users	Hardware environment	I3-6100 CPU 3.70 GHZ
		Operating system	Windows 7
	Network	Broadband	20M
	APP users	Mobile network	Wireless network
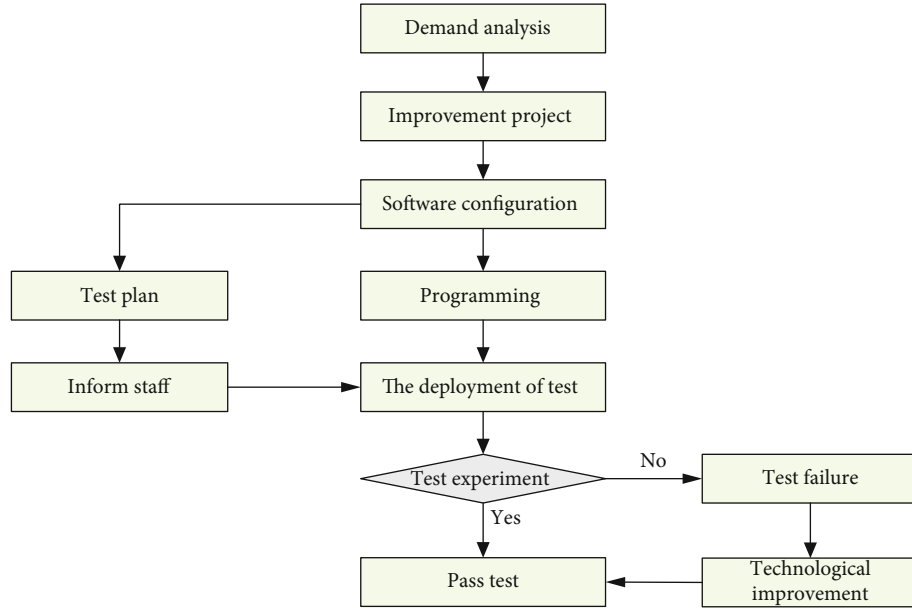
FIGURE 7: System test flow chart.

developer should configure the test environment according to the specific time, place, etc. In the test of the E-Government management system, a PC with Windows system was installed, and different browsers were used to test the function and performance of the system.

(1) *Hardware environment*: the hardware in the system test environment mainly covers three servers, namely, the server, standby server, and database server. At the same time, it should be equipped with multiple PC terminals or mobile device interfaces. The network configuration is as follows: internal network 1000M and external network 100M.

(2) *Software environment*: the software server in the system test is Windows Server, and the client is the Win7 system; Microsoft SQL Server 2015 is used for the database. The virtual software is installed on the PC. The details are shown in Table 1.

4.2. System Test Environment. According to the established test strategy, the relevant test process is made. The specific test plan and test basis are described in detail in each test stage. The test flow is shown in Figure 7.

4.3. Data Optimization Calculation Method. When data is modeled using multivariate distributions, test instances that belong to regions with low joint probability will be treated as outliers, so this probability can represent the outliers of this example.

In order to describe the dependencies between multivariates, the Copula function is used. The Copula function can easily model the relationship between random variables, so it is widely used in high-dimensional statistical analysis. The Gaussian Copula function is used to model the correlation between data features.

$$F(x_i, \cdots, x_m) = c(F_i(x_i), \cdots, F_m(x_i)). \tag{1}$$

If Formula (1) is a continuous function, then c in the Copula function is unique. The joint probability density function of the distribution of multiple variables is

$$f(x_i, \cdots, x_m) = \frac{\Re}{S} c\{F_i(x_i), \cdots, F_m(x_i)\} = \frac{c(F_i(x_i), \cdots, F_m(x_i))}{\prod_{i=1}^{M} f_i(x_i)}, \tag{2}$$

where c is the density of the Copula function.

Since there are many clauses with different dependencies and the data has high-dimensional properties, Gaussian clauses are the most suitable ones to describe characteristic dependencies. The Gaussian correlation formed by the parameter matrix is given by the following formula:

$$C_g(u_1, u_2 \cdots u_m) = \frac{F_g\{\varphi^{-2}(u_1), \varphi^{-2}(u_2), \cdots, \varphi^{-2}(u_m)\}}{f(x)}, \quad (3)$$

where Φ is the inverse cumulative probability distribution function of the standard normal distribution and F is the joint cumulative density function of the multivariate normal distribution with zero mean value and covariance matrix.

M is the parameter of the Copula function and the edge function of McGivney N independent identically distributed samples of m-dimensional x; the likelihood logarithm function is

$$L(x, \phi) = \lim_{N \longrightarrow \infty} \sum_{i=1}^{N} \log \left\{ \prod_{i=1}^{M} f(x_m) + \oint_{n=1} \log f^{-2}(x_m) \right\}. \quad (4)$$

It is a common method to use the maximum likelihood estimation method to estimate parameters, but it is difficult to calculate in practice, especially for high dimensions as the maximum likelihood joint estimation of Copula and edge parameters. Therefore, a simpler semiparametric method, the typical maximum likelihood estimation, is mainly divided into the following two steps.

Step 1. Estimation of F.

Firstly, the edge probability density function of each feature x_i is modeled using the estimation method based on the nonparametric kernel distribution:

$$\widehat{f}_a(x_i) = \int_{-\infty}^{x} \widehat{f}_a(x) dx = 2 \times \frac{\sum_{j=1}^{n} R(x_i/\phi)}{S}, \quad (5)$$

where N is the sample size, K is the Gaussian kernel function, and a is the bandwidth; then, the kernel estimator of the marginal cumulative distribution function of each feature is

$$\widehat{f}_a(x_i) = \int_{-\infty}^{x} \widehat{f}_a(x) dx = 2 \sum_{j=1}^{n} e\left(\frac{x_i}{\phi}\right). \quad (6)$$

When using the above method to model the cumulative distribution function of the feature edge, some features will appear as discrete values. As described in the definition of the Copula function, boundary values obey uniform distribution, while the cumulative distribution function of these discrete eigenvalues does not. To solve this problem, additive white Gaussian noise is added to each feature in this paper. The steps are as follows:

$$x_i^c = 6 + \frac{N(0, P)}{x_i}. \quad (7)$$

In the formula, x represents the converted continuous value feature, P represents the variance of additive white Gaussian noise N, and its calculation expression is

$$P = \frac{(P_a + 6) \times P_a}{\text{SNR}}, \quad (8)$$

where P_a represents the signal power of each feature and SNR is defined as the ratio of signal power P_a to noise power SNR, which is usually valued at 10. By simple transformation, the density of the edge cumulative distribution function of the feature follows a uniform distribution in [0,1], and the edge cumulative distribution function can be kept approximately the same.

$$L(x) = \lim_{N \longrightarrow \infty} \sum_{i=1}^{N} \ln c\left(\widehat{F}(x_m) + \log(x_m)\right). \quad (9)$$

It can be seen that the cumulative distribution function value of the discrete value variable will not satisfy the uniform distribution. In order to solve this problem, the additive white Gaussian noise is added into the variable and transformed into a continuous value variable. Therefore, the density of its cumulative distribution function values is uniformly distributed. In addition, the sample cumulative distribution function of the variable is almost constant before and after the transformation. Through simple transformation, the discrete variables can be modeled by Copula function method.

Step 2. Estimated parameters of the joint part

$$\cos(x) = \lim_{N \longrightarrow \infty} \sum_{j=1}^{N} \ln x \times \text{evr}(j), \quad (10)$$

wherein the marginal cumulative distribution function in the equation is replaced by its empirical estimate F.

New event detection based on principal component analysis (PCA) can find instances that do not conform to the covariance structure of master data by analyzing the distance between the instance and master data in the space of master components. A matrix of sentences forms an eigenvector X, which can represent this formula. The formula is the eigenvectors corresponding to the columns of an orthogonal matrix. In addition, eigenvalues and corresponding eigenvectors are usually sorted in descending order. It is worth noting that larger eigenvalues indicate higher significance.

$$\text{evr}(j) = \sum_{j=1}^{j} \varphi \times \sum^{P} \varphi. \quad (11)$$

Since the eigenvalues k are sorted in descending order, the values increase monotonically. Therefore, the difference of the last principal component will be given a high weight, resulting in a higher score for the outlier with a large difference in the last principal component.
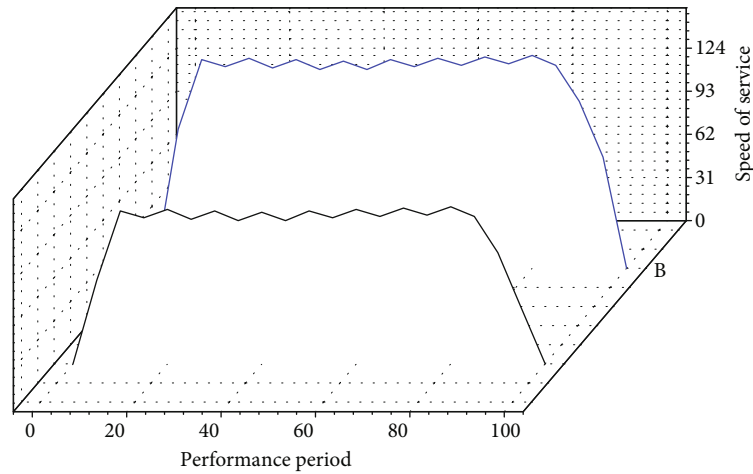
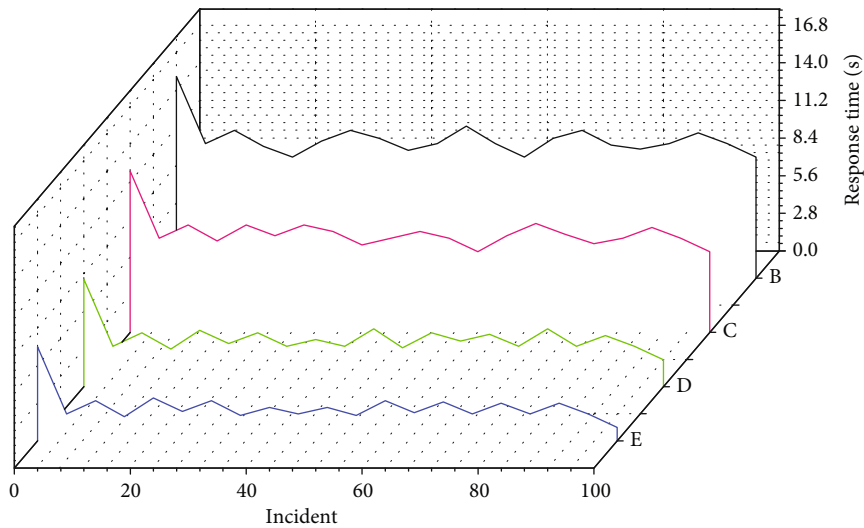FIGURE 8: User access click detection number detection results.

FIGURE 9: Average transaction response time.

4.4. System Performance Optimization Test. System performance testing is operated by software, and mainstream performance testers need software and hardware support. This performance test mainly conducts comprehensive tests on the performance of functional modules and simulates the actual operation of users in daily work. The key performance test objects are the document management module and the meeting management module.

The E-Government management system is logged in by 800 users at the same time and processes transactions at the same time. Users are simulated as follows: loading the login status of 5 users every 10 seconds, until 800 users are loaded, and 800 users are online for 5 minutes at the same time for testing and after the test is completed, 5 users log off every 10 seconds. When 800 users are online at the same time, the server is detected, and the detection result is shown in Figure 8.

Figure 8 shows that the peak CPU utilization is no more than 32%, which is far less than the standard value of 80%. The minimum disk read/write value is about 0.095%, proving that the system usage bottleneck does not exist.

In the process of the system performance test, 800 users with concurrent transaction work can get the changing process of the system data throughput and throughput increased significantly after the concurrent transactions; test results showing no abnormal situation, to a certain extent, indicates that the system can satisfy the 800 users to log in and use the system's various aspect demands. After the 800 users were loaded, the test took about 6 minutes and 30 seconds, and the meeting query interface temporarily became the test page. The average response time of the system is shown in Figure 9.

From the test results, 1 s is the average response time of the system. In terms of data transmission, there is no congestion or delay when multiple users access the system, so the response speed and efficiency of the system basically meet the requirements. Based the system test results obtained, the design and development of a county government management system have good stability; although a slow running speed occasionally occurs, it does not affect the realization of the overall function of the system.

5. Conclusion

Based on the analysis of the current situation and existing problems of the E-Government management mode at the present stage, combined with the high-performance distributed database structure, this paper uses the Copula function method to accurately analyze the data and establishes an intelligent E-Government service mode platform. Through a new intelligent government service mode, the overall framework of the E-Government platform is constructed macroscopically, which is developed and realized by using computer technology. Through data analysis and experiment test, the feasibility of the electronic administration platform is verified. In the process of administrative management, the mode optimization of modern information, networking, and automated office technology has more favourable support for service, solved the problems of a slow server and low efficiency of government service, and improved the technical level of the E-Government platform.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

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