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Research Article

Dynamic Budget Management of Rural Public Affairs Based on Internet of Things Technology

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In order to improve the budget management of rural public affairs, this paper combines the Internet of things technology to construct an information processing system that can be used for dynamic budget management of rural public affairs and optimizes the internal resource processing process of the system. In order to overcome the constraints and differences of resource QoS attributes and ensure that the QoS attribute values of candidate resources are within the user's expectations, this paper introduces penalty factors and grey incidence matrix to analyze the gap between resource QoS attribute values, and calculates the similarity between matching resources and user-requested resources. In addition, this paper combines the dynamic budget requirements of rural public affairs to construct system function modules. Finally, this paper evaluates the Internet of Things data transmission and rural public affairs dynamic budget management effects of the system constructed in this paper, and conducts simulation research based on the data collected by the network. From the experimental research, we can see that the dynamic budget management system of public affairs based on the Internet of things technology constructed in this paper has good results.

1. Introduction

Under the strict registered residence system and the high-speed urbanization, China's economic structure, social structure, and management structure of grassroots public affairs have undergone major changes. Although in recent years, with the rapid advancement of urbanization to rural areas, the rapid flow of population and the gradual weakening of the traditional small-scale peasant economic model based on the household contract responsibility system, and the boundary of urban-rural dual structure are also gradually blurred; on the whole, rural development and rural governance are still important parts of all affairs in China [1].

China is a large agricultural country with a vast territory and a large rural population, accounting for about 80% of the national population. Since the reform and opening up, China's rural economy has achieved good development. However, due to the weak foundation of rural economy and the constraints of the initial development stage of industrialization, the development pattern of urban-rural dual economic structure also brings many problems to rural economic development, such as the widening gap between urban and rural development, the widening income gap between rural residents and urban residents, and the serious pollution of rural environment [2]. These influences, together with other disharmonious factors, bring severe challenges to the long-term, stable, and healthy development of rural areas. The issue of "agriculture, rural areas, and farmers" is a major issue related to the National People's livelihood, and needs to be urgently solved. The Party Central Committee has been paying close attention to the "three rural" issues. The Fifth Plenary Session of the 16th CPC Central Committee proposed to solidly promote the construction of a new socialist countryside in accordance with the requirements of "production development, affluent life, civilized rural style, clean village appearance, and democratic management". This is not only the strategic goal of the current work of "agriculture, rural areas, and farmers" but also an important connotation of accelerating the construction of a new socialist countryside with a well-off society in an all-round way. The goal of building a new socialist countryside puts forward new and higher requirements for innovative agriculture and rural public management functions. Moreover, this also puts forward higher requirements for the work of township governments. Township government is the most grassroot level government in China and the basis of China's political power. The township government is under the jurisdiction of the superior county government and directly faces the farmers. It is an important bridge and link between the government and farmers and provides public goods and services for the stable development of rural economy [3].

In essence, finance is an important factor affecting the management of rural public affairs. Therefore, this paper combines the Internet of things technology to carry out the dynamic budget management system of rural public affairs and analyzes the dynamic management of rural public affairs through the system, so as to improve the efficiency of rural public affairs management.

2. Related Work

The literature [4] proposed a systematic theory on budget balance, marking the beginning of the midterm rolling budget. The literature [5] pointed out that the focus of the long-term annual budget is only to balance the corresponding budget in a single year. Although it can promote the effective control of the government's expenditure to a certain extent, it seriously deviates from the national macroeconomic policy. Therefore, while improving the quality and efficiency of financial management of government departments, it is necessary to emphasize midterm planning. The literature [6] emphasizes the perfect integration of evaluation results and project budgets, which has played a huge role in improving the efficiency of government budget management and effectively improving the budget efficiency of government departments. The literature [7] conducted a comprehensive study on government budget planning. The author pointed out the role of federal government management efficiency. Using budget performance management and implementing performance budgeting can make the government shift its focus from input to output. At the same time, it reduces the unfairness of the allocation of resources with political factors. Literature [8] systematically studied the performance budget and pointed out that the so-called performance budget means to establish a budget management model that can adapt to the current state of government management according to cost factors based on performance goals. Literature [9] conducted a systematic study on the use of departmental budgets, and pointed out the challenges it faces in the process of government use. For example, the lack of motivation for departmental budget reforms, the consensus on the expected accomplishment of goals, the measurement of service costs and results, and the use of performance in the budgeting process cannot be solved. Literature [10] uses a budget management system to dynamically monitor the execution of all fiscal revenues and expenditures. Literature [11] pointed out that the transparency of government budgets largely determines the authenticity of government financial data. It can be seen that when budget transparency is very high, it means that the more truthful the data, the fewer opportunities for fraudulent accounts. Therefore, we can grasp government financial information as much as possible on the basis of improved budget transparency, so as to promote citizens' participation in government affairs.

In addition, foreign scholars have also analyzed many problems in departmental budgets: first, the department did not pay attention to the importance of consensus when preparing budgets, and the content of determining common consensus was not included in related documents and systems. As mentioned, this has led to the improvement of performance and the scientific nature of the evaluation stage being greatly weakened [12]; second, since agencies do not have a clear and complete understanding of budget goals in the process of expanding business channels, they will focus on most of them, which tend to increase the number of business completions. In addition, the communication between the departments is not sufficient. This is also an objective fact caused by the departments in charge of different projects, which will cause certain difficulties in setting performance indicators. Moreover, the quality and reliability of the project itself cannot be completely determined, which also adds a burden to the performance appraisal [13]. Therefore, it is very difficult to determine the relationship between budget and performance.

Literature [14] analyzed the reasons for the establishment of the departmental budget system and answered in detail the characteristics of the departmental budget system and how to update the system. Their analysis shows that there are still many contradictions in my country's departmental budget reform at this stage, such as conflicts between zero-based budgets and revenue and expenditure items and inconsistent expenditure standards. Literature [15] proposes that departmental budgets should be prepared on a departmental basis, and the financial department should first review them, and then formulate and approve them by the People's Congress. In summary, it fully reflects the overall revenue and expenditure of each department in the budget year. After the audit by the financial department, the audit results will be submitted to the legislature for reexamination. If the relevant standards are met, a comprehensive fiscal plan can be established. The literature [16] further clarified the relationship among the people, administrative agencies, power organs, and government functional departments in departmental budget management and further explained the composition of the delegation and authorization chain in budget management, pointing out that due to information for reasons such as asymmetry, weak supervision, and low levels of punishment for corruption, the establishment of an effective supervision mechanism is the key to solving the agency problem of departmental budgets. Literature [17] pointed out that administrative units generally have problems such as insufficient budget management awareness, poor compilation quality, lack of continuous supervision in the budget process, and low overall quality of the staff involved in the preparation of the budget. A detailed analysis of the causes of these problems has been made. Starting from the two levels of the management and the leadership at the same time, it proposed solutions to improve the budget management awareness of relevant managers, strengthen the monitoring of the preparation, and strengthen the supervision.

3. Optimal Management of System Resources Based on the Internet of Things

This paper mainly considers the resources with the same service function. The QoS attributes of the resources are set according to user preferences and have certain scalability. In order to facilitate the analysis of the whole evaluation process, we give the following definitions for some parameters involved.

Definition 1. The QoS attribute set of user-requested resources is uq. $uq = \{uq_1, uq_2, \ldots, uq_m\}$ describes the QoS requirements of user requests for resources and determines the QoS attributes to be evaluated. $uq_j\,(1 \le j \le m)$ in the set is represented by the values of different QoS attributes, such as response time, availability, and price.

Definition 2. Dynamic resource price. The dynamic price of resources in the fog computing environment is shown in formula (1) [18]:

$$p_r = U * b\frac{u}{\varphi} * D_{\text{dev}}. \quad (1)$$

Among them, U is the basic price of the service, u is the number of service requests completed per unit time, and φ is the number of service requests received per unit time. B is the price adjustment factor, which is determined by the service provider. D_{dev} indicates the type of equipment. It can generally be divided into static equipment, small mobile equipment, and large mobile equipment. The relative reserved resources of each device are 1, 1.25, and 1.5 times, respectively.

Definition 3. The set of available resources is Rs. $Rs = \{r_1, r_2, \ldots, r_n\}$ is used to describe resources with the same service functions. In the resource set, $r_i\,(1 \le i \le n)$ represents the i th resource. Each resource is evaluated according to the same QoS attribute to determine the matching between user requirements and resources.

Definition 4. The QoS attribute set of available resources is Rq. $Rq = \{rq_1, rq_2, \ldots, rq_m\}$ is used to describe the QoS attribute value of available resources. Each QoS attribute $rq_j\,(1 \le j \le m)$ of the available resource is consistent with the QoS attribute of the user requested resource.

Definition 5. The resource QoS attribute matrix is R. In this paper, it is used as the decision matrix in evaluation. If it is assumed that there are n available resources and each resource has m QoS attributes, the matrix R is

$$R = \left(r_{ij}\right)_{n\times m} = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1m} \\ r_{21} & r_{22} & \cdots & r_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ r_{n1} & r_{n2} & \cdots & r_{nm} \end{bmatrix}. \quad (2)$$

Among them, r_{ij} represents the value of the j th QoS attribute of the i th resource.

Definition 6. The resource QoS standardization matrix is $z = (z_{ij})_{n\times m}$. Due to the different unit dimensions of QoS attributes, it needs to be unified. Therefore, formula (3) is adopted for standardization according to the relationship between attribute and user satisfaction [19].

$$z_{ij} = \begin{cases} \dfrac{r_{ij} - 0r_j^{\min}}{r_j^{\max} - r_j^{\min}}, (a) \\ \\ \dfrac{r_j^{\max} - r_{ij}}{r_j^{\max} - r_j^{\min}}, (b) \end{cases}. \quad (3)$$

Among them, (a) is the case where the j th QoS attribute is a positive attribute and (b) is the case where the j th QoS attribute is a negative attribute. When condition (a) is satisfied, the greater the attribute value, the higher the user satisfaction. On the contrary, the smaller the attribute value, the higher the user satisfaction. $r_j^{\min}$ and $r_j^{\min}$ are the minimum and maximum values in column J of the standardized matrix, respectively.

Definition 7. Weight of QoS attribute. In order to ensure the objectivity of the evaluation results, we use the direct weight method to determine the entropy value e_j and entropy weight w_j of each resource QoS attribute according to formulas (4) and (5):

$$e_j = -\frac{1}{\ln n}\sum_{i=1}^{n} f_{ij} \cdot \ln f_{ij}. \quad (4)$$

$$w_j = \frac{1 - e_j}{m - \sum_{j=1}^{m} e_j}. \quad (5)$$

Among them, $f_{ij} = (z_{ij}/(\sum_{i=1}^{n} z_{ij}))$, $\sum_{j=1}^{m} w_j = 1$.

Definition 8. The matching resource set is $R_p = \{rp_1, rp_2, \ldots, rp_k\}$. The matching resource set R_p is a subset of the available resource set R_s, which is used to represent the available resources that need matching calculation. Among them, rp_k is the k-th resource, $1 \le k \le n$.

Definition 9. The candidate resource set is $R_s' = \{r_1', r_2', \ldots, r_l'\}$. The set is composed of resources that meet the matching conditions in the matching resource set R_p. Among them, r_l' is the l th resource in the set, $1 \le l \le k$.

Definition 10. The resource matching matrix is R_p. It is composed of QoS attribute values of each resource in the n set and user requested resources [20].

$$P = \begin{bmatrix} rp_{11} & rp_{12} & \cdots & rp_{1m} \\ rp_{21} & rp_{22} & \cdots & rp_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ rp_{k1} & rp_{k2} & \cdots & rp_{km} \\ uq_1 & uq_2 & \cdots & uq_m \end{bmatrix}. \quad (6)$$

Among them, rp_{kj} is the value of the j th QoS attribute of the k th resource in the R_p set.

Definition 11. The matching resource standardization matrix is p . It is used to describe the standard value of the resource matching matrix P processed by formula (3).

$$P' = \begin{bmatrix} rp'_{11} & rp'_{12} & \cdots & rp'_{1m} \\ rp'_{21} & rp'_{22} & \cdots & rp'_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ rp'_{k1} & rp'_{k2} & \cdots & rp'_{km} \\ uq'_1 & uq'_2 & \cdots & uq'_m \end{bmatrix}. \quad (7)$$

Among them, rp_{kj}' is the normalized value of the j th QoS attribute of the k th resource in the corresponding R_p set. uq_j' is the normalized value of the j th QoS attribute of the user-requested resource.

Before similarity matching, resources are classified to reduce matching time and improve matching efficiency. Taking the QoS attribute value of user requested resources as the standard, each resource is regarded as a point in multidimensional space, and the Euclidean distance is used to measure the proximity between resources and user needs. Since the user has a preference for an attribute or each QoS attribute of the resource has a different impact on the measurement result, an objective weight is set for each QoS attribute according to

$$d(r_i, uq) = \sqrt{\sum_{j=1}^{m} w_j * \left(r_{ij} - uq_j\right)^2}. \quad (8)$$

$$\text{dsim}(r_i, uq) = \frac{1}{1 + d(r_i, uq)}. \quad (9)$$

In formula (8), w_j is the weight of each QoS attribute of the resource, and $d(r_i, uq)$ is the distance between the i th resource and the user requested resource in space. In formula (9), $\text{dsim}(r_i, uq)$ is the proximity between available resources and user requested resources. The range of $\text{dsim}(r_i, uq)$ is between [0, 1]. The smaller $d(r_i, uq)$ is, the closer it is to the resource requested by the user.

According to the proximity between the available resources and the user requested resources obtained from formula (9), the proximity threshold ε is set, and the range is between [0, 1]. The resources are classified by formula (10), and the resources that meet the conditions are classified into one class to form a matching resource set R_p.

$$R'(\varepsilon) = \{r_i | \text{dsim}(r_i, uq) \geq \varepsilon\}. \quad (10)$$

Based on the above resource classification, a resource matching matrix P of user request QoS and resource QoS is established for the resources in R_p set. We use the standardized method of formula (3) to process the matrix **P** to obtain the standardized matrix P' of matching resources.

This paper uses the Pearson correlation coefficient to calculate the similarity between the resources in the matching resource set R_p and the resources requested by users.

$$\text{sim}(rp_k, uq) = \frac{\sum\left(q_{rp,rp_{kj}} - \overline{q}_{rp_k}\right)\left(q_{uq,uq_j} - \overline{q}_{uq}\right)}{\sqrt{\sum\left(q_{rp,rp_{kj}} - \overline{q_{rp_k}}\right)^2}\sqrt{\sum\left(q_{uq,uq_j} - \overline{q_{uq}}\right)^2}}. \quad (11)$$

In formula (11), $\text{dsim}(r_i, uq)$ represents the similarity between any resource $\text{dsim}(r_i, uq)$ in the set R_p and the resource uq requested by the user. $q_{rp,rp_{kj}}$ and q_{uq,uq_j}, respectively, represent the value of rp_{kj} in the R_p set and the value of uq_j for the resource requested by the user. $\overline{q}_{rp_k}$ represents the average value of all QoS attribute values of the k th resource in the R_p set, and $\overline{q}_{uq}$ represents the average value of all QoS attribute values of the resource requested by the user.

In order to overcome the constraints and differences of resource QoS attributes and ensure that the QoS attribute values of candidate resources are within the user's expectations, we analyze the gap between resource QoS attribute values by introducing penalty factors and grey incidence matrix and calculate the similarity between matching resources and user-requested resources. Taking resource constraints as conditions, a penalty factor λ is set. When the value of the penalty factor is smaller, the closer to the user's expected range, the higher the correlation. Conversely, when the penalty factor is large, the farther it exceeds the user's expected range, the lower the correlation, and the lower the matching degree.

$$\lambda_j = \begin{cases} 0, & rq_j < \delta_j, \\ \dfrac{rq_j - \delta_j}{\gamma_j - \delta_j}, & \delta_j \leq rq_j \leq \gamma_j, \\ 1, & rq_j > \gamma_j. \end{cases} \quad (12)$$

In formula (12), δ_j and γ_j are the minimum and maximum values of the user's expected range corresponding to the jth QoS attribute of the resource, respectively.

The penalty factor calculated by formula (12) is substituted into formula (13) to calculate the correlation coefficient to modify the matching function. The attribute correlation coefficient is calculated as follows:

$$\xi_{kj} = \frac{\min + \eta \cdot \max}{\lambda_j \left| uq_j' - rp_{kj}' \right| + \eta \cdot \max},$$
$$\min = \min \min \left| uq_j' - rp_{kj}' \right|, \tag{13}$$
$$\max = \max \max \left| uq_j' - rp_{kj}' \right|.$$

The grey incidence matrix is expressed as

$$\xi = \left(\xi_{kj}\right) = \begin{bmatrix} \xi_{11} & \xi_{12} & \cdots & \xi_{1m} \\ \xi_{21} & \xi_{22} & \cdots & \xi_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ \xi_{k1} & \xi_{k2} & \cdots & \xi_{km} \end{bmatrix}. \tag{14}$$

In formula (13), ξ_{kj} is the correlation coefficient of the j th QoS attribute of the k th resource, $1 \le k \le n$, $1 \le j \le m$ is the resolution coefficient, which is generally 0.5. λ_j is the penalty factor of the j th QoS attribute; min and max represent the smallest difference between the two levels and the maximum difference between the two levels. From the difference $|uq_j - rp_{kj}|$ between each QoS attribute of each resource and the corresponding QoS attribute of the resource requested by the user, the respective minimum difference and maximum difference are respectively selected. Furthermore, from the minimum difference and the maximum difference of all resources, respectively, the minimum difference and the maximum difference are selected. uq_j' and rp_{kj}' are the standardized values r.

According to the above analysis, the matching function obtained after modifying formula (11) is

$$c\,\text{sim}\left(rp_k, uq\right) = \alpha * \text{sim}\left(rp_k, uq\right) + (1-\alpha) * \frac{1}{m}\sum_{j=1}^{m} \xi_{kj}. \tag{15}$$

Among them, α represents the weight, and the range is between [0, 1]. When the matching degree reaches the threshold K, that is, $c\text{sim}\left(rp_k, uq\right) \ge K$, it indicates that the matching is successful, and the resource is put into the candidate resource set Rs'.

Due to the dynamics and uncertainty of the resource itself, there are certain fluctuations in the QoS data volume and data value. Moreover, the inherent mobility in the Internet of things environment makes mobile users have a certain degree of volatility when using resources. Therefore, by analyzing the load changes of the resources themselves, further resources are selected.

The resource load is random and dynamic, and the load has the characteristics of frequent changes in a short period of time. Short-term resource forecasting facilitates real-time feedback and management of resources, which ensures the efficiency of the provided resources. Therefore, the regression-Markov chain combination forecasting method is adopted to better reflect the changing trend of resources and the characteristics of random fluctuations.

According to the difference of the interval time t, the original data sequence of the resource load value is recorded as $\left\{X^{(0)}(t)\right\} = \left\{X^{(0)}(1), X^{(0)}(2), \ldots, X^{(0)}(l)\right\}$. The data series may have certain fluctuations due to uncertain external factors, and fluctuations may have an impact on the predicted results. Therefore, in order to weaken the influence of data fluctuations on the prediction results, we add the sequence weight adjustment function to adjust the weight when performing linear regression prediction.

For any data $X^{(0)}(c)$, $1 \le c \le l$, in the original data sequence, the deviation $\Delta_c = |X^{(0)}(c) - \overline{X^{(0)}(t)}|$ of the mean $\overline{X^{(0)}(t)}$ of the sequence is calculated. By calculating the absolute deviation of all the data in the original data series, the deviation sequence $\Delta_{x^{(0)}(t)} = \left\{\Delta_1, \Delta_2, \ldots, \Delta_l\right\}$ is obtained. The sequence weight adjustment function is expressed as follows:

$$\xi(c) = \frac{\min\left(\Delta_{x^{(0)}(t)}\right) + \max\left(\Delta_{x^{(0)}(t)}\right)}{\Delta_c + \max\left(\Delta_{x^{(0)}(t)}\right)}. \tag{16}$$

Among them, $\xi(c)$ is the weight number at time c. $\min(\Delta_{x^{(0)}(t)})$ and $\max(\Delta_{x^{(0)}(t)})$ are the minimum and maximum values in the deviation sequence, respectively. When the deviation Δ_c is larger, the value of $\xi(c)$ is smaller, and its weight is smaller.

According to formula (17), the original data sequence is corrected as follows:

$$X^{(0)}(c) = \xi(c) * X^{(0)}(c). \tag{17}$$

For the revised data sequence, we first use linear regression to predict to obtain the predicted value sequence $\left\{\widehat{X}^{(0)}(t)\right\} = \left\{\widehat{X}^{(0)}(1), \widehat{X}^{(0)}(2), \ldots, \widehat{X}^{(0)}(l)\right\}$ of the resource load, and calculate the relative difference between the two sequences to obtain the residual sequence $\left\{X^{(1)}(t)\right\} = \left\{\widehat{X}^{(0)}(t) - X^{(0)}(t)\right\}$.

Then, the relative residual sequence $\left\{X^{(1)}(t)\right\}$ is divided into s state intervals according to the numerical range, and the residual one-step transition probability matrix $M_{s\times s} = M(s_j)(s_j) = p_{ij}(X_{s+1} = j | X_s = i)$ is calculated according to the distribution of state $S =$ (1, 2, ..., s).

$$M = \begin{bmatrix} M_{11} & M_{12} & \cdots & M_{1s} \\ M_{21} & M_{22} & \cdots & M_{2s} \\ \vdots & \vdots & \ddots & \vdots \\ M_{s1} & M_{s2} & \cdots & M_{ss} \end{bmatrix}. \tag{18}$$

If the condition $M_{ij} \ge 0, \sum M_{ij} = 1$, $i, j \in S$ is met, then M is a random matrix, and $P^{(n)} = (p_{ij}^{(n)}) = P^n$ is an n-step transition matrix.

We assume that after n-step transition, the Markov chain reaches a stable state, and the state vector $x = [x_1, x_2, \ldots, x_s]$ in its stable state satisfies the following:

$$\begin{cases} x = xM, \\ \sum_{t'=1}^{s} x_{t'} = 1. \end{cases} \quad (19)$$

In formula (19), the value x_{t_t} $(1 \le t' \le s)$ corresponding to each state in the state vector x satisfies the condition that the sum is 1. After that, we set the initial state and obtain the probability $p_1, p_2, \ldots, p_s$ corresponding to the error state interval by solving the probability of the steady state distribution.

According to the principle of maximum probability, the error state interval corresponding to the maximum probability is selected from the probability of each prediction interval to be solved, and then the predicted value is substituted into the solution prediction interval value. On this basis, the availability of resources in the short term can be obtained, and appropriate resources can be selected reasonably.

The proposed dynamic resource evaluation method includes two stages: similarity matching method and regression-Markov chain prediction method. First, we establish a resource QoS matrix R, and preliminarily divide the resource into a resource matching set R, through proximity calculation. Then the resource matching matrix P is established, and the matching degree between user QoS requirements and resources is calculated through the Pearson similarity coefficient and the grey incidence matrix. Set the matching degree threshold to select resources that meet the conditions and put them into the candidate resource set Rs'. Finally, the regression-Markov chain prediction method is used to analyze the load changes of resources, sort the candidate resources, and select the appropriate resources. The specific process of the evaluation method is shown in Figure 1.

In the far cloud, the data center isolates users from the underlying physical framework through virtualization technology, forming a virtual resource library for external services, and the fog computing microdata center is similar. Each user can request resources from multiple resource providers, and the resources provided by each resource provider can only satisfy a single user's request at the same time. Therefore, the one-to-many bilateral matching game method is used to evaluate and select resources. When multiple users request at the same time, based on the stable matching method, the comprehensive satisfaction of the user and the resource provider is used as the utility function, all matching results are evaluated, the result with the largest comprehensive utility function is selected, and the best one is selected for the user request resources, meet the needs of both users and resource providers, and improve overall resource utilization efficiency.

We set two disjoint sets of user request set and resource set. Among them, the user request set is $Q = \{q_1, q_2, \ldots, q_N\}$, q_i is the request of the i th user, and $1 \le i \le N$. The resource set is $P = \{p_1, p_2, \ldots, p_T\}$, p_j represents the j th resource, $1 \le j \le T$, $N \le T$.

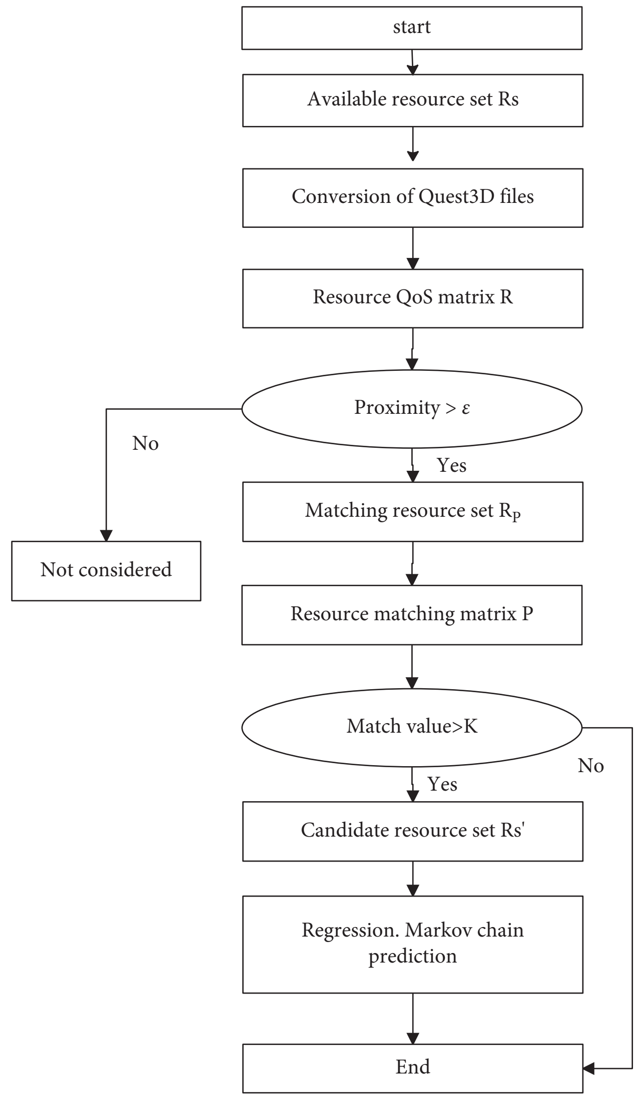

Figure 1: Flow chart of resource assessment method.

For ease of understanding, we give the following related concepts based on the literature.

Definition 1: One-to-many bilateral matching. If any $q_i \in Q$ satisfies the condition $f(q_i) \subseteq q_i \cup P$ and any $p_j \in P$ satisfies the condition $f(p_j) \subseteq Q \cup p_j$, then f represents a one-to-many bilateral match between the user request set Q and the resource set P.

Definition 2: Matching subject pairs. In one-to-many bilateral matching f, if $f(q_i) = p_j$, the subject pair (q_i, p_j) is called the matching subject pair of f. If $f(q_i) = q_i$, it means q_i does not match.

Definition 3: Stable matching. When the following conditions are not met, f is called stable matching.

In the process of stable matching, it is necessary to consider the preference sequence of user requests and resources to each other, which is used to describe the ranking results of user requests and the willingness of the other party to choose resources.

Preference sequence. $Pu_i = (pu_{i1}, pu_{i2}, \ldots, pu_{iT})$ is the sequence of user preferences for resources, and pu_{ij}

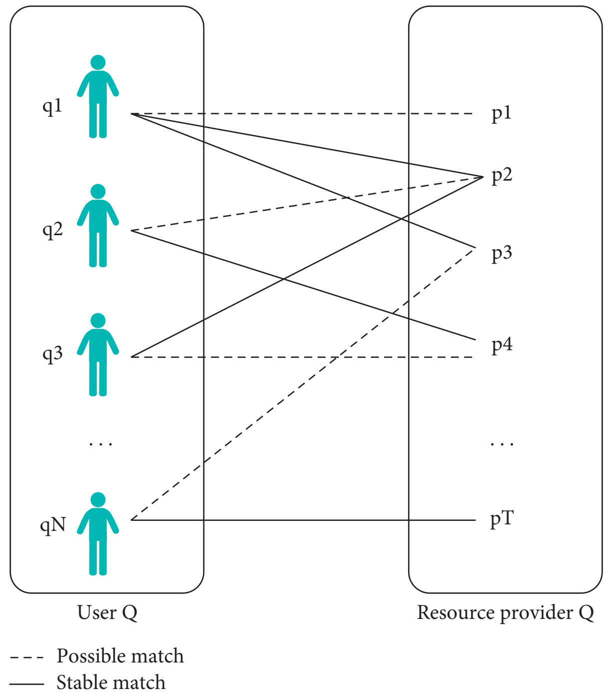

FIGURE 2: Schematic diagram of next-to-many matching in the fog computing environment.

indicates that that q_i places p_j in the pu_{ij} position. $Pt_j = (pt_{1j}, pt_{2j}, \ldots, pt_{Nj})$ represents the preference sequence of the resource to the user's request, and pt_{ij} represents that q_i ranks p_j in the pt_{ij} position.

Definition 5: Expected number of matches. For a user request, multiple resources may be required to complete the task. The number of resources that the user request q_i expects to match is s_i, $\sum_{i=1}^{N} s_i = k$. The number of user requests that resource p_j expects to match is 1.

We assume that users and resource providers are two disjoint sets, that is, there is no resource provider as a user, and the resource set that completes the user's request is the same, that is, all user requests to calculate the preference of resources in the same set. It can be seen from the above analysis that the evaluation and selection of resources under multiuser requests can be regarded as a one-to-many bilateral matching game process, as shown in Figure 2.

4. Dynamic Budget Management System of Rural Public Affairs Based on Internet of Things Technology

This paper constructs a rural public affairs dynamic budget management system based on Internet of things technology. The system adopts a three-level structure, which is divided into business logic processing layer, centralized data processing layer, and centralized system management layer. At each level, we introduce server integration technology to try to provide the simplest hardware platform. The system deployment view is shown in Figure 3.

The external interface is shown in Figure 4.

Three tier architecture is a new project system development environment as shown Figure 5. The role of database server layer in the use of engineering projects is to fix the logical relationship between data.

The developed audit data comprehensive analysis system adopts B/S architecture. After analyzing the whole work process of the audit department, it is found that auditors require the system to operate simply and quickly, and have high requirements for data security. The network layout of the system is a data server and an application server. The internal auditors of the audit unit can access directly through the internal network, and the external auditors need to pass through the network and firewall. The network topology of the financial budget execution audit data comprehensive analysis system is shown in Figure 6.

As a part of the whole financial online audit system, the budget execution module reuses and realizes its management functions in many aspects based on the application support platform provided by the system, so as to complete the realization of data collection, audit model construction, audit analysis, data early warning management, and audit report. The detailed function framework of the budget execution module is shown in Figure 7.

A general analysis tool is designed in the audit analysis management, which can flexibly query the data, flexibly analyze the data and find audit doubts in combination with the general analysis function, so as to realize the data management function. The specific query includes many aspects of work, and the data parameters need to be set before. By using a variety of tools, the displayed data can be

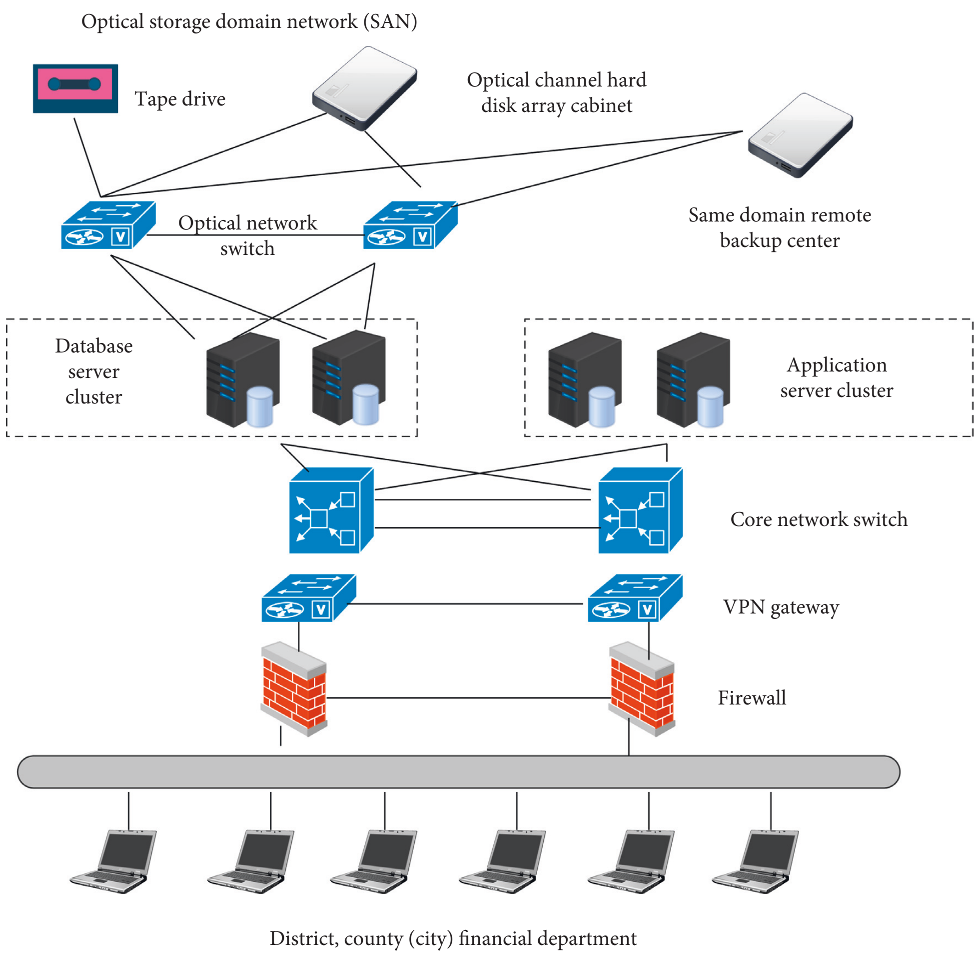

Figure 3: System deployment view.

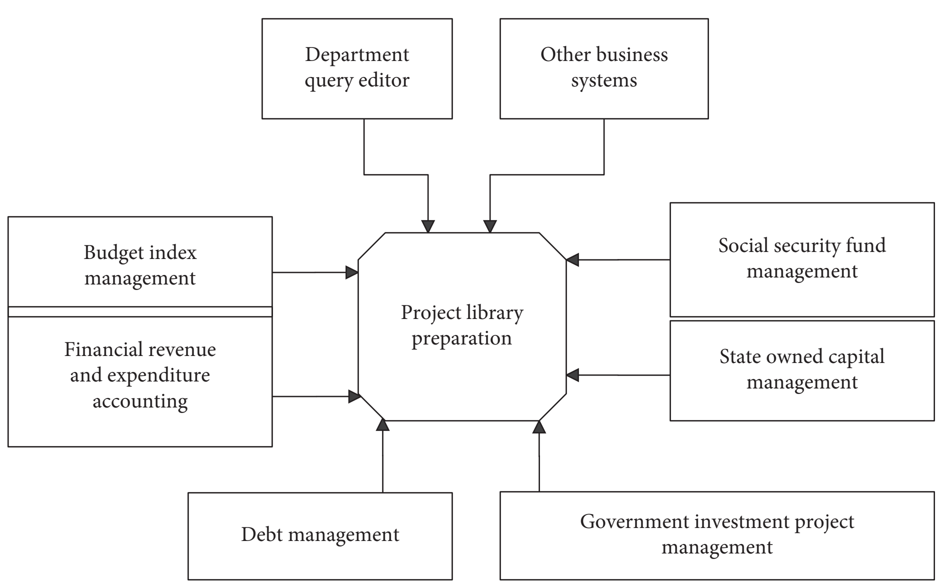

Figure 4: External interface of the project library.

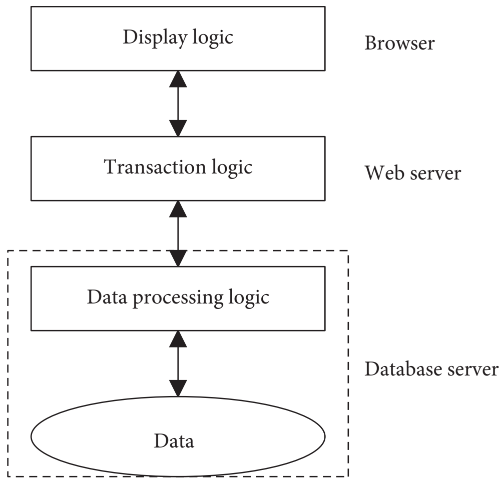

FIGURE 5: System structure diagram.

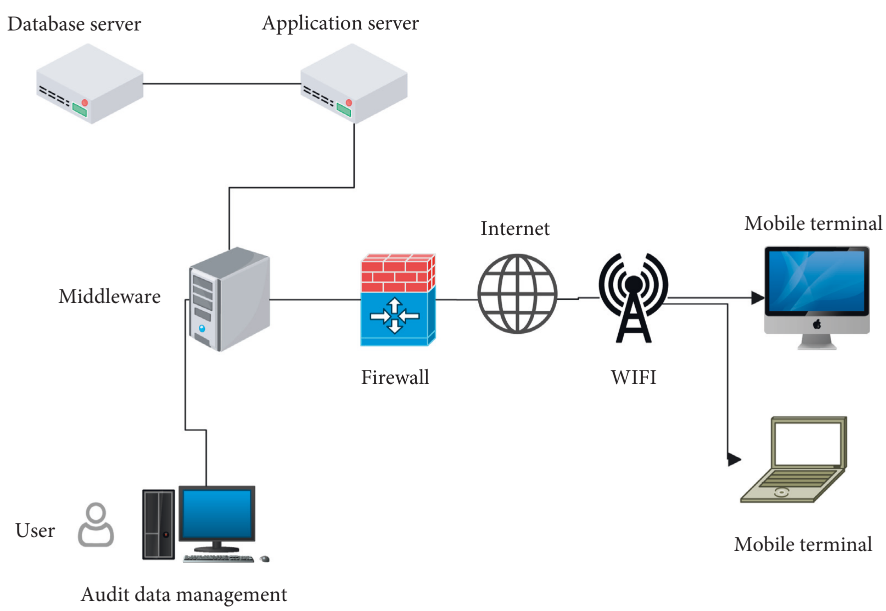

FIGURE 6: Network topology structure diagram.

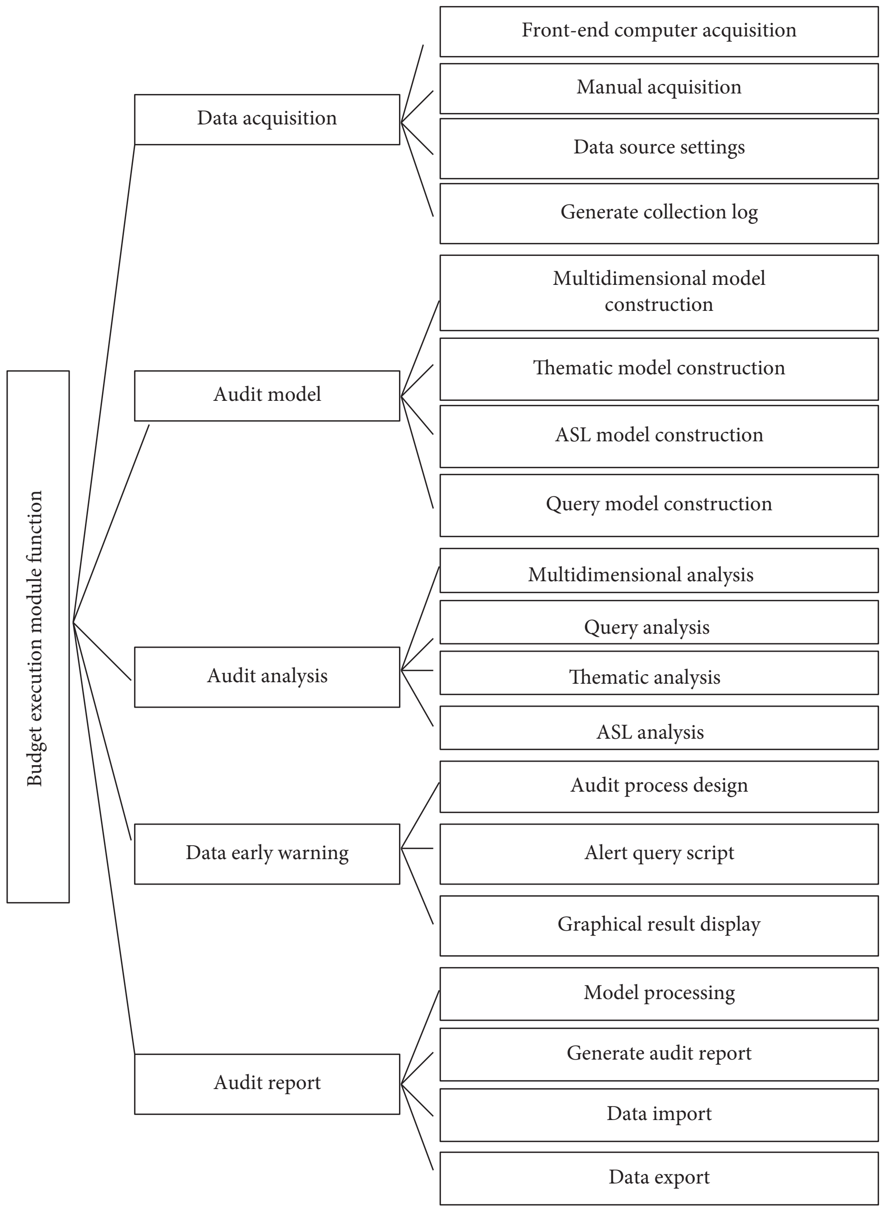

Figure 7: Detailed framework diagram of the functions of the budget execution module.

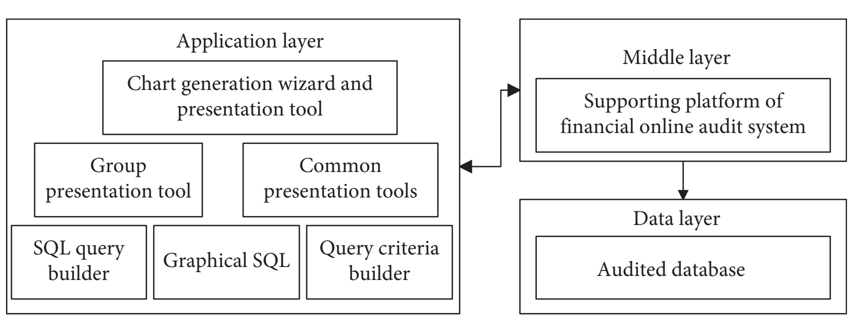

Figure 8: Structure diagram of audit analysis tool.

Table 1: Dynamic budget management effects of rural public affairs.

NO	Data processing	Budget effect
1	83.01	93.01
2	90.65	91.45
3	89.85	82.43
4	84.75	92.46
5	84.04	82.24
6	85.09	92.98
7	90.71	93.36
8	83.51	91.55
9	89.63	83.90
10	87.52	91.39
11	93.74	93.16
12	87.45	86.79
13	93.90	91.75
14	86.73	87.77
15	91.94	86.77
16	85.51	91.35
17	85.45	93.89
18	89.39	84.83
19	83.22	92.04
20	85.17	93.35
21	87.78	91.39
22	86.04	83.74
23	83.77	93.44
24	87.53	89.46
25	89.87	91.73
26	88.62	93.10
27	91.00	87.23
28	89.67	94.37
29	87.77	85.92
30	83.93	90.46
31	90.13	84.28
32	93.98	82.14
33	84.98	82.80
34	91.02	88.98
35	86.45	93.20
36	83.56	87.68
37	88.67	85.39
38	85.03	87.24
39	83.49	92.07
40	93.08	85.91
41	91.58	82.97
42	87.80	90.11
43	92.65	85.48
44	85.87	87.70
45	89.63	88.25
46	85.65	93.25
47	89.45	86.15
48	83.44	89.48
49	84.98	84.03
50	84.22	90.31
51	86.40	94.36
52	90.77	89.47
53	91.09	84.30
54	83.03	83.45
55	85.03	82.26
56	93.72	87.48
57	88.91	85.59
58	91.75	84.55
59	89.66	86.69
60	84.84	84.46

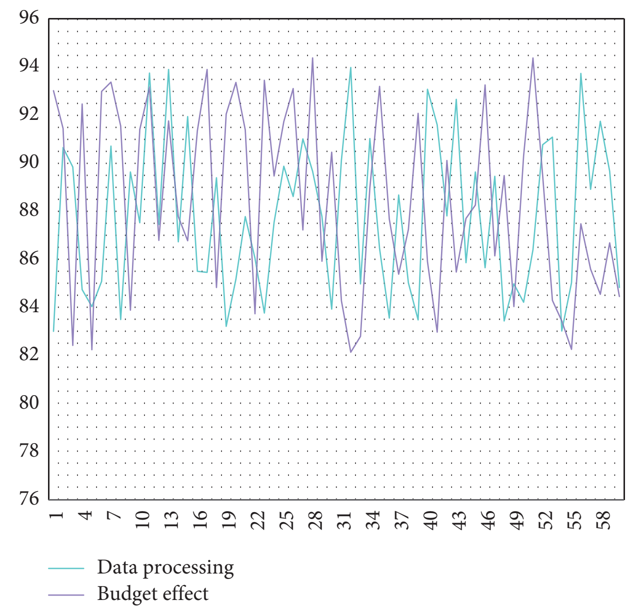

Figure 9: The experimental line chart of the dynamic budget management of rural public affairs.

further analyzed, such as grouping, sorting, filtering, statistics, calculation, and chart display. The structure diagram of audit analysis tool is shown in Figure 8.

After constructing the above system modules, the performance of the model is verified, the effect of the Internet of things data transmission and rural public affairs dynamic budget management of the system in this paper is evaluated, and the simulation research is carried out in combination with the data collected by the network. The results are shown in Table 1 and Figure 9.

From the above research, we can see that the dynamic budget management system of public affairs based on the Internet of things technology constructed in this paper has good results.

5. Conclusion

Since the implementation of the new rural construction, although most rural areas have made some development in infrastructure, environmental health improvement, and hardware conditions, the current situation of rural public services in China is worrying, and rural public services are generally insufficient, the structure is unbalanced and the efficiency is low. Specifically, the rural infrastructure is still relatively backward, the supply of rural education is insufficient, the structure is unbalanced and the efficiency is low. The imperfect and nonstandard township public management system is the biggest software factor restricting the construction of a new socialist countryside. This paper combines the Internet of things technology to construct the dynamic budget management system of rural public affairs, and analyzes the dynamic management of rural public affairs through the system, so as to improve the efficiency of rural public affairs management. In addition, this paper evaluates the effects of the Internet of things data transmission and the dynamic budget management of rural public affairs in this system, and conducts simulation research based on the data collected by the network. From the experimental research, we can see that the dynamic budget management system of public affairs based on the Internet of things technology constructed in this paper has good results.

Data Availability

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

Conflicts of Interest

The author declares that there are no conflicts of interest regarding this work.

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