

Received May 4, 2020, accepted May 18, 2020, date of publication May 22, 2020, date of current version June 5, 2020.

Digital Object Identifier 10.1109/ACCESS.2020.2996675

Research on E-Commerce Supply Chain Design Based on MVC Model and Virtual Image Technology

HUI WANG¹ AND FANG FANG²

College of Economic and Management, Hunan University of Science and Engineering, Yongzhou 425199, China
College of Business, Lyceum of the Philippines University, Batangas 4200, Philippines

Corresponding author: Hui Wang (youmao882127@163.com)

This work was supported by the Construct Program of the Applied Characteristic Discipline in the Hunan University of Science and Engineering (Applied Economics).

ABSTRACT In order to improve the intelligence of procurement under cross-border e-commerce, an e-commerce procurement system based on MVC model and virtual image technology is proposed. The procurement system under e-commerce is divided into logistics layer, management layer, financial layer, warehouse layer and procurement system transactions. Under the layer audit signature, the order is sent to the supplier, the information exchange is carried out in the MVC mode, and the integrated framework of the information organization and procurement system under cross-border e-commerce is designed through the MVC mode. This paper takes the electronic commerce simulation system as the framework and the virtual image technology as the basis to study the key technology of updating massive terrain data in real time under the condition of general computer hardware. Using the XP (Extreme Programming) programming method in the agile development mode, the development efficiency and quality are effectively improved. The design process uses UML and Visio to establish requirements and system design, simulates geographic information with virtual image technology, and provides real-time traffic scene graphic image information. The system takes the order process as the main line, realizes the system under the network environment, realizes the integration of internal and external supply chains, and solves the drawbacks of high information level and large amount of information at the bottom of traditional procurement activities. The simulation results show that the intelligent e-commerce procurement system based on virtual image technology has good intelligent processing capabilities and strong online analysis and processing capabilities.

INDEX TERMS MVC model J2EE framework, cross-border e-commerce, government procurement system, virtual technology, virtual reality, geographic image.

I. INTRODUCTION

Government procurement refers to the behavior of government organs, institutions and organizations at all levels in purchasing goods, projects and services that are within the scope of centralized procurement or above the standard of purchasing quotas formulated according to law with financial funds [1]. The origin of government procurement is earlier and larger. China's government procurement system began to be implemented in the 1990s, and the scale of procurement began at the beginning of a billion to hundreds of billions now, which has realized a great leap forward in the

scale of government procurement. With the emergence of E-commerce, the traditional mode of government procurement in the past can no longer meet the requirements of the development of the times and cannot keep up with the pace of the development of the times. The government should reform the procurement model and optimize the procurement process and procurement plans, so that government procurement can be carried out in a more open and transparent environment and platform [2].

In recent years, with the rapid development of electronic commerce in our country, the contact field of electronic commerce is more and more extensive, the turnover figure is amazing and presents an increasing trend of development, with the further development of Internet technology,

The associate editor coordinating the review of this manuscript and approving it for publication was Zhihan Lv³.

The Internet has entered various fields of the society rapidly. As a characteristic of the Internet derivative industry, E-commerce has gradually developed into a powerful business development model and economic development booster. The advantage of sub-commerce is that, through the Internet, a large network platform, the products and services produced by first-line factories are marketed through online stores and offline counters. As a result, their costs are relatively low [3]. The price will be relatively cheap, and through the form of E-commerce procurement can also be conducted with online merchants in all aspects of flexible negotiation, including the quality of goods, the way goods are transported, the price of goods, and so on. In order to improve the transparency and intelligence of government procurement, the government procurement system under cross-border E-commerce should be constructed under the mode of E-commerce [4].

In view of the above problems, this paper puts forward the design method of government procurement system based on MVC model and J2EE architecture [5]. The whole government procurement system under cross-border electronic commerce is divided into logistics layer, management layer and financial layer. Virtual geographic information system is one of the new developments of the combination of virtual reality technology and geographic information system technology. It is one of the key technologies to realize "Digital Earth". This paper takes the urban micro-traffic virtual comprehensive simulation system as the framework and the urban terrain and virtual scene as the spatial basis. It studies the key technology of real-time rendering of massive terrain data under the condition of general computer hardware. The construction and visualization of technical virtual city 3D models, combined with texture rendering and virtual image technology, provide technical support for e-commerce procurement systems. At the warehouse level, the transaction of the purchasing system starts with the report of the business department. The management audit and sign the order to the supplier, and exchange information under the MVC mode. MVC model and J2EE architecture are adopted to design the information organization and integration framework of government procurement system under cross-border electronic commerce. XP (extreme programming) programming method in agile development is adopted to effectively improve the development efficiency and quality assurance. UML and Visio are used in the design process to establish the requirement and system design to realize the optimal design of the government procurement system [6].

II. RELATED WORK

Government should carry out information-based and network-based procurement management mode. With the rapid development of information technology and network, the government should introduce E-commerce into the government procurement system, and include the mainstream E-commerce businesses such as JingDong, SUNING, Tmall Mall, etc., in the new agency. The platform of direct procurement monitoring and control is established, which connects

government procurement with mainstream E-commerce, and the purchasing units directly choose high quality and high quality goods online [7].

The government should announce the purchase plan through the network, and welcome the electronic network vendor to participate in the bidding for the relevant procurement. Through the Internet, the government can make clear the content to be purchased, the executive space of procurement, and the leading direction of procurement. With an open mind, it welcomes network suppliers to actively offer suggestions, participate in bidding for procurement, and give E-commerce access to the government. Make the government approachable really keep pace with the times, make the government procurement more market, selectivity, convenience, bargaining power. Investigate the differences between large electronic goods suppliers and traditional suppliers and actively look for opportunities to cooperate with them. Government departments should take the initiative to go out, in the context of the vigorous development of E-commerce today, to actively investigate the advantages of well-known E-commerce businesses such as JingDong and Gome, and find out the differences between them and traditional, fixed procurement suppliers [8]. Actively seek opportunities to cooperate with them, so that government procurement more and more market-oriented, more and more international [9]. To perfect the system of bidding and bidding for government procurement, and to implement the system of bidding and tendering for government procurement, to a certain extent, will help to standardize and make government procurement more standardized and effective. Perfecting the bidding and bidding system of government procurement can deepen the pace of market operation of government procurement, and ensure that government procurement is carried out in a level playing field [10]. The government should make clear the intention of bidding in the process of procurement. The specific information of public bidding enables the bidding enterprises to know their bidding direction more clearly and to formulate their own bidding plans more scientifically and clearly [11].

III. SIMPLIFICATION OF VIRTUAL CITY SCENE MODEL

Cutting based on viewpoint visibility. In the virtual city roaming, the entities in the city's three-dimensional scene should be in the view body determined by the viewpoints and perspectives [12]. The view body is an important concept in computer graphics. Usually, if there is no other clipping plane, the visible area is the quadrangular table surrounded by the near and far planes. In the virtual city scene roaming, usually there is an intersecting plane ABCD between the view body and the horizontal plane. Construction of virtual image model is shown in Figure. 1 [13].

Cutting based on viewpoint visibility is to determine which models are in this visible area. In order to solve this problem, the concept of building model bounding box was introduced. A building bounding box refers to the smallest cube that can contain all parts of a building model [14]. It can be described

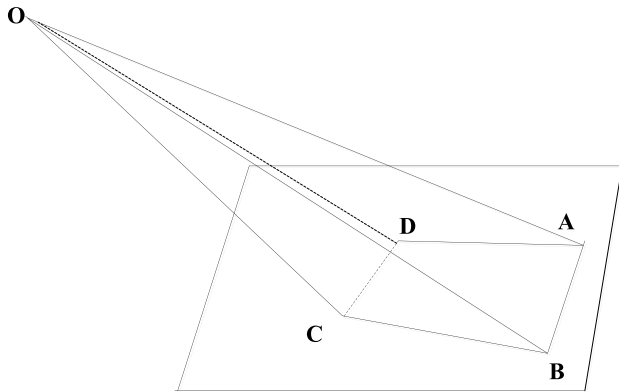


FIGURE 1. Construction of virtual image model.

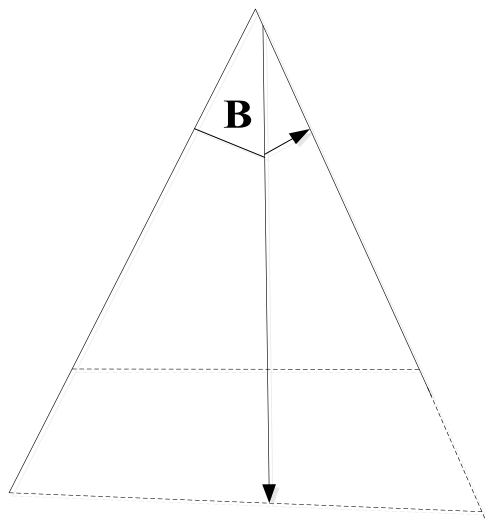


FIGURE 2. Visible area calculation diagram.

as $\text{Box} = \{\max X, \max Y, \max Z, \min X, \min Y, \min Z\}$. In general, before the view cuts, it takes two coordinate transformations of the object coordinate system to the world coordinate system, and the world coordinate system to the viewpoint coordinate system. The conversion from the world coordinate system to the viewpoint coordinate system depends on the camera model adopted by the system. In FIG. 2, a perspective projection model is adopted, and the viewpoint $E(X_e, Y_e, Z_e)$ and plane ABCD center point $C(X_c, Y_c, Z_c)$ are taken as reference points, and the plane is rotated over the reference point C to a plane parallel to the near-projection plane [15]. Thus, the new plane EFGH has an angle B with the original plane ABCD. In the perspective projection system composed of the plane EFGH, the near-projection surface, and the viewpoint, a viewpoint upward viewing vector $\vec{U}_p(X_u, Y_u, Z_u)$ is set, the viewpoint E is taken as the origin of the viewpoint coordinate system, the line of sight direction \vec{EC} is the Z axis, and take the X axis as an up vector \vec{U}_p that is perpendicular to both the Z axis and the viewing direction. The Y axis is perpendicular to the X and Z axes. The world coordinate system transforms the matrix into the viewpoint coordinate

system as [16]:

$$M = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ -X_e & -Y_e & -Z_e & 1 \end{bmatrix} \times \begin{bmatrix} (\vec{C} - \vec{E}) \times \vec{U}_p & 0 \\ (\vec{C} - \vec{E}) \times \vec{U}_p \times (\vec{C} - \vec{E}) & 0 \\ (\vec{C} - \vec{E}) & 0 \\ 0 & 1 \end{bmatrix} \quad (1)$$

As shown in Figure. 2, let the distance between the viewpoint and the near plane be D, the distance from the newly created far plane EFGH be F, the angle of view in the Y direction be β , and the ratio of the visual area be λ (that is, the width in the X direction/the length in the Y direction), then in the X direction, the perspective α is [17]:

$$\alpha = \text{Arc tan}(\alpha \times \tan(\beta)) \quad (2)$$

Set point $P(X_p, Y_p, Z_p)$, if its coordinate value satisfies:

$$(1) -Z_p \times \lambda \times \tan\left(\frac{\beta}{2}\right) \leq X_p \leq Z_p \times \lambda \times \tan\left(\frac{\beta}{2}\right) \quad (3)$$

$$(2) -Z_p \times \lambda \times \tan\left(\frac{\beta}{2}\right) \leq X_p \leq Z_p \times \lambda \times \tan\left(\frac{\beta}{2}\right) \quad (4)$$

$$F \leq Z_p \leq D \quad (5)$$

Thus P point is in the new scene projection. It is assumed that the number of vertices satisfying the above conditions in the bounding box of the three-dimensional model in the virtual city scene is M, then $M=8$ indicates that the object is in the view polyhedron, and $0 < M < 8$ indicates that the object intersects the view polyhedron, and $M=0$ represents that the object is invisible on the outside of the viewing area [18]. Level of detail (LOD) model: The above three techniques all reduce the number of polygons that need to be drawn as much as possible. Such methods accelerate the real-time drawing of images to a certain extent, but they still have shortcomings when rendering large-scale terrain scenes [19]. If an area is very far away from the pilot, the result of the drawing is only a few pixels when displayed. In this case, there is no need to use a complex model. Using a low-resolution model not only meets the visual requirements, but also can reduce the burden of system operation, based on this idea, there is a level of detail model technology [20]. LOD model technology was first proposed by Clark in 1976. Its core idea is to establish multiple models with different levels of detail for objects. When used, they are selected according to the distance of the viewpoint, and the terrain model whose local resolution depends on the point of view changes [21]. The level of detail level at different distances from the point of view of the model may be different, and with the movement of the point of view corresponding changes, to ensure the “topographical connectivity” and “time continuity” of the terrain display. In this way, the display speed can be improved as much as possible under the premise of ensuring visual effects. The research and development of LOD model simplification technology has gone through three stages: discrete LOD model stage, continuous LOD model stage and multi-resolution model stage [22].

In the process of image segmentation and synthesis, it is the process of synthesizing each brush, segmentation first, and then matching. In the segment matching process, the minimum formula of the cost function is [23]:

$$\min \sum_{i=1}^l E(x_i) \tag{6}$$

Among, l represents the length of a synthetic brush, $E(x_i)$ represents the cost of adjacent segments. If the dynamic programming algorithm is adopted, the cost of static and dynamic parts can be obtained:

$$E(x_i) = E_s(x_i) + \min_{j \in N} E_d(x_i, x_j) \tag{7}$$

Among, $E_s(x_i)$ is a static state price, $E_d(x_i, x_j)$ represents the cost of dynamic, if the dynamic programming algorithm is used to solve the minimization problem, the formula is as follows:

$$\left\{ \begin{aligned} M_i(x_i) &= E_s(x_i) + \min_{i-1} \{E_d(x_i) + M_i - 1(x_i - 1)\} \\ M_1(x_1) &= E_s(x_1) \end{aligned} \right\} \tag{8}$$

The interpolation method is called image interpolation in graphics, it is used to solve the value of a future function at a point [24]. If a specific function is built for countless points on an unknown function, the function interpolation method of structure can be divided into polynomial interpolation and piecewise interpolation method, among, polynomial interpolation method contains several interpolation methods, including image segmentation algorithm, but the segmented interpolation method contains the piecewise interpolation and spline interpolation, the piecewise interpolation is designed to avoid high order polynomials. In this paper, the algorithm of image segmentation is mainly studied, the calculation formula is as follows:

$$P_j(x) = \prod_{i=1, i \neq j}^n \frac{x - x_i}{x_j - x_i} = \frac{(x - x_1)(x - x_2) \cdots (x - x_{n-1})}{(x_j - x_1)(x_j - x_2) \cdots (x_j - x_{n-1})}, \tag{9}$$

$i, j = 1, 2, \dots, n(2-4)$

In the end, we can draw a conclusion:

$$g(x) = \sum_{j=1}^{n+1} a_j p_j(x) = 1, 2, \dots, n \tag{10}$$

The image segmentation algorithm is relatively simple in the process of realization, but if the sample point is too much, then the partition function is $n-1$, if the number of segmentation is more, there will be a possibility of shock, and there will be a great error for some image segmentation values. The interpolation based image segmentation method is often used in the process of image processing, for example, enlarging and narrowing. This method depends mainly on the pixel value of the image, if it is represented by the most adjacent interpolation, they are divided into A, B, C, and D regions, if the pixel point of the A region is given to its pixel value, by the same token, pixel points in the B, C, and D regions also

give them pixel values. In the calculation of image segmentation and interpolation, most of the images are discrete data; therefore, the interpolation results can be calculated from the use of the template.

IV. IMAGE FEATURE EXTRACTION METHOD

The image target recognition mainly aims at distinguishing the two states of the seat with or without people [14]. People's sitting posture changes frequently, it is difficult to describe human characteristics effectively, so this article uses a description based on chain code and poly. The class theory of image feature extraction method describes and extracts the characteristics of the edge of the vehicle image seat, that is, the straight line segment. As a key step in the process of vehicle image target recognition, the accuracy of linear description and feature extraction and computational efficiency are important evaluation criteria for system performance. Aiming at the application environment of vehicle image, this paper developed a straight line extraction method based on clustering and new type of chain code. This method inherits the high robustness of clustering. At the same time, due to the adoption of a new type of chain code, the computational speed of this method has been improved.

A. CHAIN CODE DESCRIPTION

Chain code is a commonly used representation method for binary images. This method uses a certain code value to represent the positional relationship between pixels, avoids the usual two-dimensional matrix structure, and stores the position and shape information in the graph with less data. This reduces the amount of calculations, reduces information redundancy, and saves storage space. Therefore, the chain code technique has been widely used in the fields of graphic processing and pattern recognition. The common chain code is mainly Freeman and the improved Freeman based on Brisk. The definition of the Freeman chain code is shown in Figure 3.

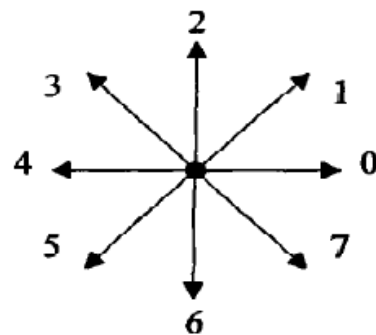


FIGURE 3. Freeman chain code.

B. EXTRACT IMAGE EDGE GEOMETRY

We first remove pixels whose local curvature is greater than a certain limit because high curvature represents the sharp point of the edge. In the object we expect to appear, there will be

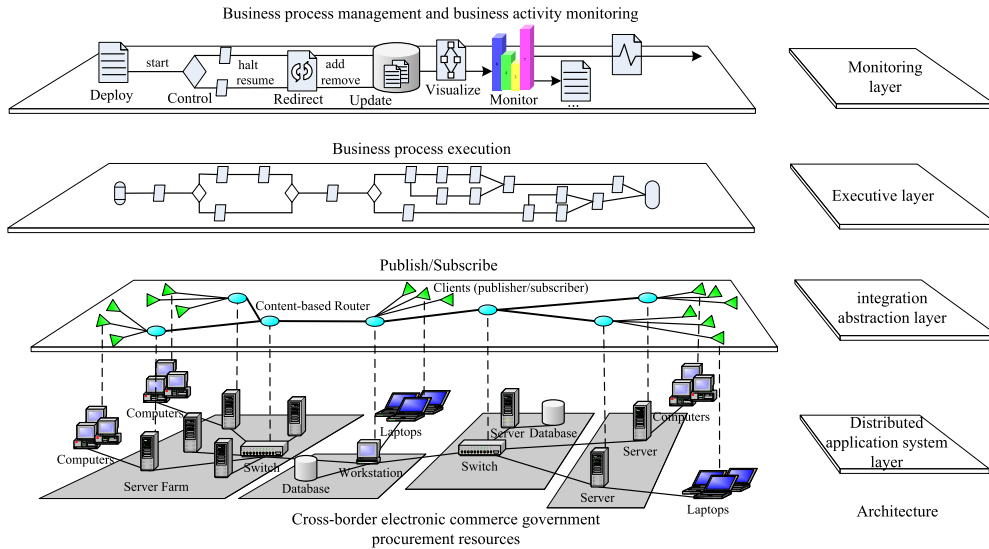


FIGURE 4. Overall design framework of the system.

no cusp on the edge. Therefore, by removing the cusp, we can disconnect the edges that originally belong to two objects but are connected together.

There are many noise disturbances in digital images in practical applications, and there are many unnatural transitions on the edges. In order to prevent the incorrect division of the curve due to unnatural transition points in the next segmentation process, the local curvature of the edge is first smoothed before the operation. Because there is no special requirement, we choose to use the mean filter for filtering. The specific filtering formula is as follows:

$$\bar{c}_i = \frac{1}{2p+1} \sum_{j=i-p}^{i+p} c_j \quad (11)$$

In the above equation, $2p+1$ is the filter window width of the averaging filter. At this point, we have obtained a smoothed local curvature \bar{c} .

C. PERFORMANCE ANALYSIS

In the feature extraction process, in order to reduce the influence of noise, the edge length value η is defined in this paper. Only the edges of digital images with the number of pixels greater than η are processed.

For real-time systems, the algorithm's speed of operation and code efficiency are key factors in determining its eligibility. Most curve recognition algorithms based on clustering theory have a large amount of computation due to too many operators. Although the image feature extraction and recognition algorithm we developed is still based on the clustering theory, it is due to the introduction of the angle chain code. Imagine that the computing speed has greatly improved compared to the classical Hough transform algorithm. We chose to compare the two algorithms by comparing the typical image with a straight line.

Because of adopting the new angle chain code, our algorithm's operation speed is much higher than that of the classic Hough transform. It increases by an average of about 7 times, and it can get a straight edge of the seat. Moreover, if the post-processing of Hough transform does not use a simple maximum value, but uses a certain clustering algorithm, the gap between our algorithm and the classical Hough transform algorithm will be even greater.

V. SYSTEM OVERALL DESIGN DESCRIPTION

First of all, it analyzes the overall design of government procurement system under cross-border electronic commerce and analyzes and introduces the functional modules. The government procurement system under cross-border electronic commerce is built on the general computer platform. The government procurement system under cross-border electronic commerce can manage government procurement and build database on different operating systems to realize adaptive scheduling and data access of government procurement under cross-border electronic commerce. The government procurement system under cross-border electronic commerce is developed under embedded Linux environment. The procedure loading control of government procurement under cross-border electronic commerce and the information management design of government procurement under cross-border electronic commerce are carried out by association rule mining method. In order to improve the portability of the system, the government procurement system under cross-border electronic commerce is built on Visual DP + 4.5 development platform. In order to improve the portability of the system, the system adopts compatible Web development technology to construct the management module of government procurement under cross-border electronic commerce. The overall design architecture of the system is shown in Figure 4.

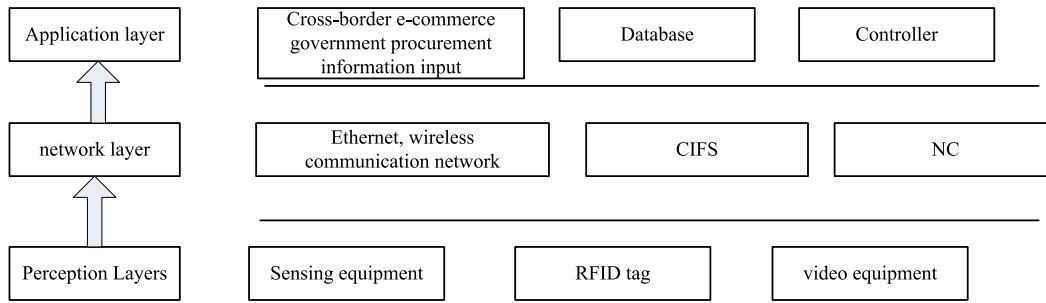


FIGURE 5. Three-tier procurement under e-commerce.

The function realization of government procurement system under cross-border electronic commerce should be established on the basis of merchants, user terminals and central servers of electronic commerce, and the government procurement system under cross-border electronic commerce should adopt a three-tier structure of B/S. The E-commerce of enterprise logistics makes logistics service extend up to market investigation and forecast, purchase and order processing; downward can extend to distribution, logistics consultation, selection and planning of logistics plan, suggestion of inventory control decision, Payment recovery and settlement, logistics system design and planning, etc. Order flow management is to produce or assemble according to customer order, take order as the center, make the information in order to be shared in real time among all nodes in the supply chain, and pull the production, supply and distribution activities of the whole supply chain. To achieve greater profit and market share and achieve better customer satisfaction. This system takes a trading company which integrates auto parts sales, auto repair and auto beauty as the development background, constructs an information and scientific management platform, and improves the efficient use of enterprise resources. The system adopts a three-tier architecture to construct the database and manage the data information of government procurement under cross-border electronic commerce in the basic layer. The database of government procurement under cross-border electronic commerce includes knowledge rule base, resource base of government procurement, according to the overall design framework model of government procurement system under long-distance cross-border electronic commerce shown in figure 1. The hardware design and software development of the system are carried out. Firstly, the function modularization design of government procurement system under cross-border electronic commerce is carried out, and the function component is developed by combining program loading control and intelligent information processing. Three-tier procurement under e-commerce is obtained as shown in Figure 5.

VI. SYSTEM SOFTWARE DEVELOPMENT PROCESS

The process of government procurement system in the whole cross-border E-commerce is divided into four levels, namely: logistics, management, financial, warehouse. The transaction of purchasing system starts from the report of the

business department. After the order is accepted, the logistics company will order the goods from the supplier or the manufacturer. The contents of the purchase operation include the statistics of the quantity of the goods, the inquiry of the trading conditions of the suppliers, the business negotiation, the contract signing of the purchase order, etc.. After the purchase order is opened, the purchasing staff can follow the stock tracking and urge the purchase]. The warehousing manager can do the warehouse schedule according to the date of the purchase list. The key point in the process is the core of the government procurement system under cross-border E-commerce. The return and the purchase will cause the stock exchange. The inventory management operation mainly manages the inventory of the products, and checks the inventory according to the inventory content, corrections the inventory books and makes the profit and loss reports; after the goods are out of the warehouse, the sales department can be based on the sales department. The receipt of the goods is made and the bill is transferred to the accounting department as a receipt. When the goods are purchased in the warehouse, the receivable department produces the inventory of the goods to be used as a supplier for audit. The accounting department makes various financial statements for reference to the policy making and operation management of the business. The distribution graph of the government procurement system is shown in Figure 6.

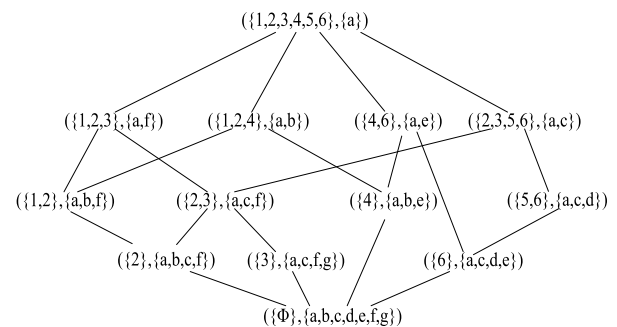


FIGURE 6. Node distribution of government procurement system in Cross-border E-commerce.

The information base of government procurement resources under cross-border E-commerce is established. In the information collection terminal, the database is used to store and schedule the resources, and the FIFO RAM buffer is used to analyze the characteristics of the state

information of government procurement under cross-border E-commerce. The remote transmission control of government procurement information under cross-border electronic commerce is carried out in the upper computer module. By means of man-machine interface and data converter, the lower computer transmission control of intelligent management information of government procurement under cross-border electronic commerce is realized. Combined with inter-process communication protocol, automatic control program loading and bus transmission of government procurement system under cross-border electronic commerce are realized. To improve the compiling ability and kernel management ability of the government procurement system under cross-border electronic commerce, the embedded ARM9TDMI is adopted as the kernel microprocessor to realize the software development of the government procurement system under the cross-border electronic commerce. QT / embedded is used as the GUI interface to develop government procurement system under cross-border electronic commerce, and information exchange is carried out in MVC mode. The MVC model and J2EE architecture are used to design the information organization and integration framework of government procurement system under cross-border electronic commerce. The MVC pattern structure of government procurement system under cross-border electronic commerce is shown in Figure 7.

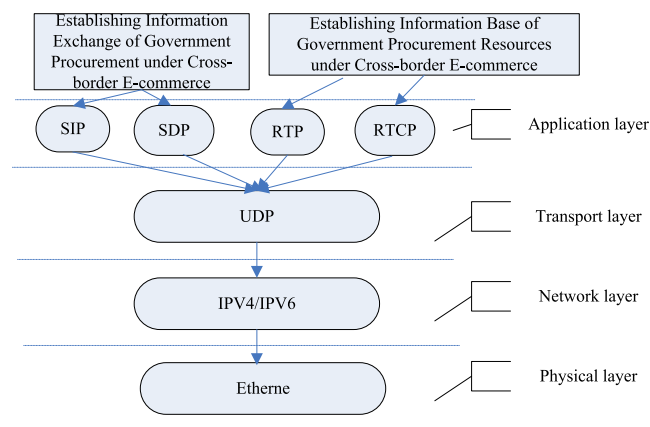


FIGURE 7. MVC model of government procurement system under cross-border E-commerce.

The web design of government procurement system under cross-border electronic commerce adopts three kinds of network topology design scheme: star type, tree type and network type. ZigBee terminal node forms the Internet of things system structure through Web network networking technology. The purpose is to ensure that the system software system and ERP and the planning of electronic commerce. Based on the analysis, the information organization and integration framework of C/S (client/Server) and B/S (browser / Server) hybrid structure is adopted. Intra-enterprise LAN users include the use of C/S structure, can handle a large number of data entry, data mining statistics, the generation

of various reports and ensure the security of key data; external customers and upstream suppliers, The B/S structure between the downstream vendors can simplify the software and hardware requirements of the client, guarantee the real-time communication, realize the real-time generation of orders, pull inventory control to upstream vendors and push inventory control with downstream vendors. The system adopts XP (extreme programming) programming method in agile development to improve development efficiency and quality assurance effectively. UML and Visio are used in the design process to establish requirements and system design. The development process uses the Visual Studio. NET Microsoft SQL Server development tools and the developer Express plug-in from Microsoft Corporation to build a system application prototype in a short period of time by using the various object-oriented visual development tools it provides, and then, the requirements of the initial prototype system are iterated, modified and improved until a more perfect and feasible system is formed. This system takes the order flow as the main line, realizes the system implementation under the network environment, realizes the integration of the internal and external supply chain, solves the disadvantages of the traditional purchasing activities, such as the low level of information, the high operating cost, and so on. It improves the whole operation efficiency of enterprise purchasing, improves the competitiveness of enterprise, and provides information support for online Analytical processing (OLAP). GUI and MySQL are used to compile and install government procurement data under cross-border electronic commerce, and register initialization operation is performed. After program initialization, the human-computer interface design of government procurement system under cross-border electronic commerce is completed. To realize intelligent information processing of government procurement under cross-border E-commerce.

In the basic layer design of government procurement system under cross-border electronic commerce, using middleware design scheme, RFD equipment can only act as terminal node in GPRS network communication. This paper uses TCP / IP Ethernet technology to construct the information resource sharing module of government procurement under cross-border E-commerce, and it carries out online inquiry and resource scheduling of government procurement under cross-border E-commerce in cloud computing environment. Design application layer, application support sublayer, network layer, communication terminal of government procurement system under cross-border electronic commerce. Based on XIX bus system, IEEE defines physical layer, medium access layer. The register ADSP-BF537 is used to cache the government procurement information under cross-border electronic commerce. In the basic layer design of government procurement system under cross-border electronic commerce, the information resource sharing module of government procurement under cross-border electronic commerce is constructed by using TCP/IP Ethernet technology. In the cloud computing environment, the online query

TABLE 1. Experimental data were compared with the results of the table.

Serial number	Raw data	Traditional algorithm		Optimized algorithm	
		Analog value	Relative error(%)	Analog value	Relative error(%)
1	142	142	0	142	0
2	159	157	1.58	158	-0.8
3	172	165	2.68	168	-0.16
4	170	175	-1.5	170	0
5	192	185	2.88	189	0.97
average error(%)		1.73		0.55	

and resource scheduling of government procurement under cross-border E-commerce are carried out. Design application layer, application support sublayer, network layer, communication terminal of government procurement system under cross-border electronic commerce. Based on XIX bus system, IEEE defines physical layer, medium access layer. The register ADSP-BF537 is used to cache government procurement information under cross-border electronic commerce, GUI and MySQL are used to compile and install government procurement data under cross-border electronic commerce, and register initialization operation is performed.

VII. SYSTEM TEST ANALYSIS

In order to verify the application performance of this method in realizing the intelligence of government procurement under cross-border electronic commerce, the simulation experiment is carried out, and the MVC model and J2EE architecture are used to construct the system cluster network protocol. In the embedded Web environment, the government procurement system is debugged under cross-border E-commerce. The ARM9TDMI processor core is used as the debugging unit, and the transmission bus protocol of the system adopts UDP protocol.

Below we begin our testing of the algorithm. Because we choose the algorithm itself is suitable for the calculation of this article, we test the test in the form of a comparative test taken when testing. Table 1 below is a comparison table of experimental data for our calculation results. The experimental data comparison of the calculated results is shown in Figure. 8.

For the data in Table 1 above, we can know that after we optimize the algorithm, the calculation accuracy of the algorithm and the calculation accuracy of the algorithm have greatly improved. This can be seen from the test data in our previous article. The relative error of the traditional algorithm is zero in the first group. Table 2 shows the comparison table between the improved GM(2,1) model and the traditional algorithm model prediction accuracy. The comparison of model precision is shown in Figure. 9.

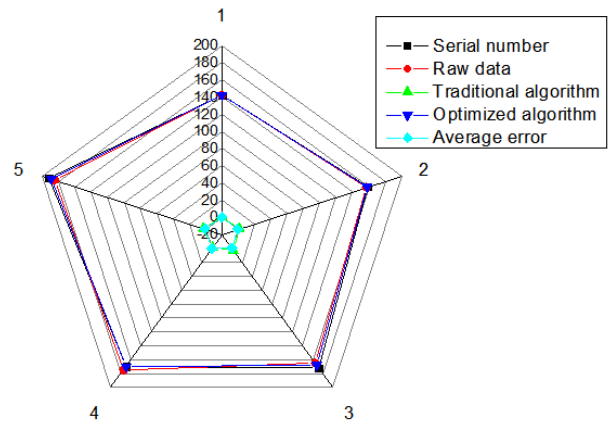


FIGURE 8. Comparison of experimental data of calculated results is shown in the figure.

TABLE 2. Model accuracy.

Model accuracy grade	Post test difference	Probability of small errors
Level 1 (good)	$0.95 < p$	$C < 0.35$
Level 2 (qualified)	$0.80 < p < 0.95$	$0.35 < C < 0.5$
Level 3 (barely)	$0.70 < p < 0.80$	$0.5 < C < 0.65$
Level 4 (failed)	$p < 0.7$	$0.65 < C$

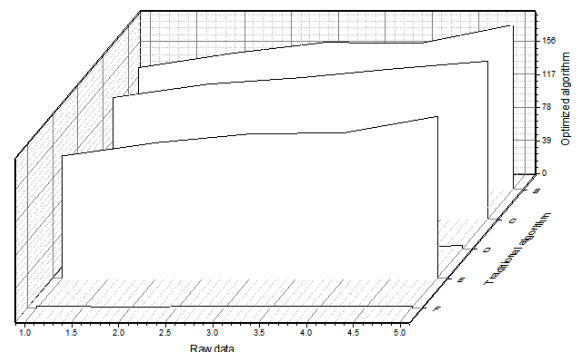


FIGURE 9. Model precision comparison.

Under the embedded environment, the design of the BS three-tier architecture of the government procurement

system under cross-border E-commerce is realized, and the Floor Request message is sent to the control server, and the information processing of the government procurement system under the cross-border E-commerce is carried out. The comparison of processing efficiency is shown in Figure 10.

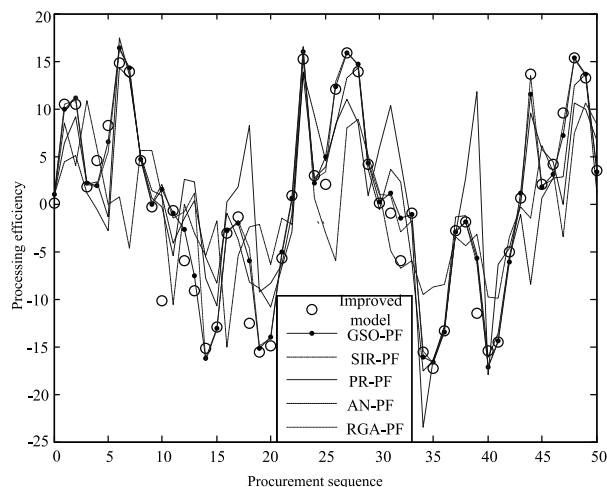


FIGURE 10. Comparison of information processing performance of government procurement system under cross-border electronic commerce.

Figure 10 shows that using this system to conduct cross-border E-commerce government procurement system artificial intelligence is better, on-line analytical processing ability is stronger.

VIII. CONCLUSION

In this paper, a design method of government procurement system under cross-border E-commerce based on MVC mode and J2EE architecture is proposed. The government procurement system under cross-border E-commerce is divided into logistics layer, management layer, financial layer, warehouse layer, and purchase system transaction starting from the report of business department. Under the layer audit signature, the order is sent to the supplier, the information interaction is carried out in the MVC mode, the information organization and the integrated framework of the government procurement system under cross-border E-commerce are designed by MVC mode and J2EE architecture. The system takes the order flow as the main line, realizes the system implementation under the network environment, realizes the integration of the internal and external supply chain, and solves the disadvantage of the information degree at the bottom of the traditional procurement activities and the high operating cost. The simulation results show that the design of the cross-border E-commerce is the next policy. The government procurement system has good artificial intelligence and strong ability of online analysis and processing, this method has good application value.

REFERENCES

- [1] Y. L. Zhao, H. Nan, and Z. H. Yu, "Improved particle swarm optimization algorithm based on twice search," *J. Comput. Appl.*, vol. 37, no. 9, pp. 2541–2546, Jan. 2017.
- [2] K. Z. Tang, X. Xiao, and J. H. JIA, "Adaptive particle swarm optimization algorithm based on discrete estimate strategy of diversity," *J. Nanjing Univ. Sci. Technol.*, vol. 37, no. 3, pp. 344–349, Jan. 2013.
- [3] L. Luo, K. Chen, and F. P. Du, "Surface fitting and position-pose measurements based on an improved SA-PSO algorithm," *J. Tsinghua Univ. (Sci. Technol.)*, vol. 55, no. 10, pp. 1061–1066, Jan. 2015.
- [4] C. Lu, W. Sheng, Y. Han, and X. Ma, "Phase-only pattern synthesis based on gradient-descent optimization," *J. Syst. Eng. Electron.*, vol. 27, no. 2, pp. 297–307, Apr. 2016.
- [5] S. H. Xu, M. L. Song, and C. Xu, "Training algorithm of process neural networks based on hybrid error gradient descent," *J. Northeast Petroleum Univ.*, vol. 38, no. 4, pp. 92–96, Jan. 2014.
- [6] W. H. Han, J. Xu, and X. H. Shen, "Hybrid of self-learning particle swarm optimization and gradient descent based magnetic flux leakage inversion," *Fire Control Command Control*, vol. 40, no. 1, pp. 88–91, Jan. 2015.
- [7] K. Z. Tang, H. Y. Li, and J. Li, "Improved particle swarm optimization algorithm for solving complex optimization problems," *J. Nanjing Univ. Sci. Technol.*, vol. 39, no. 4, pp. 386–391, Jan. 2015.
- [8] L. J. Zhou, W. Peng, and X. Q. Zeng, "Dynamic particle swarm optimization based on hybrid variable," *Comput. Sci.*, vol. 40, no. 11, pp. 143–146, Jan. 2013.
- [9] J. X. Wei, Y. H. Sun, and X. N. Su, "A novel particle swarm optimization based on immune selection," *J. Nanjing Univ. (Natural Sci.)*, vol. 46, no. 1, pp. 1–9, Jan. 2010.
- [10] Y. J. Lei, X. D. Yu, and S. H. Yue, "Research on PSO-based intuitionistic fuzzy kernel clustering algorithm," *J. Commun.*, vol. 5, no. 5, pp. 25–54, Jan. 2015.
- [11] W. Zhou, J. J. Luo, K. Jin, and K. Wang, "Particle swarm and differential evolution fusion algorithm based on fuzzy Gauss learning strategy," *J. Comput. Appl.*, vol. 37, no. 9, pp. 2536–2540, Jan. 2017.
- [12] H. Patel, "Accelerated PSO swarm search feature selection with SVM for data stream mining big data," *Int. J. Res. Eng.*, vol. 3, no. 9, pp. 15761–15765, Jan. 2016.
- [13] W. H. Li and H. Y. Ni, "An improved Adaboost training algorithm," *J. Jilin Univ. (Sci. Ed.)*, vol. 49, no. 3, pp. 498–504, Jan. 2011.
- [14] N. Li, Y. Yu, and Z. H. Zhou, "Diversity regularized ensemble pruning," in *Proc. Joint Eur. Conf. Mach. Learn. Knowl. Discovery Databases (Lecture Notes in Computer Science)* vol. 7523. Berlin, Germany: Springer, Jan. 2012, vol. 13, no. 11, pp. 330–345.
- [15] H. Parvin, M. MirnabiBaboli, and H. Alinejad-Rokny, "Proposing a classifier ensemble framework based on classifier selection and decision tree," *Eng. Appl. Artif. Intell.*, vol. 37, pp. 34–42, Jan. 2015.
- [16] G. Singal, V. Laxmi, M. S. Gaur, S. Todi, V. Rao, M. Tripathi, and R. Kushwaha, "Multi-constraints link stable multicast routing protocol in MANETs," *Ad Hoc Netw.*, vol. 63, pp. 115–128, Aug. 2017.
- [17] X.-L. Jiang, Q. Wang, B. He, S.-J. Chen, and B.-L. Li, "Robust level set image segmentation algorithm using local coreentropy-based fuzzy c-means clustering with spatial constraints," *Neurocomputing*, vol. 207, pp. 22–35, Sep. 2016.
- [18] S. Niu, Q. Chen, L. de Sisternes, Z. Ji, Z. Zhou, and D. L. Rubin, "Robust noise region-based active contour model via local similarity factor for image segmentation," *Pattern Recognit.*, vol. 61, pp. 104–119, Jan. 2017.
- [19] S. Bi, C. K. Ho, and R. Zhang, "Wireless powered communication: Opportunities and challenges," *IEEE Commun. Mag.*, vol. 53, no. 4, pp. 117–125, Apr. 2015.
- [20] S. Ulukus, A. Yener, E. Erkip, O. Simeone, M. Zorzi, P. Grover, and K. Huang, "Energy harvesting wireless communications: A review of recent advances," *IEEE J. Sel. Areas Commun.*, vol. 33, no. 3, pp. 360–381, Mar. 2015.
- [21] D.-W. Seo, J.-H. Lee, and H.-S. Lee, "Optimal coupling to achieve maximum output power in a WPT system," *IEEE Trans. Power Electron.*, vol. 31, no. 6, pp. 3994–3998, Jun. 2016.

- [22] A. Khabbazibasmenj, A. Hassanien, S. A. Vorobyov, and M. W. Morency, "Efficient transmit beamspace design for search-free based DOA estimation in MIMO radar," *IEEE Trans. Signal Process.*, vol. 62, no. 6, pp. 1490–1500, Mar. 2014.
- [23] P. F. Sannmartino, C. J. Baker, and H. D. Griffiths, "Frequency diverse MIMO techniques for radar," *IEEE Trans. Aerosp. Electron. Syst.*, vol. 49, no. 1, pp. 201–222, Jan. 2013.
- [24] W.-Q. Wang and H. Shao, "Range-angle localization of targets by a double-pulse frequency diverse array radar," *IEEE J. Sel. Topics Signal Process.*, vol. 8, no. 1, pp. 106–114, Feb. 2014.



FANG FANG received the master's degree in economics. She is currently pursuing the Ph.D. degree in management with the Lyceum of the Philippines University. She is also an Associate Professor with the School of Economics and Management, Hunan University of Science and Engineering. Her main research interests include industrial economy and e-commerce.

...



HUI WANG received the master's degree in economics. She is currently pursuing the Ph.D. degree in management with the Lyceum of the Philippines University. She is also a Lecturer with the School of Economics and Management, Hunan University of Science and Engineering. Her main research interests include international trade and cross-border e-commerce.