Hindawi
Mobile Information Systems
Volume 2022, Article ID 5007837, 13 pages
https://doi.org/10.1155/2022/5007837

Research Article

The Informatization of Small and Medium-Sized Enterprises Accounting System Based on Sensor Monitoring and Cloud Computing

Jingjing Deng

Xing Zhi College of Xi'an University of Finance and Economics, Xi'an, Shaanxi 710000, China

Correspondence should be addressed to Jingjing Deng; donnie_shaffer@stu.centralaz.edu

Received 21 March 2022; Accepted 27 April 2022; Published 27 May 2022

Academic Editor: Muhammad Muzammal

Small and medium-sized enterprises (SMEs) are an indispensable part of the development of the market economy, and they occupy a major position in the national economic system. Nowadays, the information construction of SMEs is becoming more and more important. Having an informationized accounting system can speed up the economic development of SMEs. So, this article designs a new type of accounting system, mainly for SMEs. Therefore, this article is based on sensor monitoring and cloud computing to optimize the informatization construction of the accounting system of SMEs. This paper proposes a cloud computing SOA architecture to build a cloud computing-based accounting system, and then combines the wireless sensor network routing protocol in the wireless sensor network system and the method of measuring the distance of the sensor monitoring node, and the wireless sensor network is applied to the cloud computing-based accounting system. Then, designed the enterprise information construction investigation experiment to formulate the rules applicable to SMEs, and then tested the data detection ability of the new accounting system by testing the performance of the sensor network protocol. Finally, the data obtained from the analysis of the weight of the enterprise cloud service is used to optimize the new accounting system, and the performance of the final optimized accounting system is compared with the traditional system. Experiments show that the accuracy of data monitoring by an accounting system based on sensor monitoring and cloud computing has increased by 13.84% compared to traditional accounting systems; compared with the traditional accounting system, the data processing efficiency of the accounting system based on sensor monitoring and cloud computing has increased by 14.63%.

1. Introduction

SMEs are an important part of the domestic market economy. With the further deepening and opening of domestic reforms, the large number of SMEs has played an increasingly important role in the domestic economy. As a modern management method, the only way for an enterprise to modernize its operations, improve its operating efficiency, and enhance its competitiveness is information management. The core of the enterprise information management system is accounting information. Improving the level of enterprise accounting information is a necessary condition for improving the level of enterprise informatization. Because of their important position in the domestic economy, SMEs need to improve the accounting informationization of SMEs, which account for the majority of enterprises.

The analysis of enterprise informatization needs is the first step of enterprise informatization. The analysis of informatization needs is indispensable for the construction of enterprise informatization. SMEs must attach great importance to the analysis of enterprise informatization needs. In the cloud computing environment, based on the research on the development characteristics of SMEs, the analysis of the informatization needs of SMEs has very important research significance. The SME accounting system based on sensor monitoring and cloud computing has the capability of sensor data monitoring and the data processing capability of cloud computing. This not only improves the accuracy of

data monitoring but also enhances the efficiency of the accounting system for data processing, which is very objectively helpful to the informatization construction of small and medium-sized enterprises.

Detecting the presence of anomalies and locating faulty sensors in Internet of Things (IoT) systems are critical, because incorrect data can lead to catastrophic consequences in many vertical industry applications. In order to overcome these difficulties, Xiao *Z* builds an adjacency matrix by using the distance between different sensors. It uses the irregular spatial information of IoT sensors, and uses a nonlinear polynomial graph filter (NPGF) to characterize the relationship between the collected sensor data [1]. Its main research is to detect and locate the sensors in the Internet of Things system. This positioning method can be applied to the positioning monitoring of sensors, which is helpful to this article. An important requirement for low-cost sensor systems for defect detection and characterization is to bridge the gap between nondestructive testing and evaluation (NDT&E) and structural health monitoring (SHM). Zhang *J* introduced an ultrahigh frequency (UHF) passive RFID sensor system for crack detection and potential structure monitoring [2]. Its research is the application of sensors in defect detection, but there are not many applications involving system informatization. In order to study the detection problem of sensor networks, Nayyar A considers the sequential detection problem in sensor networks. His goal is to determine the decision strategy of all sensors to minimize the total expected cost [3]. It studies the problem of sequence detection in sensor networks. If it can study the accounting system information, it will be more in line with the purpose of this article. As far as car safety is concerned, the driver plays a vital role. Muhlbacher-Karrer S proposed a driver state detection system based on cellular neural network (CNN) to monitor the driver's stress level [4]. Smart homes reduce the need for human intervention to control heating, ventilation, and air conditioning (HVAC) systems to maintain a comfortable indoor environment. Due to the limited processing power and memory of sensor nodes, the embedded intelligence in sensor nodes is limited. Cloud computing is becoming more and more popular because of its ability to provide computer utilities as an Internet service. Javed A proposed an intelligent controller model that combines the Internet of Things (IoT) with cloud computing and Web services [5]. His research is to combine the Internet of Things and cloud computing to apply in smart homes, but the application of its sensors is not comprehensive enough. This adoption of cloud computing has a profound impact on the IT industry and related industries. Because it not only affects the supplier's business model but also affects the other participants in the business ecosystem. Nieuwenhuis *L* discussed how the value network of enterprise software solutions changes with the shift from on-premise technology to cloud-based technology [6]. Its research is the application of cloud computing technology in enterprise software, but it is not deep enough to involve enterprise accounting system. The continued decline in biodiversity threatens the stability of the ecosystem and reflects that an overall planetary boundary is being destroyed. Skouloudis A aims to critically evaluate the content of biodiversity conservation and management reports by business entities in diversified countries through the widely accepted performance indicators and potential determinants disclosed in its sustainability report [7]. Its research is enterprise protection and management, but the involvement in enterprise accounting system is not comprehensive enough to study the influence of organizational culture on the accounting information system and company performance of Ghanaian companies. Kwarteng A conducted a survey of senior managers from different companies in different industries. Using structural equation modeling (SEM) to analyze the data, and using analysis of variance (ANOVA) for further post-hoc tests [8], his research is helpful to the design of the accounting system in this article, but it is insufficient in sensor monitoring and cloud computing.

The innovation of this article lies in the application of cloud computing technology to the construction of enterprise accounting systems, and the design of an informationized enterprise accounting system based on cloud computing through cloud computing SOA architecture [9]. Then, according to the wireless sensor network, the wireless sensor network routing protocol and the distance measurement of sensor monitoring nodes are applied to the cloud computing-based information enterprise accounting system, and an accounting system for SMEs based on sensor monitoring and cloud computing is obtained. The innovation in the experiment of this article is to formulate relevant rules of the accounting system in conjunction with the investigation and experiment of enterprise informatization construction, then optimize the data detection capability of the system through the data results obtained by testing the performance of the sensor network protocol, and finally optimize the data processing capability of cloud computing from the analysis of the weight of enterprise cloud services.

2. Accounting System Construction Method Combining Sensor Monitoring and Cloud Computing

2.1. Cloud Computing Technology. The cloud computing that this article believes is: a large-scale distributed business computing model driven by the market, which is an increase, use and delivery model of Internet-based related services. In this mode, the application resource pool is composed of a large number of inexpensive distributed computers. All applications are deployed in an extensible shared pool, and users use their resources through on-demand acquisition and pay-per-use.

Cloud computing is based on the development of distributed technology, but it is different from the distributed computing model. Through the abstract encapsulation of data, cloud computing technology unifies physically dispersed resource pools logically and centralizes processing tasks [10]. This effectively utilizes computing resources. It realizes the platform's independent repair and management functions through a special software system, and uses virtualization technology to provide dynamically allocated software services on demand. Through the software as a

service (SaaS) model, the cloud computing system also provides professional system software services. Users call this data platform that is invisible and intangible, but actually used as "cloud". At present, many companies have begun to choose to use the cloud as their internal system solution, as shown in Figure 1 for the application of cloud computing.

2.1.1. Features of Cloud Computing. Cloud computing is a distributed computing model of on-demand consumption. Users do not need to purchase and maintain a huge computer cluster, but only need to purchase virtual machine resources and various application services provided by cloud service providers through the Internet [11].

Unlike traditional computing models such as grids, cloud computing integrates advanced technologies such as virtualization, software as a service, and utility computing to integrate thousands of servers. This provides users with flexible resource allocation and task scheduling capabilities, with the following characteristics:

Large Scale. Cloud computing is built on the basis of ultra-large-scale resources. For example: Google [12] cloud computing has the largest number of servers in the world, up to 1 million; companies such as Amazon, Microsoft, IBM, and VMware also have more than 500,000 cloud servers.

2.2. Virtualization. The resources required by cloud users are not specific entities, but virtual machine resources and application services virtualized according to virtualization technology. Even if users do not know where the infrastructure is used, they can directly use resources and services through the Internet. Virtualization technology not only effectively improves the utilization rate of resources but also has an important function of ensuring service security.

2.3. Dynamically Scalable. Cloud computing can dynamically expand and shrink the scale according to the user's business and needs, and meet the different needs of users while reducing the user's rental costs. And it can reduce overhead costs and achieve a win-win situation for service providers and users.

2.4. On-Demand Service. The proposal of cloud computing is based on the idea that computing power should be provided to users like hydropower. Therefore, cloud computing can provide services and charges in real time according to the needs of users. After the user submits the task, the cloud scheduling center deploys the most suitable virtual machine resources according to the size and type of the task.

2.5. High Reliability. For companies that require a high degree of data security, such as banks, trade, military, cloud service providers must ensure the reliability and security of data. In cloud computing, using data replication barrier technology and data redundancy technology, the center will monitor the status of each virtual node in real time to realize the transfer of inefficient or failed nodes.

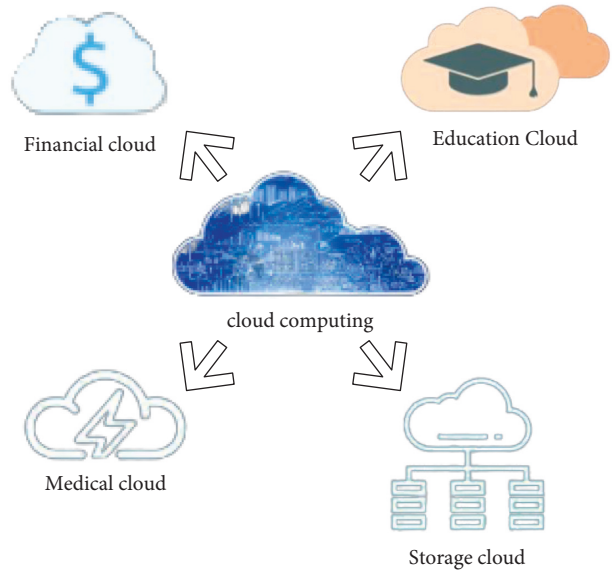

Figure 1: Application of cloud computing technology.

2.6. Cost-Effective. Cloud computing's multi-data anti-failure technology can use very low-priced nodes; the cloud computing automatic management system can greatly reduce the management cost of the data center; the virtualization technology of cloud computing can greatly improve resource utilization. In the end, with cheaper rents, more personal businesses can be attracted. Therefore, cloud computing has unprecedented high cost performance.

2.6.1. Classification of Cloud Computing. Cloud computing services are provided by cloud service providers. In order to realize accounting informatization, enterprises usually need basic network equipment, hardware and software platforms, and related technical support such as system construction and maintenance. In the cloud computing environment, these are all constructed by the cloud service provider. Enterprises do not need to equip related software and hardware, nor do they need to carry out special maintenance, and only need to purchase the required services from the cloud service provider.

Cloud computing is roughly divided into the following three types according to the service model.

As a service infrastructure, laaS model [13]. This business model means that cloud service providers allocate hardware resources to enterprise users through the network. These hardware resources include data centers and infrastructure.

As a service platform, that is, the PaaS model [14]. This business model mainly regards the software development platform as a service, but if it is sent to enterprise users, it will adopt the SaaS model. In fact, PaaS, as an application of the SaaS model, greatly accelerates the development of SaaS applications. And it is also possible to develop new applications instead of software developers with servers or other

equipment. Software as a service, that is, the SaaS model [15]. The business model is mainly provided through the Internet. It is not purchased, but leased to commercial users in the form of software. The biggest feature of the SaaS model is that the software rental cost is very low. It is hosted on the server of the cloud service provider and basically does not require user operations, so it can further reduce the cost.

According to the deployment mode, cloud computing can be divided into the following four modes:

Public cloud: in the Internet environment, all services are provided by cloud service providers. Including applications, resources and other services, most of the services can be obtained for free in this mode; of course, some are billed based on usage. And in this mode, the user's information and data are relatively safe, and its scalability is also very large. The cloud accounting used by SMEs mentioned in this article is basically a public cloud model.

Private cloud: this model emphasizes privatization, that is, this type of cloud is designed to provide services for a certain enterprise. It does not matter who manages it or who it is managed by. The key is that as long as the method of use is correct, it can give the enterprise a lot of help. However, this model requires the company to be responsible for purchasing the entire system. If any security issues arise, the company will resolve it by itself, or bear the consequences.

Community Cloud: this model is built between multiple companies in a group. These companies have similar goals and share a set of infrastructure, as if they are bundled together. Therefore, all costs are shared equally by them, resulting in limited cost savings for enterprises. Enterprises in the community cloud can obtain information or applications in the cloud.

Hybrid cloud: this refers to the mixing of two or more modes. For example, private cloud and public cloud are independent of each other, but they are combined in the cloud. In this way, both the advantages of private clouds and the advantages of public clouds can be used.

3. SME Accounting Information Construction

The development of informatization is an important means to improve the competitiveness of small and medium-sized enterprises, but in the fierce market competition, almost all small and medium-sized enterprises have a big gap with large enterprises in terms of development scale and management. Small and medium-sized enterprises can use new information technology to catch up, but the current level of informatization development is still relatively low. Generally speaking, they are in the initial stage of informatization application.

SMEs [10] occupy an important position in the national economy and have gradually become the main force in the development of social productive forces, as well as indispensable partners and assistants of large enterprises. The SME industry is widely distributed and involves all fields. SMEs are small in size, have limited funds, and have very concentrated decision-making power. They are equipped with flexible institutions. The management of SMEs is to continuously improve product quality, make full use of the advantages of SMEs, quickly respond to market changes, improve production efficiency, shorten the construction period, and speed up the results. SMEs can accurately grasp the needs of consumers while being close to customers, and are very competitive in the market for individual consumer needs. Modern science and technology pursue the development direction of miniaturization and decentralization. This development trend has promoted the growth of SMEs and has quickly become a force for modern science and technology innovation.

3.1. Accounting Information System. Accounting information system [16] refers to accounting personnel using accounting system software to make accounting books and financial statements, and using computer technology to input, summarize, calculate, and count original accounting vouchers, which refers to the management system that reports financial data obtained by analysis to the company. The bookkeeping mode of the accounting information system replaces the original manual bookkeeping mode, which improves the efficiency of corporate financial operations. As an independent subsystem of the business information system, the accounting information system vigorously supports the decision-making of business operators, which is very convenient. In addition, through the accounting information system, you can grasp the company's financial information and status at any time in order not to lag behind the company's specific interests at any time, and improve the company's ability to perform related activities.

3.2. Characteristics of Accounting Information System

3.2.1. Precision and Real-Time. Now the Internet has entered the era of rapid development. The technological and efficient operation mode has freed people from the heavy labor mode of the past. The accounting field can analyze accounting data more efficiently and accurately through computer technology. Through the operation of the computer, the complicated accounting data can complete the process of summary statistics, integrated accounting, review, and inspection in a very short time.

3.2.2. Automation and Unification. At present, in the daily practical applications of corporate accounting information systems, computers can replace traditional manual methods to solve many diversified tasks. With the permission of the user company, share the data that the user company can open on the Internet, so that more users can learn and communicate. In this way, the data can be better used in the information system, constantly highlighting its own characteristics.

3.2.3. A System That Combines Computer Technology and Basic Accounting Abilities. Therefore, accounting staff with accounting knowledge and computer operation ability can use the computer accounting information system to complete the corresponding accounting work. Of course,

companies also need to train a group of computer experts to solve computer hardware problems in a timely manner.

For the current accounting field, the extent to which companies comply with accounting standards is very important. All enterprises are gradually following the accounting standards to improve the internal financial system of the enterprise, and carry out the operation of the computer accounting information system and manual operation together. This will enable companies to better adapt to market development and actual needs.

3.3. Environmental Factors of Accounting Informationization. Accounting informationization [17] is a combination of IT technology and accounting. Accounting data is input into a computer as a resource, and then processed and output to the information requester, thereby highly sharing business information. With accounting informationization, accounting information changes from static to dynamic. In other words, starting from the production of traditional accounting pitchers based on the original pitchers, the corresponding accounting books will be registered in the order of the accounting pitchers. The production of the final sentence will be converted into a classification database. It is generated from the confirmation of original accounting data and accounting information. It generates a cumulative target database, and finally outputs various financial information materials.

Based on the survey of the progress of domestic accounting informatization in the past 40 years, this paper believes that the environmental factors affecting the progress of domestic accounting informatization are economic environment, technological environment, policy environment, and corporate needs. These four environmental factors interact and jointly determine the development of domestic accounting information.

4. Cloud Computing SOA Architecture

The SOA structure [9] builds various applications into various units, while providing users with parallel services. What it uses is the interface and agreement between various services to realize the interconnection and intercommunication with users. The settings of the interface and protocol are realized through the neutral mode. This module is independent of various programs of the system, such as programming language, operating program, software system, and hardware platform. This can ensure that it can be used in different applications of different systems, making the communication method uniform. It creates a service model that is exchangeable, shared, distributed, and modular, which has strong applicability. The purpose of SOA service is to realize the integration of all information platforms in the enterprise. It usually requires building an SOA catalog for unified management.

The SOA architecture can be transformed and upgraded through the original internal IT infrastructure. However, as an SME, it is unrealistic to rebuild a new IT architecture environment. Different information systems have different infrastructures. The entire SOA catalog contains all the information within the enterprise that can meet the needs of the enterprise, including real-time call information and data. In addition, SOA is an open structure with strong interoperability, flexibility, scalability, and connectivity, while providing high-quality application services. Then, it discovers the possibilities and potential reuse possibilities and combines them with the service, and finally uses the Web service.

The use of various operating systems and application software is the current state of business IT. Among them, the SOA structure is loosely coupled, which can be well compatible with the operating platform and software and hardware facilities that the enterprise already owns. The use of SOA architecture can better serve the actual needs of enterprises, which is conducive to the expansion of new businesses. It can build modular services to ensure timely updates and upgrades of services, better maintain and utilize existing IT infrastructure, and reduce capital investment for building business systems.

4.1. Wireless Sensor Network. The wireless sensor network is used to monitor and record the physical state of the environment through a dedicated sensor group, and to organize and manage the data collected by the network center. These are similar to wireless ad hoc networks, relying on wireless connections and spontaneously formed networks that can send sensor data wirelessly. Because some sensors are so tiny, they are sometimes called dust networks. It is as shown in Figure 2.

4.1.1. Wireless Sensor Network Architecture. The wireless sensor network [18] consists of multiple nodes, and each node is connected to more than one sensor. The general wireless sensor network node is generally composed of several parts. The wireless transceiver, microcontroller, and power source connected to the sensor that is connected to the internal antenna or external antenna are usually batteries or built-in energy harvesting devices. The size of the sensor node can be as large as a shoe cabinet or as small as dust, but the actual micro-size node has not been manufactured. The cost of a sensor node will also change, depending on the actual application requirements of the sensor node and the complexity of a single sensor node. The size and cost of sensor nodes will also cause resource constraints such as memory, computing speed, and communication bandwidth. The topology of wireless sensor networks ranges from simple interplanetary networks to advanced multi-topology networks. The propagation technology of multi-hop networks may be routing or welding. The general wireless sensor network is shown in Figure 3, which is composed of sensor nodes, sink nodes, and management nodes.

Sensor nodes: Sensor nodes are the most numerous nodes in the network. It works with a small capacity battery and is responsible for the collection of environmental data. Compared with the sink node, the data processing, data storage, and communication functions are weakened. From the perspective of network functions, in addition to local

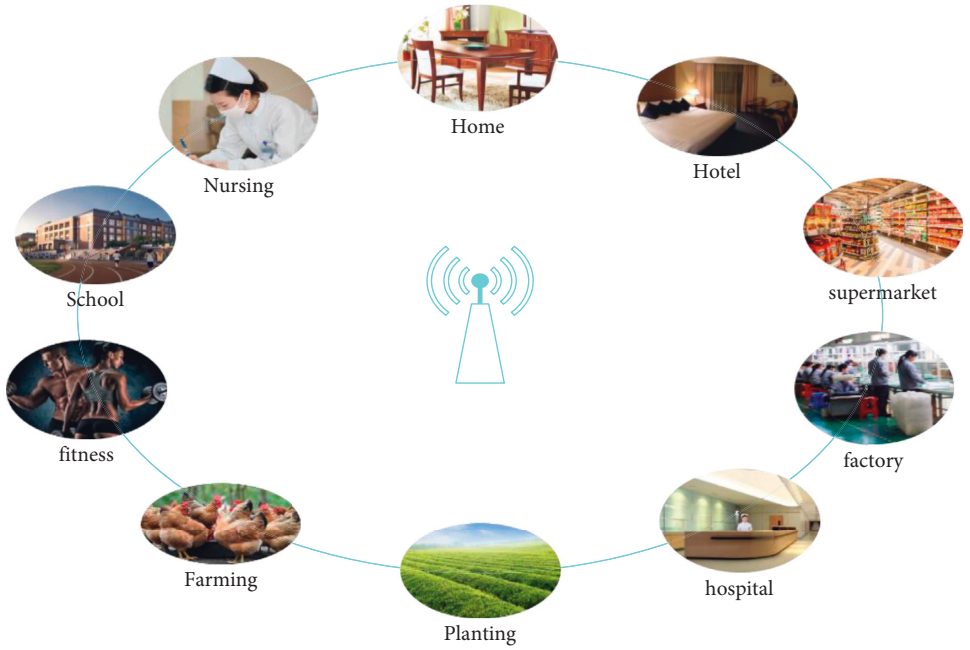

Figure 2: Wireless sensor network application.

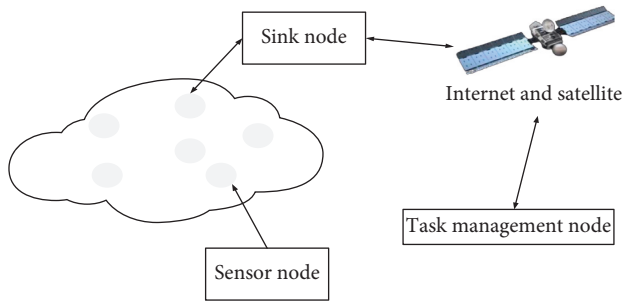

Figure 3: Wireless sensor network architecture.

information collection and data processing, each sensor node also transmits data from other nodes to the sink node.

Sink node: The sink node is the core node of the sensor network. Compared with other types of nodes in the network, it has stronger data processing, data storage, and communication functions. In addition, it is also a convergence between gateways and protocols that connect the sensor network and the external network, and at the same time sends out monitoring tasks to the sensor nodes, and transmits the collected data to the external network.

Management node: The management node can dynamically manage the entire wireless sensor network. Users can also access the wireless sensor network in both directions through the management node.

4.1.2. Wireless Sensor Network Routing Protocol. The routing protocol is the most critical part of the network system. Through the routing protocol, each node in the network can cooperate with each other and accomplish various application goals. Due to the limited resources of wireless sensor networks, no infrastructure, the possibility of being deployed in a hostile environment, and unattended characteristics, the existing research work mainly considers energy saving and security. First of all, energy saving is the basic goal considered by most routing protocols. The energy of the node is limited. In order to prolong the survival time of the network as much as possible, the energy factor must be used as a reference factor for routing. When the node sends data and needs to be addressed, it can find the path with the least or less energy consumption. Secondly, for applications with security requirements, security is also one of the core reference factors that must be considered. If the routing protocol fails after being maliciously attacked, the network will not be able to complete the task, and the high-level application goals cannot be achieved. Therefore, a secure routing protocol that can maintain normal network functions even when subjected to malicious attacks is very important. For hierarchical networks, energy balance is another important design goal. In order to avoid the interruption or

paralysis of the entire network caused by premature energy exhaustion of some key nodes, the energy consumption and remaining energy of each node should be considered as much as possible when assigning tasks.

The existing routing protocols in wireless sensor networks can be divided into different types according to different perspectives. From the topological structure of the network, it can be divided into plane routing and hierarchical routing. From the way of routing, it can be divided into single-path routing and multi-path routing. According to the characteristics of the network, it can be divided into flood routing, data-centric routing, cluster-based routing, location-based routing, and QoS-based routing. According to whether security factors are considered, it can be divided into general functional routing and routing with security mechanism. Among them, the existing secure routing protocols in wireless sensor networks mainly include secure routing based on reputation, secure routing based on key management, encryption and authentication technologies, multi-channel secure routing, secure routing based on geographic location, and secure routing based on data fusion, secure routing based on mobile agents, inter-domain secure routing management, secure routing based on auction ideas, routing based on intelligent algorithms, etc.

4.2. Sensor Monitoring Node Distance Measurement Method. Ranging technology is the basis of positioning technology. It can be used directly as a positioning technology or as an auxiliary positioning technology.

4.2.1. Direct Ranging Technology. The TDOA ranging method is as follows: the transmitter sends the RF signal and the ultrasonic signal at time S_1、S_2 respectively, the receiving end receives these two signals at time S_3、S_4 respectively, and the distance d between the two ends can be calculated by formula :

$$d = (S_4 - S_2) - (S_3 - S_1) \times \frac{Z_1 \times Z_2}{Z_1 - Z_2}. \tag{1}$$

The DV-Hop ranging process can be divided into three stages: first, the anchor node floods the query group. All nodes forward according to the minimum hops routing protocol, so that all nodes in the network can obtain the minimum hops of each anchor node.

$$Z_i = \frac{\sum_{j=1}^{n} \sqrt{(a_i - a_j)^2 + (b_i - b_j)^2}}{\sum_{j=1}^{n} H_{ij}}. \tag{2}$$

Among them, (a_i, b_i) is the coordinate of anchor node i, (a_j, b_j) is the coordinate of the jth anchor node except i, and H_{ij} is the minimum number of hops from anchor node i to j.

As shown in Figure 4, (x), Y, and Z are unknown nodes, L is the anchor node, and X is the two-hop node of L. Using Euclidean ranging technology to get the distances XY, XZ, YZ, YL, and ZL, then the distance between X and L can be obtained by the formula:

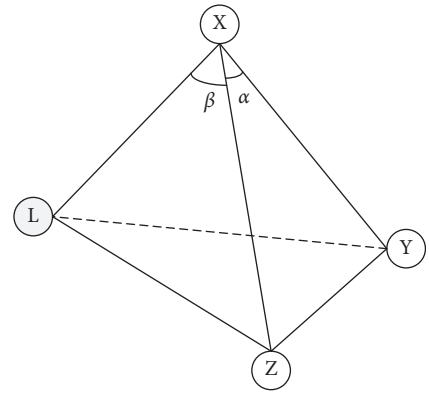

Figure 4: Schematic diagram of Euclidean algorithm ranging.

$$XL^2 = XZ^2 + ZL^2 - 2XZ - ZL \cdot \cos(\alpha + \beta). \tag{3}$$

In

$$\cos\alpha = \frac{XY^2 - XZ^2 - YZ^2}{2 \cdot XZ \cdot YZ}, \qquad \cos\beta = \frac{YL^2 - YZ^2 - ZL^2}{2 \cdot ZL \cdot YZ}. \tag{4}$$

4.3. Location Algorithm Based on Ranging

4.3.1. Trilateral Measurement Method. On a plane, if the distance from the unknown node to the three anchor nodes is given, the trilateration method can be used to determine a unique coordinate value. The coordinates of the anchor nodes x, y, and z are known to be (n_x, m_x)、(n_y, m_y)、(n_z, m_z), and their distances to the unknown node i are d_{xi}, d_{yi}, d_{zi}. Suppose the estimated coordinate of the unknown node i is (n_i, m_i) as shown in Figure 5, then there are:

$$\sqrt{(n_i - n_x) + (m_i - m_x)} = d_{xi}, \tag{5}$$

$$\sqrt{(n_i - n_y) + (m_i - m_y)} = d_{yi}, \tag{6}$$

$$\sqrt{(n_i - n_z) + (m_i - m_z)} = d_{zi}. \tag{7}$$

Linearizing formulas (5) (7) (8), the linear equation can be obtained:

$$XN + K = Y. \tag{8}$$

In

$$X = \begin{bmatrix} 2(n_x - n_z) & 2(m_x - m_z) \\ 2(n_y - n_z) & 2(m_x - m_z) \end{bmatrix}, \quad Y = \begin{bmatrix} n_x^2 - n_z^2 + m_x^2 - n_z^2 + d_z^2 - d_x^2 \\ n_y^2 - n_z^2 + m_y^2 - m_z^2 + d_z^2 - d_y^2 \end{bmatrix}, \quad N = \begin{bmatrix} n_i \\ m_i \end{bmatrix}. \tag{9}$$

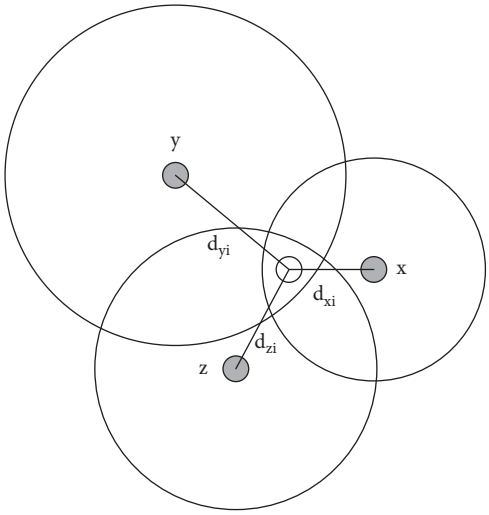

Figure 5: Trilateral measurement method positioning.

Use the standard least mean square error estimation method to get the coordinates of i:

$$N = \left(X \times X^S\right)^{-1} X^S y. \tag{10}$$

4.4. Triangulation Method. The triangulation method uses the AOA method to determine the relative angle between the unknown node and the anchor node, and converts the angle relationship into the edge relationship. As shown in Figure 6, the x and y coordinates of the anchor node and the angle $\angle xiy$ are known, when the arc xc is inside $\triangle$xyc, a circle O1 with a radius of r1 can be determined, and the center coordinate is (n_{O1}, m_{O1}). Set $\alpha = \angle xO_1 y$, then $\alpha = 2\pi - \angle xiy$, we can get the following formula:

$$\begin{aligned}
&\sqrt{\left(n_{O_1} - n_x\right) + \left(m_{O_1} - m_x\right)} = r_1,\\
&\sqrt{\left(n_{O_1} - n_y\right) + \left(m_{O_1} - m_y\right)} = r_1,\\
&\left(n_x - n_y\right)^2 + \left(m_x - m_y\right)^2 = 2r_1^2(1 - \cos\,\alpha).
\end{aligned} \tag{11}$$

Substituting the coordinates of the three anchor nodes and the distance to the unknown node into (5) (7) (8), the coordinates (n_i, m_i) can be calculated.

The maximum likelihood estimation method assumes that there are n anchor nodes in a two-dimensional space, the coordinates are expressed as $(n_1, m_1), (n_2, m_2), \ldots, (n_k, m_k)$, the coordinate of the node i to be located is (n_i, m_i), and the distances from the anchor node to the node to be located are d1, d2,. . .,d3, there are formulas:

$$\begin{cases}
\sqrt{(n_i - n_1) + (m_i - m_1)} = d_1\\
\sqrt{(n_i - n_2) + (m_i - m_2)} = d_2\\
\vdots\\
\sqrt{(n_i - n_3) + (m_i - m_3)} = d_3
\end{cases}. \tag{12}$$

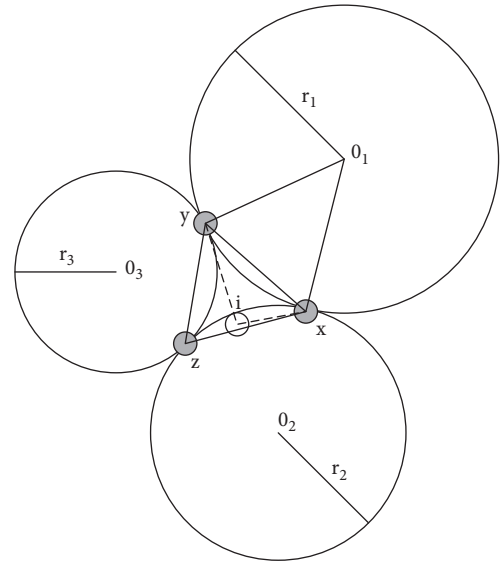

Figure 6: Triangulation method positioning.

Using the first k-1 equations in (12) to subtract the k-th equation, the resulting formula can be expressed in the form of $XN = y$, where:

$$\begin{aligned}
X &= \begin{bmatrix}
2(n_1 - n_k) & 2(m_1 - m_k)\\
2(n_2 - n_k) & 2(m_2 - m_k)\\
\vdots & \vdots\\
2(n_{k-1} - n_k) & 2(m_{k-1} - m_k)
\end{bmatrix},\\
N &= \begin{bmatrix} n_i\\ m_i \end{bmatrix},\\
y &= \begin{bmatrix}
n_1^2 - n_k^2 + m_1^2 - n_k^2 + d_k^2 - d_1^2\\
n_2^2 - n_k^2 + m_2^2 - n_k^2 + d_k^2 - d_2^2\\
\vdots\\
n_{k-1}^2 - n_k^2 + m_{k-1}^2 - n_k^2 + d_k^2 - d_{k-1}^2
\end{bmatrix}.
\end{aligned} \tag{13}$$

Then, using the least mean square error estimation method, the coordinates of i can be calculated:

Building an Accounting System Experiment for Sensor Networks and Cloud Computing.

Survey Experiments on the Status Quo of Accounting Informatization Construction of SMEs.

Accounting informatization promotes the informatization of SMEs, and provides a powerful booster for the development and transformation of enterprises. It forms an effective accounting information system and enhances the core competitiveness of enterprises. Therefore, the informatization of accounting information is not only the informatization of accounting but also the informatization of the entire enterprise related to accounting information. However, due to the irregular processes and changing needs of SMEs, the needs of SMEs for accounting informationization are not only to improve business processing efficiency but also to take into account flexibility and scalability.

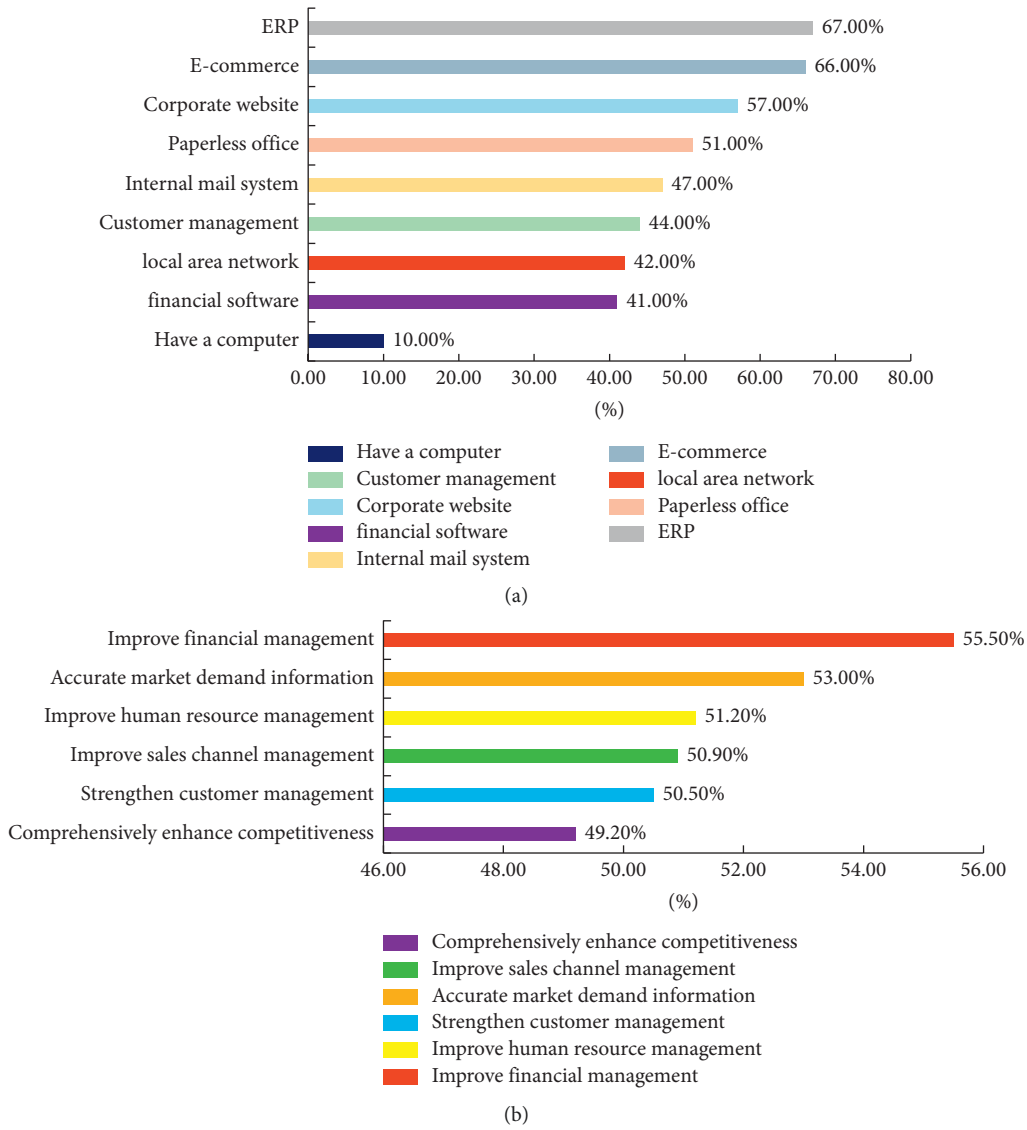

Figure 7: SMEs' understanding of enterprise informatization. (a) SMEs' understanding of informatization. (b) SMEs' understanding of the positive effects of accounting informationization.

According to the survey report on the informatization of SMEs in this article, the understanding of SMEs on the informatization of enterprises is shown in Figure 7:

As can be seen from the figure, SMEs' understanding of informatization construction is not limited to only having computers, instead, while improving office efficiency, it pays attention to whether the internal and external resources of the enterprise can be effectively integrated and optimized through certain information technology methods, so as to achieve the goal of attracting customers and reducing costs. Half of SMEs believe that accounting informatization can inject new vitality into enterprises and promote their development, and they are willing to try accounting informatization construction and enterprise information construction.

This paper investigates the needs of two groups of companies for informationization, as shown in Figure 8.

Although the original purpose of accounting informatization is to use financial management software to improve the work efficiency of accountants. However, with the advancement of technology and the requirements of the living environment and competitive environment of SMEs, accounting informatization runs through the informatization of the entire enterprise. It will affect the integration of financial management processes with other business departments of the enterprise. Therefore, the achievement of the related goals of enterprise informatization needs to be achieved through the connection of accounting informatization.

4.5. Protocol Performance Simulation Experiment. The network simulation software ns-2.35 is used to conduct an in-depth comparison and analysis of the node energy

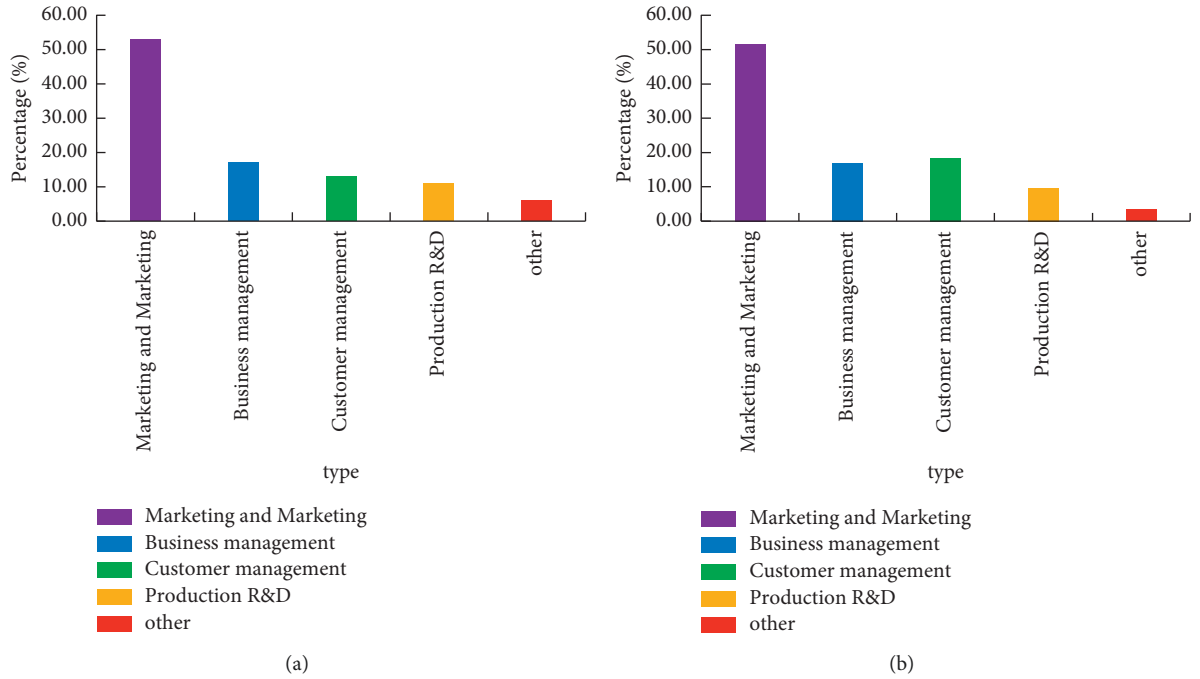

Figure 8: Enterprise information requirements. (a) First group. (b) Second group.

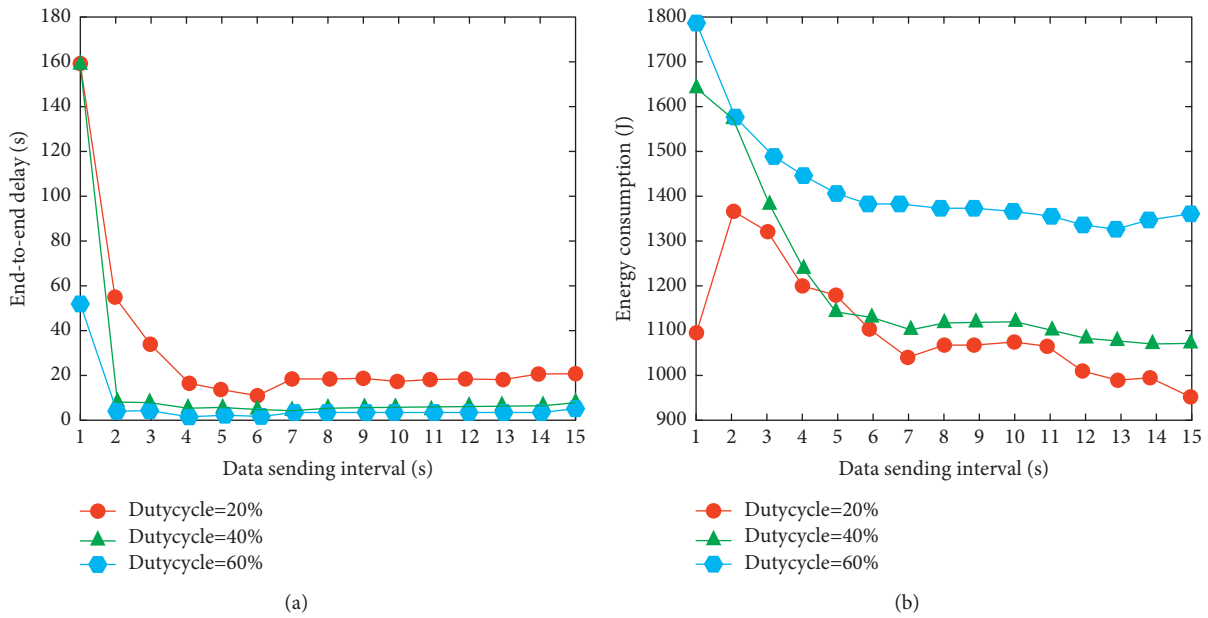

Figure 9: Sensor monitoring performance changes with different duty cycles. (a) The average end-to-end delay of sensor monitoring under different duty cycle values. (b) Energy consumption curve of sensor monitoring under different duty cycle values.

consumption, end-to-end delay and network throughput monitored by sensors under different duty cycle conditions. In the simulation of the system performance in this paper, the duty cycle is set to 20%, 40%, and 60%. It compares the impact of different duty cycles on the performance of sensor monitoring, as shown in Figure 9.

The abscissa in the figure is the service flow packet interval. The smaller the value, the greater the traffic in the channel. It can be found from the figure that as the channel flow changes, the delay performance of different duty cycles is roughly similar. Regardless of whether the network traffic is high or low, the delay performance in the case of high duty cycle is better than that of the low duty cycle protocol. Under the same conditions, a protocol with a larger duty cycle consumes more energy. When the network traffic decreases, the long-term idle listening state will waste more energy for the protocol with a larger duty cycle.

In summary, the smaller the duty cycle of sensor monitoring, the lower the energy consumption of the node, but at the same time it will cause serious delay problems. On

Table 1: Weights of various indicators of cloud services.

First level indicator	Weights	Secondary indicators	Weights	Composite weight
Service quality	0.691	Completeness	0.36	0.249
		Integration	0.015	0.01
		Reliability	0.036	0.025
		Availability	0.007	0.005
		Ease of use	0.54	0.373
		Safety	0.042	0.029
Supplier reputation	0.135	Client volume	0.49	0.066
		Reputation	0.51	0.069
Service fee	0.174	Usage fee	0.516	0.09
		Deployment fee	0.484	0.084

Table 2: Qualitative attribute evaluation values of candidate cloud services.

		U11 0.249	U12 0.01	U13 0.025	U14 0.005	U15 0.373	U16 0.029	U22 0.069
E	A1	[s3, s4]	[s2, s3]	[s2, s3]	[s3, s4]	[s3, s4]	[s2, s3]	[s2, s3]
	A2	[s2, s3]	[s2, s3]	[s3, s4]	[s3, s4]	[s3, s4]	[s2, s3]	[s3, s4]
	A3	[s1, s2]	[s2, s3]	[s1, s2]	[s2, s3]	[s1, s2]	[s2, s3]	[s2, s3]

Table 3: Quantitative attribute values of candidate cloud services.

	U11	U21	U31
A1	164151	8761	20
A2	154321	2000	125
A3	145101	10000	60

Table 4: Decision matrix.

	U11 0.249	U12 0.01	U13 0.025	U14 0.005
A1	[0.563, 0.709]	[0.431, 0.519]	[0.416, 0.716]	[0.491, 0.646]
A2	[0.419, 0.561]	[0.489, 0.701]	[0.391, 0.519]	[0.519, 0.671]
A3	[0.459, 0.564]	[0.491, 0.719]	[0.391, 0.594]	[0.691, 0.619]

the contrary, when the duty cycle is larger, although the time delay is smaller, it will consume extra energy. Therefore, when the duty cycle takes a fixed value, it is difficult to achieve a certain balance between node energy consumption and delay. It is difficult to find the situation that is dominant in both energy consumption and delay as the network traffic changes.

Performance Test Analysis of Accounting System Based on Sensor Monitoring and Cloud Computing. Analysis of the weight of enterprise cloud services: with the development of business, the sales, marketing, and service departments must provide services in a timely manner. In order to meet the needs of customers, more and more information needs to be retrieved, analyzed, and processed. Therefore, it decided to adopt a customer relationship management system and a cloud service product. It selected 3 cloud service candidates, and candidate service set $A = \{A1, A2, A3\}$. The company hires 5 experts $(E1, E2, E3, E4, E5)$ who have experience in using the three candidate services for evaluation. And its expert weight is $= (\gamma 1, \gamma 2, \gamma 3, \gamma 4, \gamma 5) = \{0.2, 0.1, 0.3, 0.2, 0.2\}$.

According to the matrix addition convex combination, the aggregation matrix is obtained, and then the satty algorithm is used to obtain the weight of the first-level indicator, and then the weight of the second-level indicator is calculated to obtain the composite attribute weight, as shown in Table 1.

According to the survey, there is no deployment fee for the three candidate cloud services, so the u32 attribute is deleted. The attribute values of usage fee and customer volume are shown in Table 2. The evaluation value of each candidate cloud service under the qualitative attributes is given by five experts who are familiar with cloud services, as shown in Table 3.

Construct a decision matrix, and use vector normalization to standardize it. The standardized decision matrix is shown in Table 4 below.

Using the evaluation method of this article to evaluate the three candidate services, the ranking results of candidate cloud services are shown in Table 5.

Through the data collected in the experiment, this paper designs an accounting system for SMEs based on sensor monitoring and cloud computing. In order to verify the

Table 5: Ranking table of the pros and cons of candidate cloud services.

	A1	A2	A3
E	[s1, s2]	[s2, s3]	[s3, s4]
Comprehensive evaluation index	[0.6194, 0.7191]	[0.2061, 0.4169]	[0.4612, 0.6164]
Sort results		A1>A3>A2	

Comparative Experimental Analysis of Accounting Systems for SMEs Based on Sensor Monitoring and Cloud Computing.

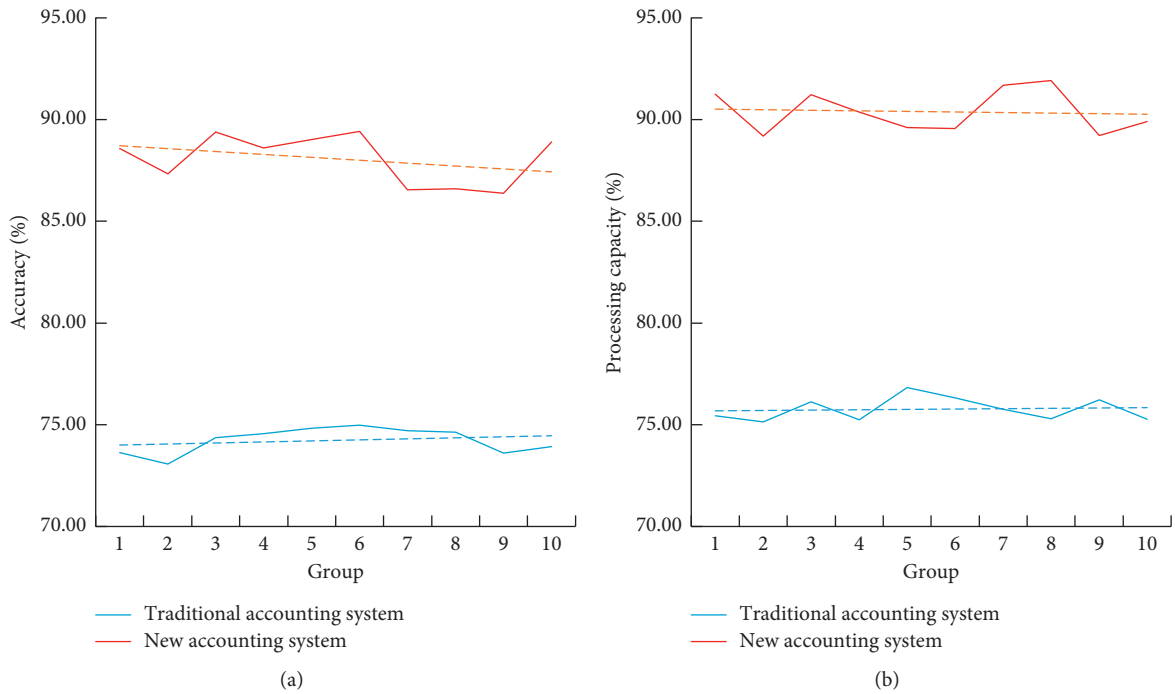

Figure 10: Results of comparison with traditional accounting systems. (a) Accounting system data monitoring accuracy comparison result. (b) Accounting system data processing efficiency comparison result.

performance of the system and the advantages of the traditional accounting system, this article compares the designed new accounting system with the traditional accounting system. The experiment mainly compares its sensor monitoring capabilities and cloud computing processing capabilities, and judges its performance through monitoring accuracy and data processing efficiency. The experimental results are shown in Figure 10.

It can be seen from the figure that the accuracy of data monitoring by traditional accounting systems is only 74.23% while the accuracy of data monitoring by the accounting system based on sensor monitoring and cloud computing can reach 88.07%. Compared with the traditional accounting system, it has increased by 13.84%. The data processing efficiency of traditional accounting systems for data monitoring is only 75.76%, while the data processing efficiency of data monitoring based on sensor monitoring and cloud computing can reach 90.39%. Compared with the traditional accounting system, it has increased by 14.63%. This shows that the SME accounting system based on sensor monitoring and cloud computing designed in this paper can effectively improve the ability of data monitoring and data processing.

5. Conclusions

This paper mainly studies the information application of the accounting system for SMEs based on sensor monitoring and cloud computing. So this article combines the SOA architecture of cloud computing to establish a cloud computing-based accounting system model. Then, combined with the wireless sensor network architecture and wireless sensor network routing protocol, the wireless sensor network is applied to the cloud computing-based accounting system model. Then, an accounting system based on sensor monitoring and cloud computing is constructed by the sensor monitoring node distance measurement method. In order to regulate that this accounting system can be applied to SMEs, this paper designs a set of survey experiments. It investigates the development and planning of the informatization construction of SMEs, and then sets the rules of the accounting system for SMEs according to the plan. Then, in order to test the performance of the sensor network protocol, this paper designs the protocol performance experimental test. Finally, this article optimizes the new accounting system based on the analysis of the weight of

enterprise cloud services, and compares it with traditional accounting systems for data monitoring and data processing performance comparison experiments. The experimental results show that the accounting system for SMEs based on sensor monitoring and cloud computing can effectively improve the ability of data monitoring and data processing.

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 declares no conflicts of interest.

References

[1] Z. Xiao, H. Fang, and X. Wang, "Nonlinear polynomial graph filter for anomalous IoT sensor detection and localization," *IEEE Internet of Things Journal*, vol. 7, no. 6, pp. 4839–4848, 2020.

[2] J. Zhang, G. Y. Tian, and A. B. Zhao, "Passive RFID sensor systems for crack detection & characterization," *NDT & E International*, vol. 86, pp. 89–99, 2017.

[3] A. Nayyar and D. Teneketzis, "Signaling in sensor networks for sequential detection," *IEEE Transactions on Control of Network Systems*, vol. 2, no. 1, pp. 36–46, 2015.

[4] S. Muhlbacher-Karrer, A. H. Mosa, L.-M. Faller, and M. Ali, "A driver state detection system-combining a capacitive hand detection sensor with physiological sensors," *IEEE Transactions on Instrumentation and Measurement*, vol. 66, no. 4, pp. 624–636, 2017.

[5] A. Javed, H. Larijani, A. Ahmadinia, and D. Gibson, "Smart random neural network controller for HVAC using cloud computing technology," *IEEE Transactions on Industrial Informatics*, vol. 13, no. 1, pp. 351–360, 2017.

[6] L. J. Nieuwenhuis, M. L. Ehrenhard, and L. Prause, "The shift to cloud computing: the impact of disruptive technology on the enterprise software business ecosystem," *Technological Forecasting and Social Change*, vol. 129, pp. 308–313, 2018.

[7] A. Skouloudis, C. Malesios, and P. G. Dimitrakopoulos, "Corporate biodiversity accounting and reporting in mega-diverse countries: an examination of indicators disclosed in sustainability reports," *Ecological Indicators*, vol. 98, pp. 888–901, 2019.

[8] A. Kwarteng and F. Aveh, "Empirical examination of organizational culture on accounting information system and corporate performance," *Meditari Accountancy Research*, vol. 26, no. 4, pp. 675–698, 2018.

[9] W. Wei, X. Fan, H. Song, and X. Fan, "Imperfect information dynamic stackelberg game based resource allocation using hidden markov for cloud computing," *IEEE Transactions on Services Computing*, vol. 11, no. 1, pp. 78–89, 2018.

[10] L. Jin, Y. Zhang, X. Chen, and Y. Xiang, "Secure attribute-based data sharing for resource-limited users in cloud computing," *Computers & Security*, vol. 72, pp. 1–12, 2018.

[11] D. Langenmayr and R. Lester, "Taxation and corporate risk-taking," *The Accounting Review*, vol. 93, no. 3, pp. 237–266, 2018.

[12] H. Hassan, S. Islam, and K. Rashid, "Corporate governance mechanisms and firm value: analysis of the influence of non-linearity based on generalised method of moments (gmm) and fixed effects methods (fe) and financial modeling implications," *Advances in Quantitative Analysis of Finance and Accounting*, vol. 15, pp. 103–136, 2017.

[13] Y. Kang, W. Rui, J. Yu et al., "Sensor attack detection using history based pairwise inconsistency," *Future Generation Computer Systems*, vol. 86, pp. 392–402, 2018.

[14] Z. Xia, X. Wang, L. Zhang, Z. Qin, X. Sun, and K. Ren, "A privacy-preserving and copy-deterrence content-based image retrieval scheme in cloud computing," *IEEE Transactions on Information Forensics and Security*, vol. 11, no. 11, pp. 2594–2608, 2017.

[15] R. Deng, R. Lu, C. Lai, T. H. Luan, and H. Liang, "Optimal workload allocation in fog-cloud computing toward balanced delay and power consumption," *IEEE Internet of Things Journal*, vol. 3, no. 6, pp. 1171–1181, 2017.

[16] B. De Bruin and L. Floridi, "The ethics of cloud computing," *Science and Engineering Ethics*, vol. 23, no. 1, pp. 21–39, 2017.

[17] T. Hirai, H. Masuyyama, H. Masuyama, S. Kasahara, and Y. Takahashi, "Performance analysis of large-scale parallel-distributed processing with backup tasks for cloud computing," *Journal of Industrial and Management Optimization*, vol. 10, no. 1, pp. 113–129, 2014.

[18] A. Barsoum and M. A. Hasan, "Provable multicopy dynamic data possession in cloud computing systems," *IEEE Transactions on Information Forensics and Security*, vol. 10, no. 3, pp. 485–497, 2017.