Research Article

Innovative Research on Intelligent Enterprise Management Mode under the Background of Smart City

Huihui Yan1,2 and Xiaohong Fang3

1Administration Office, Wenzhou Data Management and Development Group Co., Ltd., Wenzhou, 325000 Zhejiang, China
2Graduate School, Cavite State University, Indang, Cavite 1008, Philippines
3School of Management, Wuhan Donghua University, Wuhan, 430212 Hubei, China

Correspondence should be addressed to Xiaohong Fang; 2497507286@qq.com

Received 20 December 2021; Revised 13 January 2022; Accepted 20 January 2022; Published 14 March 2022

Academic Editor: Deepak Kumar Jain

Copyright © 2022 Huihui Yan and Xiaohong Fang. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

The widespread application of Internet of Things technology, new broadband mobile networks, cloudy computing, and other new information technologies on the Internet has promoted the development of "smart cities." The essence of the "smart city" is to make full use of advanced information technology to realize the intelligent management and operation of the city, thereby creating a better life for the urban people and realizing the harmonious and sustainable development of the city. This article is aimed at studying the innovation of intelligent enterprise management models in the context of smart cities. This article first analyzes and briefly describes the theoretical knowledge of the "smart city" and the current domestic development, then proposes the technology of data warehouses, and finally uses the multiple linear regression formula for analysis. The experimental results of this paper show that in the context of smart cities, the intelligent management model of enterprises has played an important role in the development of enterprises, which is 51.7% faster than the traditional model, and the accuracy is as high as 92.3%.

1. Introduction

In 2014, according to the National Development and Reform Commission, on the basis of the authorization and consent of the State Council, the relevant eight departments jointly issued a guiding opinion to promote the city’s smart and healthy development. Participating departments include the Ministry of Industry and Information Technology, the Ministry of Public Security, the Ministry of Land and Resources, the Ministry of Communications, the Development and Reform Commission, the Ministry of Science and Technology, the Ministry of Finance, and the Ministry of Housing and Urban-Rural Development. The opinions require all relevant subordinate institutions and departments to treat the tasks set forth in the guidance opinions seriously and actively implement them to promote the healthy development of the city in an orderly manner. The opinions emphasized that the people’s governments of various regions should strengthen the top-level design and work out a set of detailed and reliable urban construction plans from an overall perspective. The feature of serving people should be highlighted in the whole plan, and intelligent thinking should be run through it. On the premise of considering cost factors, people are provided with an efficient and convenient social service; on the one hand, it is necessary to improve the safety, accuracy, and reliability of information, and on the other hand, it should strengthen the promotion of resource sharing and promote the construction of a credit environment. Starting from the level, a set of specific and feasible legal standards and measures are formulated. “Smart city” is essentially the application of "smart" information technology in urban governance. In the past ten years, led by developed countries, countries around the world have successively carried out the construction of "smart cities" in order to achieve the improvement of comprehensive urban governance and service capabilities. Smart cities are based on technologies such as the Internet, the Internet of Things, cloud computing, big data, and artificial intelligence.
They use basic networks such as telecommunications networks, broadcasting networks, and wireless broadband networks as networking platforms to provide convenient livelihood services and flexible city management. A new model of urban development is characterized by efficient resource utilization and more potential industries. Under the background of the use of information technology, the construction of smart cities and the improvement of urban operation efficiency and management level are the main characteristics and general trends of urban development in the world today. While smart cities make cities more efficient, convenient, and environmentally friendly, they also bring huge industrial space. The construction of smart cities involves a wide range of related industries, and the entire market scale will be in the hundreds of billions. The huge market space has attracted the participation of many market players. My country’s accession to the WTO makes the business environment of Chinese enterprises no longer regional and unitary, but facing the world. Information technology-related companies at home and abroad, including Internet companies represented by Alibaba, Tencent, and Baidu, telecom operators represented by China Telecom, China Mobile, and China Unicom, and information technology companies represented by Huawei, ZTE, and Inspur field of “smart city” is standing.

In such an environment, enterprises are facing more challenges and also encountering more development opportunities. For enterprises to survive and develop, they must win in the fierce international market competition. The impact of enterprise management level is comprehensive and far-reaching. With the help of the smart city development concept, companies will be more flexible, faster, and more open to retrieve, transmit, and use information resources. This significantly improves information processing and decision-making capabilities, as well as program evaluation and selection capabilities, broadens the thinking space of decision makers, and expands decision intelligence. The uncertainty, arbitrariness, and subjectivity of the decision-making process are minimized, the rationality and scientificity of the decision-making are enhanced, and the effectiveness of the decision-making is improved. The world has entered a new era of smart city construction and development. Enterprises can carry out more extensive business activities, improve management efficiency, and reduce management costs. The construction of a smart city covers every area, every class, and every region of the city, leading to fundamental changes in the operation, management, production, and lifestyle of modern cities. So far, there are many pilot cities in our country, and they will continue to increase, which shows that the construction of smart cities in our country has started in an all-round way. Smart city is one of the effective ways of social management practice. The government is the leader and manager of smart city construction. The construction of a smart city must rely on the management of a smart government. With scientific overall planning and management, the construction of smart cities can avoid unnecessary resource and cost risks. The development, possession, control, and use of information will become the core of economic management, and the development in the context of smart cities will greatly affect the management mode of enterprises.

The expansion of big data and the evolution of Internet of Things (IoT) technology have played an important role in the feasibility of smart city plans. The combination of the Internet of Things and big data is an unexplored research field that brings new and interesting challenges to the realization of future smart cities. By focusing on how big data fundamentally changes the urban population at different levels, Hashem et al. discussed the vision of big data analysis to support smart cities, described the latest communication technologies and smart-based applications used in smart city environments, proposed wisdom to the future business model of urban big data, and identified business and technical research challenges. This research can provide a benchmark for the future development and development of smart cities in the context of big data for researchers and industries, but the research does not implement the proposed business model in action [1]. Traditional ITS technology has been deployed globally in smart cities, but the next generation of ITS depends on the effective integration of interconnected and autonomous vehicles, and there is still a great need to automate other road and transportation components. Menouar et al. introduced possible ITS applications that can use drones and focused on the potential and challenges of drone-supported ITS for the next generation of smart cities. However, the combination mode of UAV and ITS technology is still being explored, and the ITS application program proposed in the article is not effective [2]. Argento et al. discuss the role of performance measurement systems as government technologies in the operation of smart city programs. The interventionist approach is used to study the possibilities and limitations of using the performance evaluation system as a smart city government technology, and a longitudinal case study is provided. However, this research is based on a case study of a single smart city and did not combine different smart cities to study. It would seem decisive to analyze the causes and effects of smart city challenges [3].

The innovation of this paper is as follows: (1) from the connotation of smart city and the current domestic situation as the starting point, in-depth analysis, and research on the construction theory of smart city and (2) to develop an enterprise intelligent management system based on data warehouses. The system is developed based on the Microsoft Visual Studio 2010 development environment and accesses relational databases using C language for programming.

2. Innovative Research Methods of Intelligent Enterprise Management Mode

2.1. “Smart City” Construction Theory. The concept of smart city is as follows: urban development not only provides comprehensive knowledge, interconnection, and in-depth intelligence in technology but also provides a complete urban “smart” economy, life, and management [4, 5].

2.1.1. The Connotation of Smart City. In May 1990, an international conference on “Smart Cities, Rapid Systems, and
Global Networks” was held in San Francisco, USA, focusing on how to achieve sustainable urban development through information technology and related information about the city’s successful experience in building systems [6]. This meeting put forward the original intention and consequences of the “smart city” for the first time. After that, the information infrastructure that served as the basis for the “smart city” was gradually built. In the nineteens, with the rapid development of electronic information technology, information engineering became the main driving force of global society, economy, and culture. Developed countries began to put forward plans to comprehensively carry out national information infrastructure construction at the national strategic level [7, 8]. In 1992, Singapore launched the Wisdom Island code-named IT2D and proposed to build a national high-speed multimedia broadband network, making it the first country in the world to clearly propose a smart city plan. In September 1993, the United States announced plans for the National Information Infrastructure (NII) and Global Information Infrastructure (GII). This has stimulated discussions on the information superhighway around the world [9].

In the following fifteen years, the construction of information infrastructure has spread from developed countries to countries around the world, and the basic platform of “smart cities” has begun to take shape [10]. Under these conditions, in November 2008, IBM officially put forward the concept of “Smart Earth,” centering on the three elements of IoT, interconnection, and intelligence and fully applying new electronic information technology and internet technology to all walks of life. The “wisdom level” is improved within. So far, the construction of a “smart city” based on information infrastructure has kicked off [11, 12].

IBM made the first clear statement on the definition of “smart city.” “Smart city” is an integrated electronic information and communication technology used to track, collect, analyze, and integrate many important key information. I think this is a good use of the city management system. The needs of human life, environmental protection, safety, service, production, trade, etc. are intelligently analyzed and responded to create a better life for urban residents [13, 14]. In 2009, American researcher Giffinger and his colleagues created an impact framework for smart cities, which includes six aspects: smart economy, smart population, smart governance, smart travel, smart environment, and smart life [15]. In 2010, American scholar Harrison proposed a more “humanized” smart city definition, that is, a “sensing, interconnected, and smart city” [16]. In 2014, Kogan and Leek proposed that the government plays an important role in providing application platforms, institutional support, and proposal design and promoting collaboration to build smart cities [17, 18]. In China, the research and discussion of “smart cities” started a little later. In 2010, Chinese scholar Wu Shengwu proposed that a smart city is a smart way to change the way governments, communities, enterprises, and the public interact through a new generation of information technology revolution, thereby improving the direction, flexibility, and effectiveness of social interaction [19, 20]. Through the combination of urban information infrastructure and other inherent facilities in the city, it helps the government make more informed decisions, helps companies gain access to a broader market, and helps residents obtain a better quality of life. In 2011, the “China Smart City Architecture and Development Research Report” pointed out that smart cities have brought information technologies such as the Internet of Things, big data, cloud computing, high-speed broadband networks, and wireless mobile networks to be dispersed in their own way, and the system is integrated into an organization with strong coordination and supervision capabilities to help the government respond wisely to the various needs of public services, social management, industry, and other activities [21]. In 2012, Chinese scholars Zou Jiajia and Ma Yongjun published an article “Smart City Connotation and Smart City Construction.” The article combed the development status of smart cities at home and abroad, discussed the definition and connotation of smart cities from the perspective of theoretical research, and explained the construction of smart cities having great significance to China’s development, and the principles and framework of smart city construction are proposed [22, 23]. It defines the connotation of a smart city from three aspects: (1) more thorough perception and more comprehensive interconnection; (2) deeper integration and more coordinated operation; and (3) more diverse services and more active innovation.

2.1.2. The Status Quo of Domestic Smart Cities. The tremendous economic growth in the past 30 years and rapid industrialization and urbanization have brought many economic and social problems to China. The Chinese government will vigorously develop smart government construction, promote economic restructuring and the transformation of economic growth patterns, promote industrial upgrading and technological development, and promote retraining and employment competitiveness. We hope to increase domestic demand, increase government spending, improve government capacity and efficiency, reduce corruption, reduce energy crises and pollution, and ultimately maintain social stability and build a harmonious society [24]. Since developed countries have provided successful construction and operation cases and a group of international information industry giants such as IBM and Cisco have tailored flexible and diversified solutions for government needs, governments at all levels in China quickly accepted the concept of “smart city,” and the planning and pilot projects carried out across the country from top to bottom have created an upsurge in domestic smart city planning and construction. At the same time, a number of outstanding, referenceable, and replicable smart city application samples and applications have been born. Building benchmarks are provided [25, 26]. Figure 1 shows a statistical chart of the number of domestic “smart city” pilots from 2015 to 2020.

2.2. Data Warehouse

2.2.1. The Definition of Data Warehouses. Currently, the definition of data warehouses is not unified. The well-known data storage expert WH Inmon explained that a data
2.2.2. The Difference Between Traditional Database and Data Warehouses. Traditional databases and repositories are very different. Warehouse data sources can be retrieved from various internal data sources in the database, and files in various formats can also be obtained from external data sources [29]. These data sources can be regarded as data carriers in the data warehouse, and data can be added to the data warehouse through data extraction, cleaning, and loading. Traditional databases are mainly aimed at transactional operations, with relatively complex data structures, real-time updating of data, and facing business operators. The differences between traditional databases and data warehouses are shown in Table 1.

2.3. Multiple Linear Regression

2.3.1. General Form. Multiple regression analysis is one of the methods to quantitatively predict the development and change of things based on social economic phenomena [30]. The reasons for growth and the motivation of things are quantitatively analyzed, the quantitative relationship between the variables of things is obtained, and then their growth and motivation are predicted. Suppose that the predicted object is \( w \) and the factor that affects the predicted object is \( x_i \), where \( i = 1, 2, 3, \ldots \), is the number of influencing factors. \( x_i \) are independent of each other, and you should not choose too many factors that affect \( w \); otherwise, there will be problems such as multilinearity and heteroscedasticity, which will affect the accuracy of the prediction results. In order to avoid the collinearity problem in the prediction process in advance, the correlation coefficient \( L \) can be used to detect the correlation between the independence.

\[
L = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(x_j - \bar{x})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2} \sqrt{\sum_{j=1}^{n}(x_j - \bar{x})^2}}.
\]  

Among them, \( x_i \) is the selected predictor, the average value is \( \bar{x} = (\sum_{i=1}^{n}x_i)/n \), and the general correlation coefficient \( L < 0.3 \) considers that there is no correlation between the predictors, that is, the predictors are independent of each other.

After the correct selection of influencing factors, we assume that there is a linear correlation between the predictor and the predicted object, that is, \( w = f(x_1, x_2, x_3, \ldots, x_k) \) is a linear function; then the multiple regression model is established as

\[
\hat{w}_i = \hat{\beta}_0 + \hat{\beta}_1 x_{i1} + \hat{\beta}_2 x_{i2} + \cdots + \hat{\beta}_k x_{ik} + \epsilon_i.
\]

Among them, \( \hat{\beta}_1, \hat{\beta}_2, \cdots, \hat{\beta}_k \) is called the regression coefficient, \( \hat{\beta}_0 \) is a constant term, both can be called regression parameters, and \( \epsilon_i \) is residual. The regression coefficient reflects the degree of influence on the predicted object when the predictive factor \( x_1, x_2, x_3, \cdots, x_k \) changes.

When \( n \) observations of \((w; x_{1i}, x_{2i}, \cdots, x_{ki})\) are given, a multiple linear regression prediction model is obtained:

\[
\hat{w}_i = \hat{\beta}_0 + \hat{\beta}_1 x_{i1} + \hat{\beta}_2 x_{i2} + \cdots + \hat{\beta}_k x_{ik} + \epsilon_i.
\]

Among them, \( x_{i1}, x_{i2}, \cdots, x_{ik} \) is the \( i \) observation value, \( \hat{\beta}_0, \hat{\beta}_1, \hat{\beta}_2, \cdots, \hat{\beta}_k \) is the regression estimation parameter, and \( \epsilon_i \) is the \( i \) observation residual item. The following was recorded:

\[
X = \begin{bmatrix} 1 & x_{11} & \cdots & x_{1k} \\ 1 & x_{21} & \cdots & x_{2k} \\ \vdots & \vdots & \ddots & \vdots \\ 1 & x_{ni} & \cdots & x_{nk} \end{bmatrix}, \hat{\beta} = \begin{bmatrix} \hat{\beta}_0 \\ \hat{\beta}_1 \\ \vdots \\ \hat{\beta}_k \end{bmatrix}, \epsilon = \begin{bmatrix} \epsilon_1 \\ \epsilon_2 \\ \vdots \\ \epsilon_n \end{bmatrix}.
\]

Then the multiple linear regression models can be
written in matrix form:

\[ W = X\hat{\beta} + \epsilon. \]  (5)

2.3.2. Least Squares Estimation Method. Least squares estimation takes the minimum sum of squared errors as the condition of the accuracy of the linear regression model, that is, for a given linear regression model \( W = X\hat{\beta} + \epsilon \), the variance \( \sigma^2 \) of the random error \( \epsilon \) is the smallest, that is, the influencing factors other than the considered predictor are minimal. The following was recorded:

\[ \hat{\epsilon} = W - X\hat{\beta} \]  (6)

is the residual vector of the prediction model; then the residual sum of squares is

\[ S_b = \sum_{i=1}^{n} \hat{\epsilon}^2. \]  (7)

Then

\[ S_b = \hat{\epsilon}'\hat{\epsilon} = (W - X\hat{\beta})'(W - X\hat{\beta}) = W'W - \hat{\beta}'X'W - W'X\hat{\beta} + \hat{\beta}'X'X\hat{\beta}. \]  (8)

Among them

\[ \hat{\beta}'X'W = (\hat{\beta}'X'W)' = W'X\hat{\beta}. \]  (9)

Regarding the residual \( \hat{\epsilon} \) as a function of \( \hat{\beta} \), due to the nonnegativity of the residual, there is \( \hat{\beta} \), so that \( \frac{\partial \hat{\epsilon}'}{\partial \hat{\beta}} = 0 \) has

\[ \frac{\partial \hat{\epsilon}'}{\partial \hat{\beta}} = -2X'X\hat{\beta} + 2X'X\hat{\beta}. \]  (10)

Let \( F > F_{\alpha}(k, n - k - 1) \) and

\[ X'X\hat{\beta} = X'W. \]  (11)

From the assumption of the rank of the matrix \( X \), it can be seen that \( X'X \) is invertible, that is, there is \( (X'X)^{-1} \); then

\[ \hat{\beta} = (X'X)^{-1}X'W. \]  (12)

\( \hat{\beta} \) is the least squares estimate of parameter \( \beta \), and it is easy to prove that \( \hat{\beta} \) is an unbiased estimate of \( \beta \).

2.3.3. Coefficient Test of Regression Model. The significance of the regression model coefficient \( \beta \) is verified by the test of the statistic \( d \), and the statistic \( d = b_j/S(b_j) \) is tested. Among them

\[ S(b_j) = \sqrt{\bar{a}_{jj}S}. \]  (13)

is the sample standard deviation, \( a_{jj} \) is \( (X'X)^{-1} \), and the main diagonal element \( S \) is the standard error:

\[ S = \sqrt{\frac{1}{n - k - 1} \sum_{j=1}^{n} (w_j - \bar{w}_j)^2}. \]  (14)

Under the condition of a certain significance level \( \alpha \) and degree of freedom \( f = n - k - 1 \), if \( |t| > t_{\alpha}(n - k - 1) \), it means that \( x_j \) has a significant influence on the predicted object; if \( |t| < t_{\alpha}(n - k - 1) \), it means that \( x_j \) has an insignificant influence on the predicted object.

3. Innovative Research Experiment of Intelligent Enterprise Management Mode

3.1. Cloud Devices for Enterprise Management

3.1.1. Customized Calculation Unit. Different from the traditional fixed single server, all physical computing nodes in Power Cube are built with Hanbo’s customized server, which...
can flexibly combine the processor, memory, DAS capacity, and chipset according to the individual actual needs of enterprise customers, as well as other parts for custom combination. In addition, the server boards have been highly tailored to greatly reduce energy consumption. Each server can be configured with a maximum of 8 SAS hard disks as local storage. This has greatly improved the compatibility and reliability of the equipment.

3.1.2. Customized Storage Unit. For private clouds managed internally by enterprises, the reliability of cloud storage is very important. Compared with traditional storage devices, the concept of cloud storage systems in cloud computing cannot be simply understood as a single piece of hardware, but through functions such as parallelism, grid technology, and distributed file systems. The network storage devices are integrated through specific application software and collaborative operating systems to jointly provide storage and access functions to the outside world. At present, more and more unstructured data are encountered in enterprise management. Traditional NAS and SAN systems cannot achieve a balance of cost and efficiency. More storage system manufacturers have developed that can be used in large-scale cloud computing and large-scale cloud computing and object storage systems in data processing. The core is based on the separation of the control path (metadata) and data path (read or write data) of the object storage device. Each object storage device has specific intelligent functions that can automatically manage data distribution.

3.1.3. High-Performance Data Exchange. In the middle of the Power Cube rack, multiple data switches can be integrated. According to the needs of users, you can choose a switch with 10-gigabit or gigabit ports. Each full 10-gigabit switch is equipped with 4 40GE uplink ports and 48 wire-speed 10GE ports; a full gigabit switch is equipped with 4 10GE uplink ports and 48 wire-speed GE ports. The Opzoon data center switch has the following technical characteristics: high-density access, layer 2 forwarding, mobility, high reliability, converged and lossless network, and a complete centralized monitoring system.

3.2. Cloud Desktop for Enterprise Management. The deployment of Opzoon’s virtual desktop involves three main parts, the data center area, the network connection area, and the user area. The data center area is the core area for the deployment of virtual desktop resources. IT operation and maintenance personnel deploy and maintain uniformly in this area. The administrator can flexibly allocate CPU, memory, storage, and other resources to each user terminal in the user area. All user data is stored in a centralized manner. In the back-end data center area, the data center area is responsible for the unified management and backup of user data, as well as the deployment of various security measures. PC management includes software deployment, updates, and patches. The user area mainly refers to the terminal devices that users access to in the data center area, including network devices such as desktops, notebooks, terminals, smart phones, and PADs. As long as they can access the network, they can use the desktop cloud system. The network area is the area between the user area and the data center. It provides high-speed network connections. The background of the data center area can push various application services required by users to the user desktop through the network.

The virtual desktop topology is shown in Figure 2.

3.3. Cloud Data Center Hardware Architecture

3.3.1. Computing Subsystem. The computer subsystem is the execution core of the entire virtual data center, because all application programs must be completed by the computer subsystem. The Opzoon virtual server product line uses Intel’s latest Xeon processor, supports up to 8 cores and 16 threads, can install up to 24 memory units, provides 768 G
high-capacity memory, and is an Intel VT series. These instructions can provide high-speed, large-capacity memory to support the stable and efficient operation of the virtual machine, while ensuring that the user virtualization requirements suitable for the development of virtualized applications are met.
3.3.2. Storage Subsystem. The storage subsystem is mainly responsible for storing image files, snapshots, and information about the use and configuration of virtual machine users, as well as backup and reproduction to ensure data reliability. OPV-Suite cloud computing platform supports various storage interfaces, including file-level and block-level interface and different local storage to meet the needs of different applications. At the same time, OPV-Suite virtualizes storage resources, divides the same type of built-in physical storage resources into multiple logical volumes, and then allocates them to different virtual machines to meet the storage requirements of the virtual environment. The Opzoon storage subsystem products use the Intel SBB2.0 architecture, support up to 16 disk drives in a 3 U volume, and use the InfiniBand to synchronize memory data between dual controllers, and a failure on one controller allows the other controller to display after taking over. With a high level of communication reliability, it can complete the operation of reading and writing data to the memory. It can also automatically allocate disk space among multiple virtual machines and automatically improve the configuration according to the minimum resource space required by each virtual machine at a specific point in time.

3.3.3. Network Subsystem. The network subsystem is mainly responsible for managing the data between the physical machine and the virtual machine. In addition, it must be used in conjunction with a virtual operating environment to complete communication with external networks and provide additional functions such as IPS, anti-DDoS attacks, and address translation. The Opzoon network subsystem supports a high-performance firewall that supports 20 Gbps throughput and 200,000 new connections, as well as 48 10-gigabit ports and 4 ports over 40 G. These ports can automatically detect the performance status of virtual machines including the top black switch. You can configure the physical switch configuration and update information when migrating a computer and use it with a virtualized computer.
to understand the status of dynamic virtual machine migration.

4. Innovative Research Analysis of Intelligent Enterprise Management Mode

4.1. Cloud Data Center Virtualization Management System. The virtualization management system of the core of the entire virtualization system is mainly virtual machine management, integrated resource allocation and management, network services, operating environment monitoring, user identity management and security, and remote operation of physical equipment. Virtualization systems must provide flexible service relocation functions. For predictable service relocation, it must be able to seamlessly transfer virtual machines from one physical machine to another. In addition, the virtualization system must implement unforeseen business interruptions caused by node failures, upload sharing, or backup. At the same time, in order to respond to changing business needs, the virtualization management system needs to allocate intelligent and custom payloads based on the business volume. During the idle period, some virtual machines may be automatically shut down to reduce resource consumption. During peak hours, the operating performance of the system can automatically generate multiple virtual machines to cope with greater pressure, thereby improving the system.

Virtualization management system (OPV-Manager) integrates the intelligent virtual machine management, high scalability and flexibility, and will not lose resource control of VM. The main functions are shown in Table 2.

4.2. System Test

4.2.1. Test Environment. According to the basic system operation requirements, the appropriate software and hardware environment for system testing was selected. Table 3 shows the software and hardware environment used in the system test.

4.2.2. Functional Test Case

(1) Registration and Login Module Test. The main purpose of the registration test is to ensure that the registration reminder and registration process comply with system regulations.

(2) Login Test. The main purpose of the login test is to verify whether the connection prompt and the logged-in user comply with the system rules. Figure 3 shows the test implementation results based on the scope of the test case.

(3) Forgot Password Test. The main purpose of the forgotten password test is to detect whether the system complies with system regulations when the user forgets the password and to allow the user to obtain the password. The test realization result based on the scope of the test case is shown in Figure 4.

(4) Test of Employee Basic Information Management Module. The basic employee information management module mainly includes system management, employee-related information management, and multimedia management. Employee basic information management is mainly used to manage the personal information of the current employees of the company. The main functions include adding, modifying, searching, and deleting employee information. The test example is shown in Table 4.

(5) Employee Attendance Information and Health Information Management Module Test. The main test content of this part is as follows: the main functions of employee basic information management include adding and changing employee participation information, retrieving employee attendance information, deleting attendance, and setting commuting time. Employee health information management is mainly used to manage the health information of the company’s existing employees. The main functions include adding, changing, searching, and deleting employee

![Figure 5: Attendance information and health information management module test results.](image-url)
health information. The test results of the attendance information and health information management module are shown in Figure 5.

5. Conclusions

Intelligent enterprise management system is a comprehensive application of data warehouses and data mining technology, involving multiple disciplines and fields, and is a relatively complex science. With the continuous development of information technology, many new technologies have been introduced into business intelligence to make it more substantial and complete. Operational data storage is one of them. At the same time, the application of intelligent enterprise management mode in different industries has its own distinctive characteristics, so intelligent enterprise management is also regarded as a solution. In the context of smart cities, this paper studies and discusses several issues such as the innovation of smart enterprises in the enterprise management mode and the storage technology of operational data. Focusing on these topics, the research work is mainly carried out in the following two aspects: (1) Based on the in-depth study of the intelligent enterprise management mode and operational data storage, the framework of the traditional enterprise intelligent system is improved, and the data storage technology is introduced into the intelligent business. After managing the system, a new intelligent framework was proposed, which uses functional data storage and data storage as the data center. Among them, operational data storage is mainly responsible for real-time analysis of tactical decision-making, and data warehouses is mainly responsible for medium and long-term strategic decision analysis. It mainly studies how to update different data incrementally in the case of a large data volume. (2) According to the proposed new intelligent enterprise management model framework, combined with the characteristics of enterprise management, a certain research and discussion on the design and implementation of the enterprise management module analysis system has been done. The enterprise management module analysis system uses operational data storage and data warehouses as the data center to analyze the data in the information center, which can not only perform real-time data analysis but also analyze and predict enterprise management models etc. and provide reference for the further development of business. The intelligent enterprise management model system with operational data storage and data warehouses as the data center studied in this subject has been well applied in the enterprise management process. The development of an intelligent business management system will help the enterprise’s intelligent management applications, thereby improving the service quality of the enterprise and the market competitiveness of each enterprise.

Data Availability

No data were used to support this study.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

References

[1] I. Hashem, V. Chang, N. B. Anuar et al., "The role of big data in smart city," International Journal of Information Management, vol. 36, no. 5, pp. 748–758, 2016.
[2] H. Menouar, I. Guvenc, K. Akkaya, A. S. Ulugac, A. Kadri, and A. Tuncer, "UAV-enabled intelligent transportation systems for the smart city: applications and challenges," IEEE Communications Magazine, vol. 55, no. 3, pp. 22–28, 2017.
[3] D. Argento, G. Grossi, A. Jääskeläinen, S. Servalli, and P. Suomala, "Governmentality and performance for the smart city," Accounting Auditing & Accountability Journal, vol. 33, no. 1, pp. 204–232, 2020.
[4] M. Centenaro, L. Vangelista, A. Zanella, and M. Zorzi, "Long-range communications in unlicensed bands: the rising stars in the IoT and smart city scenarios," IEEE Wireless Communications, vol. 23, no. 5, pp. 60–67, 2016.
[5] X. Wu, H. Liang, H. Wang, and W. Fu, "Design and implementation of smart city construction information service platform," Journal of Geomatics, vol. 43, no. 4, pp. 65–67, 2018.
[6] L. Debra and G. J. Wagner, "Small and smart: why and how smart city solutions can and should be adapted to the unique needs of smaller cities," New Global Studies, vol. 12, no. 1, pp. 21–36, 2018.
[7] Y. Cui and L. Zhang, "Privacy preserving ciphertext-policy attribute-based broadcast encryption in smart city," The Journal of China Universities of Posts and Telecommunications, vol. 26, no. 1, pp. 25–35, 2019.
[8] A. Alanezi, B. Abd-El-Atty, H. Kolivand et al., "Securing digital images through simple permutation-substitution mechanism in cloud-based smart city environment," Security and Communication Networks, vol. 2021, no. 9, Article ID 6615512, p. 17, 2021.
[9] J. Chang, J. Choi, H. An, and J. Lee, "Perception analysis of pedestrian environment in the smart city from a gendered perspective: case of Sejong City’s 2-2 district (Saerom-dong) special design zone for women," Journal of the Korean Urban Management Association, vol. 33, no. 2, pp. 81–98, 2020.
[10] S. Joghee, H. M. Alzoubi, and A. R. Dubey, "Decisions effectiveness of FDI investment biases at real estate industry: empirical evidence from Dubai smart city projects," International Journal of Scientific & Technology Research, vol. 9, no. 3, pp. 3499–3503, 2020.
[11] H. Al-Yassin, J. I. Mousa, M. A. Fadhel, O. Al-Shamma, and L. Alzubaidi, "Statistical accuracy analysis of different detecting algorithms for surveillance system in smart city," Indonesian Journal of Electrical Engineering and Computer Science, vol. 18, no. 2, pp. 979–986, 2020.
[12] K. Raissi and B. B. Gouissem, "LTE scheduler algorithms for VANET traffic in smart city," International Journal of Computer Networks and Communications, vol. 12, no. 1, pp. 53–64, 2020.
[13] K. Avazov, A. Abduusalomov, and Y. I. Cho, "Automatic moving shadow detection and removal method for smart city environments," Journal of Korean institute of intelligent systems, vol. 30, no. 3, pp. 181–188, 2020.
[14] V. Rosalina, T. A. Munandar, and A. N. Hidayanto, "Electronic citizen relationship management (e-CiRM) modeling...
towards Serang as a smart city,” *International Journal of Computer Applications*, vol. 175, no. 25, pp. 27–32, 2020.

[15] G. W. Park, H. J. Park, S. H. Bae, M. K. Kim, and S. J. Hwang, “A study on the smart city core value and indicator design,” *Journal of Society of Korea Industrial and Systems Engineering*, vol. 43, no. 4, pp. 198–207, 2020.

[16] S. Jha, L. Nkenyereye, G. P. Joshi, and E. Yang, “Mitigating and monitoring smart city using internet of things,” *Computers, Materials and Continua*, vol. 65, no. 2, pp. 1059–1079, 2020.

[17] I. Chomiak-Orsa and A. Sosgórnik, “Factors conditioning the implementation of the smart city concept,” *Informatyka Ekonomiczna*, vol. 2020, no. 2, pp. 20–29, 2020.

[18] H. D. Kim and J. K. Su, “The study for city innovation platform using living lab-based smart city service modeling,” *The Journal of Korean Institute of Communications and Information Sciences*, vol. 45, no. 5, pp. 890–898, 2020.

[19] O. B. Nagy, “A smart city koncepciójának fejlődése,” *Jelenkori Társadalmi és Gazdasági Folyamatok*, vol. 15, no. 1-2, pp. 69–77, 2020.

[20] H. Leung, To WM, A. Chung et al., “Smart city development and sound planning in Macao,” *Technical Acoustics*, vol. 39, no. 5, pp. 622–626, 2020.

[21] A. M. Hasan and A. A. Kadhim, “Design and Implementation of Smart Meter for Smart City,” *Iraqi Journal of Information & Communications Technology*, vol. 3, no. 3, pp. 33–42, 2020.

[22] D. Li, L. Deng, W. Liu, and Q. Su, “Improving communication precision of IoT through behavior-based learning in smart city environment,” *Future Generation Computer Systems*, vol. 108, pp. 512–520, 2020.

[23] A. Macek, S. M. Jerman, V. Bobek, and T. Horvat, “Smart city concept in Mauritius,” *Journal of Innovative Business and Management*, vol. 12, no. 1, pp. 18–25, 2020.

[24] E. Marchigiani, “An accessible city is a healthy and people-centred smart city,” *International Journal of Urban Planning and Smart Cities*, vol. 1, no. 2, pp. 59–79, 2020.

[25] G. Fahmfam and H. Hamidi, “Factors affecting the development and management of smart city approach using a combination of big data and the internet of things and cloud computing technologies,” *Iranian Journal of Information Processing Management*, vol. 34, no. 2, pp. 557–584, 2019.

[26] J. Muvuna, T. Boutaleb, K. J. Baker, and S. B. Mickovski, “A methodology to model integrated smart city system from the information perspective,” *Smart Cities*, vol. 2, no. 4, pp. 496–511, 2019.

[27] J. Winkowska, D. Szpilko, and S. Peji, “Smart city concept in the light of the literature review,” *Engineering Management in Production and Services*, vol. 11, no. 2, pp. 70–86, 2019.

[28] P. Asmus, “Pathway to smart city resiliency: the microgrid platform,” *Public Utilities Fortnightly*, vol. 157, no. 3, pp. 29–30, 2019.

[29] B. Zhang, “Tourist enterprise management intelligent method integrating the generalized time series,” *Boletin Tecnico/Technical Bulletin*, vol. 55, no. 16, pp. 259–263, 2017.

[30] F. Xu and T. Shen, “Look-ahead prediction-based real-time optimal energy management for connected HEVs,” *IEEE Transactions on Vehicular Technology*, vol. 69, no. 3, pp. 2537–2551, 2020.