Hindawi
Mobile Information Systems
Volume 2023, Article ID 9754151, 1 page
https://doi.org/10.1155/2023/9754151

Retraction

Retracted: Application of Cloud Computing and GIS Based on Internet of Things in Oil and Gas Storage and Transportation Production Management and Safety Monitoring and Early Warning System

Mobile Information Systems

Received 19 September 2023; Accepted 19 September 2023; Published 20 September 2023

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] K. Wang, "Application of Cloud Computing and GIS Based on Internet of Things in Oil and Gas Storage and Transportation Production Management and Safety Monitoring and Early Warning System," *Mobile Information Systems*, vol. 2022, Article ID 1875479, 11 pages, 2022.

Hindawi
Mobile Information Systems
Volume 2022, Article ID 1875479, 11 pages
https://doi.org/10.1155/2022/1875479

Research Article

Application of Cloud Computing and GIS Based on Internet of Things in Oil and Gas Storage and Transportation Production Management and Safety Monitoring and Early Warning System

Kai Wang

School of Transportation and Logistics Engineering, Wuhan University of Technology, Wuhan 430063, Hubei, China

Correspondence should be addressed to Kai Wang; kaileader@whut.edu.cn

Received 27 April 2022; Revised 21 June 2022; Accepted 15 July 2022; Published 8 August 2022

Academic Editor: Liming Chen

The purpose of this study is to design an information management system, which can be used for oil and gas pipeline path planning, oil and gas production scheduling, oil and gas data statistical analysis, and other functions. In this study, a production management information system for oil and gas storage and transportation based on the Internet of Things and GIS technology is proposed. Through the integration of Internet and GIS technology, it can accurately analyze the path planning of oil and gas pipelines. The experiment proves the reliability of the system, and in the aspect of path planning, the simulated path of the system will be 20–30 km shorter than the original laying path, especially for long-distance pipeline laying, which can be reduced by about 30 km.

1. Introduction

The efficient use of energy has always been our pursuit, especially now that the resources are depleted day by day. Oil and gas resources are the most widely used and longest used resources in the world, and people have been working on their efficient storage and transportation. As a product of modern high-tech, the oil and gas storage and transportation production information system has provided tremendous help for oil and gas storage, transportation and safety management. The Internet of Things and GIS technology are also new technologies that should be developed and used in various industries. In developed countries, the research on the Internet of Things and GIS has been relatively long, and the research on oil and gas storage and transportation is relatively in-depth. As an energy source, China is in urgent need of high-efficiency technologies for oil and gas storage and transportation. Therefore, it is now managing oil and gas storage and transportation production. Research on information systems is very necessary.

In the 21st century, people have realized that energy is slowly depleting, and the awareness of the energy crisis is gradually becoming stronger. Therefore, there are many research studies on oil and gas storage and transportation and GIS technology. Al-Rojaie discussed the opinions of Qassimi Arabic speakers on the linguistic variation of their own dialects, and the socio-cultural evaluations related to their opinions. Using geographic information system (GIS) mapping software for analysis, their research shows that it is necessary to further explore the potential ideologies and social values of Arabic speakers of their own dialects and other dialects in the Arabic community [1]. Xia et al. used D-InSAR new mining subsidence monitoring to accurately obtain surface deformation and established a temporal and spatial relationship model between surface deformation and underground mining characterized by subsidence. A fast, efficient, and accurate method for identifying illegal underground mining areas has been developed [2]. Orimoloye and Ololade and others used GIS technology to study a series of ecological and environmental impacts of gold mining operations. Research results show that areas with low index values are easily affected by mining and other human activities, while areas with high index values mean little or no impact [3]. Liu et al. believe that with the rapid development of computer technology, GIS technology can be combined with database programming. However, the progress of science and technology is contrary to the principle of harmonious development between man and nature. Global warming caused by excessive carbon dioxide pollution may be the most serious environmental problem [4]. Although there are many related studies, there are still many aspects that can be strengthened for the research on oil and gas storage, transportation, and production information management systems.

This article proposes the following innovations for the Internet of Things technology: (1) Propose an information management system for oil and gas storage, transportation, and production based on the Internet of Things GIS technology. Before this, most of them were based on artificial intelligence systems or sensor networks. (2) For the information system, pay more attention to the research of tubing laying path, fully analyze its algorithm and modeling, and design a systematic geographic information database in the system.

2. Technology Internet of Things Cloud Computing and GIS Technology

2.1. Internet of Things Technology and Cloud Computing. As shown in Figure 1, the perception layer is at the foundation, and is at the bottom of the three-layer architecture. Its main function is to identify objects, perceive the environment, and collect information. With the support of the National Natural Science Foundation of China and major special funds for science and technology, the research on the sensing layer technology of the Internet of Things industry in China, such as network communication technology and sensor network, has made continuous progress. The main equipment includes two-dimensional code and readers, tags and readers, video capture equipment, wireless sensor nodes, etc. [5, 6]. The demand for big data transmission and processing platforms is a problem that the Internet of Things industry must face in the transmission network. The main technologies include embedded technology, sensor technology, item identification technology, control technology, etc. The transport layer, also called the network layer, is responsible for efficiently, reliably, and safely sending the data collected by the perception layer through a variety of networks. It solves the problem of data transmission, especially the problem of long-distance transmission [7, 8]. The Internet of Things is characterized by comprehensive perception, reliable transmission, and intelligent processing, and it is a network that can connect the physical world. The network here is not a brand-new network but is based on the mobile communication network and the Internet. The integration and expansion of various existing networks is the combination of wired and wireless, broadband and narrowband, sensing networks, and communication networks. The combination of networks can provide all kinds of users with an intelligent selection of the mode of access to the network. Commonly used network forms are Internet, wireless broadband network, wireless low-speed network, and mobile communication network [9, 10].

Cloud computing technology is not an innovation, but an integration of past technologies and the future of the software industry model. Although academics have not given a unified explanation to cloud computing, there is a saying that is widely accepted by the public. It is the development result of cloud computing, distributed computing, parallel computing, practical computing, network storage technology, virtualization, load balancing, and other traditional computer technologies. Cloud computing aims to provide users with cloud architecture nodes, and integrate a large number of relatively low-cost computer entities through the Internet or LAN to form a computer system with strong computing power. Under the SOA framework, with the help of three service providers of cloud computing: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), and other advanced software models, this distributed cloud computing system with super performance has reached the hands of users.

With the continuous advancement of technical means, the popularization and application of various advanced sensing technologies and equipment, the application prospects of the Internet of Things are very broad, and more and more sensors are deployed in a wide range of production and life fields, from national security, public health, Facilitate transportation and other government public management, to smart homes, health checks, convenient payment and other daily life of the people, and are connected by the Internet and communication technology. The physical world is free from the constraints of time and space through the digital world and can present us more accurately. The application of the Internet of Things is to connect items through sensing devices and networks to realize automatic and real-time identification, positioning, and other supervision and management activities of objects, so as to achieve the corresponding demand goals of managers and consumers for items [11, 12]. The most common application in oil and gas storage and transportation is the Internet of Things (IoT) network for oil field exploitation and transportation, which links various devices through the network for unified deployment.

2.2. GGIS Technology. Geographic Information System (GIS) is an emerging modern edge science. It is involved in many research fields such as information science, computer science, and space science. The data of its geographic database includes graphic data, attribute data, positioning data, remote sensing data, etc. These data are obtained through surveys and collection. GIS was first put forward by geographers in Canada, so all geographic databases are foreign data, and domestic users need to input their own data. The geographical information system is based on a geographic database, analyzes and processes the operation process related to these data, and provides the researcher with decision-making and planning services [13].

As shown in Figure 2, the geographic system mainly includes four major components. One is the hardware system, including hardware devices such as computers, servers, and geographic detectors that make up the GIS. The

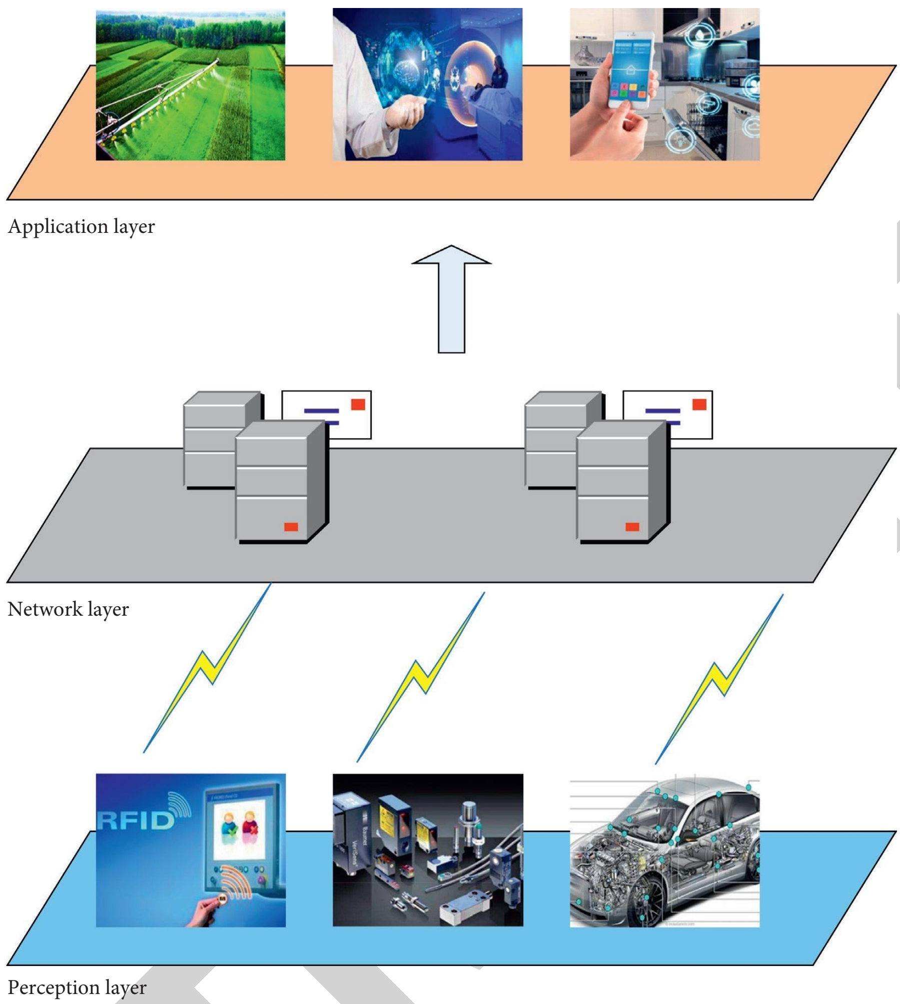

Figure 1: Basic architecture diagram of the Internet of Things.

second is a software system, which is a geographic information system developed based on GIS, which can complete certain operational tasks. The third is geographic data. The basic principle of GIS is based on geographic data, so it must be correct for geographic data. The fourth is users. As users of the system, users are divided into ordinary users and professional users. For ordinary users, it is more to use the original functions, while professional users can further develop functions based on the system and enjoy higher authority. GIS is mainly used to process geographic-related information data. Geographical information data has its own particularities. First of all, its spatial and geographic features, such as spatial location data LBS (location-based services) common longitude and latitude coordinate data, and finally, the intersection and separation of data between objects. Then there are its attribute characteristic data, such as the length, width, directionality, start point, and end point of the road data. Then there is its time-domain characteristic data, such as the time of data collection. The application of GIS technology is very extensive, involving many industries. In logistics management, it allocates resources according to the corresponding road access and material flow. It also allocates materials efficiently and reasonably in the military and urban management. In large-scale urban construction, the planning of roads, sports venues, parking lots, green spaces, etc., enables the rational distribution of facilities and the efficient use of resources [14, 15].

2.3. Application of GIS in Oil and Gas Storage and Transportation Production Management. The application of GIS technology to energy conservation master planning and sustainable development research technology in the energy conservation master plan and sustainable development research process is mainly reflected in the direct ratio of total resource savings, effective energy utilization, and energy distribution. Or indirectly analyze the powerful data processing and analysis capabilities that can be used to simulate the energy-saving dynamic change process and expected planning results. This can analyze the expected results as soon as possible, and propose feasible measures and remedial plans for some predictive results in the future. And put forward good energy-saving policies and measures to achieve a more reasonable energy-saving plan [16]. The formulation of energy-saving plans applied to different industries and projects in order to strengthen energy-saving

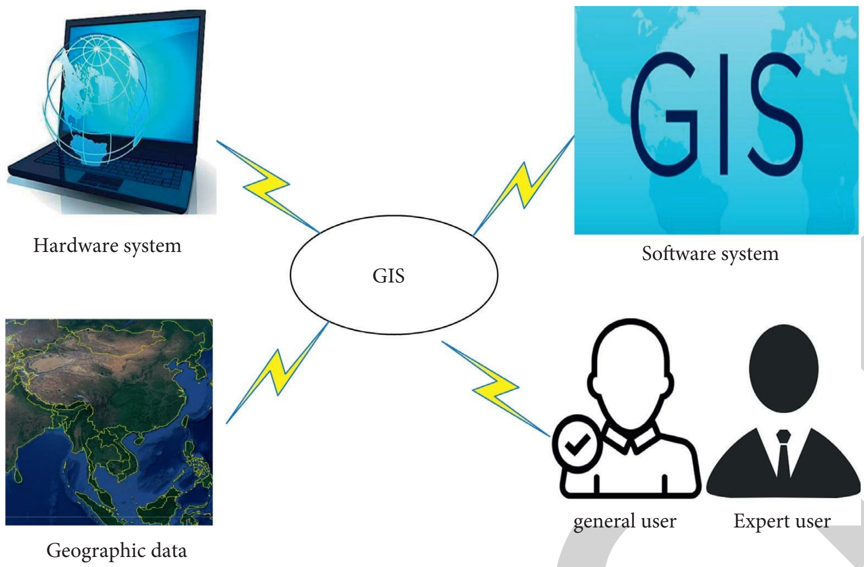

Figure 2: Composition of geographic information system.

and emission-reduction management, improve energy utilization efficiency, and achieve the sustainable development goals of energy-saving emission reduction, environmental protection, cost reduction and efficiency enhancemen. It is formulated under different industries and different economic systems. Classification of energy-saving planning is necessary. In the existing development model, as long as there are sufficient macro data and information support technology, a more reasonable professional energy-saving and emission-reduction spatial information system can be constructed, and more specific and targeted energy-saving planning can be established. For example, the energy-saving and emission-reduction development plan of natural gas enterprises, the energy-saving and emission-reduction development plan of thermal engineering, etc. can be specific to a certain industry or a large-scale implementation project, and provide different reference perspectives for the future energy-saving and emission-reduction overall planning [17, 18].

The oil and gas storage and transportation production management system should focus on improving the service quality and efficiency of the enterprise, and take the structural reform of the supply side of the enterprise as the main line. Using modern information technologies, such as GIS, Internet of Things, cloud computing, GPS, AI, to develop enterprise information resources in depth, accelerate information circulation and sharing, and build to meet the needs of enterprise decision-making, management, and executive levels for coordinated operation, efficient management and scientific decision-making The required information management system promotes the overall improvement and optimization of the production, operation, management and decision-making methods of enterprises, leads demonstrations and sets benchmarks for the informatization construction of the gas industry, and contributes to the improvement of the work quality, management efficiency and service level of oil and gas enterprises [19].

2.4. Data Acquisition and Monitoring System. The data acquisition and monitoring system (ScADA) is a computer-based automation system that can monitor and control field equipment, apply to process control and scheduling, and realize a series of automation functions from data acquisition to equipment control and even signal alarms., That is, to realize "perception" in a certain application field.

As shown in Figure 3, it is a traditional data acquisition and monitoring system, and its composition is generally divided into three levels. The bottom layer is the data collection layer, that is, the data source facing the field environment, in this layer, responsible for data collection. The middle layer is the interactive network layer. The collected data is stored and preprocessed in the network interactive layer, including data classification, data grouping, and data cleaning. The top layer is the monitoring center. After the data is collected, the data is processed in the data center and presented in the monitoring center in a visual manner [20].

3. Design of Management Information System for Oil and Gas Storage and Transportation

Oil and gas storage and transportation companies generally have multiple pipelines, multiple crude oil station depots, and multiple gas stations. The business is the "receiving, storage, transportation, and sales of crude oil and natural gas," the unified command of the production dispatching room, and the coordination of various stations and other related departments according to the requirements of the higher-level departments. Ensure the normal operation of production during this business process.

According to the production and management needs of storage and transportation companies, we should focus on the characteristics of the oil and gas field enterprises in the development, and combine the characteristics of the industry management of the oil and gas field enterprises when

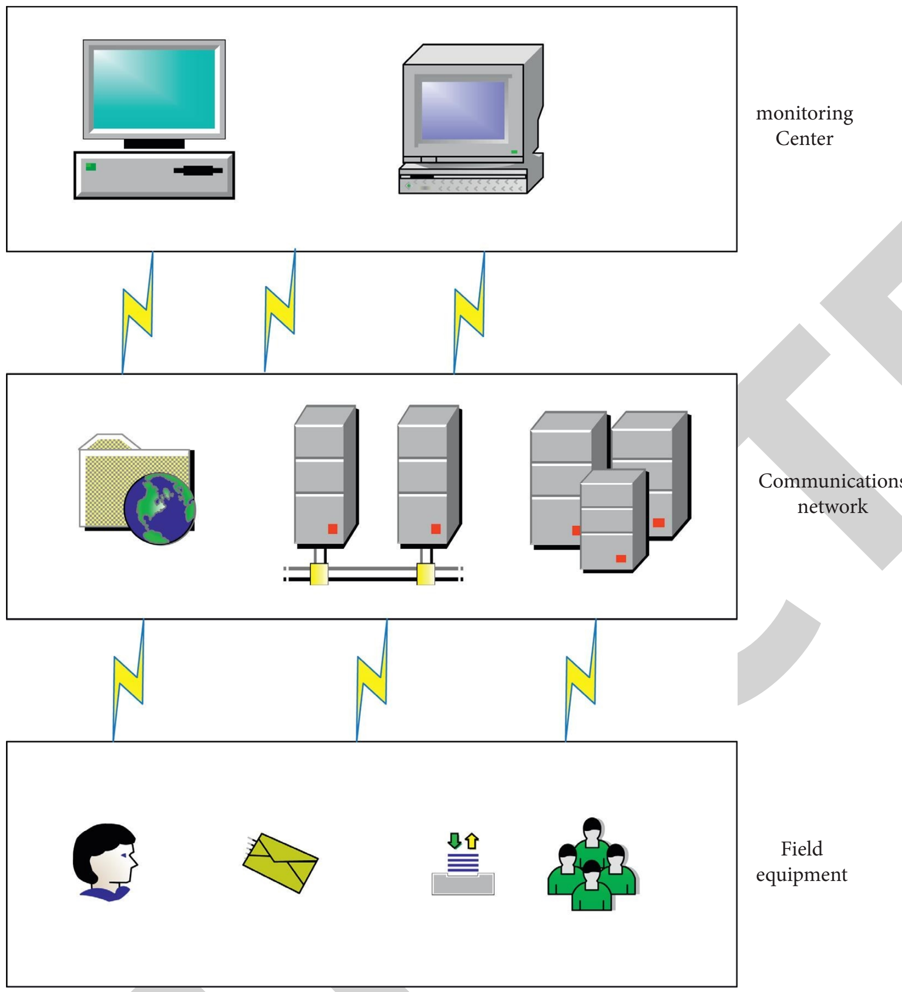

Figure 3: Traditional SCADA system.

focusing on versatility, and use information sharing and network dynamics in response to the defects of the existing systems. The technical route of management, in accordance with comprehensive management requirements, formulate a reasonable information management process, only in this way can it cater to the current development trend of storage and transportation, and in a practical sense, it can satisfy the effective control, management, and analysis of storage and transportation production [21, 22].

In the oil and gas storage, and transportation production management information system of this article, it is a visual auxiliary decision-making system for production management. The overall goal of the system is based on the basic functions of GIS, integrating the mathematical modeling methods of the main problems of oil and gas storage and transportation production management with the GIS software platform, expanding the spatial analysis functions of GIS, and making the system not only the basics of general GIS software functions, and can integrate expert knowledge in the field of oil and gas storage and transportation, conduct special research on oil and gas storage and transportation production management, and realize the integration of data input, processing, management, analysis, visual expression and decision-making in oil and gas storage and transportation production management. In particular, the following special analysis functions of oil and gas storage and transportation production management should be realized. Oil and gas pipeline structure analysis. Oil and gas pipeline safety and reliability analysis [23].

3.1. Database Design. The database design establishes a table space and an index table space for the database, which is of great benefit to the management and expansion of the database, and also helps to improve the data efficiency, so as to minimize the possibility of data damage and enhance the manageability of the database. The establishment of a database is the basis and prerequisite for the development of a management information system. Then, before the development of the oil and gas storage and transportation production management information system, a unified format of the oil and gas storage and transportation production database is first required. The entire database includes geographic data, pipeline data, and safety and reliability. Analyzing attribute data and production scheduling attribute data, the quality of the database design is very important, enough to determine the success or failure of the system.

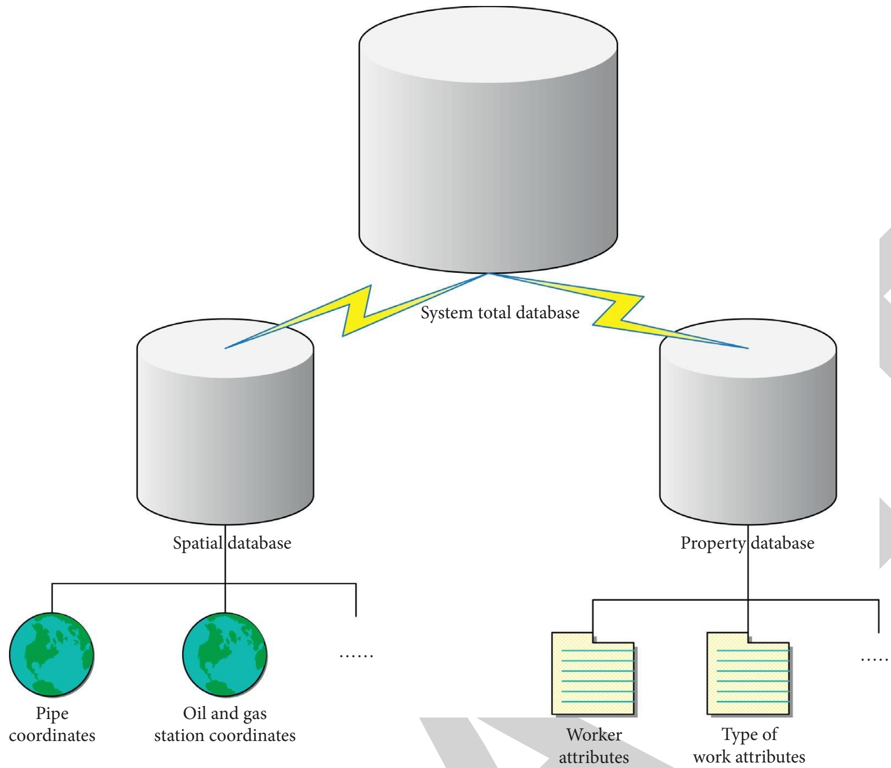

Figure 4: Schematic diagram of database composition.

As shown in Figure 4, the databases in this article mainly include spatial databases and attribute databases. Both databases will eventually be integrated into the main service system to break the barriers between data and achieve unified scheduling. For the spatial database, it mainly collects important geographic location information such as gas stations, pipeline routes, and oil stations. On the GIS system, two-dimensional geographic information data is established with north, south, east, and west as x, y. For pipeline laying simulation, three-dimensional geographic data will be established with the buried depth as z. In the attribute database, it is mainly to define the company's business, worker scheduling and other attributes, and compile attribute data into the database to achieve the purpose of data analysis, modeling, and scheduling.

3.2. Functional Framework. This system is a comprehensive information system that integrates data collection, sorting, transmission, reporting, and publishing. The system uses B/S mode to access the database for data collection and processing. The physical model of this system is designed based on the data processing center of the oil and gas storage and transportation company as the main database. The oilfield network of each grassroots station and the team is connected to the server. The client of the grassroots station and team connects to the central database through the application server. The grassroots station team can only access the data of the unit, and cannot access the data of the main database of the oil and gas storage and transportation company, which logically ensures the safety of the data, and at the same time enables the centralized management of the data to improve the utilization rate of the data. According to the requirement analysis of the system, combined with the characteristics of the GIS system and the Internet of Things, we divide the functions of the software system into three blocks: (1) pipeline construction; (2) production scheduling simulation; and (3) data analysis and processing, as shown in the Figure 5:

As shown in Figure 5, the main functions of the system are divided into three parts. The first is the pipeline laying system, which can simulate the pipeline laying between two points based on GIS technology and provide suggestions for actual pipeline laying. The second block is the production scheduling system, which can schedule workers in the system company and intelligently control oil and gas transportation by pipelines. The third block is the data analysis system, which is based on intelligent learning algorithms, records the data actually generated, performs prediction simulations, and provides data support for the company.

3.3. Pipeline Modeling

3.3.1. Mathematical Model of Oil and Gas Pipeline Simulation. In the study of oil and gas, the transportation of oil and gas is one of the most critical steps. The simulation of the pipeline model is the basis of the system's path planning. This article uses an artificial intelligence algorithm to simulate the pipeline, some of the key parameters are shown in Figure 6:

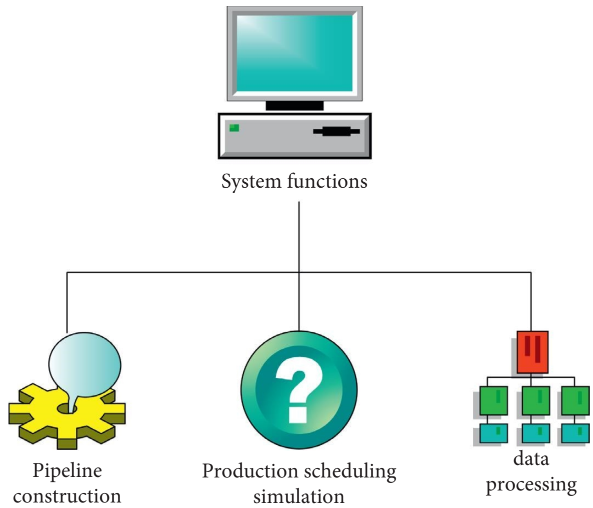

Figure 5: System function decomposition diagram.

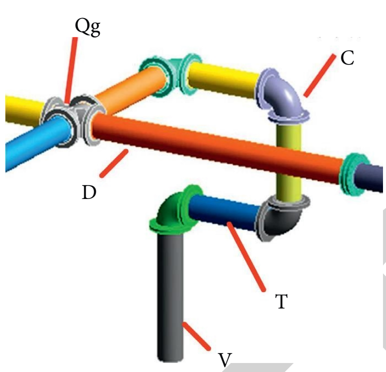

Figure 6: Schematic diagram of some parameters of pipeline modeling.

Through network configuration, optimization calculation, display and analysis of optimization results, etc., the operation conditions of the oil and gas network are simulated, and the optimized operation scheme of the oil and gas network is provided, so that the production management of oil and gas network can be rule-based and evidence-based. Equations (1)–(3) are obtained from the continuity equation, motion equation, and energy equation of the steady-state flow of gas in the pipeline.

$$\frac{v}{\rho}\left(\frac{\partial\rho}{\partial T}\right)_P\frac{\mathrm{d}T}{\mathrm{d}x}+\frac{v}{\rho}\left(\frac{\partial\rho}{\partial T}\right)_T\frac{\mathrm{d}p}{\mathrm{d}x}+\frac{\mathrm{d}v}{\mathrm{d}x}=0, \tag{1}$$

$$\frac{1}{\rho}\frac{\mathrm{d}P}{\mathrm{d}x}+v\frac{\mathrm{d}v}{\mathrm{d}x}=-\frac{\lambda}{D}\frac{v^2}{2}-g\sin\theta, \tag{2}$$

$$\left(\frac{\partial h}{\partial T}\right)_P\frac{\mathrm{d}T}{\mathrm{d}x}+\left(\frac{\partial h}{\partial P}\right)_T\frac{\mathrm{d}P}{\mathrm{d}x}+\frac{\mathrm{d}v}{\mathrm{d}x}=-\frac{4K\left(T-T_0\right)}{\rho vD}-g\sin\theta, \tag{3}$$

where ρ is the density of the gas, v is the flow rate of the gas, T is the temperature of the gas, h is the enthalpy of the gas, λ is the friction coefficient of the pipe, D is the inner diameter of the pipe, T0 is the soil temperature at the depth of the pipe, K is the total heat transfer coefficient of the pipe, and θ is the pipe, the inclination angle with the horizontal plane, g is the acceleration of gravity, and x is the tube length coordinate. Selecting the pressure regulating valve is based on the required pressure regulating valve's flow capacity. The pressure regulating valve flow capacity formula is formulas (4) and (5):

$$C=\frac{Q_g}{580\varepsilon\sqrt{\Delta\mathrm{p}\cdot p_1/\rho_g T}},\ L<0.55, \tag{4}$$

$$C=\frac{Q_g}{322p_1\sqrt{1/\rho_g T}},\ L\geq 0.55. \tag{5}$$

In formulas (4) and (5), the flow capacity coefficient of the C pressure regulating valve in formula (5), Q_g is the gas flow rate, where:

$$L=\frac{p1-p2}{p1}. \tag{6}$$

In (6), the gas pressure before the valve p1 and the gas pressure after the valve P2. Solve the model using known equations. Simplify the formula first, the simplified formula is as formulas (7)–(9),

$$a_{11}=\frac{v}{\rho}\left(\frac{\partial\rho}{\partial T}\right)_P, a_{12}=\frac{v}{\rho}\left(\frac{\partial\rho}{\partial T}\right)_T, a_{13}=1, b_1=0, \tag{7}$$

$$a_{21}=0, a_{22}=\frac{1}{\rho}, a_{23}=v, b_2=-\frac{\lambda}{D}\frac{v^2}{2}-g\sin\theta, \tag{8}$$

$$\begin{aligned}&a_{31}=\left(\frac{\partial h}{\partial T}\right)_P, a_{32}=\left(\frac{\partial h}{\partial P}\right)_T, a_{32}=1,\\&b_3=-\frac{4K\left(T-T_0\right)}{\rho vD}-g\sin\theta.\end{aligned} \tag{9}$$

From the simplified formula, the formulas (1)–(3) can be expressed as formulas (10)–(12):

$$a_{11}\frac{\mathrm{d}T}{\mathrm{d}x}+a_{12}\frac{\mathrm{d}p}{\mathrm{d}x}+a_{13}\frac{\mathrm{d}v}{\mathrm{d}x}=b_1, \tag{10}$$

$$a_{21}\frac{\mathrm{d}T}{\mathrm{d}x}+a_{22}\frac{\mathrm{d}p}{\mathrm{d}x}+a_{23}\frac{\mathrm{d}v}{\mathrm{d}x}=b_2, \tag{11}$$

$$a_{31}\frac{\mathrm{d}T}{\mathrm{d}x}+a_{32}\frac{\mathrm{d}p}{\mathrm{d}x}+a_{33}\frac{\mathrm{d}v}{\mathrm{d}x}=b_3. \tag{12}$$

Or expressed in ordinary differential equations as formulas (13)–(15):

$$\frac{\mathrm{d}T}{\mathrm{d}x}=f_T(x,T,P,v), \tag{13}$$

$$\frac{\mathrm{d}P}{\mathrm{d}x}=f_P(x,T,P,v), \tag{14}$$

$$\frac{dv}{dx} = f_v(x, T, P, v). \quad (15)$$

If $y1$, $y2$, and $y3$ are used to represent T, P, and v, then formulas (13)–(15) can be abbreviated as formula:

$$\frac{dy}{dx} = f(x, y). \quad (16)$$

In order to calculate the pressure, flow rate, and temperature in the pipeline according to (16), the pipeline grid is first drawn, and then the gas flow parameters on the grid points are calculated from the beginning to the end of the pipeline. The calculation method adopts Adam's prediction-correction calculation formula:

The prediction formula is formulas (17) and (18):

$$\overline{y}_{n+1} = y_n + \frac{h}{24}\left(55f_n - 59f_{n-1} + 37f_{n-2} - 9f_{n-3}\right), \quad (17)$$

$$\overline{f}_{n+1} = f\left(x_{n+1}, \overline{y}_{n+1}\right). \quad (18)$$

The correction formula is formulas (19) and (20):

$$y_{n+1} = y_n + \frac{h}{24}\left(9\overline{f}_{n+1} + 19f_n - 5f_{n-1} + f_{n-2}\right), \quad (19)$$

$$f_{n+1} = f\left(x_{n+1}, y_{n+1}\right). \quad (20)$$

This completes the description of the mathematical simulation of oil and gas pipelines.

4. System Effect Analysis

4.1. Oil and Gas Storage and Transportation Production Effect Inspection. First, calculate the distance of oil and gas transportation. We randomly selected two oil and gas stations on the GIS system and let the system simulate pipeline construction. In order to test the effect of the system, we selected 10 groups of oil and gas stations with a straight line distance of 50 km on the map, and 10 groups of oil and gas stations with a straight line distance of 100 km on the map. Select 10 groups of oil and gas stations with a straight line distance of 200 km on the map, and select 10 groups of oil and gas stations with a straight line distance of 400 km on the map to test the algorithm respectively. The selected distance is divided by referring to the distance between most oil and gas stations on the map. The test results are shown in Table 1:

It can be found from Figure 7 that in the simulation of different distances, the system has the effect of reducing the laying path and optimizing the path. In the short-distance pipeline laying of 50 km, the simulation effect of 9 out of 10 times is better. The effect reached 90%; in the 100 km pipeline laying, the optimization effect reached 100%, and the results of 10 simulations were shorter than the original laying path. In the pipeline laying of 200 km, the optimization effect is 60%, six simulation results are shorter than the original path, two simulation results are equivalent to the original path, and two simulation results are longer than the original algorithm. In the 400 km pipeline laying simulation, the optimization effect was also 90%, and once again it was similar to the original path. Therefore, the system has a relatively good effect on path optimization, but the effect is not particularly good in the simulation of 200 km mid-distance pipeline transportation.

Friction analysis is drag reduction analysis. For oil pipelines, too much resistance will result in a great decrease in oil delivery. There are also many studies on friction analysis-related literature. Generally, it is believed that the relationship between oil delivery and resistance is shown in the figure:

In Figure 8, H represents the resistance and Q represents the maximum oil delivery. It can be found that when the pressure of the oil transfer pump is constant, the smaller the resistance, the greater the maximum oil transfer volume. Because the resistance is impossible to eliminate, at H1, the maximum oil delivery and the resistance value reach a balanced state. At this time, the resistance is also more difficult to drop, and the drop in resistance has a small impact on the oil delivery. Therefore, we hope that the simulated frictional resistance of the pipeline can be closer to H1. In actual operation, the resistance of oil pipelines is generally fixed, and we can reduce the resistance by drag reducer.

4.2. System Risk Assessment. As shown in Figure 9, in the risk assessment of the system, we need to focus on analyzing the security of the system network.

4.3. LoadRunner Test. Carry out a LoadRunner test on the system, and test the performance of the system under high intensity by simulating multiple users online at the same time through LoadRunner. The test results are as follows:

As shown in Figure 10, LoadRunner is used to simulate 50 people online at the same time, and the response time of each person in the system is recorded separately. It can be seen that the response time of 50 people is between 4 s and 5 s, which conforms to a stable time series. The response time of the system is considered to be relatively stable, the lowest response time is 4 s, the highest is 5 s, and the difference is 1 s. In the actual situation, the average user's stay time will not exceed 5 s. If it exceeds 5 s, most users will choose to leave. It can be found that the system in this article is in line with actual usage requirements. Then analyze the performance of the system.

In order to test the maximum performance of the system, LoadRunner is used to simulate the number of people online from 1 to 100 at the same time. Each simulation is performed 10 times and the average value is the response time of the number of people online at the same time. As shown in Figure 11, with the increase in the number of people, the response time is also at the right price, and the overall rise is stepped up. What can be found is that when the number of people at the same time reaches more than 80 people, the response time exceeds 5 s. At this time, the user experience is very bad. When the

Table 1: Comparison table of test results.

50 km		100 km		200 km		400 km	
Original path	Algorithm simulation path	Original path	Algorithm simulation path	Original path	Algorithm simulation path	Original path	Algorithm simulation path
80	65	151	126	263	260	476	434
81	60	142	128	262	221	488	447
79	60	136	110	246	258	461	463
84	59	157	136	268	250	490	444
74	70	140	138	254	253	485	447
62	65	158	123	240	221	491	432
89	55	146	118	242	255	479	447
79	65	154	119	249	223	499	441
68	56	155	130	255	254	475	447
82	55	156	132	267	232	482	442

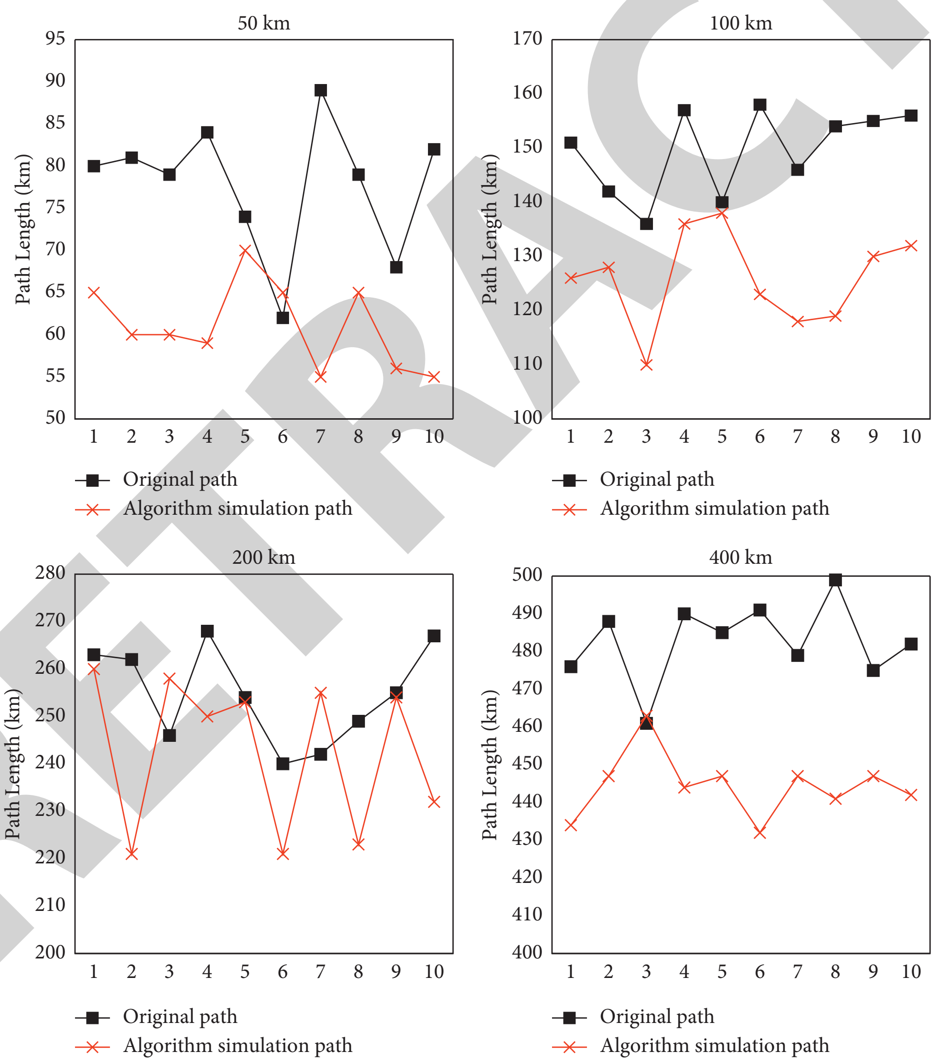

Figure 7: Simulation of different distance systems.

number of people online at the same time reaches 95 people, the response time soars to more than 9 s, and the user experience for the level card is now almost unusable. Therefore, the maximum number of simultaneous online users of the system is best controlled within 80 people, and the system is still acceptable when there are less than 95 people. The performance is stuck and the maximum number cannot exceed 95 people.

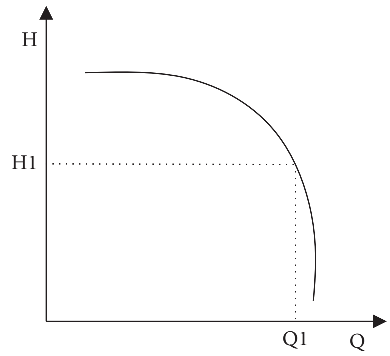

Figure 8: The relationship between resistance and maximum oil delivery.

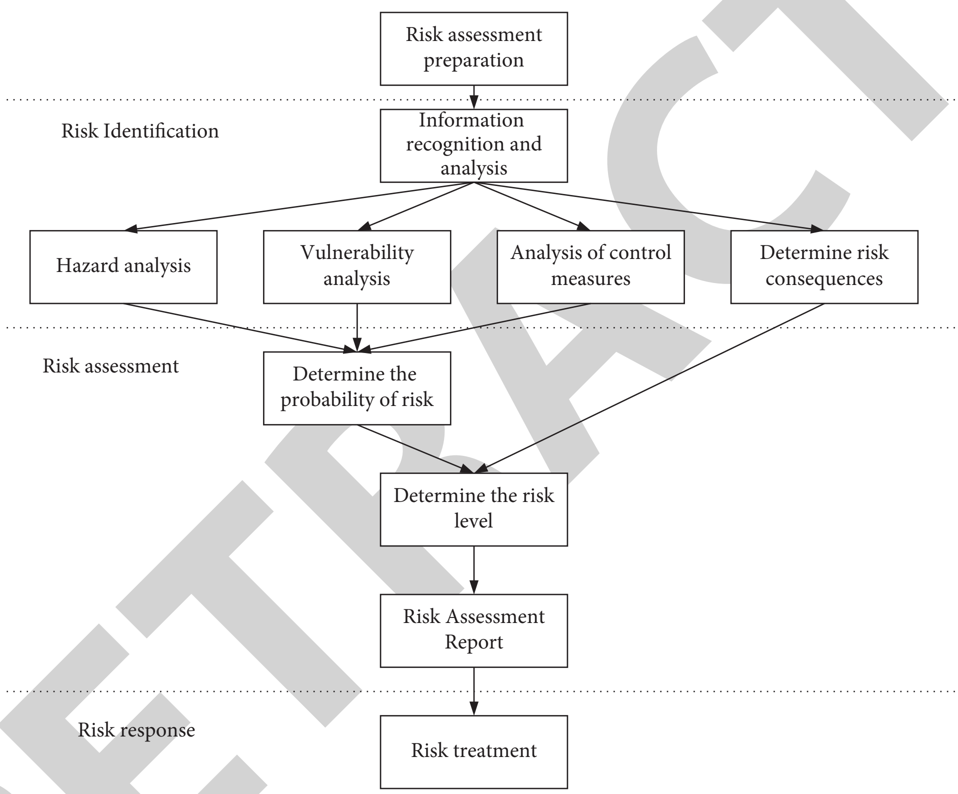

Figure 9: Risk assessment flowchart.

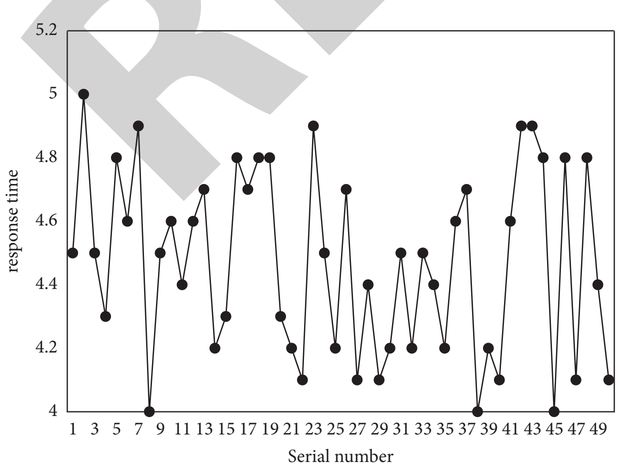

Figure 10: The response time of each person when 50 people are online at the same time.

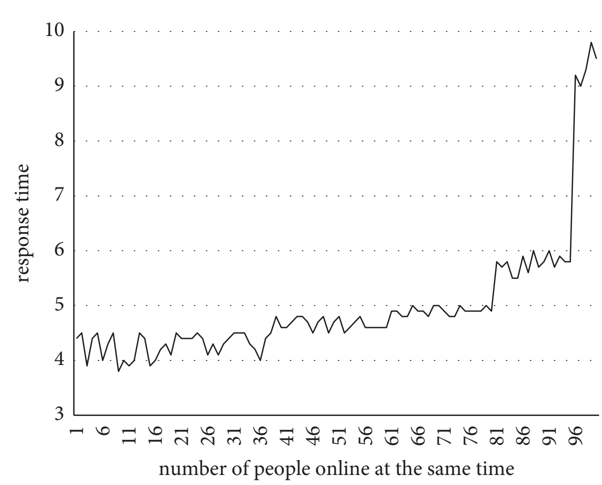

Figure 11: System performance analysis.

5. Conclusions

The 21st century is an era of the knowledge economy and information society. The development of oil and gas storage and transportation also requires the wings of information. Information sharing, multidisciplinary integration, intelligent production, and real-time collaborative research across time and space will be the future. This study studies the oil and gas storage and transportation production information management system, especially for the simulation of oil and gas pipelines, and conducts a detailed analysis. And the results have also achieved satisfactory results. Many aspects are analyzed in the article to analyze the reliability of the system. However, there are some shortcomings in the text. It is hoped that in-depth research can be continued in the follow-up research.

Data Availability

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

Conflicts of Interest

The authors declare that they have no conflicts of interest.

References

[1] Y. Al-Rojaie, "Mapping perceptions of linguistic variation in Qassim, Saudi Arabia, using GIS technology," *Journal of Linguistic Geography*, vol. 8, no. 1, pp. 9–30, 2020.

[2] Y. Xia, Y. Wang, and S. Du, "Integration of D-lnSAR and GIS technology for identifying illegal underground mining in Yangquan District, Shanxi Province, China," *Environmental Geology*, vol. 77, no. 8, pp. 319.1–319.19, 2018.

[3] I. R. Orimoloye and O. O. Ololade, "Spatial evaluation of land-use dynamics in gold mining area using remote sensing and GIS technology," *International journal of Environmental Science and Technology*, vol. 17, no. 11, pp. 4465–4480, 2020.

[4] P. L. Liu, X. Zhao, and B. Wan, "COVID-19 information exposure and vaccine hesitancy: the influence of trust in government and vaccine confidence," *Psychology Health & Medicine*, vol. 14, no. 6, pp. 1–10, 2021.

[5] Y. Guo, Z. Zhang, and S. Zhang, "Advances in the application of biomimetic surface engineering in the oil and gas industry," *Friction*, vol. 7, no. 4, pp. 289–306, 2019.

[6] H. Patel, D. Prajapati, D. Mahida, and M. Shah, "Transforming petroleum downstream sector through big data: a holistic review," *Journal of Petroleum Exploration and Production Technology*, vol. 10, no. 6, pp. 2601–2611, 2020.

[7] Hu and H. A. O. Yongle, "Technologies and practice of CO_2 flooding and sequestration in China," *Petroleum Exploration and Development*, vol. 46, no. 4, pp. 104–117, 2019.

[8] L. Uden and W. He, "How the Internet of Things can help knowledge management: a case study from the automotive domain," *Journal of Knowledge Management*, vol. 21, no. 1, pp. 57–70, 2017.

[9] Z. Chen and X. Wu, "Research on regional energy efficiency based on GIS technology and image quality processing," *Journal of Visual Communication and Image Representation*, vol. 62, pp. 410–417, 2019.

[10] Z. Shi and K. Lv, "Retracted article: green highway evaluation based on Big Data GIS and BIM technology," *Arabian Journal of Geosciences*, vol. 14, no. 11, pp. 1022–1115, 2021.

[11] Q. Wang, "Research on the function orientation of xiongan-shangqiu railway with GIS technology," *Journal of Railway Engineering Society*, vol. 35, no. 10, pp. 6–10, 2018.

[12] L. Liu, H. Rui, and L. Yang, "Definition of the weihe single-thrusting compressional basin and its reservoir-forming conditions," *Northwestern Geology*, vol. 51, no. 2, pp. 186–202, 2018.

[13] N. Q. Wu, Z. W. Li, and T. Qu, "Energy efficiency optimization in scheduling crude oil operations of refinery based on linear programming," *Journal of Cleaner Production*, vol. 166, no. 10, pp. 49–57, 2017.

[14] D. Boyd, "Compression innovations help accommodate country's growing output," *The American Oil & Gas Reporter*, vol. 62, no. 5, pp. 54–61, 2019.

[15] S. H. Khan, A. Kumari, G. Dixit, C. B. Majumder, and A. Arora, "Thermodynamic modeling and correlations of CH4, C2H6, CO2, H2S, and N2 hydrates with cage occupancies," *Journal of Petroleum Exploration and Production Technology*, vol. 10, no. 8, pp. 3689–3709, 2020.

[16] C. Sun, Y. Li, H. Han, J. Zhu, S. Wang, and L. Liu, "Experimental and numerical simulation study on the offshore adaptability of spiral wound heat exchanger in LNG-FPSO DMR natural gas liquefaction process," *Energy*, vol. 189, no. 1, pp. 116178–116178.30, 2019.

[17] U. Lindqvist and P. G. Neumann, "The future of the Internet of Things," *Communications of the ACM*, vol. 60, no. 2, pp. 26–30, 2017.

[18] Z. Liu, K. K. R. Choo, and J. Grossschadl, "Securing edge devices in the post-quantum Internet of Things using lattice-based cryptography," *IEEE Communications Magazine*, vol. 56, no. 2, pp. 158–162, 2018.

[19] S. S. Reka and T. Dragicevic, "Future effectual role of energy delivery: a comprehensive review of Internet of Things and smart grid," *Renewable and Sustainable Energy Reviews*, vol. 91, pp. 90–108, 2018.

[20] M. A. Salahuddin, A. Al-Fuqaha, M. Guizani, K. Shuaib, and F. Sallabi, "Softwarization of Internet of Things infrastructure for secure and smart healthcare," *Computer*, vol. 50, no. 7, pp. 74–79, 2017.

[21] T. Kumrai, K. Ota, M. Dong, J. Kishigami, and D. K. Sung, "Multiobjective optimization in cloud brokering systems for connected Internet of Things," *IEEE Internet of Things Journal*, vol. 4, no. 2, pp. 404–413, 2017.

[22] Z. Cui, Y. Cao, X. Cai, J. Cai, and J. Chen, "Optimal LEACH protocol with modified bat algorithm for big data sensing systems in Internet of Things," *Journal of Parallel and Distributed Computing*, vol. 132, pp. 217–229, 2019.

[23] H. Liang, H. Chen, J. Zuo, and X. Zuo, "Detection and identification method of drilling total hydrocarbon gas based on infrared spectroscopy and KL+BP-rbf algorithm," *IEEE Transactions on Instrumentation and Measurement*, vol. 71, pp. 1–10, Article ID 2504510, 2022.