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Improvement of Monitoring Technology for Corrosive Pollution of Marine Environment under Cloud Computing Platform

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Abstract: In view of the increasingly serious problem of marine ecological environmental pollution, the traditional marine environmental corrosive pollution monitoring technology has poor monitoring accuracy and poor monitoring timeliness, and the improvement of the marine environmental corrosive pollution monitoring technology under the cloud computing platform is proposed. The research significance and corrosion influence factors of steel corrosion in the marine environment are described, and the research progress of corrosion mechanism in five different zones of the marine environment is reviewed. Cloud computing parallelizes the processing of corrosive pollution data in the marine environment through virtualization and distributed technology, which greatly improves the efficiency of the algorithm. This paper studies the existing cloud computing platform and ocean monitoring system architecture, uses the distributed architecture to design a cloud computing-oriented ocean monitoring system and meets the design requirements in data collection and data processing. The experimental results show that the precision of marine environmental corrosion pollution monitoring technology proposed in this paper is 96% on average, and the completion rate of monitoring images is 82% on average, which can effectively realize marine environmental corrosion pollution monitoring.

Keywords: cloud computing; marine environment; corrosive pollution; environmental monitoring

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1. Introduction

The global marine environmental problems endanger the safety of marine ecosystems and human health. Online, real-time, sensitive, and safe implementation of marine environmental monitoring, providing a scientific basis for marine environmental planning, environmental management (especially pollutant total control, environmental law enforcement), environmental governance, etc., has become a major social demand and a key scientific issue. The ocean contains huge resource wealth and has extremely broad development prospects: the development and utilization of ocean resources cannot be separated from the construction of offshore infrastructure. Because the marine environment is very corrosive to the steel structure, it is easy to form corrosive water film on the steel surface due to the influence of the atmospheric environment with far higher relative humidity. Moreover, seawater contains a high concentration of salt, forming an electrolyte solution that is easy to conduct electricity, and has extremely high corrosiveness [1]. At the same time, waves, tides, and currents will produce low-frequency reciprocating stress and impact metal components. In addition, marine microorganisms, attached organisms, and their metabolites will directly or indirectly accelerate the corrosion process. Therefore, engineering materials such as steel structures widely used in many engineering fields are prone to various catastrophic corrosion damage. This not only involves the waste of materials but more serious is the cause of catastrophic accidents, causing oil and gas leakage, causing environmental pollution, casualties, etc., resulting in huge economic losses. As an industrial material, steel materials are widely used in marine environments due to their high toughness, high strength, and low price. However, the harsh marine corrosive environment makes the corrosion of steel structures inevitable. Therefore, steel corrosion and protection in the marine environment is a major issue as a research subject [2,3]. Therefore, monitoring technologies for corrosive pollution in the marine environment is of great significance for extending the service life of marine steel facilities, ensuring the normal operation and safe use of marine steel structures, and promoting the development of the marine economy.

The development of the ocean by mankind has put more and more pressure on the marine environment; at the same time, marine pollution sources are diversified, such as industrial chemical pollution, marine noise pollution, and biological pollution. The accuracy and timeliness of real-time monitoring of pollution sources is the key to the entire marine environmental protection system [4,5].

Wu and Liao (2019) propose a laser-induced fluorescence marine pollution detection method [6]. According to the law of ultraviolet radiation energy distribution given by Beer's law, a large number of laser-induced fluorescence detection of the influence of ultraviolet radiation on marine oil pollution are eliminated, and the wavelength is 360 nm. The laser raises the Raman scattering peak, reduces the overlap of Raman scattering and fluorescence, and reduces the detection error; Qin et al. established a hazardous chemical marine environment emergency monitoring information card, which includes classification, index number, and inclusion in the list, physical and chemical judgment of nature and behavior characteristics, health hazards and protection requirements, detection methods and evaluation standards, and four other types of information [7]. It is recommended to further screen the typical or high-risk chemicals involved in marine pollution accidents, refine the SEBC system, and strengthen rapid detection technology research.

The traditional marine environment monitoring system is based on single-center information processing. With more and more types of pollution sources monitored, the single-center processing structure has become increasingly unable to adapt to the timeliness requirements of modern monitoring systems [8–12]. With the development of network technology, data collection is moving towards large concurrency and broadband development. The later data transmission and processing capabilities need to match the front-end concurrency and rate requirements. The cloud computing platform is based on a new generation of computing and storage architecture. It uses virtualization technology and distributed technology to uniformly logically divide the hardware of different protocols in the network; at the software level, it uses MPI technology to parallelize multiple algorithms, and the divided logical subprograms are dispatched to each logical computing unit to realize the parallelization of the program. This paper proposes an improved technology for monitoring corrosive pollution in the marine environment under a cloud computing platform.

2. Corrosive Pollution of the Marine Environment

2.1. Influencing Factors of Steel Corrosion in Marine Environment

Seawater is not only constituted of salinity between 32% and 37%. Other important factors affecting corrosion are the pH value between 8 and 8.2, such as the sky value, the flow velocity, marine organisms, and other environmental elements [13–15]. They are also often interrelated.

(1) Dissolved oxygen: Oxygen is a depolarizer for the seawater corrosion of steel. If there is no dissolved oxygen in the seawater, steel will not corrode. Therefore, dissolved oxygen in seawater is one of the important factors affecting the corrosion of steel in the sea. It continuously reacts in the cathode area of the microbattery corroded by steel and produces strong cathode depolarization. The metal in the anode area of the microbattery continuously dissolves to form ferrous hydroxide, which causes the metal to be corroded. On the other hand, for those metals that rely on surface passivation film to improve corrosion resistance, such as stainless steel, the formation, and repair of the metal surface oxide film can inhibit the corrosion reaction to a certain extent.

(2) Salinity: A large number of neutral salts such as NaCI, KCI, and Na_2SO_4 are dissolved in seawater, of which NaCl accounts for 78%. The concentration of NaCl in seawater is generally about 3%. The corrosion rate is at its maximum near this concentration. When the salt concentration is low, the corrosion rate increases rapidly as the salt content increases. This is mainly due to the increase in cl-promoting the anode reaction. In addition, since the solubility of oxygen decreases with the increase of salt concentration, the corrosion rate decreases significantly when the salinity in the solution continues to increase.

(3) Temperature: The oxidation reaction of iron and steel occurs in seawater. Generally speaking, the reaction speed increases when the temperature rises. However, this mutual relationship is very complicated, and the corrosion rate does not increase proportionally with the increase in temperature. It is also related to other factors such as oxygen diffusion. The corrosion rate is dominated by oxygen diffusion. At a temperature of 1.2 L, the solubility of oxygen in the solution is reduced, which slows down the reaction process of the cathode. In a closed system, when the temperature rises, the oxygen in the solution does not decrease, and the corrosion rate increases linearly with the rise of the temperature; but in an open system, the oxygen content in the water gradually decreases as the temperature rises. When the water temperature is between 80 and 90 °C, the corrosion rate is significantly reduced. When the temperature reaches the boiling point of 100 °C, the corrosion rate drops to the lowest value.

(4) pH value: Generally speaking, the increase of the pH value of seawater is beneficial to inhibiting the corrosion of steel by seawater. However, the pH value of seawater has a small change, which will not have a significant impact on the corrosion of steel and seawater (far from it with a large oxygen content). Although the pH value of surface seawater is higher than that of deep seawater, surface seawater has higher oxygen content than deep seawater, so surface seawater is more corrosive to steel than deep seawater. The pH value of seawater mainly affects the deposition of calcareous scale, which affects the corrosiveness of seawater. Under the condition of the pH value of seawater, the carbonate in the seawater is generally saturated, so even if the pH value does not change much, it will affect the deposition of the calcium carbonate scale. As the pH value increases, calcium deposits are easily formed, and seawater is less corrosive. When applying cathodic protection, this deposited layer is beneficial to cathodic protection.

(5) Flow rate: The flow of liquid on the metal surface can promote the circulation of corrosion products in the solution, accelerate the diffusion of oxygen, and also remove the corrosion products attached to the metal surface, thereby promoting metal corrosion. However, this refers to steel that is difficult to form a passivation film on the surface. The steel that easily forms a passive film on the surface is different, such as stainless steel. Due to the flow of seawater, a passive film is easily formed on the surface, and the corrosion rate will decrease instead. In a nearly neutral aqueous solution, since the corrosion reaction of the metal is controlled by the reduction of oxygen, the higher the flow rate, the more severe the corrosion. No matter what the situation, a thin water film will always adhere to the metal surface. When the flow rate becomes larger, at this time, the thickness of the film will be reduced, making it easier to diffuse oxygen through the film to the metal surface.

(6) Marine life: The impact of marine life on steel corrosion is complex. Sometimes the attachment of some organisms can reduce the corrosion rate of steel, but soon it will accelerate the corrosion, produce pitting corrosion, or damage the coating. First of all, the surface of steel: the part covered by the organism becomes the anode because the supply of oxygen is controlled, and the part not covered by the organism becomes the cathode, which will cause local corrosion, or the inside and outside of the adhesion layer may produce oxygen concentration cell corrosion; secondly, due to biological life activities, the composition of the seawater on the surface of the steel is changed, which

changes the nature of the water and accelerates the corrosion of the steel. In addition, certain sea creatures can penetrate the protective layer when they grow, and directly destroy the protection. The adhesion of certain marine organisms to the protective layer is even greater than the adhesion of the protective layer to the metal. Therefore, under the action of mechanical loads such as seawater impact, the marine organisms peel off with the protective layer, causing the protective layer to be damaged, and the corrosion of steel is changed.

2.2. Corrosion Mechanism of Steel in Various Corrosion Zones in the Marine Environment

From the perspective of corrosion, the marine environment is generally divided into five corrosive zones: the ocean atmosphere zone, wave splash zone, tidal range zone, sea umbrella flood zone, and the submarine soil zone. There are three corrosion peaks in the marine corrosion environment. One peak is located in the spray splash area at the average high tide level. It is the most severe area of steel corrosion and the most severe marine corrosion environment. The second peak usually occurs 0.5–1.0 m below the average low tide line. The third peak occurs below the junction with sea and mud [16,17].

(1) Corrosion of steel in the marine atmosphere: the marine atmosphere refers to the atmosphere above the splash zone and the coastal atmosphere. For steel structures in the ocean, it refers to the parts that are not in contact with seawater all year round. The ocean atmosphere has high humidity, and water vapor easily adheres to the surface of the steel to form a water film invisible to the naked eye. The standard electrode potential of the main element of steel and the trace element carbon is different. They form when they are in the electrolyte solution (water film) at the same time. In galvanic cells, iron is oxidized as an anode and loses electrons, turning into rust. This is basically the same as the corrosion in the inland atmosphere. However, due to the high relative humidity of the ocean atmosphere, the thick water film, the high salt content, and the strong electrolytic capacity of the water film, the corrosion of steel is accelerated. At the same time, the steel in the ocean atmosphere is exposed to sunlight during the day and the water evaporation increases the surface salinity. With the formation of a wet surface, this dry-wet cycle makes the corrosion rate greatly accelerated;

(2) Corrosion of steel in the splash zone: the splash zone refers to the marine environment. Seawater can splash on the surface of the structure, which is the part of the section that cannot be submerged by the seawater when the seawater is at high tide. For many metal materials, the splash zone is the most corroded part of all marine environments. Foreign scholars believe that the reason the splash zone has become the most severely corroded part of all marine environments, is due to sea water splashingasit is difficult to form a protective rust layer on the surface of steel with a short drying time; and compared with the marine atmosphere, its sunlight exposure is the same. This is due to the movement and evaporation of seawater so that the accumulation of sea salt particles within a certain range of the average high tide level is far greater than the accumulation in the ocean atmosphere. In general, the large number of salt particles, the long water film retention time, and the high frequency of dry and wet alternates are external factors that cause severe corrosion of steel in the splash zone. The internal factor is that the steel in the splash zone is corroded due to surface rust during the corrosion process.

(3) The corrosion of steel in the tidal range refers to the area between the average high tide level and the average low tide level of seawater. There are two main types of steel corrosion in the tidal range. One is the corrosion of steel components that are isolated in the tidal range, for example, the corrosion of the sewage gate in the tidal range; the other is the steel pile type. The corrosion + experiment proved that the corrosion rate of the respective tufted pieces in the tidal range is much greater than that of the long-length coupons. Through the corrosion current measurement experiment, the main reason for the above phenomenon is that the macroscopic battery is formed between the underwater part and the tidal range of the long-length coupon. The tidal

range is the cathode area where oxygen is fully supplied to form the macro battery, and the underwater part becomes the anode area of the macro battery. The anode area provides protection current to the cathode area to reduce corrosion in the tidal range. It should be pointed out that although the specimens in the tidal range are protected to a certain extent, they still corrode. Although all the specimens in the tidal range get the protection current of the specimens in the seawater full immersion zone, the upper part of the specimens has a short immersion time in the seawater, and the time to obtain the current is short, plus the time in the air. Longer immersion timemeans the free corrosion time is also longer; while the corrosion of the lower part of the specimen is just the opposite. Therefore, the corrosion rate of the upper part of the specimen in the tidal range is greater than that of the lower part of the specimen.

(4) Corrosion of steel in the seawater full immersion zone: the seawater full immersion zone refers to the area below the low tide level all year-round to the seabed. According to different sea depths, it is divided into shallow water area (within 20 m–30 m below the low tide level), continental shelf full immersion area (in the water depth area of 30 m to 200 m), and the deep sea area (>200 m water depth area): the three areas affect the corrosion of steel structures. The elements of this water are different due to the water depth. In the shallow sea area, the seawater velocity is relatively high, and there is offshore chemical and sediment pollution. Steel corrosion is mainly electrochemical, and the physical and chemical corrosion is supplemented. The corrosion in this water area is lighter than that in the shallow sea area; the pressure increases with the depth of the water, the dissolved mineral salt decreases, the water flow, and the temperature aeration are low, and the steel corrosion is mainly electrochemical corrosion and stress corrosion, and chemical corrosion is the second. Therefore, generally speaking, due to the high content of oxygen in seawater and the almost neutral pH, the corrosion mechanism of metals in seawater is mainly controlled by the cathodic reaction produced by the reduction of oxygen.

(5) Corrosion of iron and steel in the submarine soil zone. The sea cement soil zone refers to the part below the seawater flooding zone, which is mainly composed of seabed sediments. The physical, chemical, and biological properties of seabed sediments vary with the sea area and sea depth. Compared with terrestrial soil, the submarine mud area has high salt content and low resistivity. The submarine mud is a good electrolyte and corrodes steel more strongly than in terrestrial soil. In addition, the bottom soil area usually contains bacteria, mainly anaerobic sulfate-reducing bacteria, which can grow and multiply under anoxic environmental conditions. The static pressure of seawater will increase the activity of bacteria.

2.3. Intelligent Image Monitoring Technology for Corrosive Pollution in the Marine Environment

Relying on the integrated data collection of intelligent digital remote sensing technology and water quality sensor monitoring technology, the pollution information is fully extracted. Because of the huge amount of extracted data, a comparative analysis is difficult. To solve the above problems, we optimize the big data comparative analysis method to process the collected data. First, redefine the type of data source to be collected. By extracting image information and data sources, and comparing big data with standard pollution images and pollution parameters, comprehensive monitoring results can be obtained. A water quality sensor is one of the important methods of marine environmental pollution monitoring technology. In this paper, the dissolved oxygen, salinity, temperature, and pH value of seawater are monitored by a water quality sensor.

The introduction of intelligent digital remote sensing technology is to rely on remote sensing satellites to build intelligent data modules to monitor marine environmental pollution and obtain available information through screening and analysis of multi-layer databases. Intelligent digital remote sensing technology structure includes image layer, ocean information display layer, and ocean analysis display layer. The function of the image layer is to use remote sensing satellites to remotely sense the marine environment, to simply process and package the captured pictures, and to send them to the marine information processing interface through wireless transmission [18–20]. The marine information processing layer digitally displays the monitored information in the image layer and processes it by relying on the marine object database and the marine environment physical field analysis database. The data is passed to the analysis display layer for data analysis. The analysis display layer accepts the data information of the ocean information display layer and uses the data link mode, image data module, and data mining technology to perform image processing. The intelligent data remote sensing database structure process is shown in Figure 1. The main function of the marine satellite image database is to process and segment satellite images, identify objects, construct multi-dimensional image organization, and calculate the physical distance between images. The main function of the marine object database is to analyze the manifolds of the marine environment physical field, the embedded dimensions of the marine physical field manifolds, the low-micro distribution analysis, and the feature extraction of marine objects [21].

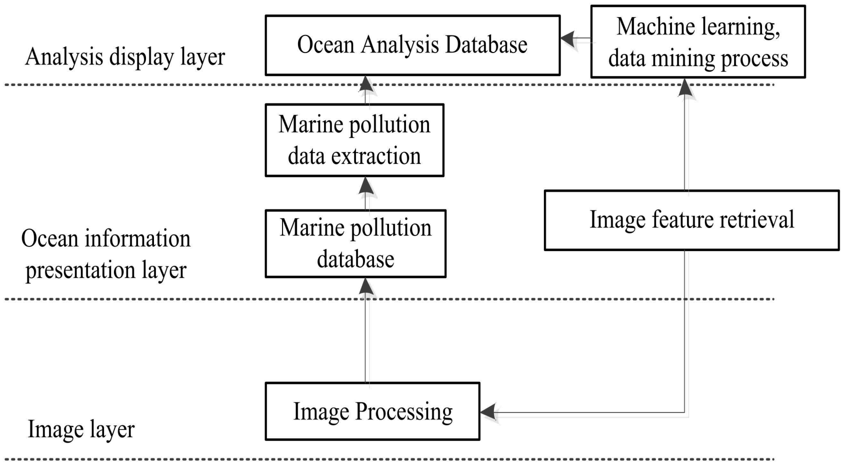

Figure 1. Intelligent remote sensing monitoring structure of corrosive pollution information in marine environment.

3. Improvement of Monitoring Technology for Corrosive Pollution in the Marine Environment Based on Cloud Computing Platform

On the basis of the above-mentioned intelligent image monitoring technology of marine environmental pollution and corrosive information, a cloud computing platform is introduced. The proposed ocean environment system for the cloud computing platform provides a brand-new architecture process in sample collection, data synchronization, and data transmission processing. The extraction and distribution of corrosive pollution in the ocean environment are carried out by using the phase space distributed reconstruction method. For reconstruction, extract the corrosive pollution characteristics of the ocean environment of the cloud computing center, and realize the synchronous monitoring of data.

3.1. Functional Modules of the Marine Environment Corrosive Pollution Monitoring System

The function of the ocean monitoring system of the cloud computing platform is divided into two parts: the system client and the mobile terminal [22]. The entire ocean monitoring system is divided into the following four types of functions according to functions:

(1) System management. Including system management and task management, it can realize the addition and deletion of the overall system functions.
(2) Data recruitment and processing. Including data collection, recruitment, classification, and processing, it is the core of the entire system.
(3) Data encoding and encryption. Since the marine environmental monitoring systems of various countries may contain secret level information, the collected data needs to be encrypted and the data must be encoded at the same time.

(4) Data synchronization function. Keep the data of the monitoring system synchronized with the data of the marine ship information center and storage server.

3.2. Design of a Monitoring System for Corrosive Pollution in the Marine Environment Based on a Cloud Computing Platform

3.2.1. System Total Module

The client of the entire system is mainly divided into five functions: environmental monitoring sample data collection, function parameter configuration, data synchronization, various tool integration, and environmental monitoring task configuration [23–25]. Among them, environmental monitoring sample data collection is classified according to various types of monitoring information, including marine water quality data collection, marine mineral data collection, marine microbial organism data collection, and marine meteorological data collection. Each data collection package sets different types of keys. It also performs synchronous interaction in the data center to complete the issuance of collection commands and the upload of collected data [26].

Function parameter configuration and task configuration are the basic configurations of the ship before going to sea, including the general task of going to sea; tool integration includes all kinds of tools that the ship needs to carry for environmental monitoring tasks (see Figure 2).

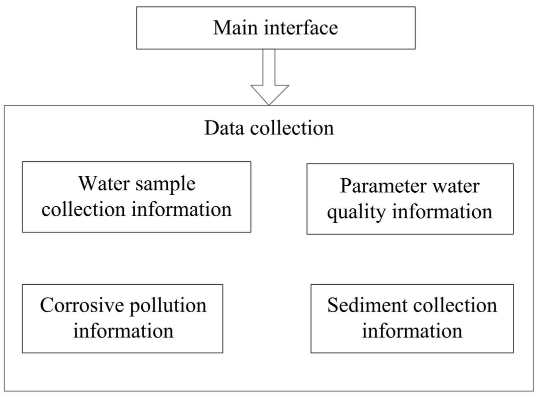

Figure 2. Functional module diagram of the marine environment corrosive pollution monitoring system.

3.2.2. Jump to Each Activity Task on the Mobile Terminal

The start and jump of each task between the mobile terminal are realized through Intent. Its essence is to bind the port of different task processes. It can bind the same port of multiple processes at the same time, and send the opening and closing of the task component through the Intent and the mobile terminal. The client activity program is based on data collection, coefficient parameter setting, data collection handover, tool integration, environmental monitoring task initialization, and client main program. The designed components include: MainAxtivity, SampleActivity, SetActivity, HandoverActivity, SynchroActivity, ToolActivity, TaskActivity, UserActivity, InputActivity, TsiActivity. Process switching between tasks through Intent.

After the mobile client is opened, it first executes the MainAxtivity task, and at the same time sends task instructions to MainAxtivity, which can directly jump to any other components. This kind of jump does not involve data interaction, which is called a single jump. The mobile client program contains multiple UIs, and each UI (User Interface) corresponds to an Activity. The switching of these Activity activities is also switched through the Intent process. The intent process carries the jump message, which contains the following content:

(1) Action: Used to identify the specific jump type, such as the jump initiate Action_Call, data synchronization Action_Sync.
(2) Category: Activity behavior type of this UI, formulate specific Intent type.

(3) Data: The data to be transmitted.
(4) Component: Various components are included in the action behavior. The Intent process parses the jump behavior, all data is packaged in the Manifest.xml file, and all actions are registered during initialization. The Intent then parses out the type of Action and makes a response jump, while data transmission is performed.

3.2.3. Data Synchronization

The phase-space distributed reconstruction method is used to construct the cloud computing center sample sequence distribution structure model, and the fuzzy information fusion method is used to extract and distribute the corrosive pollution of the marine environment, and extract the characteristic value of the corrosive pollution of the marine environment of the cloud computing center:

$$j \in N_i(k), N_i(k) = \{\|x_j(k)\| < r_d(k)\} \tag{1}$$

In the formula, $N_i(k)$ is the sample sequence distribution, $x_j(k)$ is the output limit deviation rate, $r_d(k)$ is the cumulative distribution function of the standard normal distribution.

The matched filter detection method is used to obtain the statistical distribution matrix C_2 of corrosive pollution in the marine environment of the cloud computing center, and its element $C_2(m,n)$ is:

$$C_2(m,n) = cum\{x_m^*(t+1), x_{m+1}(t), x_{n+1}^*(t), x_n(t)\} \tag{2}$$

In the formula, m,n is the corrosive pollution surface distribution and depth distribution, $x(t)$ is the corrosion area, $*$ is the conjugate function.

Using the method of information fusion filtering analysis, the marine environment corrosive pollution information fusion is carried out [27], and the following matrix is constructed to represent the characteristic quantity of the corrosive pollution in the marine environment of the cloud computing center:

$$C = \begin{bmatrix} C_1 & C_2 & C_5 & C_4 \\ C_2^H & C_1 & C_6 & C_7 \\ C_5^H & C_6^H & C_1 & C_3^H \\ C_4^H & C_7^H & C_3 & C_1 \end{bmatrix} = \overline{A} C_{4s} \overline{A}^H \tag{3}$$

In the formula $\overline{A} = \left[A^H, (A\Lambda)^H, (A\Omega)^H, (A\Phi)^H\right]^H$, it represents the characteristic quantity of the similarity of the corrosive pollution of the marine environment of the cloud computing center.C_i is the various corrosion parameters, H is the weight, Λ, Ω, Φ is the similarity.

Calculate the maximum utility merging set, establish a fitness function for adaptive optimization of marine environment corrosive pollution monitoring, in the frequent item [28], obtain the fusion function of the cloud computing center for marine environment corrosive pollution detection:

$$\begin{cases} a(H_{ac}) = 1 - \frac{H_{ac}}{\max(H_{ac})+l} \\ \max(H_{ac}) = \log_2 k \end{cases} \tag{4}$$

In the formula, H_{ac} is the fuzzy attribute value of similarity, l is the minimum utility threshold, k is the adaptive degree.

The adaptive optimization algorithm is used to perform multi-dimensional search and fuzzy clustering of corrosive pollution in the marine environment of the cloud computing center, and improve the detection capability of corrosive pollution in the marine environment.

In this paper, the client data synchronization based on the cloud platform is implemented based on a message-driven mechanism. The design concept is as follows:

(1) Message: The specific message object has a unique ID and is managed by Message Queue.

(2) Message Queue: Message queue, which receives the message sent by the Handler and saves it; at the same time, the Looper polls, and if it is not processed, the Handler is notified to process it, otherwise it is deleted.
(3) Handler: The process of sending and receiving messages.
(4) Looper: The polling process of messages. In the marine environment, each activity data needs to be synchronized with the central server. This article uses a WIFI network for data transmission. First, turn on the WIFI, and the client process sends a 0 × 0000 confirmation command to the server to confirm whether the server program is ready; if it is ready, the client process subpackages the collected data process and performs MD5 verification. The subpackage package needs to include the synchronization number.

4. Experimental Analysis

4.1. The Purpose of the Experiment

To test the monitoring effect of the marine environment corrosive pollution monitoring technology under the cloud computing platform of this paper, the methods of Wu and Liao and Qin et al. are used as experimental comparison methods to compare the monitoring effects of the marine environment corrosive pollution and analyze the experimental results [6,7].

4.2. Experimental Parameters

In a fixed sea area, a 1000 km^2 monitoring area is selected, and different simulated pollution sources are monitored simultaneously through traditional ocean monitoring technology and intelligent image monitoring technology. After recording the monitoring results, change to another fixed sea area, select a different flow velocity and different contrast environment, and then conduct different simulated pollution source monitoring tests, and record the monitoring results. Collect seawater pH, seawater dissolved oxygen, seawater conductivity, seawater temperature, salinity, pH value, flow rate, and marine organism types, observe the degree of corrosion pollution of steel at regular intervals, and form a data set.

4.3. Experimental Results and Analysis

The detection and identification degree calculation is performed on the monitoring results, and the identification degree-simulated pollution source area curve is shown in Figure 3.

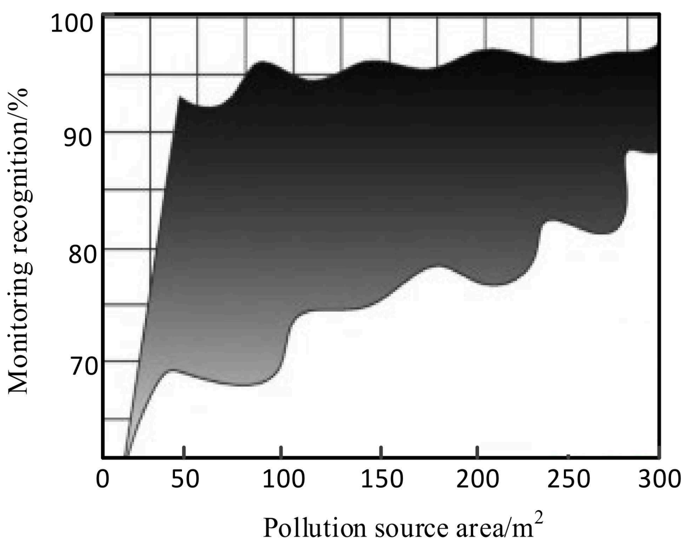

Figure 3. Identification degree-simulated pollution source area curve.

From the identification degree-monitoring range curve, it can be concluded that the traditional marine pollution monitoring system is not suitable for monitoring small pollution sources. When the monitored pollution source is less than 300 m^2, its identification degree is less than 85%, and when the monitored pollution source is less than 200 m^2, its identification degree is low at 80%, and the degree of identification is largely limited by the size of the monitored pollution source. In intelligent image monitoring technology, when the monitoring pollution source is equal to 75 m^2, its recognition degree is higher than 90%. As the area of the pollution source increases, the monitoring recognition rate remains balanced.

According to the above-mentioned monitoring model for experimental comparison, the monitoring effect of the marine environment corrosive pollution monitoring technology under the cloud computing platform of this paper is compared with the monitoring effect of the methods of Wu and Liao and Qin et al., and the obtained monitoring accuracy comparison chart and as shown in Figure 4 [6,7]:

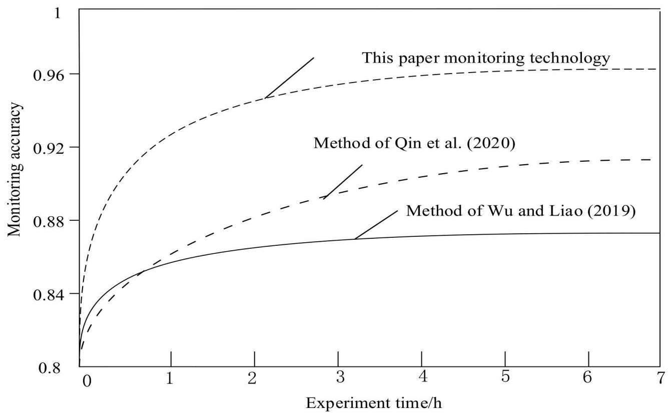

Figure 4. Comparison of monitoring accuracy.

Comparing Figure 4, it can be seen that under the same parameter conditions, the monitoring accuracy of the method of Wu and Liao is 86% on average, and the monitoring accuracy of the method of Qin et al. is 90% on average [6,7]. However, the marine environment under the cloud computing platform in this paper is corrosive. The monitoring accuracy of pollution monitoring technology is relatively high, at about 96% on average. The main reason for this difference is that this article collects data on corrosive pollution in the marine environment, strengthens the control of the data, and at the same time facilitates the development of monitoring experiments under the same conditions, and so, can better obtain effective data. The interference of factors reduces the influence of unfavorable factors, and finally obtains a more complete monitoring image, which is convenient for the research of monitoring objects, enhances experimental concentration, reduces monitoring errors, further improves the monitoring performance of the monitoring system, and finally obtains a higher monitoring accuracy rate. However, traditional methods deal with this aspect poorly, the initial data processing is imperfect, and the monitoring accuracy rate is low.

Comparing Figure 5, it can be seen that when the number of monitoring samples is 100, the complete rate of monitoring image collection of the method of Wu and Liao is 20%, and the complete rate of monitoring image collection in the method of Qin et al. is 30%. The image collection integrity rate is 60% [6,7]. When the number of monitoring samples is 200, the monitoring image collection integrity rate of the method of Wu and Liao is 25%, and the monitoring image collection integrity rate of the method of Qin et al. is 38% [6,7]. The monitoring image collection integrity rate of the monitoring technology in this paper is 68%, and the average monitoring image collection integrity rate of the monitoring technology in this paper is 82%. Because this paper performs secondary processing on the corrosive pollution data collected in the marine environment, cloud computing is used to strengthen the processing and analysis of the data. In this way, we can further realize the large-scale processing of data, increase the processing rate, strengthen the completeness of the monitoring image reproduction operation, complete the high-level processing of the data, enhance the clarity of the image, increase the intake of useful image data, and improve the image collection degree of completeness.

Figure 5. Comparison of complete rate of monitoring image collection.

5. Conclusions

The improvement of the marine environment corrosive pollution monitoring technology proposed in this paper under the cloud computing platform analyzes the corrosion influencing factors and corrosion mechanism of steel in the marine environment. The cloud computing platform of the marine environment monitoring system realizes online real-time monitoring, real-time transmission of marine environmental corrosive pollution data, and provides comprehensive, safe, and reliable monitoring data for marine environmental planning, environmental management, and total pollutant control. The system can meet the development requirements of marine environment monitoring systems such as security, wireless, intelligence, miniaturization, integration, and networking. It is a breakthrough in marine environment monitoring system technology. However, it is alimitation of this study that a wider database is not used for testing, which will be improved in future work to improve the applicability of the method proposed in this paper.

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