Water Resources Information Management System Based on Agent Model

Fu Wang\textsuperscript{1,2,}\textsuperscript{*}
\textsuperscript{1}Mianyang Teacher’s College, Mianyang 621000, Sichuan, China
\textsuperscript{2}Chengdu University of Technology, Chengdu 610059, Sichuan, China

*Corresponding author e-mail: wangfu@cdut.edu.cn

Abstract. With the rapid development and wide application of computer technology and network technology, the Internet has become an important information infrastructure in modern society. However, the resource capacity used by the Internet is much smaller than the actual resource capacity. How to choose the right resources to serve the people has become a crucial issue. Huge data resources, heterogeneous distribution and unreasonable resource organization are important reasons for this phenomenon. When solving the problems of batch data, heterogeneous distribution, complex processing, and cumbersome use in a distributed heterogeneous network environment, the traditional methods of resource processing and resource aggregation services become more and more difficult. In recent years, how to redistribute and organize scattered resources in a dynamic and open environment, how to effectively gather different resources, realize resource sharing and full utilization, and provide users with reasonable and convenient resource collection services have become one of the main research points. This paper mainly uses the questionnaire survey method to study the water resources information management system based on the Agent model. First, it summarizes the characteristics of the Agent model and the problems existing in the water resource information management system based on the Agent model through the literature research method, and then uses the questionnaire survey method, investigate some evaluations and suggestions about the need to use the water resources system. The results of the survey show that in the evaluation of the use of the water resources information management system based on the Agent model, about 50% of people encounter the waiting time for the system. For long-term phenomena, about 30% of them are stuck. The recommendations for the use of water resources information management systems based on the Agent model are more concerned about the simple operation of the system, with about 54% of the choices, and about 36% of the people choosing when there is no lag.

Keywords: Agent Model, Information Management, Water Resources Management, Use Evaluation
1. Introduction
The water resources system involves multiple parts and hydrological elements, and the relationship between the elements has a certain regularity, and at the same time has obvious spatial randomness and time uncertainty [1-2]. The conversion between surface water, groundwater, soil and atmosphere in the system, and the exchange and feedback with external systems are quite complex; different administrative regions, units and individuals have complex goals and interests in development and use [3-4]. At present, water resources management is carried out by their own interest groups or administrative departments. Each group mainly represents the interests of the group, leading to the unreasonable development and utilization of water resources [5-6]. With the development of society, people are increasingly aware of the necessity of unified planning and unified management of water resources [7-8].

In the research of water resources information management system based on the Agent model, many scholars have studied it and achieved good results. For example, Li Y, based on the analysis of the status quo of water resources management, decentralization and decentralization of interests in my country, pointed out it is necessary for my country to establish integrated water resources management, and use factor theory to determine intelligent factors according to the characteristics and functions of each management department or entity, and propose a hierarchical MAS model for integrated water resources management [9]. According to the links between different entities, Xiang X puts all their information exchanges in a unified network environment. Each agent is regarded as a client, and each agent uses the information related to its own goals in the network and passes. The computer network is connected to level the reverse structure, and preliminary organizational research has been conducted on the functional organization of the model. Finally, there are some questions worthy of study and discussion [10].

This paper mainly uses the questionnaire survey method to study the water resources information management system based on the Agent model. First, the characteristics of the Agent model and the problems existing in the water resource information management system based on the Agent model are summarized through the literature research method, and then the questionnaire survey method is used. To investigate some evaluations and suggestions on the need to use water resources systems.

2. Research on Agent Model and Water Resources Information Management System

2.1 Research Method
(1) Literature research:
Reading books and articles about the research of water resources information management system based on the Agent model and the relevant literature of big data at home and abroad, the advantage is that you can understand the development process of the research object from the source, and understand the development status of the research object, and provide a clear and structured theoretical basis for in-depth thesis development.

(2) Investigation and research method
The questionnaire survey method is that this article conducts a survey through pre-prepared questions and analyzes the answers of the interviewees to draw the necessary conclusions. Through the design of questionnaires, research on the evaluation of the use of water resources management systems.

(3) Quantitative analysis
Qualitative analysis is related to quantitative analysis. Quantitative analysis refers to the analysis of mathematical hypothesis determination, data collection, analysis and testing, and it is also quantitative and qualitative.

Qualitative analysis refers to the qualitative analysis of the research object. It refers to the process of conducting research based on subjective understanding and qualitative analysis, through research and bibliographic analysis.
2.2 The Characteristics of the Agent Model

(1) Autonomy.
It is also called autonomy, which means that it can actively and spontaneously control its own behavior and internal state without being interfered by human or agent factors and its own goals or intentions.

(2) Intelligence.
Intelligent Agent has its own thoughts and wisdom. Based on the analysis of the environment and information resources, it makes intelligent behaviors according to the user's preferences and interests.

(3) Adaptability.
In other words, we can formulate action plans according to the requirements and constraints of goals, environment, etc., and modify our goals and plans according to environmental changes.

(4) Sociality.
An agent usually cannot exist alone in the environment, but must work with other agents in the same environment. Cooperation requires negotiation, negotiation requires information exchange, and the way of information exchange is mutual exchange.

(5) Reactivity.
When an intelligent agent is placed in a specific environment, he can not only perceive environmental information to determine his own position and actions, but also act in the environment to cause environmental changes. He can also negotiate and cooperate with other intelligent agents according to the target movement, and must adapt and influence each other at the same time.

(6) Collaboration.
Target-oriented intelligent agents communicate and cooperate with each other to achieve specific goals.

(7) Mobility.
Intelligent Agents sometimes have the ability to move. In order to achieve this goal can be moved to the correct location. For example, access to remote resources, transfer to the appropriate node to work in the environment, etc. There are also honesty, obedience, rationality, etc. Due to these characteristics of Agent, the Agent-based system should be an advanced system, which should have many advantages, such as flexibility, intelligence, scalability, persistence and organization.

2.3 Problems in the Water Resources Information Management System Based on the Agent Model

(1) No water resources management for complex adaptation theory
After synthesizing a large number of documents at home and abroad, it is found that Agent theory and methods have been widely studied and applied in three aspects: optimal allocation of water resources in river basins, urban residential water management and water resources management. In non-urban areas, although complex adaptation theories also involve other aspects of water resources, the application of ABM to certain potential water resources management problems is relatively blank.

(2) Strengthening ABM research on uncertain water resources management
There are many uncertainties in the resource system: climate change, hydrological conditions, water supply, crop prices, etc. However, many current ABM researches on water resources management ignore these uncertain factors; in terms of water resources management, it also reduces the validity and rationality of the research results.

(3) Explore the decision rule modeling method based on machine learning
There are many types of modeling methods for ABM micro decision-making rules for water resources management, but they are mainly based on traditional research methods such as equation optimization, dynamics, and econometric regression. However, because the subject's feature space is very large, and there are many variables that affect decision-making behaviors, and there may be many unknown nonlinear relationships between features and behaviors and between variables and behaviors, it is difficult to express them in equations.
2.4 Algorithm of Water Resources Information Management System Based on Agent Model

(1) Ability coefficient of resource agent

For the new resource Agent $a_0$ that joins the system, the service Agent of the alliance first counts the number of resource Agents that can perform similar tasks in the alliance, which is recorded as count, and the number of these resource Agent $a$, each participating in the execution of such tasks, Denoted as $m$, if count=0, then the value of Trust ($a_0$) is 0. If count>O, the trust degree is calculated as shown in formula (4-1), and the initial trust degree obtained in this way is a weighted average, so that the resource agent newly added to the system can have a similar history with other agents performing the same function process.

$$\text{Trust}(a_0, t) = \frac{\sum_{i=1}^{\text{count}} m_i \text{Trust}(a_i, t)}{\sum_{i=1}^{\text{count}} m_i}$$  \hspace{1cm} (1)$$

After the service agent receives the notification of the task execution result, the adjustment rule of the trust degree of the resource agent participating in the collaboration is as follows, and the trust degree before the adjustment is recorded as Trust,

$A$ is the winning agent of this task collaboration, and the task completion degree is greater than the completion threshold, use the following formula (4-2) to adjust the trust degree:

$$\text{Trust}(a, t) = \alpha \times \text{Trust}_0 + \beta \times \text{Completed}(a, t)$$  \hspace{1cm} (2)$$

3. Application Situation of Water Resources Information Management System Based on Agent Model

3.1 Research Purpose

The questionnaire survey method is used to investigate the use of the Agent model-based water resources information management system, mainly for the evaluation of the use of the system and some suggestions, and the results are integrated to get some directions for improvement.

3.2 Questionnaire Survey

(1) Number of questionnaires

According to the minimum sample size formula in statistics, the author sets the confidence level of the questionnaire to 80%, and the allowable error does not exceed 8%. Calculate the minimum sample size as

$$n_0 = \left( \frac{t_m}{2\Delta p} \right)^2 = \left( \frac{1.645}{2 \times 0.075} \right)^2 = 120$$  \hspace{1cm} (3)$$

That is, the minimum sample size of this questionnaire is 120 copies.

(2) The source of the questionnaire

The questionnaire survey is aimed at the water resources management system, so it is targeted. The questionnaire distribution is mainly aimed at water companies with water resources management systems, the city's water resources bureau, and industrial water areas that require irrigation. Randomly select three water supply companies, local water conservancy bureaus and industrial water areas in this city. The number of questionnaires distributed were 70, 30, and 40, and the number of questionnaires returned was 70, 29, and 39, respectively.

4. Data Analysis

(1) Application evaluation of water resources information management system based on Agent model

This paper uses the questionnaire survey method to investigate the use evaluation of the water resources information management system based on the Agent model. The results of the survey are shown in Table 1.
Table 1. Evaluation on the use of water resources information management system

|                      | Water company | Local water conservancy bureau | Industrial water area |
|----------------------|---------------|-------------------------------|-----------------------|
| Long waiting time to enter the system | 56%           | 50%                           | 54%                   |
| Stuttering           | 36%           | 38%                           | 34%                   |
| The interface is not beautiful | 18%           | 22%                           | 22%                   |

Figure 1. Evaluation on the use of water resources information management system

It can be seen from Figure 1 that in the evaluation of the use of the water resources information management system based on the Agent model, about 50% of the people encountered the phenomenon of long waiting time for entering the system, and about 30% experienced the phenomenon of lag.

(2) Suggestions for the use of water resources information management system based on the Agent model

This paper uses the questionnaire survey method to investigate the recommendations for the use of the Agent model-based water resources information management system. The results of the survey are shown in Table 2.

Table 2. Suggestions on the use of water resources information management system

|                      | Water company | Local water conservancy bureau | Industrial water area |
|----------------------|---------------|-------------------------------|-----------------------|
| Simpler operation    | 50%           | 54%                           | 56%                   |
| The interface is more beautiful | 21%           | 20%                           | 18%                   |
| Not stuck            | 39%           | 36%                           | 36%                   |
Figure 2. Suggestions on the use of water resources information management system

It can be seen from Figure 2 that the use of the Agent model-based water resources information management system is more concerned about the simple operation of the system, with about 54% of the choices, and about 36% of the people choosing when there is no lag.

5. Conclusions

Water is an irreplaceable natural resource that human society depends on for survival and development, an important guarantee for regional sustainable development, and one of the most precious natural resources for sustainable social and economic development. The history of the development of human society is the history of the development and utilization of water resources. Water shortage and water pollution have always been a global water crisis, which has severely affected industrial and agricultural production and the lives of urban and rural people. It has become increasingly restrictive on the sustainable development of society and economy, and has attracted worldwide attention. However, due to the shortage of water resources, the uneven distribution of time and space; coupled with the insufficient water supply capacity of the project and low water use efficiency, the contradiction between supply and demand is becoming increasingly acute; poor management and deterioration of water quality lead to water pollution. In the ecological environment, the contradiction between water use in certain areas or parts is very fierce, which seriously hinders the function of water resources and makes the development and utilization of water resources face severe challenges. Water is no longer an inexhaustible and inexhaustible resource, but it has increasingly become a limited resource. With population growth and economic growth, water has become a key factor restricting social, economic and environmental development. Therefore, it is necessary to study in detail the problems faced by water resources in order to realize the sustainable use of water resources and ensure the sustainable development of society, economy and environment.

References

[1] Li Y. Research on the model optimization of information management and information system based on cloud computing. Revista de la Facultad de Ingenieria, 2017, 32(9):377-385.
[2] Furqan K H, M. B C. Effect of Hydrogeologic and Climatic Variability on Performance of a Groundwater Market. Water Resources Research, 2019, 55(5):4304-4321.
[3] Shi L. Research on dynamic model of optimal simulation system for urban water resources sustainable utilization based on complex scientific management. Desalination and water treatment, 2018, 125(SEP.):156-163.
[4] Zhao J, Jin J, Zhu J, et al. Water Resources Risk Assessment Model based on the Subjective and
Objective Combination Weighting Methods. Water Resources Management: An International Journal, Published for the European Water Resources Association (EWRA), 2016, 30(9):3027-3042.

[5] Anderson K R, Salem Y, Shihadeh S, et al. Design of a Compost Waste Heat to Energy Solar Chimney Power Plant. Journal of Civil Engineering Research, 2016, 6(3):47-54.

[6] Yang Q, He L, Liu X, et al. Water resources management in China based on coordinated development index. Desalination and water treatment, 2018, 121(JUL.):256-264.

[7] Naabil E, Lamptey B L, Arnault J, et al. Water resources management using the WRF-Hydro modelling system: Case-study of the Tono dam in West Africa. Journal of Hydrology Regional Studies, 2017, 12(C):196-209.

[8] Wang L, Huang Y, Zhao Y, et al. Optimal Allocation Model for Regional Water Resources Management Based on the Supply-oriented Model. Yingyong Jichu yu Gongcheng Kexue Xuebao/Journal of Basic Science and Engineering, 2017, 25(6):1160-1169.

[9] Li Y, Yang W, Shen X, et al. Water Environment Management and Performance Evaluation in Central China: A Research Based on Comprehensive Evaluation System. Water, 2019, 11(12):2472.

[10] Xiang X, Li Q. Water Resources Vulnerability Assessment and Adaptive Management Based on Projection Pursuit Model. Journal of Coastal Research, 2020, 103(sp1):431.