

Retraction

Retracted: Research on the Architecture of Cold Chain Logistics Multimedia Monitoring and Tracking Service Platform Based on Fuzzy Sorting and Heuristic Algorithm

Advances in Multimedia

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1].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] Q. Zhang, "Research on the Architecture of Cold Chain Logistics Multimedia Monitoring and Tracking Service Platform Based on Fuzzy Sorting and Heuristic Algorithm," *Advances in Multimedia*, vol. 2021, Article ID 5998153, 7 pages, 2021.

Research Article

Research on the Architecture of Cold Chain Logistics Multimedia Monitoring and Tracking Service Platform Based on Fuzzy Sorting and Heuristic Algorithm

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With the continuous development of social economy, the logistics system has been continuously improved. In addition to traditional domestic postal transportation and car consignment, emerging logistics methods such as SF Express and Yunda have also emerged. Aiming at the features such as fragility of fruits and vegetables and high storage requirements, in this paper, a cold chain logistics multimedia monitoring and tracking service platform is built in an attempt to monitor the preservation environment and safety status of agricultural products relying on fuzzy sorting and heuristic algorithms, trace agricultural products with labels, and design the direction of the key data. The practice results show that the system is effective.

1. Introduction

With the continuous development of social economy, the logistics system has also been continuously improved. In addition to the traditional domestic postal transportation and automobile consignment, emerging logistics methods such as SF Express and Yunda have also appeared [1]. The logistics has been transformed from automobile consignment to the operation of goods by professional companies. Meanwhile, the content of transshipment has also expanded from ordinary commodities to seafood cold chain, fruits, and vegetables [2]. However, it should be noted that due to the vast territory of China, long-distance transportation will cause time delays, which will cause great losses in the transportation of agricultural products, which is also a great waste of resources [3]. The safety and quality of agricultural products will also directly endanger human health. Therefore, the supervision of agricultural products is strengthened, the quality of agricultural products is controlled, and the traceability of each link of agricultural products is fully realized [4].

Therefore, cold chain logistics has gradually emerged, that is, after fruits and vegetables are harvested from the place of production, the product in each stage is kept in a low

temperature environment to ensure the preservation and quality of the product, while avoiding contamination and reducing product loss. However, how to ensure the coconstruction and sharing of cold chain transportation in the entire process requires higher data quality and also has obvious requirements for interconnection and sharing. Therefore, the multimedia monitoring and tracking of cold chain logistics to ensure the safety and health of the people is the top priority [5–9].

In the context of multimedia, a cold chain monitoring and tracking system is built for agricultural products in an attempt to monitor the preservation environment and safety status of agricultural products, and labels are used to trace agricultural products, aiming to use new technologies to ensure the safety of agricultural products based on the fuzzy sorting and heuristic algorithms in this paper.

2. Fuzzy Ranking and Heuristic Algorithm

In monitoring, there are usually two methods such as wireless sensor network and RFID. Both methods have their advantages and disadvantages. Wireless sensor networks have the advantages of low cost, small volume, and frequent

topology changes. RFID can be used to realize rapid identification of products, especially in harsh environments, and realize prompt and handiness, but the relative cost is high and the effective distance is short. Therefore, environmental monitoring of products can be effectively identified and applied at the same time [9].

2.1. Sorting Model. For heuristic algorithms, the objective function is to save money, as obtained from the calculation based on formula (1). Formula (2) is used for a quantitative calculation of the quantitative relationship of balance, formula (3) is a quantitative analysis of the relationship between supply and demand, and formula (4) represents the relationship between freight warehousing and customer demand.

$$\min f(x) = \sum_{hijk} (A_{hij} + B_{hjk}) X_{hijk} + \sum_j F_j Z_j + \sum_{hj} S_{hj} \left(\sum_{ik} X_{hijk} \right) + \sum_{hk} D_{hk} (T_{hk}), \quad (1)$$

$$\sum_{ij} X_{hijk} = Q_{hk}, \quad (2)$$

$$\sum_{jk} X_{hijk} \leq Y_{hi}, \quad (3)$$

$$I_j \left(\sum_{hjk} X_{hijk} \right) \leq W_j. \quad (4)$$

2.2. Hierarchical Division of Evaluation Indicators and Determination of Evaluation Values. For agricultural product tracking, social, economic, and crossdepartmental factors are inevitably involved. Therefore, these influencing factors are comprehensively considered to establish a related evaluation index system and divide the evaluation into three categories according to user needs, mainly including overall evaluation, evaluation indexes, and evaluation factors, where the evaluation layer B_i ($i = 1, 2, \dots, m$) is used to represent subevaluation factors, including product distribution, economic benefits, environmental protection, and other factors, and the evaluation layer C_{ij} ($i = 1, 2, \dots, m; j = 1, 2, \dots, n$) is the product-related impact of the j -th evaluation index of the i -th evaluation factor.

2.3. Determination of the Evaluation Value of Each Evaluation Index. Quantitative evaluation of various indicators is carried out, and the membership function is introduced to carry out an analysis for membership indicators.

Definition 1. Assuming that the mapping of set U in the range of $[0, 1]$ is $U_A: U \rightarrow [0, 1], U \rightarrow U_A(u)$, a fuzzy set A is determined, where U_A is the membership function of A and the degree of membership can be expressed by $U_A(u)$.

For the degree of fuzzy membership, the quantitative results are clarified, which can effectively realize the quantitative analysis of the fuzziness of the evaluation object and obtain a more accurate characterization value.

First, an expert system based on fuzzy sorting is established according to the Delphi method, assuming that the set of agricultural products is $X = \{x_1, x_2, \dots, x_g\}$ and the set of review experts is $S = \{s_1, s_2, \dots, s_k\}$. For any sample sorting set $x \in X$, $U = \{u_1, u_2, \dots, u_n\}$ is used to indicate the ordered index and $V = \{v_1, v_2, \dots, v_p\}$ is used to indicate the sorted comments. The fuzzy relationship of $U \times V$ is represented by R , the arbitrary sorting object x can be represented by $R(u_i, v_j) = r_{ij}$, ordinary matrix R_t ($t = 1, 2, \dots, k$) is transformed into a fuzzy matrix $R = (r_{ij})_{n \times p}$, and quantitative analysis is carried out according to formula (5).

According to the analysis results of all experts, the product opinions are analyzed and processed and the final evaluation matrix is determined, and the specific result is obtained as shown in the following formula:

$$r_{ij} = \frac{\sum_{t=1}^k \alpha_t r_{ij}^{(t)}}{\sum_{t=1}^k \alpha_t}, \quad i = 1, 2, \dots, n; j = 1, 2, \dots, p. \quad (5)$$

In the formula, r_{ij} is the evaluation value given by the t -th expert s_t on the sorting index u_i for v_j is the degree of membership $r_{ij}^{(t)} \in \{0, 1\}$. For $R = (r_{ij})_{n \times p}$, let $\sum_{j=1}^p r_{ij} = 1$. α_t is the weight of the t -th expert, $\alpha_t \in [0, 1]$. Obviously, $r_{ij} \in [0, 1]$.

2.4. Determining the Weight of the Indicator System. The index system is determined by using the knowledge of experts to carry out the Delphi scoring method, to determine the lowest evaluation index, and to obtain a higher level of score [9–12], and finally, the main steps for determining the weight of the index according to the relevant analytic hierarchy process include the following:

- (1) According to each group of judgment indicators in the indicator system, the evaluation factor judgment matrix $B = (b_{ij})_{m \times m}$ and the evaluation factor judgment matrix $C = (c_{ij})_{n \times n}$ of the indicators are established through the corresponding scaling criteria. Among them, B_{ij} means that A , B_i , and B_j are numerical expressions of relative importance, and C_{ij} means that B_i , C_{ii} , and C_{ij} are numerical expressions of relative importance.
- (2) According to the matrix, the maximum eigenvalues of B and C are obtained, $\lambda_{b_{\max}}$ and $\lambda_{c_{\max}}$, and their corresponding eigenvectors $W_{B_i} = [W_{b_1}, W_{b_2}, \dots, W_{b_m}]$ and $W_{C_{ij}} = [W_{c_1}, W_{c_2}, \dots, W_{c_n}]$; then, the vectors W_{B_i} and $W_{C_{ij}}$ are the relative weights of the corresponding evaluation factor layer and evaluation index layer.
- (3) Make judgments on matrix consistency and error analysis. $C.I. = (\lambda_{\max} - n) / (n - 1)$ is set as a

consistency index. When B and C cannot be completely consistent, the characteristics of the judgment matrix will change simultaneously. The change of the characteristic root of the judgment matrix can be used to verify the value of the index, which indicates that the consistency is farther, and vice versa.

- (4) The indicators are combined with the weights relative to the overall target, and the analytic hierarchy process is used to calculate the weights of the total sorting of the levels and then perform the setting analysis.

3. Analysis of Cold Chain Logistics of Agricultural Products

Fresh fruits and vegetables have higher requirements for logistics, and the main factors are reflected in the following points:

- (1) Many of the agricultural products are transported by refrigerated cold chain frozen transportation. For each agricultural product, temperature indicators are different. Therefore, there is strict temperature control in the cold chain logistics process. When the temperature reaches a certain threshold, an alarm is required.
- (2) Relevant RFID tags are pasted on each product to facilitate the monitoring and tracking of agricultural products and meanwhile facilitate the management of agricultural products and storage information about the products.
- (3) The supply chain management of agricultural products requires the timely accessibility of logistics, that is, "Same-Day delivery" and "Next-Day delivery" to ensure the freshness of the fruits and, at the same time, to respond immediately to the needs of users.
- (4) In the cold chain transportation process, the identification and location of agricultural products are monitored, and the products are traced to realize the openness and transparency of product transportation. Meanwhile, it is open to the outside world through the Internet to ensure the safety of agricultural products.
- (5) It should be noted that, in the process of agricultural products passing through the cold chain, logistics costs are particularly worthy of attention. At present, this is also a solution that is difficult to satisfy users and logistics companies.

The entire cold chain process for perishable agricultural products mainly includes (1) precooling after picking, attaching relevant labels, and storing information; (2) refrigerating to refrigerated trucks for transportation; (3) wholesale station refrigerated warehouse to supermarket freezer; and (4) delivering to the user. It should be noted that, during the entire transportation process, on the one hand, the refrigerated warehouse is used for static storage; on the other hand, the cold storage is used for dynamic

storage during the transportation process. It is necessary to monitor the real-time environment of refrigerated transport vehicles and also to pay attention to the management during the transfer process to ensure that the quality and quantity of harvesting and distribution are guaranteed and, at the same time, to ensure that agricultural products are traceable in every link [13–15].

4. Design of Logistics Monitoring and Tracking System of Agricultural Products

4.1. Monitoring and Tracking during the Refrigerated Transportation of Agricultural Products. Agricultural products are transported through the cold chain. Therefore, it is necessary to ensure that the agricultural products are stored and transported at the most suitable temperature in the vehicle, while ensuring the validity and timely update of label information. The specific monitoring diagram is shown in Figure 1.

According to the management results in Figure 1, RFID tags are placed on each agricultural product in an attempt in this paper, and meanwhile, they are placed in the refrigerated truck at a certain density according to the characteristics of the agricultural product based on the intelligent node. The smart node includes temperature, gas, and taste sensors, which can effectively monitor environmental parameters and return RFID tag information to the data center. The data center performs simple processing based on the received information and communicates through 5G and other communication technologies; the details are shown in Figure 2. When the data center processes the returned information and triggers related exceptions, it will alarm and remind the transportation personnel to take emergency measures according to the warnings and return solutions and losses to the data center. When the data center receives the signal, it can issue guiding opinions to the vehicle through the 5G communication technology, query according to each intelligent node, and finally realize the synchronization of information between the data center and the cold storage management center.

In such a system, smart nodes are densely arranged in the vehicle and real-time monitoring of refrigerated vehicles is carried out in various ways. Meanwhile, it is coordinated with real-time positioning navigation receivers (such as BeiDou and GPS) to realize real-time navigation of the location.

4.2. Monitoring and Management of Refrigerated Warehouse. The network architecture of the refrigerated warehouse is shown in Figure 3, which is mainly composed of RFID tags, reader-writer, WSN nodes, and data management centers. Among them, the reader-writer identifies and records the agricultural products through reading the RFID tags of the goods and stores them in the agricultural product information to facilitate the traceability and tracking of the agricultural products. Meanwhile, a certain density of intelligent nodes is deployed to collect the temperature and humidity of the refrigerated warehouse, extract the smell of cold storage to judge the quality of agricultural products, and return relevant information to the data management center in real time, so

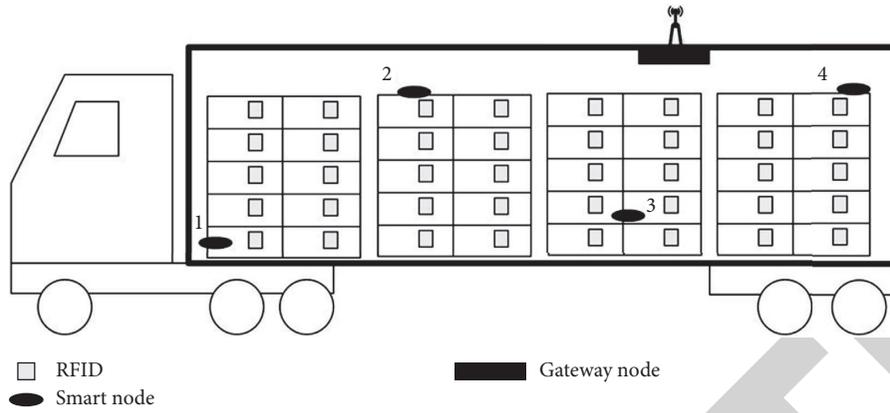


FIGURE 1: Schematic diagram of refrigerated truck monitoring.

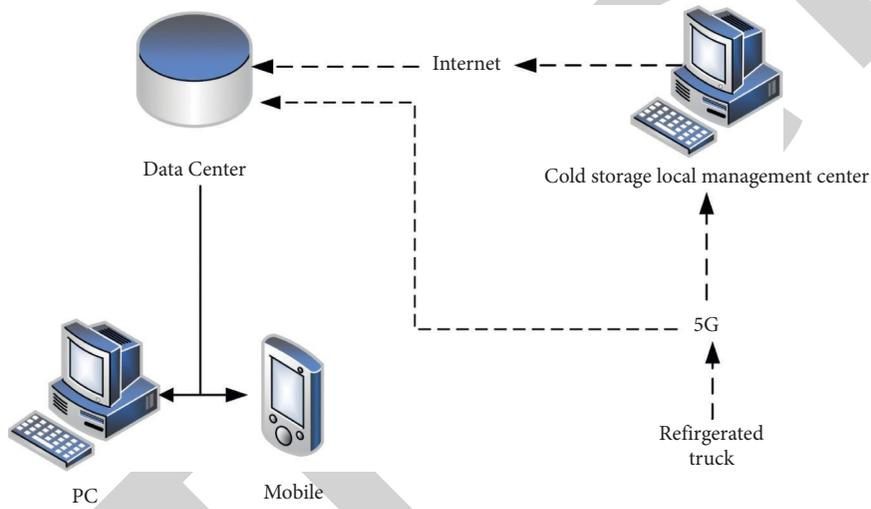


FIGURE 2: System data flow diagram.

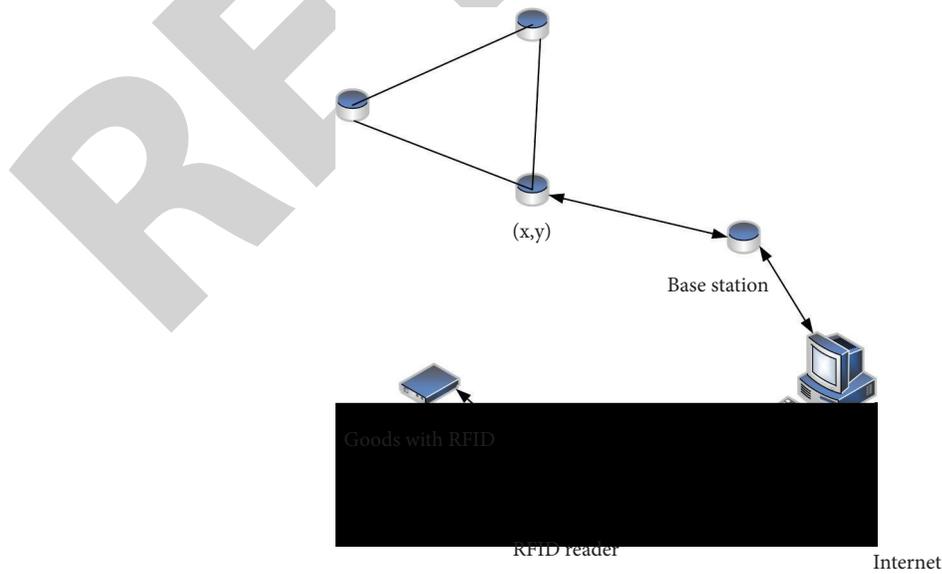


FIGURE 3: Refrigerated warehouse monitoring and management network architecture diagram.

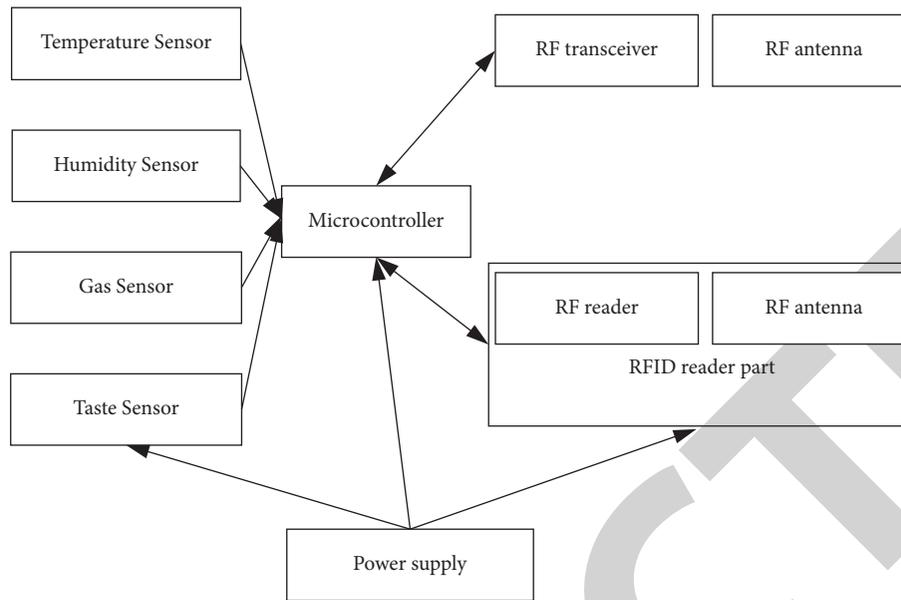


FIGURE 4: Structural drawing of the smart node.

that managers can grasp the parameters, shelf life, and other information in a timely manner and take other emergency measures such as replenishment and replacement to improve the management and operation level of cold chain transmission. The specific data center delivery is shown in Figure 3

For the arrangement of intelligent nodes, the method of sorting is adopted to realize the positioning of agricultural products. According to the relevant position and positioning information, the actual coordinates in the refrigerated warehouse are judged to realize the correlation. The intelligent nodes transmit their numbers together when transmitting the information, and the refrigerated warehouse information center determines the actual cargo location based on the feedback information.

4.3. Data Flow. The specific framework structure diagram is shown in Figure 2. The cold chain logistics multimedia monitoring and tracking service platform system includes refrigerated warehouse, multimedia data center, 5G communication network, users, and other components.

Relevant data of refrigerated warehouse and vehicles are transmitted by the 5G network to ensure that the multimedia data center has real-time transmission of all data. The data center monitors all agricultural and sideline products in the whole chain according to the logistics company or the “vegetable basket” project publicized by the government, monitors the status of agricultural products or specific data flow, and realizes the tracking and tracing of agricultural products. Meanwhile, users can also query the logistics information of agricultural products through PC and mobile terminals to ensure the safety of agricultural products.

4.4. Smart Node Design. As shown in Figure 4, specific smart nodes mainly include sensors, readers, microcontrollers, and communication modules. Among them, in order to make a certain simplification to cooperate with agricultural

products, the reader can read the key label information data and reduce the cost. The microcontroller monitors the data and performs corresponding data processing. The communication module realizes real-time return of mutual status, signals, and locations to the data center.

5. Experimental Results and Analysis

Based on fuzzy sorting and heuristic algorithms, the analog simulation of cold chain logistics and distribution monitoring methods is carried out in this paper; the fuzzy sorting and heuristic algorithms are used for real-time monitoring and optimization, respectively. RFID technology-based cold chain logistics and distribution big data monitoring, the big data monitoring of cold chain logistics distribution based on RFID technology, and the test of monitoring of cold chain logistics distribution based on large-dimensional data are also carried out. The dynamic feature weights of three different methods are compared. The test results are shown in Figure 5.

As shown in Figure 5, QZ represents the dynamic feature weights of fuzzy sorting and heuristic algorithms, LL represents the real-time monitoring and optimization method of cold chain logistics and distribution big data, RF represents the cold chain logistics distribution based on the RFID technology data monitoring method, DW represents the cold chain logistics distribution monitoring method based on large-dimensional data, CS represents the number of experiments of three different methods, and PJ represents the average dynamic feature weights of cold chain logistics distribution big data obtained by using three different methods.

Of which, the dynamic feature weights of QZ, LL, and RF are (8, 9, 8, 8, 9, 9, 7, 7, 6, 5, 5, 6, 4, 4, 5, 6, 4, 4), respectively. Comparing the average dynamic feature weight results, the fuzzy ranking and heuristic algorithm are higher than the other two methods, and the obtained dynamic features have higher credibility.

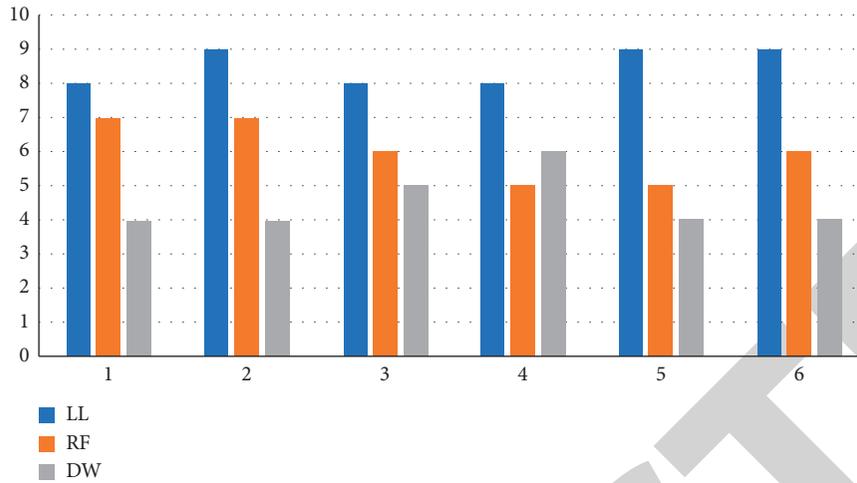


FIGURE 5: The credibility of the dynamic characteristics of the three different methods.

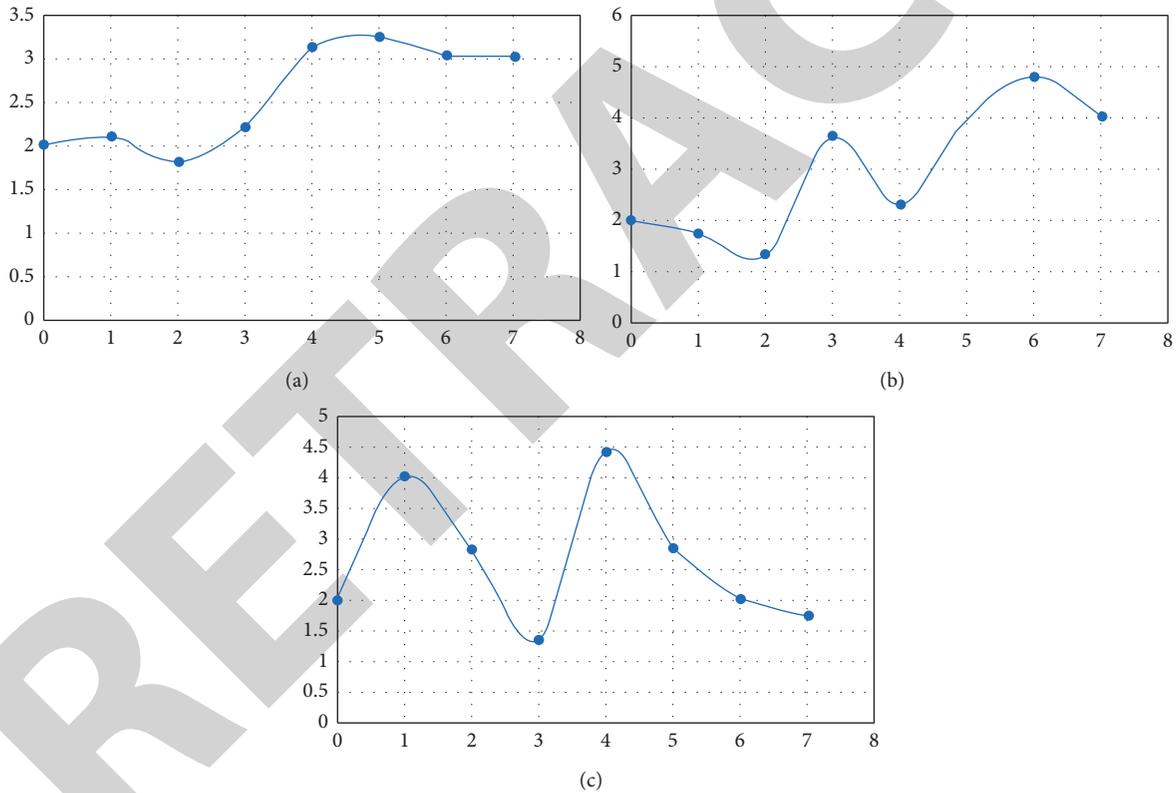


FIGURE 6: Test results of three different methods. (a) Test results of method 1. (b) Test results of method 2. (c) Test results of method 3.

The service of multimedia monitoring and tracking of cold chain logistics is to determine the location of cold chain logistics. By determining the three methods of QZ, LL, and RF, the calculated results and actual results are obtained. The comparison result is shown in Figure 6:

- (1) For QZ, the obtained measurement position almost coincides with the actual position, completing the real-time monitoring of big data of cold chain logistics and delivery

- (2) For the two methods of LL and RF, the deviation from their actual positions is large, so the relative positioning is poor and the accuracy cannot meet the requirements

6. Conclusions

This paper combines fuzzy sorting and heuristic algorithms to try to build a cold chain logistics multimedia monitoring and tracking service platform to monitor the preservation

environment and safety status of agricultural products and uses tags to trace agricultural products, design key data retention, and reduce labor costs. It improves work efficiency and accuracy, effectively achieves transparency and safety in every link, effectively solves the problem of quality of agricultural products, and lays the foundation for subsequent large-scale promotion.

Data Availability

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

Conflicts of Interest

The author declares no conflicts of interest.

Acknowledgments

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