Application of Internet of Things Information-Driven in Rural Revitalization

Wenjie Liu(✉)

Unit Aba Normal College, Wenchuan 623002, China
liuwenjie0998@163.com

Abstract. In order to realize the great vision of rural revitalization and promote the development of China's agriculture in the direction of intelligence and efficiency, an application research of Internet of Things information-driven in rural revitalization was proposed. This paper first summarizes the concept of the Internet of Things and its advantages, and discusses the application of the Internet of Things technology in facility agriculture in the development of characteristic agriculture. Secondly, it analyzes the significance of the application of Internet of Things technology in rural revitalization, and finally summarizes the application countermeasures of Internet of Things technology in rural revitalization. It can be said that realizing the application and development of the Internet of Things technology in rural areas has gradually become an important work in rural revitalization in China. Therefore, with the help of the application research of the Internet of Things technology in rural revitalization, summarize the application ideas of the Internet of Things technology in the development of rural areas, with a view to providing technical support for rural revitalization and development.

Keywords: Internet of Things · rural vitalization

1 Introduction

Today, information technology is the core and pillar of today's knowledge economy and the most powerful engine of national economic development. It is changing people's economic activities, work and lifestyle, and is having a profound impact on social change. With the development of smart agriculture, information technology and Internet of Things technology will be widely used, break the limits of traditional agriculture, open up new ways to support agriculture through science and technology, protect the new engine of smart agriculture, and help the development of rural areas. With the advancement of science and technology, the Internet of Things is gradually entering people's work and daily life, creating a new way of revival and development in rural areas. In the new era, it can be said that the promotion and use of Internet of Things technology in urban development can support the modernization of various business sectors in rural areas and lay the foundation for realizing the economic goals of urban development [1, 2]. As shown in Fig. 1:

V. Gaikar et al. (Eds.): ECIT 2023, AHE 18, pp. 135–141, 2023.
https://doi.org/10.2991/978-94-6463-210-1_17

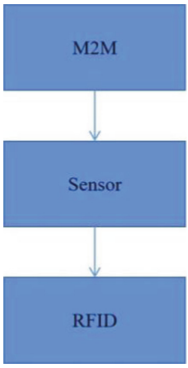

Fig. 1. Internet of Things technology

2 Internet of Things Technology

In contrast to Internet of Things technology, the Internet of Things is connected to it, but has distinct characteristics from the Internet of Things, the Internet of Things is its extension and expansion, and has a positive impact on service requests and Internet usage. The item itself is autonomous, it can identify individual item trailers based on QR code and FID, obtain corresponding information, and monitor, manage, and resolve the information to achieve smart management goals. Broadly divided into four types of applications, i.e. M2M, sensor, RFID, worldwide wireless, etc., the sensor belongs to the new type of data collection node device, i.e. by setting Raised on the monitor, everything can be collected. About the type of information in time, and about the integration of information collection, transmission and control. The application of RFID technology is based on the integration of network technology and digital technology, so that the FID tag and product control are the same, and the complete Internet of Things is to create the label and product management. In terms of human-computer interaction, the main role of M2M is to implement human-machine and machine-to-machine interaction and control [3, 4]. As shown in Table 1:

Table 1. Application technology of Internet of Things

Main technologies	Main applications	advantage
RFID	Logistics, orientation and other industries	Low cost, no power consumption
sensor	Home, building automation and various monitoring applications	Reliable, power and cost advantages, convenient networking
Wireless universal	Wide range of voice and data transmission applications	Wide coverage and good quality

2.1 Advantages of Internet of Things Technology

First of all, the Internet of Things can integrate various information transmission equipment and systems on the basis of traditional Internet systems, manage terminals based on cloud platform, promote the transformation from virtual network to virtual and real network, promote the integration of animals and things, and achieve efficient interconnection between different regions, different links and different modules. Secondly, with the promotion of mobile phones, computers, tablets and other devices, the Internet of Things technology can effectively use the integration of things and things to realize the rapid expansion of the scope of information systems, so as to investigate and coordinate all kinds of things in reality. Finally, the Internet of Things system also has a certain data analysis function, which can realize the automatic classification and integration of the collected information, and help all walks of life to achieve comprehensive information collection, intelligent information processing, and efficient scenario analysis, so as to provide important support for all industries to improve their development efficiency and realize their own adjustment and optimization [5].

3 Application of Internet of Things in Rural Revitalization

The application of Internet of Things technology in rural revitalization can promote the development of various industries in rural areas in the direction of intelligence and informatization. It can be said that realizing the application and development of the Internet of Things technology in rural areas has gradually become an important work in rural revitalization in China. As shown in Fig. 2:

3.1 The Significance of the Application of Internet of Things Technology in Rural Revitalization

Helps to Accelerate the Pace of Intelligent Production
Some scientists emphasize the importance of raising the level of local economic development and getting new support. Internet technology has developed in rural areas. For example, satellite remote sensing, regional agriculture, education, robotic agriculture and other information technologies are widely used to accelerate the development of building materials in rural areas. This is a great opportunity to increase the use of modern techniques, equipment and technology in rural areas [6].

Helps to Improve Regional Operation Efficiency
Strengthening the promotion of the Internet of Things technology in rural areas can help rural areas rely on the connection between things and the sensing function in the Internet of Things system, based on various information platforms and systems, realize various industrial informatization and intelligent production and operation, provide information technology support for various production and operation activities in rural areas, and also provide support for improving the efficiency of information transmission, operation and decision-making in rural areas [7].

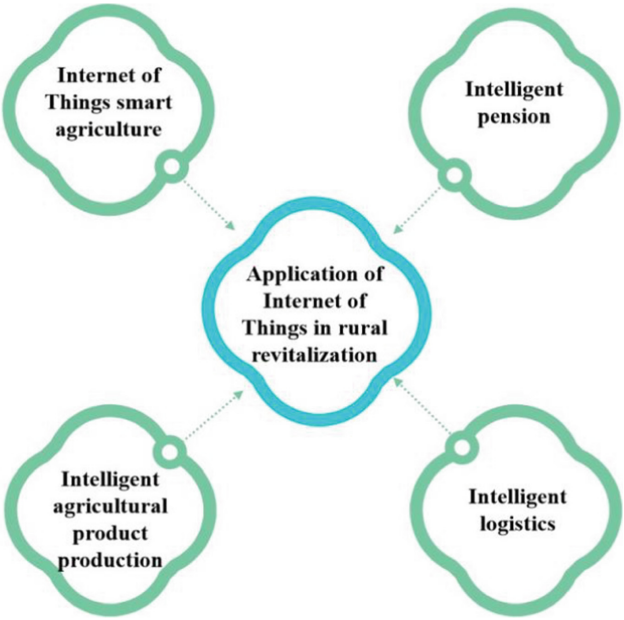

Fig. 2. The Application of the Internet of Things in rural revitalization

3.2 Intrusion Detection of Agricultural Systems Based on the Cluster Analysis Algorithm of the Internet of Things

The intrusion detection system based on the cluster analysis algorithm designed in this paper also has the dynamic identification function, which can accurately locate and filter the isolated intrusion data free from the cloud computing network, and further improve the accuracy of data detection. The dynamic data clustering algorithm adopts the threshold control method in detecting the size of data control, which can control the size of data clustering by adjusting the size of the threshold. In the big data environment, the malicious data intrusion detection process of cloud computing network based on data clustering algorithm is shown in Fig. 3.

In the process of data feature comparison and rule extraction, determine whether to standardize the collected original data, and then conduct spatial comparison, analysis and rule recording of the data sources entering the system based on the data clustering analysis algorithm, so as to realize the intrusion security monitoring of cloud computing network data in the context of big data. In the big data environment, the original data set collected from the cloud computing network contains n data objects, and these original data objects contain M data variables, so the data composition of the cloud computing network can be represented by a matrix:

$$\begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1m} \\ x_{21} & x_{22} & \cdots & x_{2m} \\ \cdots & \cdots & \cdots & \cdots \\ x_{n1} & x_{n1} & \cdots & x_{nm} \end{bmatrix} \tag{1}$$

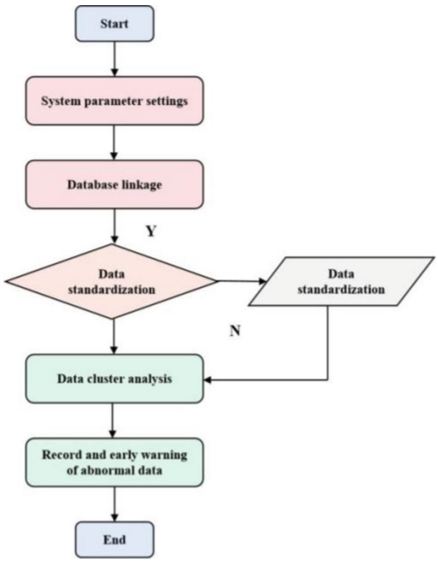

Fig. 3. An intrusion detection process based on the cluster analysis algorithm

Use function f(i, j) to determine the degree of difference between data object i and object j. if the value of function f(i, j) is larger, it indicates that the degree of difference between object and object j is larger. The degree of difference matrix between different data objects can be expressed as:

$$\begin{bmatrix} 0 & & & & \\ f(2,1) & 0 & & & \\ f(3,1) & f(3,2) & 0 & & \\ \cdots & \cdots & \cdots & 0 & \\ f(n,1) & f(n,2) & \cdots\cdots & 0 & \end{bmatrix} \tag{2}$$

Measure the similarity between the data objects to be detected based on the Mings distance algorithm, and identify the intrusion data in the cloud computing network according to the difference of similarity:

$$d_{ij}(\lambda) = \left(\sum_{k=1}^{n} \left| x_{ik} - x_{jk} \right|^{\lambda} \right)^{1/\lambda} \tag{3}$$

where, λ is the key parameter in the distance determination of data object. When $\lambda = 1$, the Mings distance between data object i and data object j can be expressed as:

$$d_{ij}(1) = \sum_{k=1}^{n} \left| x_{ik} - x_{jk} \right| \tag{4}$$

When $\lambda = 2$, the Mings distance between the data object and the data object J is converted to the Euclidean distance:

$$d_{ij}(2) = \left(\sum_{k=1}^{n} \left| x_{ik} - x_{jk} \right|^2 \right)^{1/2} \tag{5}$$

Since the Mings distance algorithm does not fully consider the correlation between data objects, it is necessary to redefine the covariance distance between data objects:

$$d_{ij}^2(x) = \left(x_i - x_j\right)^T \sum^{-1} \left(x_i - x_j\right) \tag{6}$$

In the intrusion detection of original data, the similarity coefficient between the i-th data object and the j-th data object is usually expressed by the included angle α_{ij} of vector cosine, and the included angle cosine value of data intrusion detection can be expressed as:

$$\cos\left(\alpha_{ij}\right) = \frac{\sum_{k=1}^{n} x_{ik} y_{jk}}{\sqrt{\sum_{k=1}^{n} \left(x_{ik}^2\right) \sum_{k=1}^{n} \left(x_{ik}^2\right)}} \tag{7}$$

However, in the big data network environment, the intrusion data types of cloud computing network include numerical type and network type. The distance between data objects can be determined based on data clustering algorithm, and then the characteristic differences between normal data and intrusion data can be identified, so as to realize the comprehensive and accurate detection of intrusion data of cloud computing network [8, 9].

4 Conclusion

The rehabilitation and development of rural areas is a long-term commitment, and each region must actively integrate all resources and seek ways to improve it. Intensifying the advancement and application of Internet of Things technology in urban innovation will facilitate the advancement of technological progress, innovative business and development in rural areas, and accelerate various industrial innovations in the process of urban development and construction in rural areas. Technology will play a good role in improving social life and rural development. As effective technology improves and standards develop, its usage rate will continue to increase and its application will become more widespread, and the Internet of Things technology will play an important role in rural development.

References

1. Wang, Z. , & Zheng, X. . (2021). Application of internet of things information security in the informationization of sports training and education. Journal of Intelligent and Fuzzy Systems,14(4), 1-7.

2. Li, L. E. . (2022). Research on status information monitoring of power equipment based on internet of things. Energy Reports, 8, (2)81–286.
3. Chinnathambi, N. D. , Samuel, C. R. , Tamilarasu, K. , & Nagappan, K. . (2022). Internet of things-based smart residential building energy management system for a grid-connected solar photovoltaic-powered dc residential building. International Journal of Energy Research, 46(2), 1497-1517.
4. Zhang, J. . (2021). Cloud trust-driven hierarchical sharing method of internet of things information resources. Complexity, 2021(6), 1-11.
5. Goyal, S. B. , Bedi, P. , Yadav, D. K. , & Vakil, N. A. . (2021). Internet of things information analysis using fusion based learning with deep neural network. Journal of Physics: Conference Series, 1714(1), 012022 (9pp).
6. Lin, T. . (2022). Research on communication information hiding method of industrial internet of things based on deep fusion. International Journal of Internet Manufacturing and Services,25(3), 8.
7. Hughes-Lartey, K. , Li, M. , Botchey, F. E. , & Qin, Z. . (2021). Human factor, a critical weak point in the information security of an organization's internet of things. Heliyon, 7(3), e06522.
8. Yang, Y. C. , Ali, F. , & Nazir, S. . (2021). Selection of devices based on multicriteria for mobile data in internet of things environment. Mobile Information Systems, 2021(8), 1-7.
9. Mikhnenko, Y. , Skulysh, M. , Kurdecha, V. , & Mikhnenko, G. . (2021). Method of transmitting information on the internet of things. Information and Telecommunication Sciences(1), 41–47.
10. Ren-Wei, H. E. , Guo, S. L. , Deng, X. , & Zhou, K. . (2022). Influence of social capital on the livelihood strategies of farmers under china's rural revitalization strategy in poor mountain areas: a case study of the liangshan yi autonomous prefecture. Journal of Mountain Science, 19(4), 958-973.