

# Research on Food Security System Based on Internet of Things Technology under the Background of Big Data

Yanchun Ruan<sup>1</sup>, Hanxuan Chen<sup>2</sup>

<sup>1</sup>College of Cuisine Science and Technology, Jiangsu College of Tourism, Jiangsu 225100

<sup>2</sup>Jiangsu Ocean University Applied Technology School, Lianyungang Jiangsu 222001

ruanyanchun@163.com\*

**Abstract.** Food security is the main topic of social and economic construction in the new era, which directly affects the physical and mental health of urban residents. As the production, processing, sales and other links of food enterprises are the basic components of safety management, each link may cause food safety problems. Therefore, it is necessary to use modern technical means to collect and analyze the production data of each link, and pay attention to creating a safe and stable production environment, so as to ensure food safety and quality on the basis. On the basis of understanding the application advantages of Internet of Things technology in the era of big data, this paper takes the food tracking system as an example to deeply discuss the key technologies and main functions in order to provide technical support for solving food safety problems.

## 1. Introduction

With the steady development of social economy, science and technology, urban residents pay more and more attention to food safety, and begin to conduct in-depth research in combination with new ideas and technologies, and pay attention to establishing a scientific and perfect food safety guarantee system to fundamentally solve the food safety problem. Especially after entering the era of big data, the safety management of food enterprises has gradually changed the traditional ideas and started to use the Internet of Things technology to optimize and innovate. From the perspective of practical application, the application of Internet of Things technology in food safety management has the following advantages: firstly, it can effectively collect data information of food safety management, and provide convenient conditions for food safety management based on data tracking, data calling and data analysis on the basis of establishing a food safety database; Secondly, the management department of food enterprises can conduct more accurate data analysis and daily work based on the Internet of Things technology, construct standardized and perfect management files, and implement products certification, credit management and other tasks in an orderly manner; Thirdly, Internet of Things technology can comprehensively track and control food safety and quality, and provide technical support for information application and data management in the era of big data. Finally, the application of Internet of Things technology in various data management can provide an effective basis for enterprise management decisions on the basis of building an evaluation model of security risks.[1-3]

Under the background of the all-round popularization of Internet of Things technology, small and medium-sized food enterprises, as an important force in the construction and development of China's food industry, although their leaders have clearly recognized the importance of technological innovation and management optimization, they do not attach great importance to Internet of Things during data processing, are unwilling to add software and hardware to improve data processing capabilities, neglect the training of professional and technical personnel, and fail to give full play to the application value of Internet of Things technology theory, which leads to the failure of food enterprise security system. At the same time, food enterprises lack advanced hardware and software facilities for safety management, and the application of Internet of Things technology can't keep up with the development of the times. Foreign large-scale system software still occupies an important market share in China, and most food enterprises will give priority to the system models and components produced abroad. This is because China's production quality in some aspects can't guarantee the safety management of food enterprises. Therefore, in the face of

the gradual improvement of food safety management requirements, our country pays more attention to the rational use of the Internet of Things technology theory while increasing the publicity and education of small and medium-sized food enterprises. However, because enterprises are faced with restrictions of various influencing factors, it is necessary to consider specific problems in application research. In addition, aiming at the weak awareness of Internet of Things technology application in food safety management of most small and medium-sized food enterprises, we should put forward effective solutions, and pay attention to cultivating the professional skills and comprehensive quality of department staff, which can play a better role in promoting the safety and stability of food enterprises. On the basis of understanding the structure of food safety guarantee system based on Internet of Things technology under the background of big data, this paper mainly makes an empirical analysis by using food tracking management system to clarify the important role of Internet of Things technology in food enterprise safety management.[4-6]

## 2. Methods

### 2.1 Industrial big data

The sources of food big data based on the Internet of Things technology are mainly reflected in two aspects: on the one hand, various data generated in the production, processing and sales of food, such as warehousing information, inspection information and product information; On the other hand, the main body communication among government functional departments, production enterprises, consumer groups and news media, the specific structure is shown in Figure 1 below:[7]

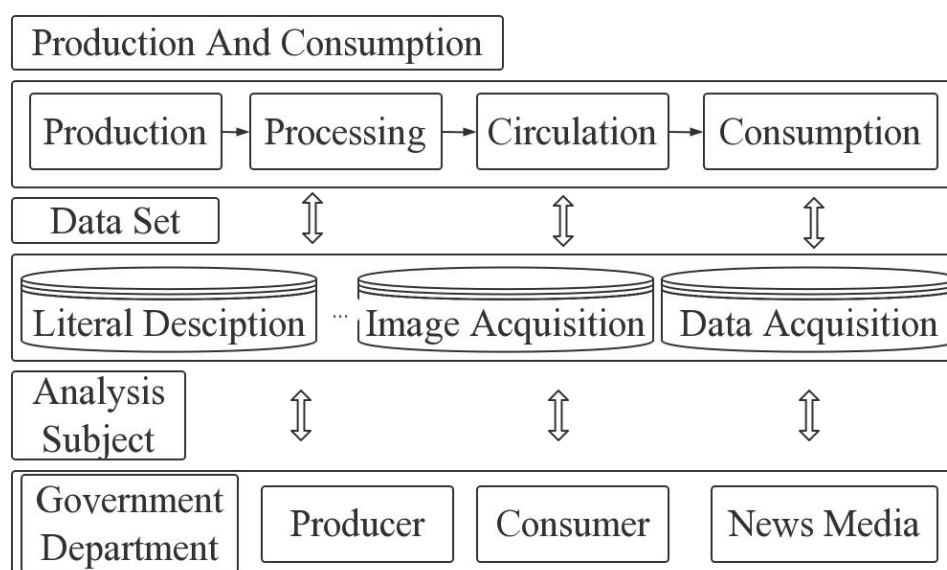


Figure 1 Big Data Structure of Food Industry

In the era of big data, the information is growing faster and faster, and the information processing technology is becoming more and more perfect, which provides technical support for automatic information collection and later information processing. First of all, the Internet of Things makes it possible to automate the information processing of food production and consumption. Food safety can be obtained by various sensing devices, such as image acquisition probes, humidity temperature sensors, RFID tags, etc., and automatically entered into the data collection with the help of the Internet of Things platform, while intensive sensor networks and information transmission channels are the basic facilities to realize the rational use of food big data; Secondly, diversified information exchange platform is an important channel for food safety management and information collection. Under the background that the government office network and enterprise management network have gradually developed into the mainstream, information

exchange and sharing can be realized reasonably with the help of Internet of Things technology. The specific structure is shown in Figure 2 below:[8-10]

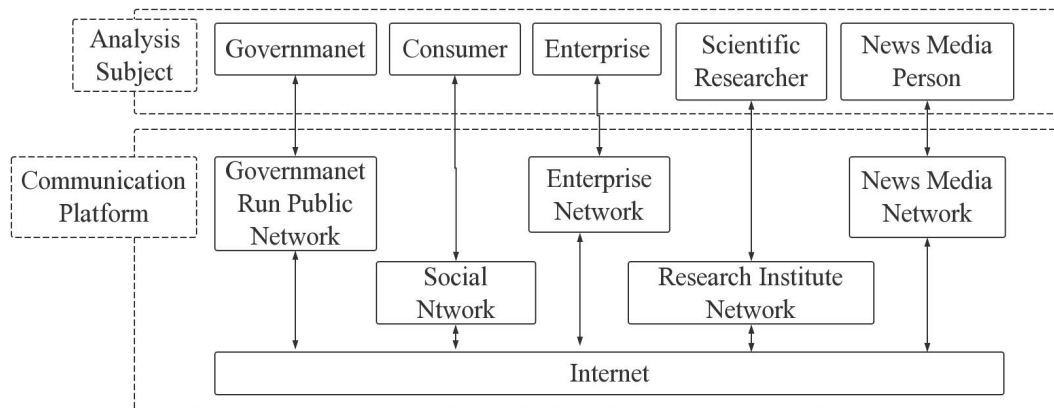


Figure 2 Food information collection channels based on the Internet of Things

According to the above analysis, it is found that the communication platform based on Internet of Things technology can ensure that the government, users, enterprises, news media and other subjects can quickly obtain more information resources, break the traditional communication constraints between subjects, and facilitate food enterprises to complete data analysis and integration research.

Finally, as the gathering place of food data, data collection is also an important processing place of food big data. From the current situation of data storage application in food enterprises, there are many problems in practice. Therefore, we should use the Internet of Things technology and virtual storage services to formulate a clear solution.[11]

## 2.2 main frame

The research and application of food safety management system can't be separated from the support of Internet of Things technology. It can not only provide rich data information for department employees, but also enhance the safety and accuracy of risk assessment according to the data information, so as to ensure the orderly safety work of food enterprises. In order to achieve the expected development goals, government departments are regarded as the main body of food safety management. Based on the Internet of Things technology theory, the main body framework shown in Figure 3 below is created:[12]

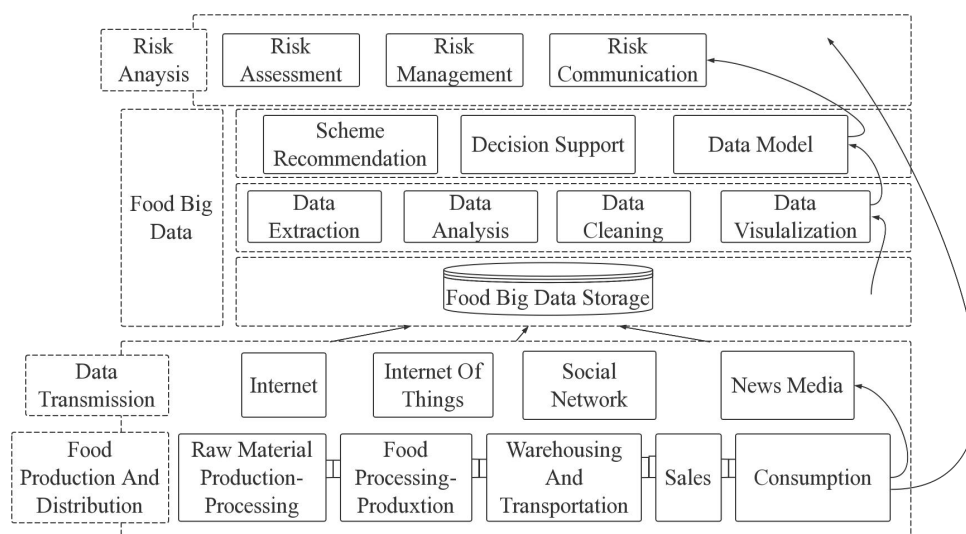


Figure 3 Framework structure diagram of food safety management subject based on Internet of Things technology

### 3. Result analysis

#### 3.1 Case introduction

Taking food tracking system as an example, this paper mainly discusses its application effect to Internet of Things technology under the background of big data. Considering the current situation of food enterprise safety management in the market, the following key technologies of the Internet of Things will be applied when building a food tracking system: Firstly, barcode technology. This technology can automatically collect and identify the data information in the system, with low practical application cost and high accuracy, so it has been widely used in food safety labeling. According to the coding rules, bar codes are divided into one-dimensional and two-dimensional forms, among which two-dimensional codes are widely used in food tracking systems. In our country, two-dimensional code has largely replaced one-dimensional code, which has the advantages of high density, large amount of information, strong error correction ability and high anti-counterfeiting function. Secondly, RFID technology. As a non-contact automatic identification technology, it includes antenna, reader, tag and many other contents, and can automatically acquire and identify analysis data. When tracking food safety information, RFID tags can automatically record various data information of the environment in which the goods are located, such as time, humidity, temperature, etc., and build a good cooperative relationship with the database. However, the system can be set according to the corresponding time of the tag, complete the data record in an orderly manner, and transmit it to the corresponding database, saving the manual monitoring and recording procedure. When setting the database information, it can ensure that the information will not be tampered with, and ensure that the overall system monitoring work is carried out in an orderly manner. Among them, the tracking process of RFID tags is shown in the following figure 4:[13]

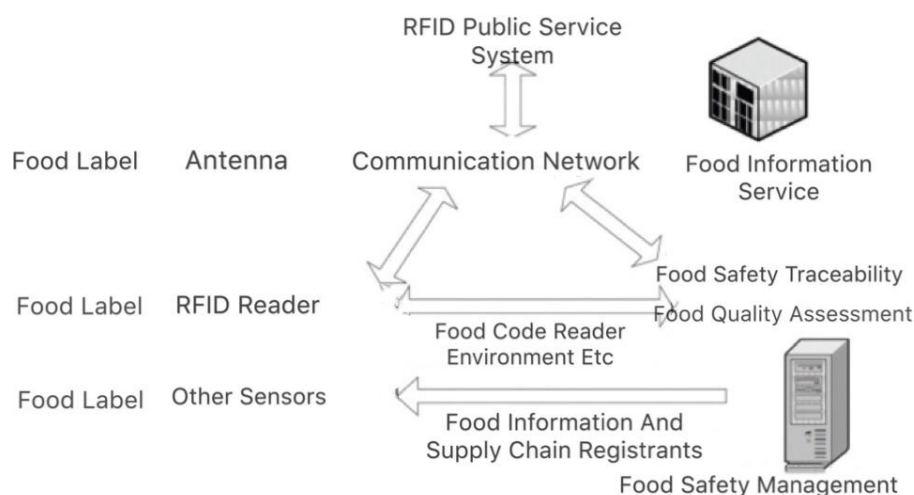


Fig. 4 tracking flow chart of RFID tag

Finally, EPC-ONS technology. Electronic Code (EPC) is a brand-new technology theory of Internet of Things, which is built by using the Internet and tags. It will encapsulate a string of codes in RFID tags to uniquely identify an object, and finally form a network platform for real-time sharing of global goods information. The system mainly includes communication network, radio frequency identification system, coding system, etc. The specific tracing process is shown in Figure 5 below:[14]

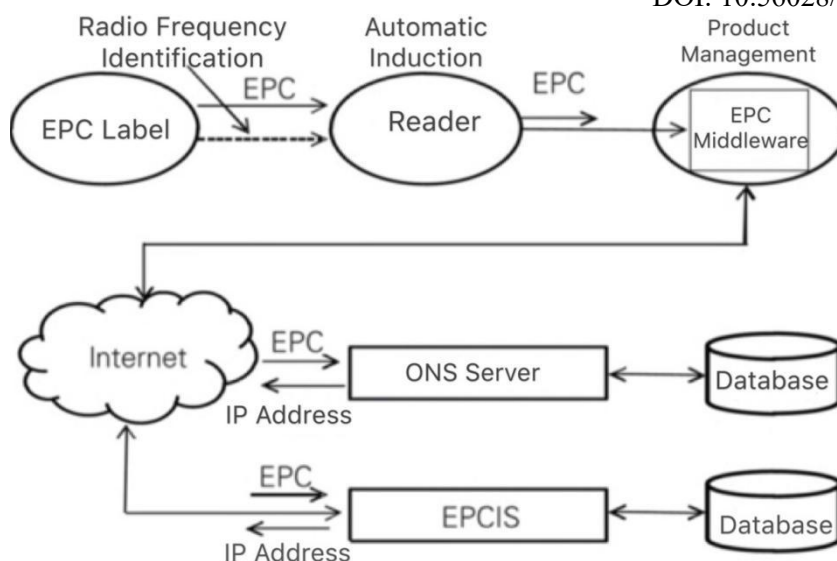


Fig. 5 system tracing flow chart

### 3.2 Application results

From the perspective of practical application, the overall system function includes the following contents: First, the basic information management module. When applying food traceability system to food safety management, all kinds of information will be collected and processed in a unified way according to food coding standards, and the permissions of different users in data application and query will be set, and the scope of use of all kinds of users will be defined. Secondly, the enterprise traceability module. This module design is mainly provided to food enterprise users, which is convenient for department employees to trace production raw materials, processing information, logistics information, etc., and lays a foundation for ensuring food safety and quality; Thirdly, the government supervision module. The design of this module should give full consideration to quality verification, traceability inquiry, food recall, etc. Employees of all departments should comprehensively supervise the food transportation status and sales situation of the whole supply chain, recall unqualified food types in time, publish information to the food traceability platform, and inform operators at all levels to stop selling; Finally, the public service platform module. The design of this module is divided into two parts. On the one hand, it refers to the retrospective inquiry, which provides various permissions to the public, so that consumers can buy goods and inquire about information at retail terminals. On the other hand, it refers to the complaints and suggestions, and the consumers meet with security.[15]

### Conclusion

To sum up, the Internet of Things, as an important technical means of intelligent management of food enterprises, studies the key technologies and main functions of food safety guarantee system based on relevant technical theories, which can not only solve the problems faced by traditional food safety production and operation, but also build a high-quality enterprise management environment, and finally provide consumers with high-quality products and services.

### Acknowledgments

Supported by Sichuan Cuisine Development Research Center, Sichuan Provincial Key Research Base of Philosophy and Social Sciences (CC20Z16).

## References

- [1] Xia Zhang . Constructing and evaluating food safety standard system based on big data [J]. China Food Industry, 2021, 000(014):P.4-5.
- [2] Junqin Zhang , Shuping Wang . The application of big data thinking in the formulation of food safety standards [J]. Food Safety Guide, 2021(18):2.
- [3] Qingjie Meng, Haichang Yao . Food safety supervision based on neural network technology in big data environment [J]. Food and Machinery, 2021(1):104-107.
- [4] Mengzi Yin . Food safety information tracing platform based on big data governance [J]. Microcomputer Information, 2021, 000(016):38-39,42.
- [5] Ling Li , Xiaomiao Hu , Ying Liu. Big data thinking to develop food safety standard system countermeasures [J]. China Food Industry, 2021(24):2.
- [6] Xi Wang, Xiaohong Sun , Kai Wu , et al. Research on the probe of food safety public opinion monitoring based on Bayesian network [J]. Computer System Application, 2022, 31(1):8.
- [7] Xinning Su, Naixuan Zhao . Taking the management of big data information resources as a sharp weapon to overcome the difficult problem of food safety supervision-comment on "China Food Safety Supervision Index Research: Theory, Model and Practice" [J]. Library and Information Work, 2022, 66(2):149-151.
- [8] Xiaoting Yang , Yufeng Tao , Na Zhang , et al. Research on the construction of quality control analysis and evaluation model of food safety laboratory supervision and inspection based on new market supervision mechanism [J]. Quality Safety and Inspection, 2022, 32(3):4.
- [9] Jun Fang , Jiaming Qu , Aijun Zhang , et al. Establishment of evaluation standard system for emergency response effect of food safety emergencies: a Delphi consensus study [J]. Food Industry Science and Technology, 2022, 43(10):7.
- [10] Yu Niu . Thoughts on the application of big data and intelligence in food supervision-comment on "Research on Food Safety Supervision System of Online Shopping" [J]. Journal of Food Safety and Quality Inspection, 2022, 13(9):2.
- [11] Zhiying Liu . Construction of food safety inspection and evaluation system based on big data technology [J]. China Testing, 2021, 47(S01):3.
- [12] AARON Li. Analyzing the innovation of food safety management and its challenges based on the background of big data [J]. China Management Informatization, 2022, 25(10):3.
- [13] Yong Wang . Research on the application of big data technology in food safety supervision [J]. China Food, 2022(18):3.
- [14] Zheyuan Wu , Xinyi Wang , Xiaokui Guo , et al. Literature research on big data-driven whole health decision support [J]. China Journal of Health Information Management, 2022(002):019.
- [15] Yijing Wang , Hong Liao . Using big data technology to improve the intelligence of food safety traceability system [J]. China Automatic Identification Technology, 2021(6):77-79.