

## Research Article

### Research and Development of Cloud-based Food Safety Traceability System

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**Abstract:** Currently, the food safety problem has become a serious problem and the research aims to develop a set of traceability system which can be applied in the food. The Internet-based cloud computing solution was adopted to manage the database on the source area of the food and production time and achieve the real-time inquiry through the phone. With the test, the system can realize the online inquiry on the origin of each food. The system can effectively prevent the occurrence of food safety accident and it plays an important role for the maintenance of food safety.

**Keywords:** Cloud computing, food safety, traceability

#### INTRODUCTION

Currently, the food safety accident in the whole world occurs frequently and the situation is not optimistic. The whole process from planting, breeding, storage processing for the agricultural product until becoming the food is very complex. If any medium section appears the problem, it may cause the occurrence of the food safety accident. On December 6, 2008, the Irish government reported that in a routine inspection, the Irish Food Safety Agency found that the killed live pig was contaminated by the TCDD and the contained TCDD ingredient was 80 to 200 times of the upper limit of the EU safety standard. Some pork may be exported to 25 countries including US and China; in 2006, the cleaning equipment sewage from the world's famous chocolate food enterprise British Cadbury Company contaminated the chocolate and 42 people were poisoned by the chocolate contaminated by the salmonella. The company urgently recalled millions of chocolate within the EU and worldwide. In China, according to the incomplete survey, 20.2% urban consumers and 18.3% rural consumers believed that there were too many problems in the current food safety situation and it was disappointing; 45.3% urban consumers and 36.6% rural consumers were unsatisfactory on the current governmental food safety supervision and management work; Over 10% consumers held that the current food safety situation was failed (Galimberti *et al.*, 2013). The government responsibility and obligation is to solve the social and public issues, while the food is a social and public issue. Solving the food safety problem is the obligatory duty of

the government. Currently, the frequent occurrence of the food safety issues exposes the contradiction between the public's growing food safety demand and the insufficient food safety the government provides (Kochetkov, 2013). Therefore, reforming the food safety regulatory system and improving the effectiveness of the food safety regulation are the hot issues to be resolved by the government regulating departments (Hajnal *et al.*, 2004).

A key point to eliminate the food safety problem lies in the food's traceability mechanism in the circulation and consumption. Due to the feature of the food, the influence of the front end of the food chain (such as the production section and processing section) and the factors for the food to be produced, processed or consumed at the different places, there are more and more factors influencing the quality safety in the circulation and consumer fields. Therefore, strictly controlling and managing the food safety at the circulation play an important role to ensure the human health, social stability and economic development (Han-Chen, 2013).

Cloud computing is a synonym for distributed computing over a network and means the ability to run a program on many connected computers at the same time (Corkery *et al.*, 2013). The phrase is also, more commonly used to refer to network-based services which appear to be provided by real server hardware, which in fact are served up by virtual hardware, simulated by software running on one or more real machines. Such virtual servers do not physically exist and can therefore be moved around and scaled up (or

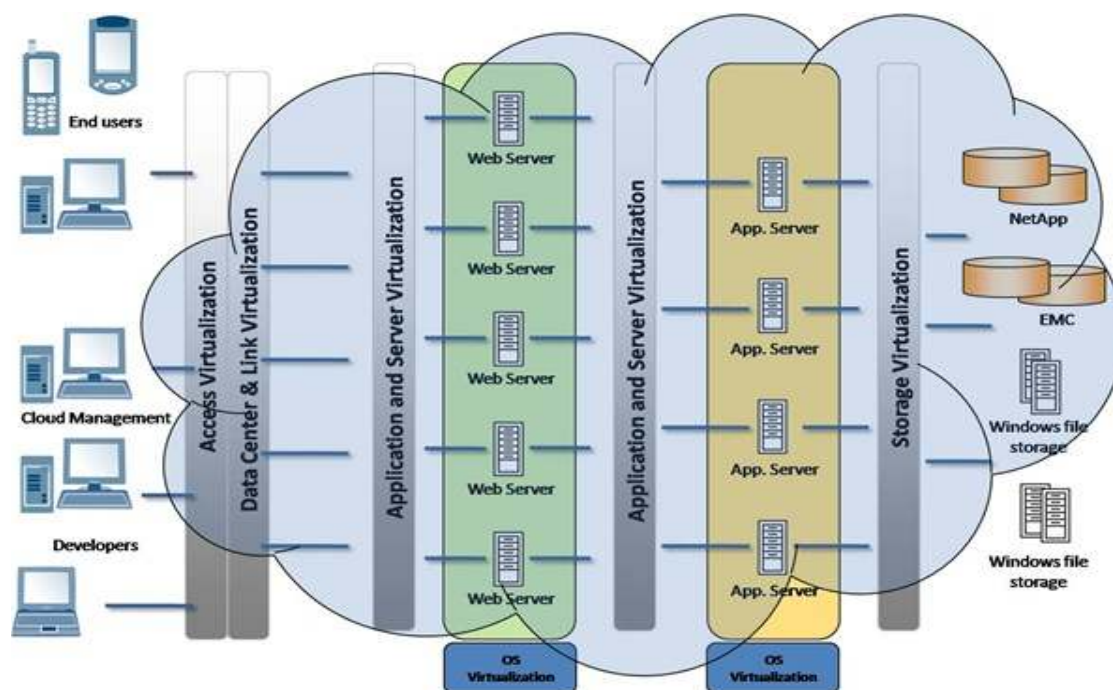


Fig. 1: Frame of food safety traceability system

down) on the fly without affecting the end user-arguably, rather like a cloud.

The research aims to establish the Internet-based food safety traceability system, realize the regulation in the circulation, achieve the whole-process traceability, maximum avoid the occurrence of the food safety accident and propose the measures to strengthen the food safety in the circulation and consumption fields in our country from the systematic, scientific and reasonable perspectives.

## MATERIALS AND METHODS

**Major equipment for the client:** In order to facilitate the user to view the food safety regulatory code at any time and any place, the system client-side adopts Android operating system-based smart phone or portable tablet PC as the terminal. The equipment is portable and convenient for the network connection, which is very suitable to be the client-side of the system (Bisio *et al.*, 2013).

**Background service terminal:** The background of the system adopts the U1 cloud computing platform researched by Dell Company. The platform can be divided into 3 parts.

**Management server:** It adopts the multiple management machines and manages the cloud computing platform. It avoids appearing the malfunction of the management machine.

**Storage server group:** Through iSCSI, the storage cluster file system can form a unified storage pool, thus providing the logical disk storage, unstructured data storage and integrated backup service for the virtual machine within the node.

**Computing server group:** The computing server is the professional server with high configuration.

**System development method:** The system is a set of Internet application developed based on the “cloud computing” program; therefore, the frame can be divided into the show layer, intermediate layer and infrastructure layer. In order to carry the vast amounts of data and ensure the manageability of these data, a set of distributed storage system is needed. The optimization in the expansion and management is made based on the original relational database to make the “cloud computing” work well. The main frame of food safety traceability system can be seen in Fig. 1.

### The process solution of food safety traceability system:

- **Code:** From the production of various primary raw materials to the final consumption food, the food supply chain includes the production and circulation of the primary raw material in various forms, the processing and circulation of the semi-finished at different sections and intermediate level, the manufacturing and circulation of the final consumption food. Therefore, achieving the full-

process traceability on the food shall not only encode the final consumption food, but also conduct the unified coding on the primary raw material and semi-finished product at the intermediate level. Meanwhile, the product batch and other information must be included in the code and the code shall be universal to exchange the effective information with the similar system at other countries or regions. The system adopts the three-dimensional image form through the overlay of UCC coding as the representation code of the system commodity. UCC code is the coding rule formulated by EAN International-Uniform Code Council (EAN-UCC) that included product barcodes which are printed on the great majority of products available in stores worldwide and electronic commerce standards. It is unique in the world, so it is suitable to be the code of the product traceability system.

- **Data transmission:** The key for the system realization is how to easily and effectively collect and summarize various information. Considering that the food supply chain concerns various enterprises and product amounts and the information that the food traceability needs to collect is dispersed in the time and space and it is hard for the single server to effectively support the real-time asynchronous information collection and traceability in the performance. Therefore, for the information collection within the large spatial scope, the system respectively sets the regional server connected with the central server according to the division of geographical location when realizing. Meanwhile, for the stable information with large quantity of information of enterprise information, product information and structure information, the related enterprises shall online entry the regional server through the on-line terminal. For the product process information with more entries, inconvenient live online entry and small amount of data, it will store the RFID mode and attach the three-dimensional coding information in the product package for the automatic collection based on the related technology in the Internet of Things through holding the wireless terminal equipment. Then, the wireless terminal will automatically position the geographical location through GPS and other technologies and remotely send the three-dimensional information and the enterprise collecting the information, collecting time, location and principal to the regional server through Wifi and other means (Zhou and Qin, 2013).
- **Database application:** The database layer is responsible for the data access and control and the design of database layer is an important step to realize the cloud computing system. The software needs to process the different designs aiming at the feature of cloud computing system and the

realization maturity. The database layer in the system mainly includes the shared data sheet and the private data sheet. The system public module and some public user information are mainly stored in the shared data sheet, the information after each system user defines the system and the private data of the enterprise are mainly stored in the private data sheet. User uploads the coding information collected from the cell phone or other mobile device to the private database. Through the comparison, the corresponding information of the food code can be queried in the enterprise database and finally return to the user terminal.

## EXPERIMENT AND RESULT

Through the experiment test, the system can successfully complete the following functions:

**Photograph and scan of three-dimensional code:** It can automatically adjust the camera of Android system, shoot the three-dimensional code of the commodity and analyze the shoot content as the corresponding information.

**Upload the traceability information:** Through the client software, the information that the user queries can be uploaded to the application program cloud. Through the comparison, the corresponding original information of the food can be found out.

**Pass back the commodity information:** Through the system cloud computing application, the commodity information can be passed back to the phone.

**Display the warning information:** Through the food traceability platform, the food production enterprise and government regulation department can release the food safety early warning information and the consumer can query the food safety situation existed in a certain region or a certain food safety early warning information through the mobile terminal.

Through the above steps, the three-dimensional code in the commodity tag can query the food production batch information, manufacturer information and other information in the production process, such as production data and inspection information. Along with the development of mobile Internet technology, providing the seamless Internet food safety service for the public becomes possible. Meanwhile, the universal use of the smart phone allows people to query the food information we bought at any time and any place easily through the mobile device (rather than the computer).

## CONCLUSION

The system is occupied with the good user experience of clear interface and convenient operation and takes into account the system usability and

portability, which can practically resolve the difficult internal traceability of the food enterprise and opaque external traceability, make the government regulating department and buyer find the food safety problem as early as possible and conduct the rapid response. However, the system also has the following problems:

- How to make more enterprises join the set of food safety platform is a pressing problem needing the government and enterprise to work together.
- The system can only be used in the platform equipped with the Android operating system. In the future, the system based on Apple iOS and Win8 platform will be developed to facilitate more portable devices to use the set of software.

### REFERENCES

- Bisio, I., F. Lavagetto, M. Marchese and A. Sciarrone, 2013. GPS/HPS-and Wi-fi fingerprint-based location recognition for check-in applications over smartphones in cloud-based LBSs. *IEEE T. Multimedia*, 15(4): 858-869.
- Corkery, G., U. McCarthy, K. McDonnell and S. Ward, 2013. Ireland develops smart biometrics for animal ID. *Res. Eng. Technol. Sustain. World*, 20(4): 10-11.
- Galimberti, A., F. De Mattia, A. Losa, I. Bruni, S. Federici, M. Casiraghi, S. Martellos and M. Labra, 2013. DNA barcoding as a new tool for food traceability. *Food Res. Int.*, 50(1): 55-63.
- Hajnal, É., G. Kollár and M. Láng-Lázi, 2004. IT support and statistics in traceability and product recall at food logistics providers. *Period. Polytech. Chem.*, 48(1): 21-29.
- Han-Chen, H., 2013. Construction of a health food demand prediction model using a back propagation neural network. *Adv. J. Food Sci. Technol.*, 5(7): 896-899.
- Kochetkov, A., 2013. Cloud-based biometric services: Just a matter of time. *Biometric Technol. Today*, 2013(5): 8-11.
- Zhou, Z. and H. Qin, 2013. The game analysis of public participation in food security supervision. *Adv. J. Food Sci. Technol.*, 5(3): 323-327.