The design and implement of the safety production management & quality trace system for poultry

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Abstract—**Traceable system, which is as an effective way to control the quality and safety of agricultural products receives increasingly attention globally. Using the poultry as the research object, the paper builds a safety production management and quality trace system in order to achieve the goal of quality trace. This paper designs the process to fulfill the main function, discusses the key techniques and develops the safety production management and quality trace system. The system has several functions-producer management, production alert, bar code print, sending messages and quality trace for consumers. The results indicate that this system can increase the level of production management, enhance the awareness of agricultural production for the consumers, which builds solid base for poultry full process trace.**

Keywords-Trace system; Quality safety of agriculture production; production management

I. INTRODUCTION*)*

In the recent years, the food safety crisis-such as livestock and poultry diseases, serious agricultural residual drugs and the increasing imports of foreign food materials occurs frequently, which caused widespread concern in the world[1~3].

In China, in addition to the effects of epidemic and pollution, the misuse of veterinary drugs is very frequent which has serious impact on people's health. How to effectively manage the production of livestock and poultry products is becoming an extremely urgent global issue[4~5].

The poultry production management system-VALLSUN Series utilizes RFID technology throughout the poultry production, breeding, slaughter or production, distribution, and consumption that are strictly controlled. The system establishes a complete poultry product safety production management system for the industrial chain. The system applies the database technology, network technology, distributed computer technology to build poultry production and aquaculture database in order to integrate the information integration, query, monitoring.

Based on the system, the poultry products enterprise can form a closed production loop to provide the community with quality assured food supply and ensure high-quality data exchange. For the poultry food industry, it can ensure the food source traceable and the completely transparency of the food supply chain

II. STRUCTURES OF THE POULTRY SAFETY PRODUCTION MANAGEMENT AND QUALITY TRACE SYSTEM BASED ON RFID

The poultry safety production management and quality trace system using the poultry primary products as research objects, using the production enterprise-sale end(such as supermarket or community service center) as basic model. The system is designed from the producer and consumer perspectives. It includes two parts-poultry safety production management system and poultry quality trace system which are on the basic of RFID technology. Figure 1 indicates the scheme.

In the figure, the poultry safety production management system in the enterprise end forms the products archive recording the farmers' information, fields information, production process information and package information, which is stored in the enterprise database and periodically uploaded to the central database; The bar code with the products archive information is formed by some specific coding rules during the products packaging; the complete archive data is formed in database of the trace center when the products enter the markets; finally the consumer can trace the products by different platforms, such as the websites of the quality trace system, text message or scanner in the supermarket.

III. THE MODULE DESIGN OF THE SYSTEM

The paper is the application in poultry safety production management and quality trace system with RFID technology. It designs a kind of high power, low power consumption poultry information writer-reader which can be used for poultry information trace.

The writer-reader can be divided into five parts-microcontroller module, RF module, PC interface module, storage module and power module, which can be seen in Figure 2.

The main function of the microcontroller module is to send commands to the poultry tags, control the communication between the poultry tags and the writer-reader; it encodes the signal when sends the data; it needs plenty of storage space and high processing speed to run anti-collision algorithm in the environment with multiple tags; it also encrypts and decrypt the data and identify the status between the writer-reader and tags in order to ensure

the data security; it can read available poultry data and upload to upper monitor when communicates with application software.

The RF module is the data exchange interface between the writer-reader and electrical tags. The radio frequency carrier signal usually generated by the RF oscillator is processed by the RF processor, amplified by the RF amplifier and finally sent by the antenna.

The PC interface is used for the communication between the writer-reader and PC. The application software running in PC can send commands to the writer-reader via the interface. The writer-reader can also send the available data to PC by the interface. It will be convenient to process large amount of data in background to relieve the load of the writer-reader.

The data read by the writer-reader is processed at fixed time, thus the memory merely in the microcontroller can't meet the requirement for storage when the amount of poultry data is large. The storage module will fix the problem. The module can store the data of the tags from the writer-reader whose volumes can vary according to the different applications.

The power module ensures the power supply of other modules and effective operation of the whole system.

The typical RFID system usually can be divided into 3 parts: electrical tags, writer-reader and computer communication center, as in Fig. 3.

A. Electrical tags

Electrical tag, also called RF tag or transponder is the carrier of poultry RFID data which normally installed in the detected poultry in order to save the poultry information. The poultry electrical tags will vary in shape, size and frequency with different environment. It finishes the data communication and energy transmission by the space coupling between the couple element and the poultry RF signals. The tags can be classified as active tag and passive tag by the power supply.

The active tag has embedded battery, which can work more distance like tens or even hundreds meters. However the lifetime of the tag is short and the cost is quite high due to the embedded battery.

The passive tag is the tag without interior battery which uses the electromagnetic field energy sent by the writer-reader. Compared with active tag, the passive tag works less distance, but it has long lifetime, low cost and different shapes that can be suitable for many situation.

B. Writer-reader

The writer-reader, also called poultry information reader establish communication with poultry electrical tags, read or write electrical tag information and send the tag information to computer communication networks. In the operation, the communication establishment, anti-collision and status identification is finished by the reader.

C. Computer communication center

Computer communication center is responsible for sending commands to poultry writer-reader, receiving data

from the writer-reader and processing the data according different requirements.RS-232, RJ-45, USB, Ethernet and wireless networks are used to transmit the data to writer-reader.

IV. ANTI-COLLISION ALGORITHM DESIGN

The writer-reader sends a request command which will be responded by nearby poultry electrical tags. All of the tags will send IDs to the writer-reader. At this more than two tags will send the IDs simultaneously and collision occurs. If there is only one tag sent, the tag will be detected as shown in figure 4. The algorithm will cause 'tag hungry'. When the quantity of the tags is large the collision will continually happen and no tags will be detected. The performance of the algorithm will not be affected with the increasing amount of tags. The utilization of the channel can be up to 88%.

V. EXPERIMENT AND SIMULATION ANALYSIS

The system applies B/S structure based on the consideration of multi-users and scalability. The poultry quality trace system provides the public with a query platform in the form of websites. Other platforms can be integrated in the system. The whole system is developed by .net platform, using CC#.net as development tools and object-oriented program. The function is fulfilled on the basis of compiling system public class. The hardware requirement is shown in table 1.

After programming and using the systems as the experiment object, the results is shown in figure 5. The poultry merchandise identification code can be used as global trade project code with (01) as identification. The package date and production field use (11) and (10) to identify. The production date uses the encoding method of YYMMDD. The production field uses the first 4 digits to identify the farmer and extra 2 digits to identify field. Thus the information in the following tag is Beijing Leping agricultural products production and marketing company No. 0002 farmer No.02 field, the packaging date is 05/23/2005. The trace code generated by this method can provide sole production information, such as production field and date. It also meets the EAN/UCC coding standard. In order to achieve the trace and convenience of multi-platforms, the bar codes can be hided and compatible production trace code can be designed when print the bar codes. When there is scanner the bar codes can be scanned for trace, while the trace codes can be typed when there is no scanner. The trace code is specific for each products with 20 digits. The format is following, package date + No. of farmer field + name of the products and No. of the products + products level and No. of package + the sole identification, as shown in figure 6.

From the analysis results, the system can process the experimental data well and meet the requirement of real-time and accuracy.

VI. CONCLUSION

Using the poultry as the research object, the paper builds a safety production management and quality trace system in order to achieve the goal of quality trace from the

information technology perspective. This paper designs the process to fulfill the main functions, discusses the key techniques and develops the safety production management and quality trace system.

From the experiment results, the system can increase the enterprise production management level and enhance the safety awareness of the agriculture products for the consumers, build solid base for poultry full process trace.

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REFERENCES

[1] Schwagele,F. Traceability from European perspective[J].Meat Science, 2005(71):164－17

[2] MousaviA,SarhadiM,LenkA,eta1.Tracingandtraceabilityinthemeatprocessingindustry:asolution[J].British Food Journal, 2002, 104(1)：7－19.

[3] SmithGC, TatumJD, BelkKE, etal. Traceability from a US perspective[J].Meat Science, 2005, (71)：174－193.

[4] StanfordK,StittJ,KellarJA,etal.TraceabilityincattleandsmallruminantsinCanada[J].Scientific and Technical Review, 2001, 20(2)：510－52

[5] BlancouF.A history of the traceability of animals and animal product[J].Revue Scientifiqueet Technique，2001，20(2)：413－425.
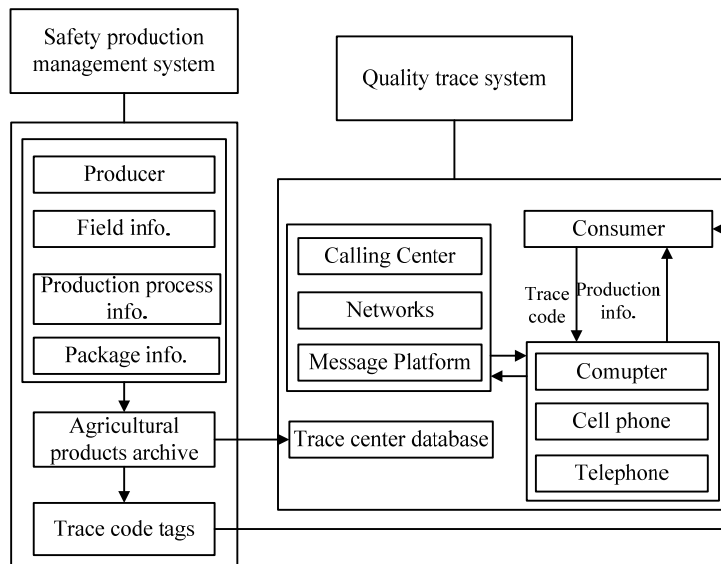
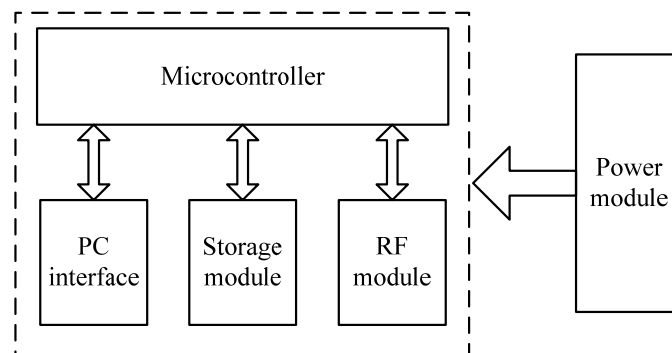Figure 1.   Scheme of the system

Figure 2.   Writer-reader hardware structure
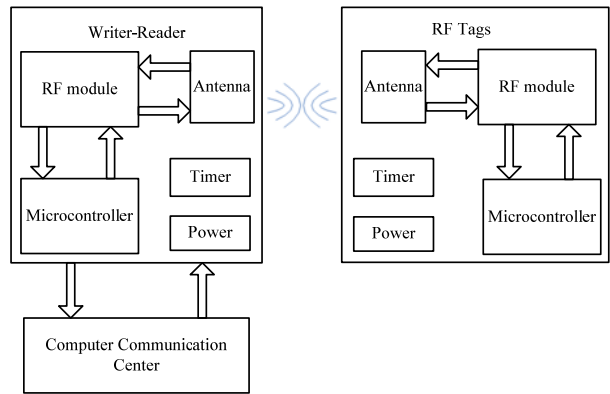
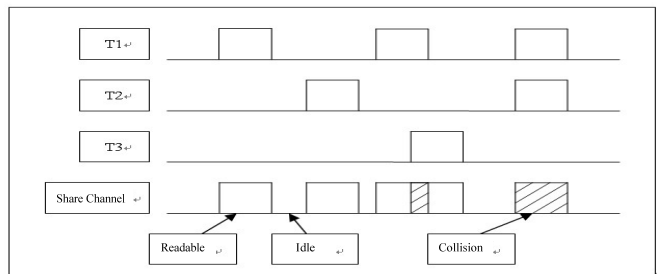Figure 3.   Poultry RFID trace system structure
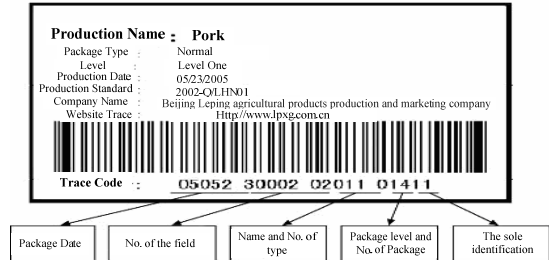

Figure 4.   Scheme of the anti-collision algorithm

Figure 5.   Experiment results analysis

TABLE I.   CONFIGURE REQUIREMENT FOR THE MANAGEMENT SYSTEM

Operation System	Hardware			Software
	CPU	*RAM*	*Disk*	
Windows XP or above	Intel P4 1GHz or above	1G or above	250G or above	Microsoft SQL Server2005 Microsoft .NET Framework 2.0 or above