

Research on Traceability of Agricultural product based mostly on net of Things

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Abstract - with the rapid development of science and technology, modern agriculture has created nice progress. But frequent agricultural safety incidents have affected people's trust in agricultural production. These incidents (such as mad cow disease, avian flu) have seriously affected the scenario of agricultural production in an exceedingly region or product, and even affected the economic and social development. Based on the study of the prevailing traceability merchandise, we constructs the agricultural traceability system of agricultural merchandise based mostly on web of things through the net of things technology data security technology and cloud computing technology during this paper. Through the system customers can effectively perceive the elaborate method and risk standing of each section of agricultural merchandise, such as cultivation, processing, storage and sale, and the problem of counterfeiting within the method of production and circulation will be solved. Finally, the agricultural traceability system can offer effective basis for agricultural trade, logistics and safe consumption.

Key Words: Agricultural products; Traceability; Internet of things; RFID tags

1. INTRODUCTION

Agriculture is the basis of economic development and social stability, and the safety of agricultural products is additional closely associated with the health and safety of every national [1, 2, 3]. In recent years, safety issues of agricultural productions, which might occur in each stage of planting / breeding, processing, storage, transportation, and sales, have seriously affected agricultural development. These incidents, such as European mad cow disease, the United States of spinach, peanut bacterial contamination, China's Sanlu milk powder incident, aquatic products feeding contraceptive method medicine, vegetables spray poisonous pesticides, etc., seriously restricts the further development of agriculture, affecting the social and economic development [4,5,6].

In order to unravel the issues of agricultural production, the government, experts, scholars and international organizations have carried out analysis and analysis on the agricultural traceability system. Moe explained that traceability can be seen the power to trace a product batch and its history through the full, or part, of a production chain from harvest through transport, storage, processing, distribution and sales or internally in one of the steps within the chain[7]. Golan purpose out that traceability systems ar a tool to assist corporations manage the flow of inputs and merchandise to boost potency, product differentiation, food safety, and product quality and complete traceability is impossible. So there is no absolute traceability, but the performance of traceable systems will be measured by breadth, breath and precision[8].The International Standard Organization (ISO) printed the general principles and Basic needs for the planning and Implementation of traceability systems for feed and food offer chains in 2007[9]. On the basis of those studies, with the development of technology like Internet of Things, Web GIS, cloud computing, most of product traceability systems have been used product code because the identification of traceability systems. [10, 11, 12]. For example, the British government established an Internet-based stock pursuit system. China Commodity writing Center construction and operation of the national food safety traceability platform, by the government, enterprises, consumers, third parties to use, with one-dimensional coding, two-dimensional code, RFID Label, to achieve the standard and safety of food business information analysis and process, as well as information content, public inquiry, diagnosis and early warning, quality complaints and other functions. However, traceability tags, such as code and EPC tag, which have the straightforward structure, easily be cast and attacked and the its' affected the safety of traceability system. Therefore, we study the traceability of agricultural merchandise from the web of Things technology, and put forward the planning of traceability system of agricultural merchandise supported RFID tag that improve the security of the system.

II. MAIN TECHNOLOGY

A. Agricultural Products authentication and traceability

The ISO 9000:2000 guidelines outline traceability as the "ability to trace the history, application or location of that which is beneath consideration" [13]. Walker [14] point out authentication and traceability of agricultural production will be utilized in four distinct contexts, each with a totally different silent sense:

(1) Desire to have confidence in what we have a tendency to ar uptake

(2) Desire to pay a correct price for the merchandise

(3) Health and safety issues

(4) Prevention of criminal activities and Safeguarding environments by preventing the spread of malady and invasion of non-indigenous species.

Traceability and certification principles will be followed in our agricultural traceability system style.

B. Internet of things

International Telecommunication Union (ITU) pointed out that the net of Things is thru the sensor, such as two-dimensional code reading equipment, radio frequency identification equipment, infrared sensors, GPS and laser scanners and alternative data sensing instrumentality to collect data to attain intelligent identification, positioning, tracking, monitoring and manage the network. In the Internet of things, information assortment instrumentality to follow the communications protocol / information processing protocol to connect the net, to achieve data exchange and communication. The Internet of things is sometimes divided into 3 levels: sensing layer, network layer and application layer. Among them, the sensing layer is responsible for the identification of things and knowledge assortment. Through the Internet the network layer is to blame for uploading the information obtained by the sensing layer to the applying layer. The application layer processes the obtained data and preforms data processing to get the knowledge that the user wants.

In the agricultural traceability system, the sensing layer is responsible for identity and information assortment. The network layer is responsible for connecting to the net to transfer the collected information. The application layer is to blame for data analysis, processing and call support. In the system implementation, by the sensor, camera, positioning equipment, etc. to collect data, through the LAN, DDN, 3G/4G LTE upload information, agricultural traceability system are accountable for processing and analysis.

C. Coding technology

The bar code or EPC tags is generally used because the unique identification of traceability system within the field of the agricultural merchandise. Bar codes are typically divided into one-dimensional codes and two-dimensional codes. One-dimensional codes generally carry data not extraordinary one hundred bytes, two-dimensional code can carry additional data and have a bound error detection and error correction capability, such as PDF417 code can carry 1108 computer code characters [16]. RFID tags can store 16k-64k bytes, compared with the two-dimensional code greatly increased storage capability. Although the two-dimensional code storage capability is restricted, but it has a coffee price, easy to scan the blessings. In the agricultural traceability system, both RFID and two-dimensional codes will be used as distinctive identifiers.

The International Standards Organization (ISO), the Codex Alimentarius Commission (CAC), the International Dairy Federation (IDF), and the International Standards Association (GS1) have proposed standards for traceability. In the agricultural traceability system, we selected EAN • UCC system, which is established by EAN (European

Article Numbering Association and UCC (Uniform Code Council), to encode agricultural merchandise. The traceability agricultural product code contains the fixed message needed by the GS, such as production lot range, a shift number, and the additional message like encoding and signcrypton message.

D. Encryption and Hash Funicton

Encryption algorithms and hash algorithms ar necessary means that of making certain traceability system security and nonrepudiation. Encryption algorithmic program is used to avoid data escape. Hash function algorithmic program is used to ensure the integrity and credibility of message. Since some of the knowledge within the traceability system is open, the public key algorithmic program is chosen within the encoding algorithm. In the public key algorithm, the key is composed of two parts: the general public key and therefore the personal key. And the key pair is generated by the certificate authority. In traceability system, the agricultural enterprise get the personal key and traceability system obtain code and the public key of agricultural and unharness it. Commonly used public key algorithms ar RSA, ECC, NTRU, etc. With the same security intensity, key length of ECC algorithmic program greatly a lot of shorter than that RSA (For example, 160 computer code key will get the same intensity of security as 1024 RSA key). Considering that the application of ECC algorithmic program has been wide utilized in recent years and therefore the hardware and computer code are well supported, so the traceability system uses the computer code algorithmic program for encoding. MD5, SHA, LHASH, etc are ordinarily used hash perform. Considering the security intensity and processing speed of the algorithmic program [18], the SHA-3 algorithm is designated in agricultural traceability system.

III. OVERALL STRUCTURE OF SYSTEM

The agricultural traceability system uses the traceability code as the retroactive mark, collects data from the web of Things, and encrypts data through the RSA and SHA-3 algorithmic program to guarantee the safety and non-repudiation of information.

A. The overall Structure of the system

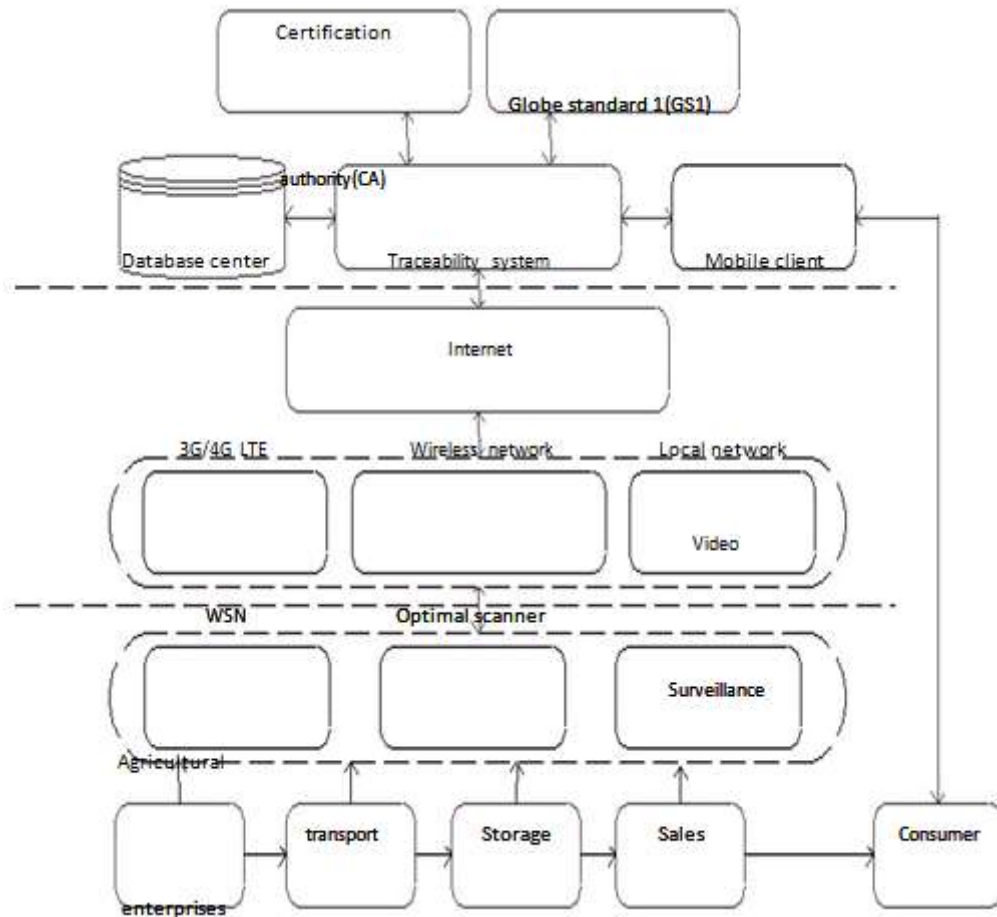


Figure 1.Overall Structure of the agricultural traceability system

From the actual process of agricultural product in provision, the traceability system based on net of things consists of 3 levels that that square measure sensing layer, network layer and application layer. The overall frame is shown in Fig. 1. As the network layer is accountable for data not the main focus of the paper discussion, the latter will not be concerned within the network layer of content. The following uses AE to represent the producer of agricultural products, CA identifies the certification center, GS1 represents the International Article Numbering Association, and TS indicates the traceability system.

B. Pretreatment

First of all, the agricultural production enterprises submit the enterprise qualification to the traceability system. Second, after checking and auditing the enterprise qualification, traceability system respectively apply for company business code and security certificate to the GS1 and

CA. Finally, the traceability distributes the receive information from the GS1 and CA through the secure channel (such as offline or encrypted channel).

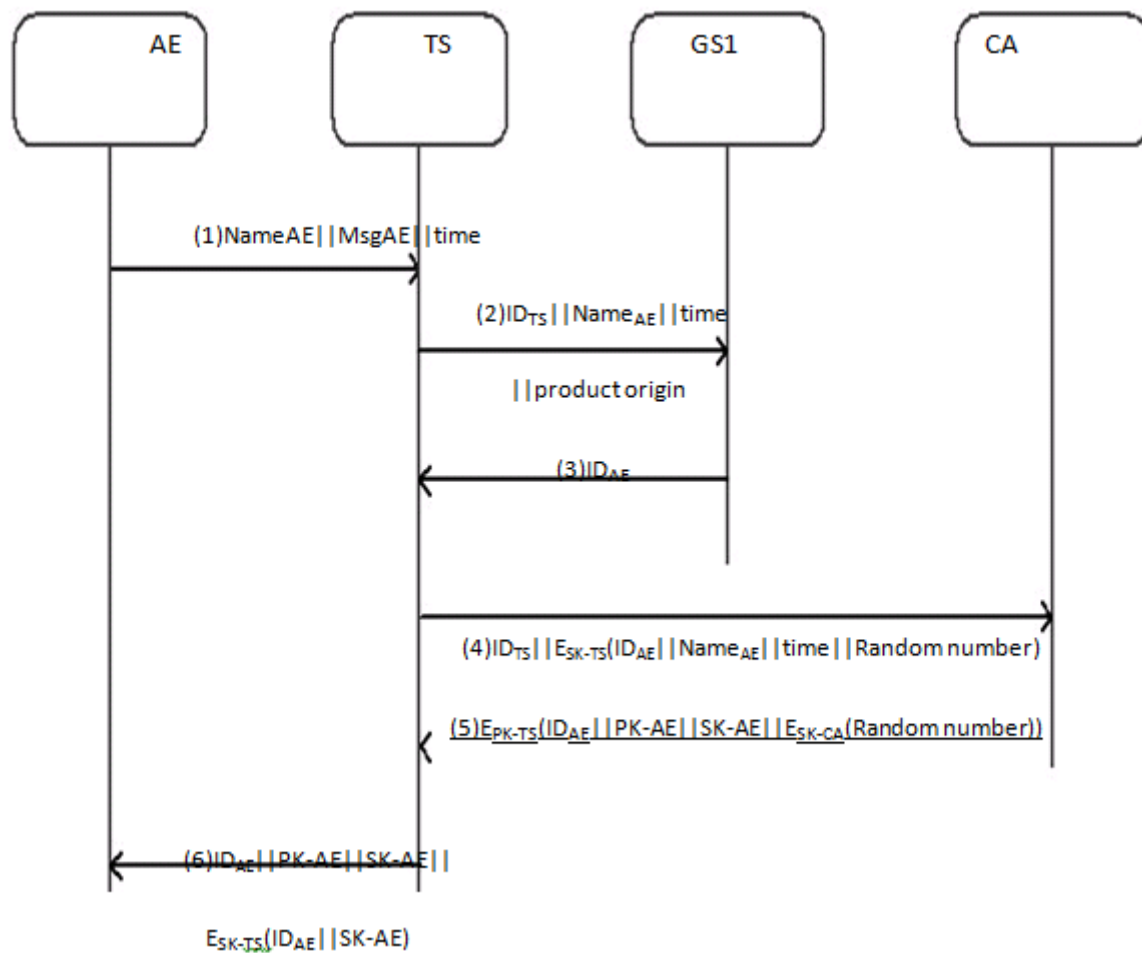


Figure 2.Pretreatment

Step 1. The agricultural production enterprises send the agricultural production enterprises name (NameAE), the qualification information (MsgAE) and application time to the traceability system.

Step 2. The traceability system send its own identity information (IDTS), NameAE, origin information and application time to GS1, and applies for the user identity.

Step 3. GS1 sends the generated enterprise identity (IDEA) to the traceability system and publishes it on its own bulletin board.

Step 4. The traceability system sends IDTS and signcrypton the message, which is composed of the producer identity, the application time, and the random number (RN), with its secrete-key to the CA.

Step 5. CA generates AE's public-key and secrete-key pairs and sends the encryption message, including plan, key pairs, and signcrypton random numbers, with the public key of AE to the traceability system.

Step 6. TS sends the user ID EA, key pair and the corresponding sign info to the AE through the protection channel.

C. Production, storage, logistics and sales of agricultural product

At pretraeatment of this stage, the agricultural production enterprise obtains a complete tag related to the cultivation / breeding product from TS. In the production stage, the process info is transmitted to the TS through the WSN network. At the time of storage, transport and sale, the information and acquisition method knowledge of the relevant enterprise square measure sent to TS, and TS generates the final two-dimensional code for the user and published within the bulletin board.

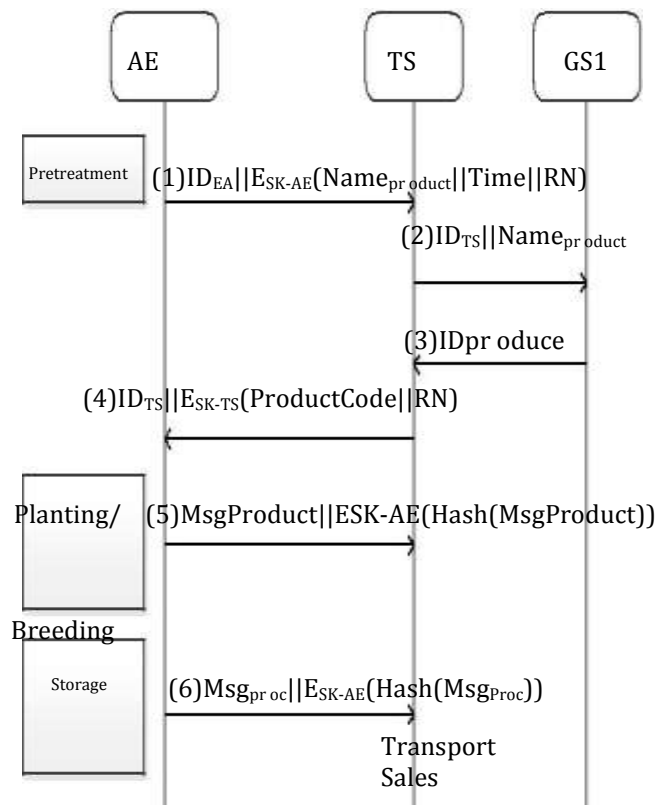


Figure 3. Production, storage, logistics and sales of agricultural product

Step 1. The agricultural production enterprise sends its own identity information plan, and signcryption message, including agricultural product info, application time and random number (RN) info to TS.

Step 2, 3. TS get the agricultural product code information from GS1.

Step 4. TS generates the corresponding info of the agricultural product (generated by the two-dimensional code / RFID tag information and the encrypted information ESK-AE (Nameproduct || Time || RN)), and send it to AE. AE generates a two-dimensional code label or RFID tag according to the encoded information and associates it with the merchandise.

Step 5. During the planting / breeding stage, the AE sends the sampled data collected from the WSN (i.e. 1-2 times a day) and the signcryption information (the hash worth of the sampled

data) to the TS. TS stores the information to the info center and manages it through agricultural product for traceability.

Step 6. In the storage, transportation and sales process, similar to step 5, the process info is saved to the info center.

Consumers through shopper application, scanning tags of agricultural products, get the non-repudiation agricultural products ID. According to the data, consumers through the knowledge center to get the whole cycle of agricultural info to make sure the protection of agricultural product.

IV. CONCLUSIONS

In order to resolve the matter of traceability of agricultural products, we designed a traceability system primarily based on net of Things. Through the Internet of things technology, information security technology, coding technology, the traceability tags are effectively combined with the signcryption info. By the client application, the customers can scan and trace the agricultural product. The system is ensured that consumers will quickly, easily to obtain to rest assured that the agricultural product.

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