Using RFID Technology in Produce Traceability

Ruey-Shun Chen a, C-C Chen c, K.C. Yeh b, Y-C Chen d, and C-W, Kuo b
a Department of Information Management, China University of Technology, Hukou, Hsinchu, Taiwan
b Institute of Information Management, National Chiao Tung University, Hsinchu, Taiwan
c Department of Information Management, Tunghai University, Tai-Chung city, Taiwan.
d Department of Computer science and Information engineering, National Cheng Kung University, Tai-nan city, Taiwan.

Abstract: - In recent years, food safety events occur because of epizooty. Many countries build food traceability systems to solve these problems. However, the current food traceability system must be executed by paperwork and need a lot of manpower. It also cannot trace and track back the origin and destination of food. Due to the fact that RFID technology can trace object, therefore, it can solve these problems.

The research method integrates RFID technologies on the food produce traceability system. Using RFID technology will be easy to trace each object, not only for the goods lots. RFID technology can also record all events automatically and acquire the information about the food production by handheld devices.

The research result of this paper is providing an integrated tactility system for the entire food supply chain by RFID technology. The benefit of this research can trace the food production, and let consumers get the complete food production information to choose and buy the safety food.

Key-Words: - RFID, Produce traceability, Food supply chain, Food safety.

1 Introduction

With the economy growth, the standards of living improve. That enables consumers pay much attention to the quality of food. In recently years, many governments try to build food traceability system to let their consumers know more detail production information. It can not only increase reliance upon the food, but also track the problems and trace the production flow when food safety events happened.

In Taiwan, Taipei EasyCard is a well-known RFID solution. Besides, the wafer factories and package factories in Taiwan also use RFID technology to track its wafer produce.

When SARS happened, ITRI installed the sensors in the hospitals, and let people in hospital to talk along RFID ID card. When someone fall ill, hospital can crystal know patient and activity path in 20 minutes. TMU also use RFID chips and clinical thermometer to trace patient and employee’s status and contact history.

ITRI and Ministry of Economic Affairs, ROC establish RFID research and application united.

In Taiwan, council of agriculture establish food traceability system positively. But consumer can get a little information about producing. Besides that, all food traceability information are recorded by farmer’s hand. That information must key into information system by other.

The research proposes combine RFID technology and chicken food traceability system to:
1. Reduce manpower and time cost in record and read food traceability information. And make entire process more automatically.
2. Make food traceability information more detail and let entire process can be record and query.
3. Improve food traceability information safety and make them easier to read.

2 LITERATURE REVIEW

2.1 Food traceability system

Food traceability system is to record all information include growing, breeding, processing, transporting, and selling [6].

Every role in food supply chain must record every producing data and mark on package to make food traceability system work. Food traceability system can help consumer purchasing safety food and track food safety causing more easily [2].
Therefore, food traceability system can let producer and consumer trace or track food producing information and:
1. Increasing trust of information: it is helpful proving mark by product identification management and relation of tags [1, 8].
2. Help to improve food safety: when food safety happened, FTS can lock and focus, trace producing process, and recycle product currently and fast [3, 7].
3. Improve business process: it can manage product by identification. It can make reserves management and quality management more effectively [4, 6, 9].

3 THE ACTUAL STATE OF FOOD TRACEABILITY SYSTEM
3.1 The process of actual food traceability system
In producer view, the actual food traceability is recorded by below ways:
(1) Paper form: farmers record all producing process on paper. After gathering, this information will input to information system by farmers or farmers’ association.
(2) By agriculture management system: council of agriculture developed “agriculture produce and sale management system” before. This system can help to record produce trace information.
(3) By TAFA: formers can login to TAFA site to input produce trace information.
(4) By production and marketing group or a farmers’ association: farmers can record produce trace information by production and marketing group or a farmers’ association.
(5) By PDA: by PDA and GPS technology, farmers can locate where he is and record produce trace information by PDA.

In consumer’s view, the actual food traceability is recorded by below ways:
(1) By Internet: consumers can access TAFA web site and query after they purchased agricultural products with producing traceability information.
(2) By KIOSK machine: consumers can query produce traceability information by KIOSK machine. It will show the information on screen.

4 An Integrate RFID CHICKEN PRODUCING TRACEABILITY SYSTEM
4.1 System design
4.1.1 System architecture
The system combines RFID and information system to monitor chicken from breeding, processing and selling stage. In the system, there are four roles. They are a chicken farm, a slaughter house and processing factory, and a retailer. The system will meet the four role requirement in food traceability information management and provide a central management system to gather together the information.
The system is a three-tier architecture. RFID reader and RFID tags on chicken is applied food supply chain to read and write food traceability information. Besides that, retailer has a KIOSK machine to let consumer query the information of food traceability. In second tier, the information system of every role in food supply chain can management the information of food traceability and make entire supply chain process more automatically. In third tier, there is a central management system. The system will receive the food traceability information from every role in food supply chain. When food safety event occur, government can fill out the chicken. The system data flow is below:

1. Initial data input for chicken
2. Read chicken information from RFID tags
3. Write chicken information to RFID tags
4. Upload the information to information system
5. Upload the information to central management system
6. Query the food traceability from the central management system

4.1.2 Trace and track function
To trace and track chicken is most important function of food traceability system. When food safety event occur, we can only input the chicken ID number or product ID number and then system can output the information of food traceability. These information can help government to control food safety event. Show as figure 1.

5 PROTOTYPE IMPLEMENT
5.1 System development
Prototype use PDA and Web site. So we use VB 2005 to control RIFD reader and use ASP.Net to control web site. And use MS SQL 2000 as database. Entire hardware environment shows as figure 2. We use two pc and a PDA. One pc runs food traceability system. The other runs database. PDA control RFID reader.

5.2 Analysis and comparison
1. Benefit analysis
   A combine RFID chicken food traceability system can:
   (1) Completely record agricultural product status and information in supply chain: in every stage in supply chain build RFID food traceability system can help to more automatically and detail record agricultural product information
   (2) Make food traceability information more currently: many processes can replace by machine. These let food traceability information more currently.
   (3) Easier to identify, search, trace and track chicken and the information: combining RFID
technology can relation between chicken and the information. And can help to trace back and track where food to go. These will help food more safety

2. Compare of the actual and the combine RFID food traceability system

<table>
<thead>
<tr>
<th></th>
<th>The actual food traceability system</th>
<th>The combine RFID food traceability system</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scope</strong></td>
<td>Only production stage</td>
<td>Entire supply chain</td>
</tr>
<tr>
<td><strong>Way to record</strong></td>
<td>Most use paper to record</td>
<td>Handhold device and combine machine</td>
</tr>
<tr>
<td><strong>Ability identify</strong></td>
<td>Identify by batch</td>
<td>Identify by one</td>
</tr>
<tr>
<td><strong>Ability of trace and track</strong></td>
<td>Bad</td>
<td>Easier, faster to get trace and track information</td>
</tr>
</tbody>
</table>

Of the actual food traceability system, the chicken farm use paper form to record chicken breeding information easy. Then input to computer. Before chicken leaving, give them barcode to identify. Of the combine RFID food traceability system, we can record all information in RFID tags and reduce error occurred.

6 Conclusion
Food traceability system is system to trace food and information. The combine RFID food traceability system can help to trace problem food and let consumer get food complete information and purchase safety. Our results are:

1. Build a combine RFID food traceability system: the system can record production information more automatically, and expand the scope to entire supply chain.
2. The system can complete record every status and data of agricultural product, and let the system be execute more actually.
3. Chicken and product can relation closely by RFID. These help food production and identify

References:

TELECOMMUNICATIONS and INFORMATICS (TELE-INFO '08), 2008
[7] Wim Verbeke & Ronald W. Ward, " Consumer interest in information cues denoting quality, traceability and origin:


