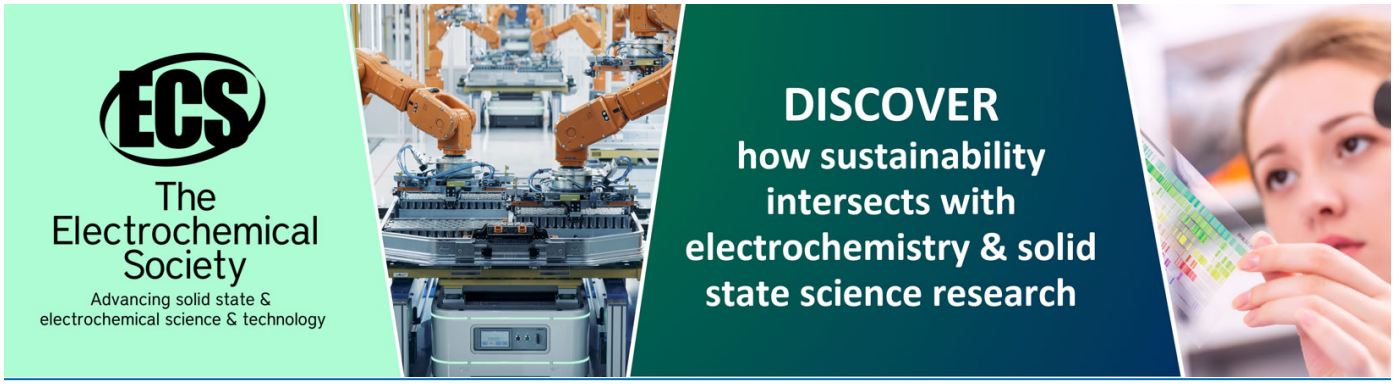
The Database and Functional Structure Design of the Breeder Pigeon `s MIS for Optimization in Selecting and Matching Based on RFID Technology



IOP Conf. Series: Journal of Physics: Conf. Series **1314** (2019) 012206 doi:10.1088/1742-6596/1314/1/012206

The Database and Functional Structure Design of the Breeder Pigeon `s MIS for Optimization in Selecting and Matching Based on RFID Technology

Siyu Chen[1], Xiumin Wu[1*]

[1] Business School, Sichuan Agricultural University, Chengdu, Sichuan, 611830, China

[*] Corresponding author's e-mail: 727398989@qq.com

Abstract. In order to improve the production and breeding efficiency of pigeon breeding farms, and at the same time to ensure the quality of pigeons, pigeon breeding farms should be managed scientifically. In the process of breeding, breeder pigeon optimization has become an important part of pigeon breeding production, which directly affects the quantity and quality of offspring pigeons. At the same time, this is also a pigeon management of the most important information subsystem. This paper hopes to develop a set of modern information management system for the optimal breeding of breeder pigeons, and build the breeder pigeon breeding management information system by combining the special RFID tags for breeder pigeons, computer network and database technology, so as to realize the effective traceability and sharing of all aspects of data of breeder pigeons. It is expected to establish corresponding mobile terminal software to realize data access and query anytime and anywhere, which can make the information management method of pigeon breeding yard more scientific and standardized, so as to achieve better economic and social benefits. Its technical achievements can also be applied to poultry farms and other breeding enterprises.

1. Introduction

With the arrival of the information industrialization era, the application of computer technology has penetrated into all fields comprehensively and profoundly. The advanced management level of an industry depends on the application of computer technology [1]. Since the 1980s, China's pigeon breeding industry have begun to develop on a large scale. It is an emerging poultry industry following the "three birds". It has unique characteristics in development speed, breeding scale, market sales and other aspects. However, the information content of farms in the production process is rising rapidly, and the continued use of traditional methods, such as manual collection, sorting and manual statistical summary, can no longer meet the needs of the rapid development of today's pigeon breeding industry. Therefore, it is necessary to make full use of computer technology to develop a set of management information system about the production of pigeon, which is necessary to replace manual operation, strengthen breeding management and improve work efficiency.

In recent years, another important problem in the process of pigeon breeding is how to select and breed high quality breeder pigeons. With the rapid development of the pigeon market, people's demand for the meat quality of pigeon is also increasing. Breeder pigeons is a crucial part of creating a bird that is succulent, nutritious and strong. Due to the poor management of the traditional pigeon breeding farms, the pigeon archival data is scattered and not comprehensive; the pedigree management is chaotic as well as the record is not systematic. It is difficult to track all the data, so breeder pigeons are prone to inbreeding. This leads to serious degradation and low product quality of them. In addition, in

the breeding process of breeder pigeons, there will also be a situation where the feed supply and nutrition ratio cannot meet the physiological needs of breeder pigeons and the needs of reproduction and production, resulting in smaller individual pigeon, lower meat quality and lower price.

Therefore, we need to design and develop a set of breeder pigeon optimal breeding management information system suitable for meat pigeons, to achieve the scientific breeding of breeder pigeons, improve the efficiency of optimization, improve the accuracy of breeder pigeons optimization, to ensure that the vast majority of selected breeder pigeons are healthy and excellent, to ensure the quality of offspring.

2. Research Status

With the development of computer technology, there are more and more successful cases of computer management in poultry breeding and animal husbandry. In the modern management information system, the database has been in the core position [2]. Therefore, in the development process, the database design is particularly important.

2.1. Abroad Research Status

In terms of breeding management, the most advanced arctic fox breeding technology in the world is the breeding electronic data processing (EDP) system in Finland. The development of sampo software provides the world with the most advanced fox breeding and management computer software. The main function of this software is to help users fill in the fox id card and store the latest fox breeding data [1]. Using advanced algorithmic statistics to develop animal reproductive indicators; The comprehensive evaluation of animal breeding ability is made to determine the breeding fox to be retained, so as to make selecting and breeding more scientific and reliable. This system greatly facilitates the selecting and breeding of fox farms.

In livestock production, in 1951, the United States began using computer technology to process dairy production records. In the 1960s, computers were used to manage dairy farms. Pennsyvania used a computer to manage 300,000 cows, including the selection and matching of improved breeds. As a result, the average milk yield of one cow doubled and the income of the dairy farm tripled [2]. In 1968, the American federation of breeding services initiated a genetic seed selection and mating service (CMS) program, established the national cow improvement association, and established nine data processing centers using computers to speed up seed determination and seed selection and mating [3].

2.2. Domestic Research Status

In the dairy farming management, Zhu Yimin took the lead in establishing a database with DBASE language in 1983, which is specially used to store the information of dairy cows. In the early 1990s, Chen Dezuo developed a computer management system for dairy cow production information [4]. The system included database management, information query, daily management, statement printing, feed formula, breeding value estimation, statistical analysis and milk volume prediction. Among them, cow information included genealogy source, growth and development, reproductive performance, production performance, bull performance, disease status, feed composition and nutritional needs, and economic accounting data [5].

In the poultry breeding industry, Lu Lvhua first developed the computer-aided management system for laying hens in 1991. He not only used BASIC language and C language to compile application software, but also quoted, digested and absorbed a lot of foreign software. He used PC -- NONLIN non-linear parameter software package and self-programming method to program and provided a set of system suitable for laying hens [2]. In 1998, Xing Guangya developed a set of layers production management database, which was based on FOXBASE2.10, including seven functional modules of input information, maintenance, data query, report, drawing and consulting, and provided an effective method for production data management of layers [6].

3. Technical Advantages of RFID

RFID (radio frequency identification, radio frequency identification) is a non-contact automatic identification technology [7]. The target and related information are accessed automatically through RFID without manual intervention. It can also quickly recognize large Numbers of objects. RFID tags need to have some features: not easily damaged, rich storage information, easy to read and rewrite. These enable RFID technology to play a good role in the breeder pigeon breeding management, so that it can achieve each breeder pigeon has a unique code tag, strengthen the identification of breeder pigeons, manage pigeons`files.

RFID technology based breeder pigeon information management platform includes RFID tags, handheld readers, wireless networks and databases. RFID tags are composed of chips and antennas, with unique electronic coding, and a certain amount of information storage capacity, used to identify breeder pigeons. The RFID reader of the control radio frequency module transmits signals to the tag, reads the information, makes it receive and respond from the tag, then decodes the tag information, and sends the information on the tag to the background host for processing. The database stores basic information on labels and other data related to breeder pigeons. The transmission of wireless network is used for data exchange between reader and database.

As shown in figure 1, its working principle is: handheld readers send out RF signals of fixed frequency through the antenna. When the tag is found in a magnetic field, it generates an induced current to gain energy and sends its own code and other information. Then, a reader receives it, decodes it, and wirelessly uploads it to the database server [8].

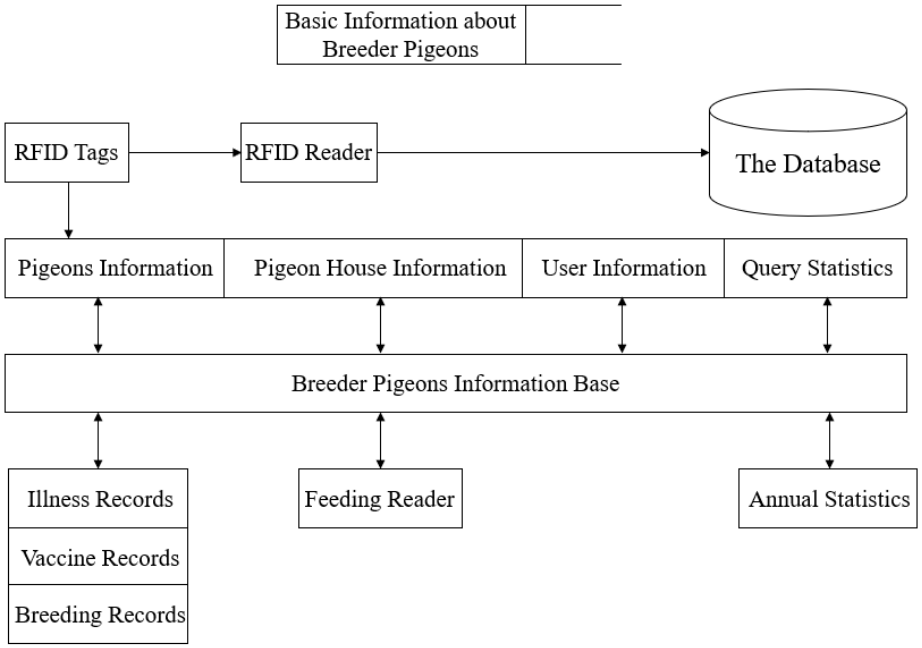


Figure 1. Information flow in the breeding system of selected pigeons.

4. System Design

4.1. System Feasibility Analysis

Optimum breeding management information system is a crucial part of pigeon breeding field, which can provide the managers with correct breeding information and convenient query function to help select high-quality breeder pigeons, improve the quality of offspring and ensure the quality of pigeons. Using RFID technology, the breeder pigeon data is stored on the tag of its foot ring, which is convenient to read, write and trace the data, realizing the accurate identification of the breeder pigeon. Using PHP to build the breeder pigeon optimal breeding management information system, using MySQL database, can achieve the breeder pigeon and other information input, delete, modify, query,

generate a variety of data chart, visual image, convenient for raising pigeon farm staff to grasp the breeding pigeon information, but also can print reports. In the program, there is also a section of user login and permission management to ensure the safe operation of the system. The system has reasonable design, stable operation, convenient operation and perfect function.

4.2. System Demand Analysis

The optimal breeding management information system of breeder pigeons requires a reasonable functional framework and a good human-computer interaction interface to facilitate user operation. Accurate and complete record and management of breeder pigeon information, improve the accuracy rate of screening high-quality breeder pigeon and the success rate of breeder pigeon matching, and also simple to operate, to be able to timely and effectively input, alter, delete and query various types of information data. The most important point is to be able to provide critical chart information for the decision making of the farm staff.

The main task of system development is to realize the systematization and standardization of breeder pigeon information management and the scientization of breeder pigeon optimization. On this basis, we can conclude that the system needs to complete the following functions: user management, basic information about breeder pigeon management (pigeons management), pigeon house management, illness record management, feeding record management, vaccine record management, breeding record management, query statistics.

The system divides the rights of users into system administrator and general administrator. Only the system administrator can operate on the system setup module. In this system, first of all, the basic information of breeder pigeons should be effectively managed, for example, pigeons information, pigeon house information, illness records, feeding records, vaccine records, breeding records; Then according to the basic information input, breeder pigeon optimization or breeder pigeon out of house or other operations; On top of this, based on the information of the selected breeder pigeons, the operation of breeder pigeons pairing or breeder pigeons out of the cage or into the cage, etc. In this system, can also automatically generate annual statistical table. The system flow chart is shown in figure 2.

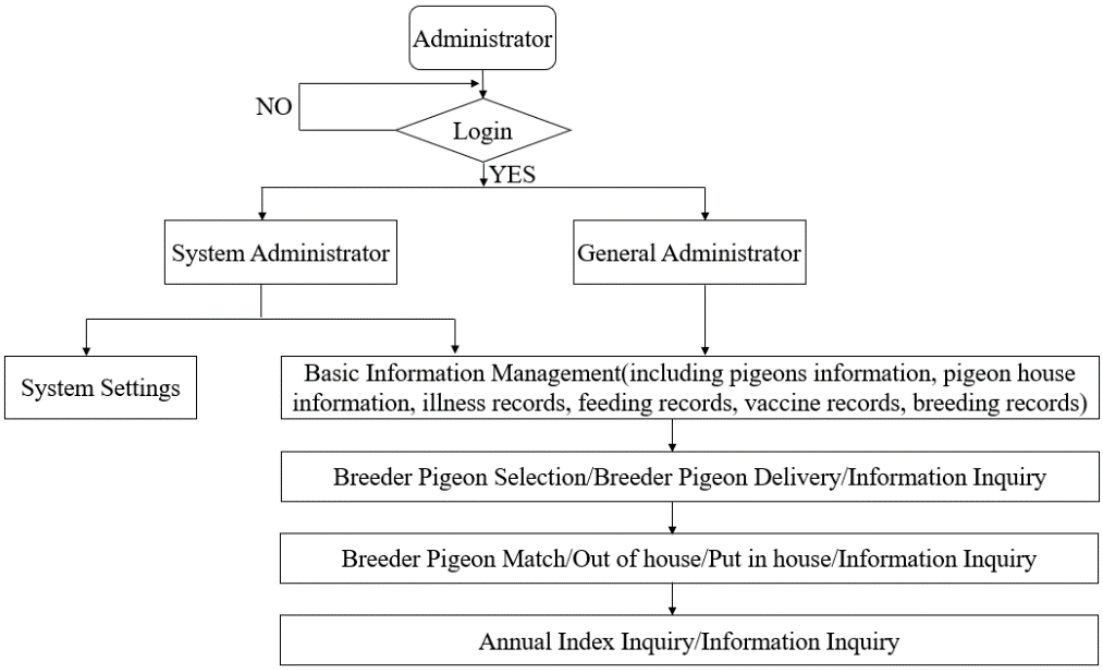


Figure 2. Flow chart of selecting and breeding MIS for breeder pigeons.

4.3. Functional Structure Design

Optimum breeding management information system mainly includes user login module, user management module, basic information module, pigeon group management module, pigeon house management module, query statistics module and system settings module.

The user login module is the first step for administrators with different permissions to log in the system for operation. User management module includes changing password, user logging out; The basic information module includes the management of pigeons information, pigeon house information, illness record, feeding record, vaccine record and breeding record, including addition, modification and deletion; Pigeon group management module includes breeder pigeon storage, breeder pigeon delivery, breeder pigeon optimization, breeder pigeon matching; Pigeon house management module includes breeder pigeons into the house, breeder pigeons out of the house, pigeon house environment settings; Query statistics module includes annual index statistics query, pigeons information query and sorting, pigeon house information query and statistics, illness record query and statistics, vaccine record query and statistics, feeding record query and statistics, breeding record query and sorting; The system settings module includes adding administrator, changing administrator rights and deleting administrator.

According to the above functional structure analysis, the overall functional structure of the system was designed, and the functional structure diagram of this system was obtained, as shown in figure 3:

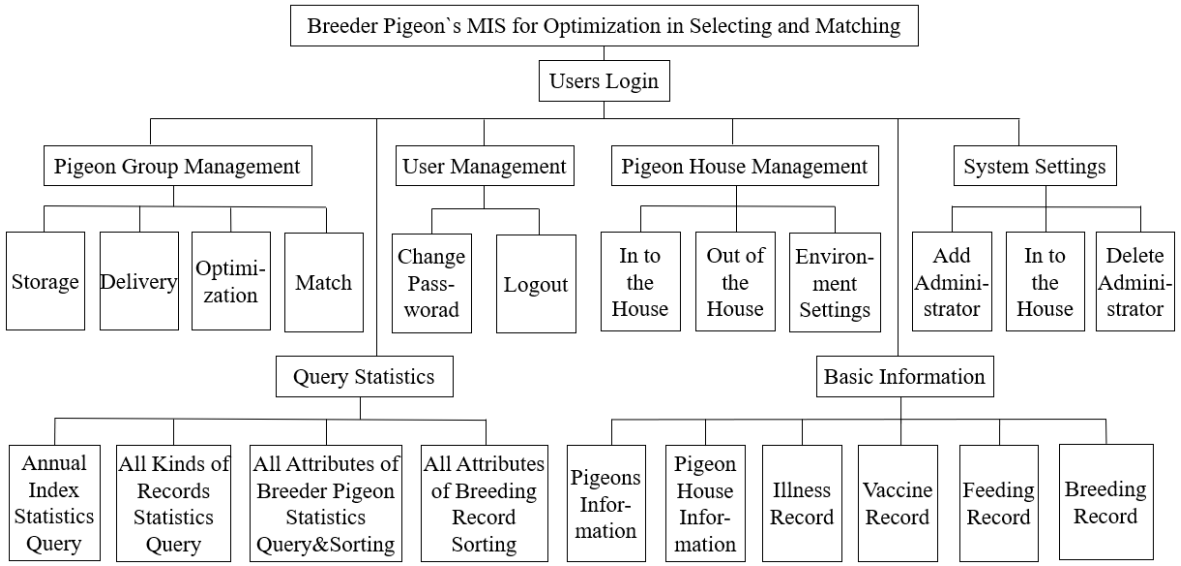


Figure 3. Functional structure diagram of selecting and breeding MIS for breeder pigeons.

4.4. Database Design

First is the conceptual structure design. The goal of this stage is to summarize an abstract conceptual model and lay a foundation for the next step of database design. In the process of designing the conceptual model, one of the most commonly used methods is "entity-relationship model", which is to express the conceptual model of a system by establishing an E-R diagram [8]. The E-R diagram is composed of three parts, namely entity, attribute and relationship. In the database of this system, the overall E-R diagram is shown in figure 4 (with the underlined attribute as the primary key):

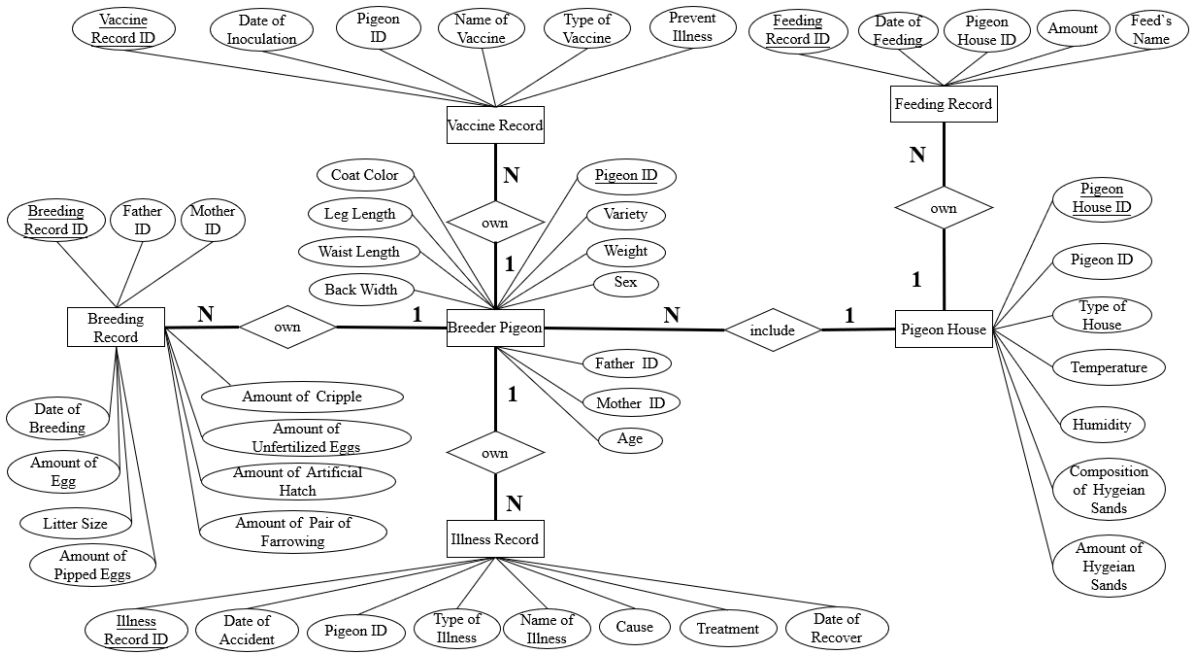


Figure 4. The whole E-R diagram.

Then comes the logical structure design. The main goal of this stage is to transform the conceptual data model obtained in the previous stage, namely the E-R diagram, into the logical structure consistent with the data model supported by the database management system product. First, transform the model:

User:

User (UID, password, permission)

Pigeon House:

House (HID, PID, H_type, temperature, humidity, S_composition, S_amount)

Pigeons:

Pigeon (PID, variety, weight, sex, age, waist, back, leg, color, PID, PID)

Illness Record:

Illness (IID, PID, date_of_accident, date_of_recover, I_type, I_name, I_cause, I_treatment)

Feeding Record:

Feed (FID, HID, date_of_feeding, F_name, F_amount)

Vaccine Record:

Vaccine (VID, PID, date_of_inoculation, V_type, V_name, V_illness)

Breeding Record:

Breed(BID, PID, PID, date_of_breeding, egg_amount, litter_amount, pipped_amount, cripple_amount, unfertilized_amount, artificial_amount, pair)

Annual Statistics:

Annual(P_amount, egg_rate, fertilization_rate, hatch_rate, live_rate, death_rate, birth_pigeon_amount, birth_rate)

(NOTE: the primary key property marked with a straight underline, the foreign key property marked with a wavy underline, and the primary key property together with the foreign key property constitute the primary code.)

In the relationship mode User, House, Pigeon, Illness, Feed, Vaccine and Breed, there is no partial function dependence of non-main attribute to main attribute or transfer function dependence, which has reached 3NF, that is, the model has been optimal.

According to the requirements of this system, we can establish the view classification table as shown in table 1, which can be expressed intuitively and conveniently:

Table 1. View classification table.

User Object	View Expression	Function
General Administrator	User Management 1(username, password)	For administrators to log in, log out, change the password and other operations.
System Administrator	User Management 2(username, password, permission)	For administrators to increase, delete general administrators, change permissions and other operations.
Administrator	Pigeon House Information(pigeon house ID, type of house, pigeon ID, temperature, humidity, composition of hygeian sands, amount of hygeian sands)	For administrator to inquire the details of breeder pigeons in the pigeon house, and provide reference opinions for the decision of breeder pigeons entering and leaving the house.
Administrator	Pigeons Information (pigeon ID, variety, weight, sex, age, waist length, back width, leg length, coat color, father ID, mother ID)	For administrator to query and sort the pigeons information to provide data support for breeder pigeon optimization and pairing.
Administrator	Illness Record(illness record ID, pigeon ID, date of accident, date of recover, type of illness, name of illness, cause, treatment)	For administrator to inquire and count the health condition of each pigeon.
Administrator	Feeding Record (feeding record ID, pigeon house ID, date of feeding, feed`s name, amount)	For administrator to query the feeding situation of each pigeon house.
Administrator	Vaccine Record（vaccine record ID, pigeon ID, date of inoculation, type of vaccine, name of vaccine, prevent illness）	For administrator to inquire and count the inoculation of breeder pigeons.
Administrator	Feeding Record (breeding record ID, father ID, mother ID, date of breeding, amount of egg, litter size, amount of cripple, amount of pipped eggs, amount of unfertilized eggs, amount of artificial eggs, amount of pair of farrowing)	For administrator to search and sort reproduction condition of breeder pigeons to provide data for selecting high quality breeder pigeons.
Administrator	Annual Statistics（amount of pigeons, annual laying rate, fertilization rate, hatching rate, survival rate of squabs, mortality of adult pigeon, annual output of squabs, rate of out_of_house）	For administrator to check whether the annual indicators are qualified, whether the system has played a helping role, whether improvement is needed.

And then physical structure design. The task at this stage is to build the index. The purpose of indexing is to provide faster access to attribute columns or groups. Indexes can be built on a basic table to provide multiple storage paths and speed up access [8]. As one of the main functions of the system is query statistics, so in the data query requirements are very high, so we can establish more indexes.

According to the needs of the system and users, the primary key index needs to be established on these two attributes because the pigeon house ID and pigeon ID are often used as the connection conditions of the table. As the ID of illness record, feeding record, vaccine record and breeding record are often used as query conditions, it is necessary to establish a primary key index for the table where they are located, as shown in table 2.

Table 2. Primary key index table.

Table Name	Index Name	Index Type	Basic terms for reference
The Table of Pigeon House Information	HTDInfo	Primary key	HID
The Table of Pigeons Information	PIDInfo	Primary key	PID
The Table of Illness Record Information	IIDInfo	Primary key	IID
The Table of Feeding Record Information	FIDInfo	Primary key	FID
The Table of Vaccine Record Information	VIDInfo	Primary key	VID
The Table of Breeding Record Information	BIDInfo	Primary key	BID

The attributes such as date_of_accidence, date_of_inoculation, date_of_feeding and date_of_breeding are often searched in order, so aggregation index needs to be established, as shown in table3.

Table 3. Aggregation index table.

Table Name	Index Name	Index Type	Basic terms for reference
The Table of Illness Record Information	DoaInfo	Aggregation	date_of_accident
The Table of Feeding Record Information	DoiInfo	Aggregation	date_of_inoculation
The Table of Vaccine Record Information	DofInfo	Aggregation	date_of_feeding
The Table of Breeding Record Information	DobInfo	Aggregation	date_of_breeding

5. Conclusion

This system is an optimal selecting and matching management information system for breeder pigeons, which is designed to make up for shortcomings such as incomplete manual record data, inaccurate and timely manual query data, and inability to make correct and efficient decisions in the optimal cultivating process of breeder pigeons in the traditional pigeon farms. It mainly serves as an auxiliary pigeon farm staff to select and cultivate high-quality breeder pigeons.

This system mainly has the function of data storage and query statistics, on this basis, derived a series of functions such as user management, system setting, basic information management, breeder pigeon optimization management, breeder pigeon pairing management and so on. We hope to realize effective and complete storage of data, fast and efficient query of data, and timely tracking of data.

6. Deficiency and Improvement

Although the functional structure and database design of this system have been basically completed, it has not been realized yet. It needs to be improved in the subsequent construction process:

- Data backup and data recovery are not considered. When the external environment (power failure, network virus, etc.) interferes with the system, the system should be set to automatically protect the original data. In this way, data loss or corruption can be avoided to ensure the safety and reliability of data storage.
- When data entry is abnormal, we can set up a reminder window. For example, the normal data entry of the weight of breeder pigeons is about a few hundred grams. However, if the administrator makes a mistake when entering data and records the weight as several kilograms or even tens of thousands of grams or a few grams, at this time, the system should be able to pop up a prompt window, showing that the current input data is too different from historical input data, whether to determine the input. In this way, the administrator can confirm whether there is abnormal data, improving the accuracy of data into the database.
- In the pigeon house management module, we can set up an empty house reminder. The system regularly checks the table of pigeon house information to display pigeon houses whose information are empty except the pigeon house ID as a table to facilitate the administrator to understand the use of the pigeon house.

Reference

[1] Nie C.Y, Zhang W, Yin Y.J. (2005) Design and application of production management information system for fox farms. Journal of northeast forestry university, 33(6):104-105.
[2] Yang M. (2014) Management system of small and medium-sized poultry farms. University of electronic science and technology of China, Chengdu.
[3] Liu H. (2016) Research progress of computer application in animal husbandry and veterinary science. Jiangxi agriculture, 25(7):11-13.
[4] Nie C.Y, Nie C.L, Bao S.Z, Yuan G.X, Yin Y.J. (2007) Design and application of production management information system for mink farms. Heilongjiang animal husbandry & veterinary medicine, 3:98-99.
[5] Gou D.M, Lu Z.X. (1995) application survey of database technology in animal husbandry in

China. Journal of animal husbandry and veterinary medicine,2:47-48.
[6] Tian X.H. (2017) Design of high consumption enterprise energy management system based on Internet of things. North China electric power university, Beijing.
[7] Bo Y, Lee D.Y. (2009) Application of RFID in emu breeding management information system. In : ISECS International Colloquium on Computing, Communication, Control, and Management, Sanya. pp. 170-173.
[8] Wang S, Chen H. (2012) Principles of database system. Tsinghua university press, Beijing.