

# Aquatic Animal Disease Diagnosis System Based on Android

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**Abstract.** In recent years, as long as the rapid development of aquaculture, the occurrence of aquatic animal diseases increase year by year, which restrict the sustained, steady, and healthy development of aquaculture. So the rapid diagnosis of aquatic animal disease is particularly important for their prevention and control. In the present work, an Android-based aquatic animal disease diagnostic system has been developed in order to provide more convenient and effective aquatic animal disease diagnostic services to ordinary farmers. The designed system includes the part of the man-machine interface (user interface, expert interface), inference engine, the case base, knowledge base and so on. Interactive interface is a visual display interface. Inference engine was written in the Java programming language. Case base and knowledge base were created using SQLite. The results show that ordinary farmers can easily use this system to realize the convenient, fast, and accurate access to the findings of disease diagnosis and prevention measures as well as aquaculture expert can add, delete, modify, view the case base and knowledge base at any time.

**Keywords:** Android · Aquatic animals · Disease diagnosis

## 1 Introduction

Fishing industry has been rapid development since the 1990s in China, and has Fishing is the competitive industries of agriculture economic development, fisheries and aquaculture in the world compared with other edible animal breeding, world aquaculture industry has developed very quickly [1]. However, with the rapid development of aquaculture, aquatic animal disease has become increasingly serious. It is the major factor constraints the sustained and healthy development of aquaculture industry. During April to October in 2004, 126 kinds of disease of 74 kinds of aquaculture species are monitored by 30 provinces, autonomous regions and municipalities of China. The results show that from April to October 2004, the direct economic losses due to diseases reached 15.144 billion yuan. 4.56 billion yuan more than 10.584 billion yuan of 2003 [2]. So, how can we make the production of aquaculture on the way to the

healthy development has become an issue for aquatic animal experts. The research and promotion of diagnostic methods and prevention of diseases of aquatic animals has become urgent priority of aquaculture development.

In order to reduce the losses caused by diseases in aquaculture, research and develop various aquatic animal disease diagnosis expert system to assist aquaculture farmers has become the main topic among various research institutions. Currently because the aquatic animal disease experts is lack, the personnel of aquaculture are mainly farmers, and the distribution of farms tend to be more dispersed, the technical level of the breeding staff is not high. Thus in the process of diagnosis of aquatic animal disease, losses take places often due to the lack of experts or the experts can not get the scene as soon as possible. In addition, because the disease can not be accurately diagnosed, science prescription and grasp dose, farmers often abused medicines, antibiotics, it also had a significant impact on ecological environment and food safety and the healthy and sustainable development of aquaculture is restricted [3–7]. In order to reduce the economic losses, resolve the conflicts between frequent aquatic animal diseases and lack of experts, many research institutions developed a variety of expert systems for aquatic animal disease diagnosis by using some advanced technology products and information technology. We can use these expert systems to mimic the effect of working off-site, by this way the problem of lacking experts can be resolved.

At present, all kinds of aquatic animal disease diagnostic systems research and development of the country is mainly aimed at the personal computer, Hand personal computer and personal digital assistant applications terminal [8–13]. But for the actual results now, on the one hand, in terms of ordinary farmers, PC machine, PDA, and HPC applications such as intelligent terminal system applications in agriculture, is not only expensive, single function, but also a strong dependence on the network environment, resulting in very limited in its application crowd. On the other hand, the current agricultural intelligent system development platform almost based on Windows operating systems [14], it leading to poor results in terms of free sex, open source, and human-computer interaction. Therefore, it is important to seek one simpler interface and more friendly agricultural intelligent system application terminal and build an open source and free development environment for the popularization of aquatic animal disease prevention and control technology to farmers.

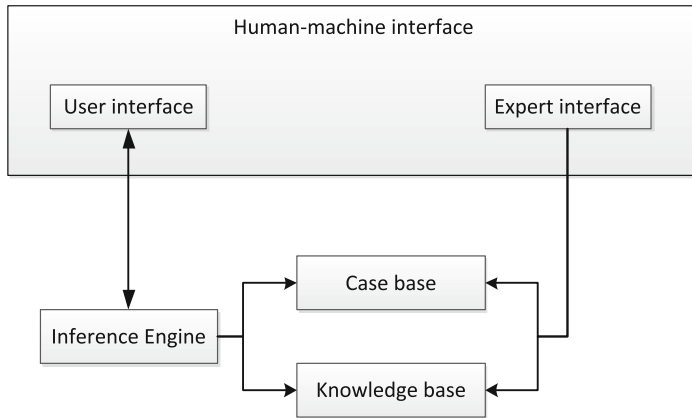
In recent years, with the development of the global smart phone, Google released Android operating system and promoting China's 3G network coverage project, China's 3G smart phone has been rapid development [15]. Especially after thousands of smart phones launched within Android 3G, Android smart phones in China's mobile phone market share has been increasing [16–18]. Android 3G intelligent mobile phone is a set of call, Internet, multimedia and other functions in one of the intelligent terminal, its price is low, and can avoid the "two into". In addition, the Android operating system is a free and open source code operating system based on Linux. It is not only able to provide flexible independent design space for software designers, but also supports voice, touch screen and a series of new interactive technology.

In this paper, an aquatic animal disease diagnosis system based on Android is developed.

## 2 Design of Aquatic Animal Disease Diagnosis System Based on Android

### 2.1 Structural Design of Aquatic Animal Disease Diagnosis System Based on Android

The design of the structure of aquatic animal disease diagnosis system based on Android is composed of four modules, human-machine interface, inference engine, case base and knowledge base. Its structure is as shown in Fig. 1.



**Fig. 1.** Aquatic animal disease diagnostic system structure

The man-machine interface includes a user interface and expert interface. The user interface is a visual display interface used by ordinary farmers. Aquatic animal disease expert can use the expert interface to add, delete, modify or view the case database and knowledge base. The inference engine is programmed by JAVA programming language. Case base and knowledge base are developed by SQLite3 and independent of application development.

### 2.2 Build the Application Development Environment

Android development platform not only supports Windows, Linux also supports Mac OS systems. In this paper, the development environment is built on the Linux operating system and constructed by “JDK (Java development kit) + Eclipse + Android SDK (Software development kit) + ADT (Android development tools)”.

### 2.3 Build the Application Development Environment

SQLite is a compliant relational database management system that embedded light-weight and comply with the ACID. It takes resources are very low, open source and

supports most of the SQL statement. This paper uses SQLite database to store large amounts of data, and to achieve the use of data, updating, maintenance and other operations. And install SQLite3 as “aquatic animal disease diagnosis system based on Android” database development platform on Linux operating systems.

### 3 Design of Aquatic Animal Disease Diagnosis System Based on Android

#### 3.1 Database Design

The system includes three main types of data tables, tables of various types of aquatic animal disease knowledge, case table or case weight table. Tables 1, 2, 3 and 4 are the associated data table design.

**Table 1.** An aquatic animal disease cases table

Primary key/foreign key	Field name	Field type	Length	Empty	Description
PK	ID	Int	5	N	Case number
	type	Int	5	N	Case type
	Dis_name	varchar	60	N	Names of diseases
	Dis_type	varchar	60	N	Type of disease
	Sym_set	varchar	300		Symptoms collection

**Table 2.** Weight information table

Primary key/foreign key	Field name	Field type	Length	Empty	Description
PK	ID	Int	5	N	Weight number
	type	Int	5	N	Case type
	Weight_set	varchar	1000	N	Sets of weight

**Table 3.** An aquatic animal disease information table

Primary key/foreign key	Field name	Field type	Length	Empty	Description
PK	ID	Int	5	N	Disease number
	Dis_name	varchar	60	N	Names of diseases
	Dis_type	varchar	60	N	Type of disease
	cause	varchar	1000		Cause of disease
	prevent	varchar	1000		Precaution
	treatment	varchar	1000		Treatment programs

**Table 4.** Symptom chart

Primary key/foreign key	Field name	Field type	Length	Empty	Description
PK	ID	Int	5	N	Symptoms number
	Sym_name	varchar	60	N	Symptoms name
	Sym_type	varchar	60		Symptoms type

### 3.2 System Inference Engine Design and Analysis

This system establish a aquatic animal disease diagnostic reasoning model by using case-based diagnostic reasoning combined with expert symptom scoring method. In order to achieve complementary advantages of the two diagnostic methods, improve the accuracy of diagnosis of aquatic animal diseases. Diagnostic reasoning as follows:

Step 1: Use case diagnosis and numerical diagnosis to do disease diagnosis respectively based on the symptoms information that farmer input, then compare the two results obtained by the two diagnostic methods.

Step 2: If the two diagnostic results are different, the system will show the symptoms information of both diseases and ask farmer input symptoms information again, then diagnosis again.

Step 3: If the two diagnostic results are same, then judge whether the value of Similarity that obtained by case diagnosis is between diagnostic threshold (0.65) and Very similar threshold (0.95), when the condition is satisfied then multiplexed on this case and display diagnostic results.

Step 4: If there is no enough conditions then ask the user whether they are satisfied with the result or not, if they satisfied with it then show the results of the diagnosis. When they are not satisfied with it then back to step 1.

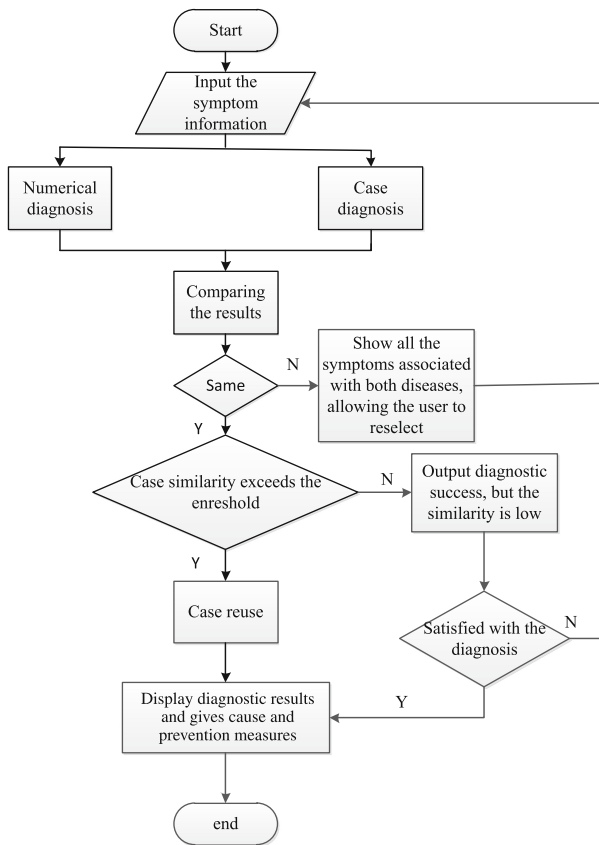
Reasoning process flow chart shown in Fig. 2.:

Because in the implementation process of inference engine need to involve the processing of the database, so SQLiteDatabase categories should be imported, and then create or open the database by the static method of SQLiteDatabase categories.

### 3.3 System Migration and Updates

Under the development environment of aquatic animal disease diagnostic system based on android, perform “Run As Android Application” can generate a installed package (i.e. APK file) of system, then upload it to the server. Users can download the system to the Android smart phone by 3G wireless network, or download it to the Android smart phone SD by PC, after this the migration of the system is finished.

The system updates is divided into two parts, expert and client. Experts can add, delete, modify or view the case base and knowledge base timely by the end of expert.



**Fig. 2.** Aquatic animal disease diagnostic flowchart

Then upload the new database to the server when the condition of network is smooth. Farmers can get the information of system update by the client, they can choose whether to update the system or not.

**4 System Integration and Implementation**

In this paper, LinearLayout, RelativeLayout classes and AbsoluteLayout class provided by Android SDK are used to design the human-computer interaction of the system. We also use a variety of controls, such as Button, TextView, EditText, etc. to complete the interactive interface design.

After the system is installed on the user’s or experts’ smart phone, users can enter the login interface and choose breeding objects, then start the operation of disease diagnosis(show as Figs. 3, 4 and 5). Experts enter the login interface and choose the operation such as modify the rules, delete rules(show as Fig. 6).



Fig. 3. Breeding user selects diagnostic object interface



Fig. 4. Disease diagnosis process interface

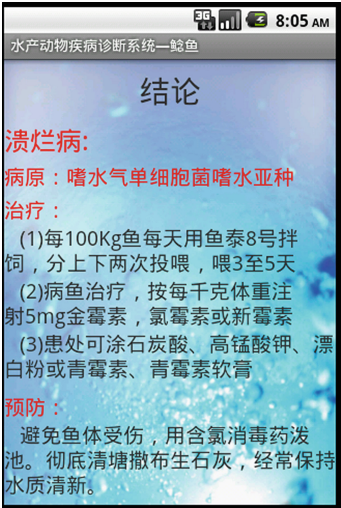


Fig. 5. Disease diagnostic conclusions interface



Fig. 6. Experts function main interface

## 5 Conclusions

This paper chooses the Android operating system as a development platform and develops an aquatic animal disease diagnosis system based on Android. Allow users to get rid of the constraints and inconvenience caused by computer and network. This system provides a more convenient and effective aquatic animal disease diagnostic services for farmers.



Farmers can use the system put forward in this paper to get the result of disease diagnosis and prevention measures. Experts can operate the case base and knowledge base timely, they also can upload the new data to server when the network is smooth, so that the farmers can get the latest data.

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