Android-based Management System Designed for Dairy Farms

1Guangming Liu, 2Wenxing Bao

1, School of Computer Science and Engineering, Beifang University of Nationalities, Yinchuan Ningxia, P. R. China. Beifang University of Nationalities, lgmdq@163.com
*2, School of Computer Science and Engineering, Beifang University of Nationalities, Yinchuan Ningxia, P. R. China. Beifang University of Nationalities, bwx71@163.com

Abstract

At present, the farming methods of animal husbandry are relatively backward and its informationization level is low. This blocks the development of stockbreeding in our country. In order to change this situation, this paper designs an Android-based management system which applies to dairy farms. In this system, the mobile terminals are based on Android intelligent platform while this system is also designed close connection with the norms of the day-to-day operations of the field staffs. We integrate WiFi, Two-dimensional bar code, data synchronization and other technologies to achieve informationization management in dairy farms, and to improve work efficiency as well as economic benefits of dairy farming enterprises. The design and application of this system can benefit stockbreeding's standardizations and informationization in our country and supply other domestic breeding industry with technical support.

Keywords: Dairy farming, Android, WiFi, Two-dimensional bar code, Data synchronization

1. Introduction

In recent years, the animal husbandry in Ningxia has become a pillar industry of the regional agriculture and the rural economy, and its development is very quick. While Ningxia is located in northwestern China, the rural economy and its breeding methods of Livestock Park are relatively backward and its informationization level is low. As a result, it is difficult for the breeding park to implement the information of feeding and management. These reasons have seriously affected the economic benefits of breeding park, so that the local farmer’s income grow slowly, and Ningxia animal husbandry’s further development has been severely constrained [1]. Ningxia as the only Hui Autonomous Region in China, the enterprises in breeding park provide halal milk for Ningxia province, therefore dairy farming management is the core of the enterprises’ internal management. The level of informationization and management are directly related to the enterprises’ economic interests and social benefits. With the deepening of the country’s economic system reform, new and higher requirements are proposed to production and management work of dairy farming enterprise [2].

With the rapid development of computer technology and the increasing maturity of Android mobile devices, all of these provide technical support for developing advanced and practical Android-based management system designed for dairy farms. The development of this system will significantly improve the breeding dairy enterprise informationization level and management level, thus it can effectively improve the efficiency of the breeding enterprise production. Enterprise managers can
effectively monitor the whole flow lines of products and also can track some links of them to manage scientifically a series of problems such as production, cultivation and breeding and realize the standardization management of the supplementary feed, cowshed, and other related processes [3]. In order to query the disease information of the dairy, the system also inherits the experts rule base. This system is the key to solve the problems of Ningxia Muslim characteristic cultivation’s integration information application system and to improves the Muslim characteristic farming industry informatization management level.

The target of Android-based management system designed for dairy farms is to satisfy the modest scale information needs of dairy farming enterprises in livestock breeding zone in Ningxia. On the basis of the existing equipments in the breeding zone, we purchase a certain number of Android devices and wireless facilities according to the needs of users. Meanwhile, we research and develop a set of Android-based management system which has practical value designed for dairy farms. The details in this system are followed: monitor and early warning in the entire process of milk production breed and feed forge; and standardized administration of the cowshed information, disease prevention information. Android mobile devices to be integrated with traditional server network in this system, so this is conducive to promote the use of this system in the same category dairy farming of breeding garden in Ningxia.

2. System Architecture

After research on dairy farms in Ningxia breeding garden and analysis of relevant research data, this paper propose a set of solutions for Android-based management system designed for dairy farms. Android terminals are mainly responsible for the cow drinking water control module, PDF417 barcode scanning module and RFID data reading module and a wireless data transmission module. At the same time, according to the need of the breeding dairy enterprise, each Android terminal has a reasonable distribution of key points in breeding park, so that the staffs can input the scene of breeding dairy enterprise into terminal at any time. And the Android terminal can obtain the data identified by RFID reader automatically, then upload these data to the server through wireless data transmission module; Using JSP technology, server-side mainly implement dairy farming management module, milk production and management module, system management module, message sending module and wireless receiving module, which are the dairy farming company's core. Server-side analyzes the data sent from Android mobile terminals and makes corresponding analysis of the results, and then returns the results to the enterprise management layer [4]. Management layer can make a strategic decision according to these data. So that management layer can discover the existing problems in breeding dairy and discuss the solution in time. This system can improve the enterprise's ability to respond to emergency situations; at the same time message push module can send text messages which mainly introduce some related information of the breeding enterprises to the mobile phones in the breeding garden. By this way, this module can improve the reputation of the breeding dairy enterprises. Major software architecture of the system is shown in Figure 1:
3. Relevant Technologies

3.1. Android Platform

Android bases on the Linux platform, the name of open source mobile operating system, announced by Google on November 5, 2007. This platform consists of the operating system, middleware, user interface and application software. The Android platform has the following characteristics: (1) rich development environment, including the Eclipse integrated development environment, device emulator, tools for debugging, memory and performance analysis chart; (2) the internal integrated browser based on the open source WebKit engine; (3) The application framework supports the reuse and replacement of components; (4) Dalvik virtual machine optimized specifically for mobile devices; (5) SQLite for structured data storage. Figure 2 is architecture of Android operating system, from Figure 2 we can get that Android operating system architecture is divided into four layers. The order, from top to bottom is: applications, application frameworks, the Android runtime library and other library layer and the Linux kernel.
Android release version always comes with some core critical applications, such as E-mail client, SMS program, calendar, electronic maps, browser, phone book, etc.

3.1.2. Application frameworks layer

Android developers can use the API framework used by the core applications. The application architecture is designed to simplify the reuse of components. The components released by any applications that can be called by other applications (must comply with security restrictions prescribed by application framework), and also allow components to replace other components. This layer includes scalable view, content providers, resource manager, notification manager and activity manager.

3.1.3. Android runtime library and other library layer

The Android runtime library includes a core library; the core library provides most of the functions of the core library of the Java programming language. Every Android application run in its own process, and has a separate Dalvik virtual machine instances. Android also includes a C/C++ library used by various components of the Android system, which provide services to developers through the application framework.
3.1.4. Linux kernel layer

Android's core services rely on Linux2.6 kernel; the kernel provides the functions including system security management, memory management, network management, process management, and driver model.

3.2. SQLite Database

SQLite is a lightweight database and this database also complies with the ACID relational database management system. It is designed for embedded system, and it has been used in many embedded products. It takes up very low resources, only a few hundred K memory are enough in embedded devices. In Android system, we use SQLite database engine to achieve the goal of structured data storage.

3.3. WiFi

Wi-Fi is a technology that can interconnect PC, handheld devices (such as PDA, cell phone) and other terminals via wireless. WiFi is a wireless network composed by the AP (Access Point) and wireless card. Its main advantage that does not require wiring is very suitable for mobile office needs because of lower power and more security.

3.4. SyncML Data Synchronization Protocol

SyncML (Synchronization Markup Language) is a kind of information synchronization standard protocol with platform-independent. It’s an open standard, and it also can conduct data synchronization in compatible equipment, procedures and network. SyncML synchronization is based on a client/server model. SyncML data synchronization protocol consists of three parts: SyncML synchronization protocol\[7\], SyncML expressed protocol\[8\], SyncML transmission binding methods\[9\]. Figure 3 is SyncML synchronization system architecture.
4. Function Modules

Through a detailed analysis and discussion for the needs to dairy farming enterprises in breeding zone, this paper divide Android-based management system designed for dairy farms into four subsystems: server management system, dairy cows drinking water management system, SMS push system, two-dimensional bar code reading system.

![SyncML synchronization system architecture](image)

**Figure 3.** SyncML synchronization system architecture

**4.1. Server management system**

The server site uses B/S architecture, and takes databases, computer networks, and the MVC framework as technical support. Then it does some systematic analysis and management for fundamental data and breeding data of dairy cows which are involved in the breeding dairy enterprises of breeding garden, thus the manager can get the details information of every cow from entering enterprises to allocating to its barn. So this can help corporate decision makers to do efficient
management. The main tasks of the system are: information management of dairy cows, milk production information management, breeding information management, husbandry and feed information.

4.2. Dairy cows drinking water management system

At present, most of enterprises in breeding zone adopt constant speed pump compression as the dairy cows’ drinking way. This way can not response to the changed pressure of the water supply network in time, and the degree of automation is low. When water consumption is low, the pipe network runs at overpressure state over a long period of time. So the phenomenon of blast is serious. Hard start of motor produces Water Hammer effect easily leading to big destruction and large consumption energy. Android dairy cows drinking water control software can adjust automatically according to changes of water. Figure 5 is external wiring diagram of dairy cows drinking water management system.

![External wiring diagram](image-url)
4.3. SMS push system

Using text messaging modem and mobile communication technology, system will automatically send information about dairy farming enterprise of breeding garden to mobile phone users in a timely manner, when the mobile phone users enter into the range of wireless network in breeding zone, so as to achieve the purpose of providing more detailed information of dairy farming enterprise to mobile phone users[10]. And in order to identify potential customers, the system also introduces related service information to mobile phone users.

4.4. Two-dimensional bar code reading system

Android can easily develop the application which can identify the two-dimensional bar code by using open source component zxing. A major feature of Android is that you can get URL via recognizing the barcode, and then staffs can directly access the address and download materials with the URL, this feature is undoubtedly provides a great convenience for the dairy farming enterprises in breeding zone. A lot of equipments in dairy farming enterprise have Two-dimensional bar code, when some devices malfunction, the staffs can scan the Two-dimensional bar code on the equipment and product by using Android terminal, and then retrieve related information about the equipment or product via WiFi according to the barcode information, so staffs can get solutions in time[11].

5. Test results and analysis

In this paper, we design Android-based management system for dairy farms with the technologies of mobile terminal, WiFi, data synchronization; the system is in the testing phase currently in dairy farming enterprises. There will be data synchronization interruption where the WiFi signal is weak in breeding zone, so this can result in data inconsistent between mobile terminal and server-side. Then the server-side will do statistical analysis of the data which uploaded by mobile terminals. When the abnormal situation occurs, the system can give the correct early warning information. Dairy cows drinking water management system can adjust the water lever in water trough. This not only can guarantee the supplies of daily drinking water but conserve energy and reduce cost largely. SMS push system can popularize breeding enterprise and raise its reputation. And the introductions about its related production which are sent to client in SMS can bring large amount of potential clients. Thereby it can improve enterprises’ production efficiency. This management system of dairy cow farm based on Android provides breeding enterprise a convenient and efficient management platform. The system can find the problem in dairy cow farm promptly and help the decision makers make response immediately to avoid potential lost. Compared with the artificial breed way in past, this system not only increases productivity obviously but also reduce cost. The usage results of this system are favorable according to dairy enterprises’ experience feedback in breeding zone. It can improve the level of information management in Ningxia’s breeding farm through promote the use of this system.

6. Conclusion
The target of this paper is to satisfy the modest scale information needs of dairy farming enterprises in livestock breeding zone in Ningxia, and then design and implement a dairy cow’s farm management system based on Android. In this paper, we develop mobile terminals for dairy farming enterprises by using Android embedded operating system, it provide convenience for the staff who work at the scene. Terminals can synchronize information about cows, milk production, breeding, feeding and fodder to the server-side through WiFi. So it can provide data support to business decision makers, therefore this system can help to improve the level of enterprise information management and the efficiency of production. SMS push system in this system can bring more commercial value to dairy farming enterprises. Moreover it is in favor of the dairy farm to ensure the quality of the milk and increase enterprises’ popularity in domestic market.

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8. References