
NFC Sample Tree Information Acquisition System Based on Android

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Abstract

In order to make sample tree information acquisition more convenient and efficient, this paper, taking advantage of NFC Near Field Communication, Android and web application development, and other modern information technologies, produces a Sample Tree Information Acquisition System combined with sample tree mark, information acquisition, and information management, thus providing technical support and meet the need for sample tree acquisition businesses. This paper focuses on system structure and its functions, and analyzes them deeper and deeper. Eventually, the overall design of Sample Tree Information Acquisition System is completed.

Keywords

NFC label, Information acquisition, Information management.

1. Introduction

In recent years, followed by the concept "precision forestry", the demand for the precision of forestry survey data has been increasing year by year. Sample tree information acquisition is an important component of forestry survey, which is significantly influenced by meticulous collection of sample tree information, work efficiency and data precision. However, the traditional way of the collection of sample tree information is mainly recorded on paper. In this way, many human resources is invested to conduct field measurement, and only when the measurement is finished, can the data collected be organized and analyzed, therefore, checking the rationality of data [1]. The delay of data organization disables data collectors to find out the mistakes, like sample tree label disorder, nonstandard data record, incomplete data collection timely. It not only decreases precision and usability of data, but also makes trouble for the following processing work. For this reason, it is necessary to use modern information technology to solve the problems in traditional sample tree information acquisition.

Along with the development and application of information technology in forestry industry, some mobile devices for forestry resources data collection like PDA with 3S technology come into being, which largely increases the precision of information collected. But PDA cannot be widely used because of small screen, outdated operation system and high cost [2].

On the condition of low cost, to realize meticulous collection of sample tree information, work efficiency and precision of the information collected, this paper develops a NFC Sample Tree Information Acquisition System based on Android. It uses NFC (Near Field Communication) as its medium [3], and is combined with the need for sample tree information acquisition and relevant knowledge about forestry.

2. System Structure

2.1 Analysis of System Demand

NFC sample tree information acquisition system based on Android is designed to solve the disadvantages in the present way of sample tree information acquisition. And it is designed by business need and the features of the technology it uses, aiming to realize the meticulous collection of sample tree information and provide convenient services and function for its users. According to the states quo of sample tree information acquisition and the need of forestry industry, sample tree information acquisition system serves following functions:

1. labeling sample tree automatically to solve the problems of sample tree label disorder and mistakes in data record.
2. providing real-time storage and check of the data collected to ensure completeness and accuracy of data.
3. recording the location of sample tree automatically to provide convenience for the second measurement.
4. providing convenient data management platform, including services like real-time collection, analysis, management and examination of sample tree information.

2.2 Design of System Structure

The relation among system components is based on the concept of modularization. Because of the huge differences of application set and operation environment among function modules, we arrange them into different component modules according to their own features. This system uses NFC labels to mark sample tree, realizing the uniqueness of sample number and information interaction with mobile APP. Mobile APP is used for sample tree information acquisition. While server website works for later data management. Database is data storage and the connection center between website and APP. Component relationship is shown by figure1-1.

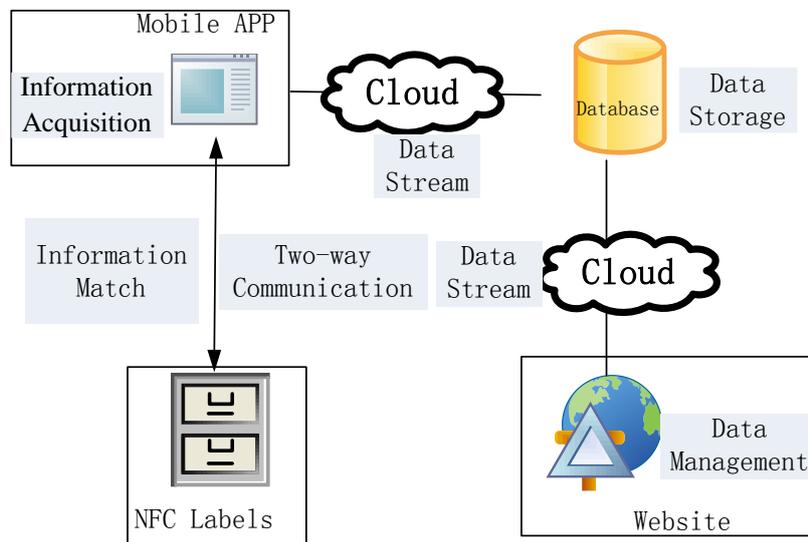


Figure 1-1 System composition diagram

This structure is hierarchically designed. It is divided by different functions. Applications are at the top, visible to users. Business processing rules are at the middle. And database visit control is at the bottom. The whole structure is made up by presentation layer, business logic layer and data visit layer [4]. In this system, the structures of website and APP are both individual and related. They have their own individual layer, but there are also connections between their business processing rules. Besides, they visit the same database. The structure relationship is shown by figure 1-2.

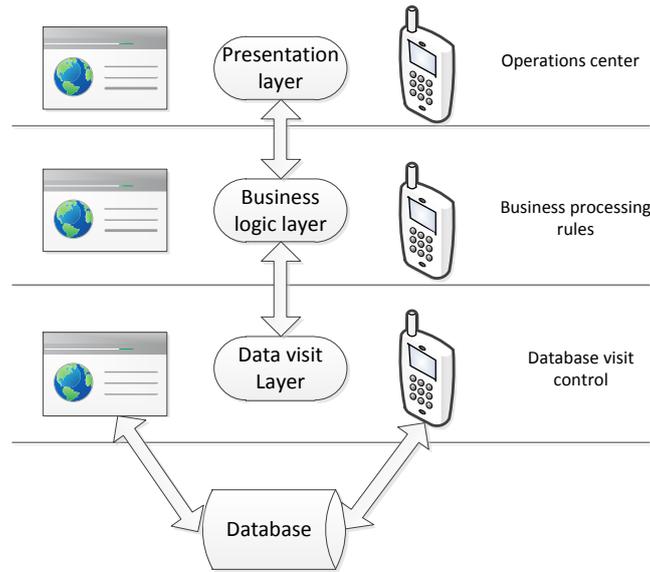


Figure 1-2 System Structure Diagram

3. The Function of Systems

According to the components relationship and demand analysis, main functions are embodied in its important components: NFC label, APP. Server side website. They serve the functions of sample tree marking, information collection and information management separately. Functions are shown in figure 2-1.

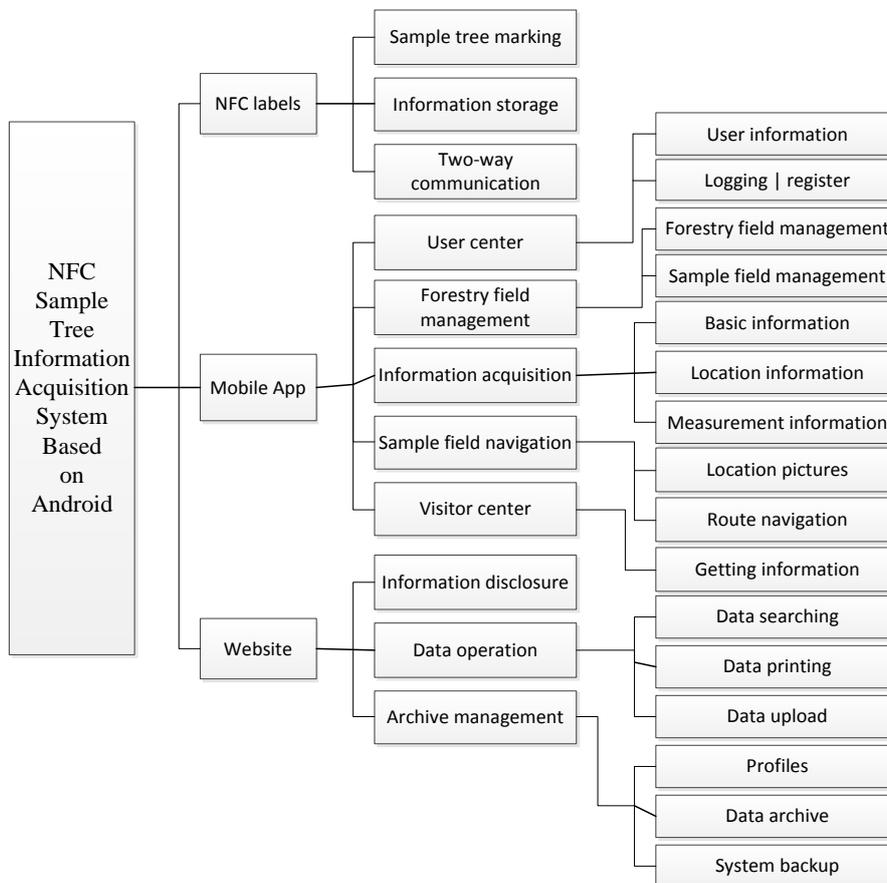


Figure 2-1 System function block diagram

3.1 NFC Label

NFC Label takes the advantage of features of Near Field Communication, such as short distance, high frequency, two way communications, fast connection, high security to realize the marking function of sample tree [5]. Data collectors give every sample tree ready to examine a NFC label. Then, they use the two-way communication function between NFC label and mobile APP, to trigger APP arranging logic ID procedure for every sample tree label [6]. In addition, after the record of sample tree information is completed, they use two-way communication function to synchronize sample tree information and information stored in NFC label to ensure the uniqueness and consistency of sample tree information.

The functions of NFC label and APP are closely related. NFC label is the mark of sample tree, but also the trigger of specific APP functions, such as arranging logic ID for every sample tree automatically, recording sample tree information, navigating the location of sample tree.

3.2 APP

APP serves for sample tree information acquisition, the core of the entire system. It includes five function modules: user center, forestry field management, information collection, sample field navigation, visitor center.

1. User center. It is the entrance of this system. It enables users to manage his or her personal information, including logging in, registration, user role management, changing personal information and password.

2. Forestry field management. This includes information management in forestry fields and sample fields, which is the preparation before sample tree information acquisition. Users, first of all, need to build new field to measure or select one from present fields. Building a new forestry field needs to collect basic information about the forestry field, including field number, location and research information. After that, in the selected field, people need to build new sample field, or select from the present sample field. Building a new sample field also needs to collect its basic information.

3. Information acquisition. After forestry field management, it is sample tree information acquisition. This system is equipped with two ways to collect information to tell the first measurement from the second. In the first measurement, first of all, the two-way communication between NFC label and mobile APP should get started. Then the system arranges logic ID for sample trees. In the second measurement, we can directly read sample tree number through two-way communication. Next, we can input sample tree information including basic biological information of the sample tree, location and other measurement information according to the results. Finally, according to the recorded information, the system will conduct simple examination automatically to ensure the rationality of the information, and reduce accidental errors.

4. Sample field navigation. According to the sample tree location information, the system can automatically picture the sample tree location. On this picture, its navigation function is realized by using Incremental shortest path optimization algorithm and two-way communication function between NFC label and APP. In this way it can find the best measurement way for the second measurement.

5. Visitor center. This module is designed for non-registered users to access to the open information of sample tree in NFC label, which is mainly used to recognition activity. Managers in the forestry field can type in unlocked sample tree information in NFC label, like species, age, tall, breast-height diameter. Therefore, when tourists visit around, they can learn forestry knowledge on their own.

3.3 Backstage Management Website

Backstage management is used for information management. It contains three function modules: information disclosure, data operation and archive management.

1. Information disclosure. This module is a window to show the sample tree information acquisition development, and to share the research results to the whole society.

2. Data operation. This module is a platform for researchers to organize, analyzed, obtain data and upload research report. After collectors upload sample tree information. Other industry members can organize data and analyze them in real-time on the Internet, thus efficiently reduce the time to acquire useful data.

3. Archive management. This includes personnel and sample tree data archive management. It is the management of system managers for system user group and data. Its major function include user verification, data check, user empowerment, and system back-up.

4. Conclusion

NFC sample tree information acquisition system based on Android integrates information technologies like NFC label, Android mobile APP, Web and MySQL database. Its aims are sample tree marking, information acquisition and information management. It realizes meticulous collection of sample tree information, overcomes drawbacks in traditional sample tree information acquisition, like sample tree number disorder, delay of data organization and examination, and blurring records. Although it still needs improvement, it can make forestry research more scientific and intelligent with its unique marking, fast connection, high security and two-way communication [7].

Acknowledgements

Project No. 201510022049 supported by National Training Program of Innovation and Entrepreneurship for Undergraduates.

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