

Application of RFID in Information Management of Electric Power Equipment Based on Android

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Abstract. In view of the traditional power equipment running status monitoring can only run in PC, can't do the outdoor inspection when the power equipment monitoring, power equipment information management is not timely and other issues, this paper presents a RFID and Android platform for power equipment information management mobile terminal solutions. The basic principle is the fusion of RFID tag encryption technology and multi tag anti collision technology, in a certain range of mobile phone terminal identification of power equipment encryption RFID tags, through the network communication technology and information management server for data exchange, taking into account the advantages of mobile terminal power consumption of the relevant optimization. Experimental results show that the program to achieve the electrical equipment information management and real-time accuracy.

Keywords: Power equipment, Information management, Real-time monitoring, RFID

Introduction

With the continuous development of smart grid, power equipment in steady state operation and high efficiency output is the basis for the production and operation of the power grid. With the introduction of the State Grid Corporation in 2010 promulgated the "smart grid technology standard system planning", the development of advanced online power equipment management system is imperative^[1]. The new system must meet the requirements of the planning and standards, to use the principle and method of modern equipment management, improve the efficiency and economy of power equipment maintenance.

For information management process of electrical equipment, currently used inspection methods are manual record mode, barcode inspection methods. Notes artificial way in which the inspection takes a lot of human resources, information recording process also there is a higher probability of error; barcode approach requires close inspection scan barcodes to obtain information on electrical equipment, but not close to dangerous electrical equipment, it can't scanning. Also, the conventional defects, maintenance, maintenance and other project inquiries and records are in the power equipment management software^[2], but the traditional online monitoring system and equipment information management can

only be achieved in the PC, can't be achieved in the outdoor power equipment state that information management, real-time monitoring^[3], resulting in information management for power equipment efficiency is not high and the poor accuracy of the information. Therefore, to ensure that electrical equipment is often in good technical condition, the full potential of existing power facilities, and improve the efficiency of electrical equipment maintenance and economy become critical.

In this paper, a power equipment information management system based on RFID and Android is proposed^[4]. Realization of electrical equipment information management without geographical restriction, effectively reducing the power failure due to the potential danger of electrical equipment. At the same time, taking into account the power consumption of the mobile phone side of the problem, this paper presents the relevant optimization scheme, and shorten the running time of the platform.

System Components

In view of the current situation and specific task requirements of real-time information management for power equipment in power grid enterprises, this paper proposes a mobile terminal solution based on RFID and Android platform^[5]. The system consists of RFID tags, mobile intelligent terminals, server-side

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components. As the only identification of the information of power equipment, the security of RFID tags is very important. Thus, it will be encrypted RFID tag technology. Mobile intelligent terminal is mainly used for the identification of the electrical equipment encrypted RFID tag while applying anti-collision technology for multiple tags within a certain area for

accurate identification. Server-side, the database is used for the storage and updating of the information of electric power equipment, and the information exchange between the server and the mobile terminal is responsible for the Service Web^[6]. The system structure shown in Figure 1.

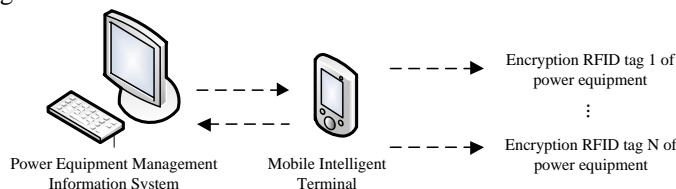


Figure.1 system structure diagram

This system has realized the real-time, network, standardization and intelligence of the on-line monitoring of power equipment, and further strengthen the power supply reliability, improve the management level and economic benefits of power grid enterprises, and promote the development of smart grid.

RFID Tag Design

RFID tag identification is required in the application of mobile intelligent terminal NFC (Near Field Communication) technology. Therefore, the RFID tag selection should also take into account the suitability of NFC technology. RFID tags include 3 types of

passive, semi-active and active. Passive RFID tags, which is not battery inside the tag, rely on the magnetic field generated by the electromagnetic induction, low cost, long service life, but the transmission signal distance, low rate of response signal; Semi-active RFID tags, that is, the internal configuration of the battery is only for the internal digital line power supply, not external role, although the cost is not high, the reaction rate is higher, but the transmission signal distance is near; Active RFID tags that label inside the battery, for generating a signal outside, without antenna trigger, although the cost is high, but long life, signal transmission distance, store large volumes of data. The characteristics of each type of RFID tags are shown in table 1.

TABLE 1. CHARACTERISTIC ATTRIBUTES OF ESCH TYPE OF RFID TAGS

	Passive type	Semi-active type	Active type
Battery	Have	Have	No
Cost	High	Low	Low
Life	Longer	Longer	Long
Transmission distance	Far	Farther	Near

Because the three types of tags can be identified by the NFC function of mobile intelligent terminal, it only takes into account the cost of building the system, the maintenance and other factors, the combination of the operation characteristics of power equipment and installation location of the special, select the active RFID tags, and can simultaneously read multiple tags.

Although the RFID tag itself has a certain confidentiality, but can't meet the electricity grid companies for device information confidentiality requirements, it is necessary to encrypt the RFID tag. In order to ensure the safety of the information of power equipment, the system will be combined with the encryption technology of RFID and encoding technology, and the RFID is encoding. In combination with the environment of the open demand of the

design and the large amount of information of power equipment, asymmetric encryption and decryption AES algorithm is adopted for RFID tags. And, when a number of power equipment RFID tags at the same time, will inevitably lead to signal overlap confusion, can't correctly identify tags. Therefore, the system is designed to encrypt RFID multi-tag anti-collision algorithm. The asymmetric encryption algorithm AES and anti-collision algorithm combines of RFID tag, designed asymmetric encryption and decryption of AES dynamic frame slotted ALOHA algorithm. Assuming that the Android defines the L as the frame length, the N is a certain range of the number of the encrypted tags to be identified, then the probability of a n tag to select a time slot I is subject to two distribution, that is, the:

$$p(X = n/\text{Select the slot } i \text{ of } n \text{ labels}) = C_N^n \left(\frac{1}{L}\right)^n \left(1 - \frac{1}{L}\right)^{N-n}$$

Well, the ratio of the number of slots to the total number of time slots for successful identification:

$$S = \frac{N \left(1 - \frac{1}{L}\right)^{N-1}}{L_{\text{total}}}$$

Thus, in the Android side of the encryption of a number of RFID tags to identify, to improve the efficiency of the algorithm, the key is to estimate the number of encrypted labels and adjust the optimal frame length.

The algorithm process is as follows:

(1) Initialization, set the initial label N, initial slot number F, the system sends a query command waits label reply.

(2) After receiving the query command of the system, the system is decoded, and a number of randomly selected [0-F] is included in the slot counter.

(3) The system sequentially queries each time slot, according to the response message collision record label.

(4) By using a tag estimation method, the number of remaining tags is estimated by the collision.

(5) Determine whether the number of tags N is 0, not 0, then hit (2) to continue to be identified until all tags are identified.

(6) After all the label identification system is decrypted and displayed on the screen accordingly.

Work flow chart is shown in figure 2.

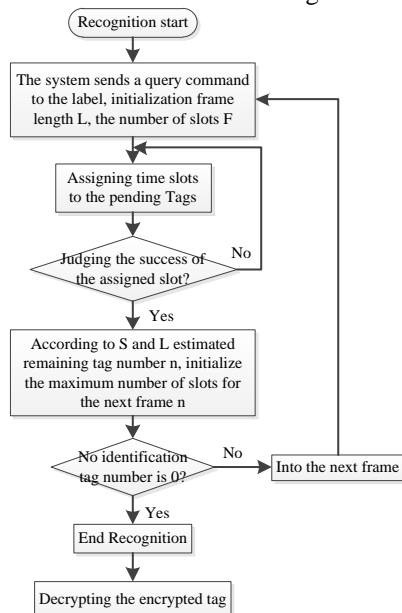


Figure.2 Asymmetric encryption and decryption of AES dynamic frame slotted ALOHA algorithm flowchart

Performance optimization of mobile terminal

In this design, the largest amount of computation is the RFID tag decryption and anti-collision algorithm module, the general use of JAVA programming, but the running speed is very slow, so the use of C language to write. That is, the application of JAVA to the framework of the main program, the application of C language to the RFID tag decryption and anti-collision part of the preparation. Thus, the maximum power consumption of the decryption and anti-collision module running time is shortened, increase operating speed.

Conclusions

With the application of RFID identification technology to power equipment management system, the automation and intelligence of data acquisition are realized, and the completeness and effectiveness of power equipment management system are improved. This paper designs the power equipment information system management platform to make full use of the storage data and the results of data and applications to facilitate and efficient query, greatly reduce the power equipment management in the hardware equipment, effectively improve the management efficiency of power equipment, reduce management costs. And, after the use of the performance optimization scheme, the mobile intelligent terminal's standby time is prolonged, and the running time is shortened. Promote the development of the electric power equipment management system in the direction of more intelligent management.

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