Design of Anti-Counterfeit Read-Write System for Dual-Band Auto Parts

Peng Peng [1+] and Zhijun Deng [2]

[1, 2] School of Automotive and Transportation Engineering,Shenzhen Polytechnic,Shenzhen, China

Abstract. China has entered a period of rapid automobile development,Healthy reuse of new and second-hand auto parts is related to the normative development of the whole automobile industry.This paper designs a RFID reading and writing system which combines UHF and HF in one RFID label for auto parts,and analyzes the main modules and functions of the system.Aiming at the four kinds of security vulnerabilities in the RFID system at IOT,the corresponding four-layer security design is proposed.The system can effectively trace the circulation state of auto parts in the whole life cycle,identify the genuine and counterfeit parts,and better standardize the auto parts market.

Keywords: dual-band, auto parts, RFID, anti-counterfeit

1. Introduction

Sales industry of auto parts has also been developed quickly in China after 2012.In recent years,disputes caused by the quality of auto parts accounted for seventy percent of the total auto disputes,bringing great harm to the consumers and auto parts enterprises,and bringing hidden troubles of traffic safety.Nowadays it is mature to use RFID technology to realize automatic manufacturing and monitoring in automobile manufacturer.In the second-hand car industry,the process monitoring of vehicles and auto parts by using the Internet of Things technology is also fully in line with the management requirements of heavy traffic in china.

Healthy reuse of second-hand cars and second-hand auto parts is related to the normative development of the whole automobile industry.If auto parts are given anti-counterfeit "electronic identity number",consumers will be more reassured to repair their cars,and government quality control will also be more effective.If the automobile maintenance quality dispute occurs,the government department may use the anti-counterfeiting number,quickly and accurately lock the auto parts source,and better help consumption safeguard legal rights.

The automobile industry has always been the leading edge of the transformation and innovation of manufacturing mode.With its huge scale and extensive links with various sectors of social economy,It has changed the development way of manufacturing worldwide.The application of information technology has provided strong technical support for the change.Automobile networking technology is the development direction of automobile industry,and the RFID technology used in automobile has applied.But up to now,there is no monitoring and anti-counterfeiting operation platform for the whole life cycle of auto parts in China to integrate auto parts flowing through various automobile industries,enterprises.

We use with dual-band RFID label just like "electronic identity number",which can automatically identify auto parts for different purposes,combine with IoT technology.We design security and traceable algorithm that binds dual-band digital encoding and auto product information,and design a RFID reading and writing system to achieve lifecycle traceability and anti-counterfeit of all kinds of auto parts.

2. System Structure

+ Corresponding author. Tel.: +86-755-26731091; fax: +86-755-26731033.

E-mail address: ppjsj@szpt.edu.cn.

Running environment uses Microsoft SQL Server2010 database system.Considering that only manufacturers,maintenance manufacturers and sales enterprises of auto parts have the right to write to RFID readers,At the same time,these work is relatively concentrated,so this part of the function is processed into a C/S structure of the program,using C# to develop a separate software.
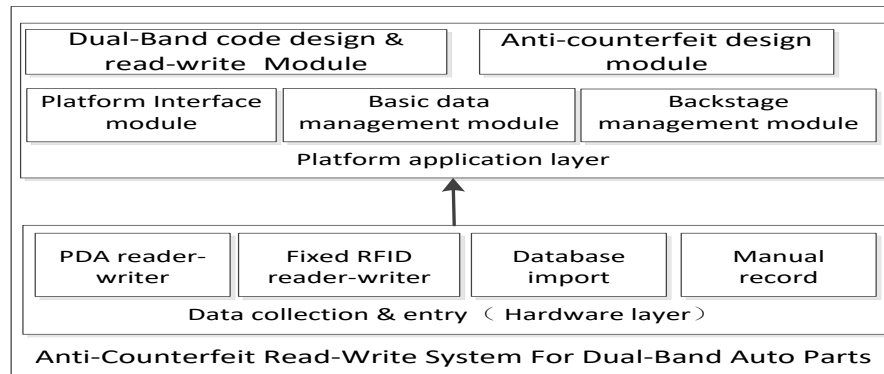

Fig.1: System modules

As the main part of the system ,platform application layer includes five main modules in Fig.1:

- Dual-Band code design & read-write Module:including design of high-frequency code and ultra-high-frequency code properties of the setting,bits read and write setting.
- Anti-counterfeit design module:including a variety of anti-counterfeiting technologies to prevent auto parts from being copied and counterfeited the dual-band code,by setting up a unique electronic id card for each auto part.In a complete RFID system,there are four security vulnerabilities,including the data vulnerability in the label itself; the vulnerability in the wireless dissemination of data on the label; the vulnerability in the reader authority;Background database and application software data vulnerability.Accordingly we design dual-band anti-counterfeiting algorithm,AES content encryption algorithm,reader password authentication algorithm,database authentication method this four ways to encryption and anti-counterfeit.
- Platform Interface module:the presentation layer of the system.It mainly calls the function of the business interface,including the system interface design,the input and output format of each business process,and generating the real-time view according to the system.
- Basic data management module:ultra high frequency reader and high frequency reader parameters setting.Mainly including support protocol,frequency band selection,working mode,maximum&minimum power,baud rate,etc.
- Backstage Management module: including user management,user privilege,upgrade and so on.

3. Dual-Band RFID Anti-Counterfeiting Technologies

The system faces four security vulnerabilities,including the data vulnerability in the label itself; the vulnerability in the wireless dissemination of data on the label;the vulnerability in the reader-writer authority;Background database and application software data vulnerability.Four kinds of anti-counterfeiting technologies to deal with the four-layer security vulnerabilities are designed in Fig.2.

- Dual-band anti-counterfeiting algorithm:design to deal with the data vulnerability in the label itself.The dual-band label in UHF area records the unique auto parts code with only a few numbers just like "ID card Number",it is read-only for most users,only a few government users,high-grade users and administrators can modify.The dual-band label in HF area records all attributes of auto parts with High volume codes,it is widely writable under appropriate authority.With the hash function MD5,HF code is hashed into code A.All the attributes of auto parts are stored in the center traceability database,including the field B,and field B is created by hashing all the fields of one auto parts record in database.Through querying center traceability database by UHF code, we can find out the corresponding field B at database, and then match and compare the codes A in HF area, If consistent, label traceability is valid and auto part is genuine, otherwise is counterfeit.(Fig.3).
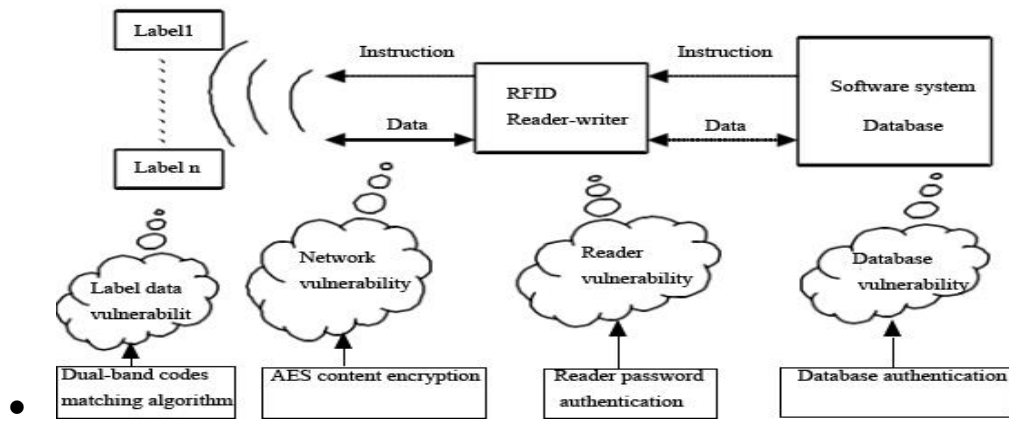
Fig.2: Vulnerabilities and anti-counterfeiting measures in the system
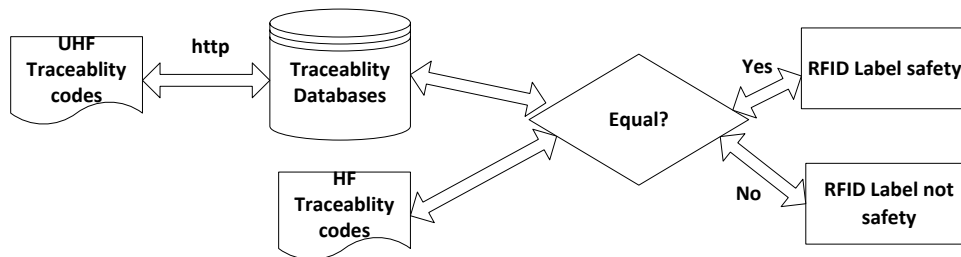

Fig.3: Anti-counterfeiting of UHF traceablity codes with HF traceablity codes

- AES(the advanced encryption standard) content encryption algorithm:design to deal with the vulnerability in the wireless dissemination of data on the label.We use a combination of symmetric encryption(AES) and asymmetric encryption(RSA) to encrypt HF codes and UHF codes in the label when transfering data between RFID reader-writer and RFID label through wireless network.Since HF codes'data capacity is relatively large for combining the whole datas in lifecycle of auto parts,the defect of speed makes the asymmetric encryption algorithm not applicable,although it is more secure and convenient in secret key distribution and use.Therefore,the dual-band encoding content is encrypted with AES which can be very low memory requirements,and Asymmetric encrypt the secret keys of AES by RSA.This ensures the security of the key distribution and the encryption speed.The implementation of this algorithm requires the distribution of asymmetric private keys through the center authentication and the central database,according to the authority,to the RFID readers of all automobile enterprises.It realizes the information data security of auto part in each datas transmission and writing process,improves the level of information security and reliability in automobile manufacturing and after-sales service.
- Reader-writer password authentication algorithm:design to deal with the vulnerability in the reader-writer authority.The second generation EPCgolbal protocol standard of RF enhances the security performance of passive label.The new standard itself provides the cryptographic protection mechanism.For this purpose,the system uses the EPC standard and the password protection method brought by the reader-writer.In order to ensure the normal work of RFID readers,the auto companies need to set the hardware password in their own reader and provide protection of hardware level.That is,To protect the high frequency and ultra high frequency area of RFID label,only the authorised reader-writer has the right to read or write the active label with correct password.
- Database authentication:design to deal with Background database and application software data vulnerability,we directly use the SQL2000 database with its own encryption method.

The design of the four-layer anti-counterfeit encryption algorithm effectively guarantees the reliability of the dual-band codes of auto parts and the safety of the data in the RFID system.

4. Summary

The use of networking technology of dual-band RFID to ensure auto parts' information recognition has a very good application prospect.Industries of auto parts affix electronic labels,install RFID information reader,and link to the anti-counterfeit read-write system for dual-band auto parts,to conveniently obtain fast,accurate and consistent data transmission and disposal.The system can identify the genuine and counterfeit auto parts,and better standardize the auto parts market,connecting to another software system "the Traceability and anti-counterfeit system of auto parts with dual-band RFID",collectively and effectively trace and ensure the circulation state of auto parts in the whole life cycle.

5. Acknowledgments

6. References

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