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Design about petroleum product tracking and sales management system based on internet of things

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ABSTRACT

As Internet of Things technology is applied to petroleum industry in China, petroleum product tracking and sales management are one of the tendencies of its application to the petroleum industry in future. On the basis that current situations about application of Internet of Things technology are analyzed and sales tracks of petroleum companies' petroleum products are surveyed, this thesis proposes design methods related to petroleum product tracking and sales management system based on Internet of Things, involves system structure and key techniques represented by RFID radio-frequency technique and cloud technology, simulates real application scenes of the management system and puts forward main framework and key technologies of application. Preliminary design and analyses of the management system provide theoretical support for us to expand application and realization of Internet of Things in the petroleum industry.

KEYWORDS

Internet of things; Petroleum product; RFID; Cloud technology; Tracking and sale.

INTRODUCTION

Internet of Things refers to a huge network that is formed by combining various kinds of information sensing equipment (for instance, different devices like Radio Frequency Identification (RFID) device, infrared inductor, global positioning system (GPS) and laser scanner with internet, which is an important component of a new generation of information technology and will become the third wave of information industry after computer and internet[1]. In the aspect of development of Internet of Things, China starts early. Thus, technical and standard development basically synchronizes with international situations. Natural Science Foundation of China (NSFC), '863' and '973' etc provide much support for *Internet of Things industry. Outline of the National Program for Medium and Long-term Scientific and Technological Development* (2006-2020) include content of sensor network in the three aspects major special projects, preferential themes and cutting-edge technology. National Science and Technology Major Project which is being carried out also regards wireless sensor network as one of the main directions and provides support for some key technology fields and important application areas.

So far, Internet of Things has obtained preliminary progress in many fields of China, such as intelligent logistics, smart home, intelligent environmental protection, intelligent medical treatment and public health, financial service industry and public security[2]. Besides, China has formed basically complete industrial system of Internet of Things and some fields have formed a certain market scale. Meanwhile, the gap between network communication-related technology and industrial support ability and that in foreign countries is small. In detail, China holds numerous products with proprietary intellectual property rights and patens in the aspects of sensors, communication and network, and basically stays in the same starting line as foreign countries. Besides, cloud computer commercial service of China has been started and SaaS has formed a scale. In the aspect of cloud safety, Chinese enterprises have some features and advantages. As scale of application of Internet of Things advances, internet develops rapidly, course of our country's informatization deepens continuously, cloud computing service of China will form huge space of market demands and show a trend of rapid development during the '12th Five-year Plan'.

The petroleum industry is an industry that started to Internet of Things early. Currently, all large petroleum companies of China enhance their strategic cooperation with local government, related industries and colleges, and develop main researches on application of Internet of Things to logistics and product and asset tracking management of petroleum and petrochemical industry, petroleum drilling monitoring, pumping well and offshore production platform monitoring, wireless meter reading for meters of oil fields, petroleum pipelining monitoring and emergency management[3].

Application of Internet of Things to the petroleum industry is a typical case about cooperation between the petroleum industry and many industries likes electronic and information industry, logistics transportation and equipment manufacturing industry. In the system, various industries integrate with one another to a large extent and informatization is used to improve cooperation level of the petroleum and petrochemical industry chain and realize maximum benefits of the whole value chain. In future, main application of Internet of Things to the petroleum industry will be expanded to intelligent monitoring about oil equipment, real time monitoring about pollution discharge of the petroleum industry, petroleum product tracking and sales management as well as management of petroleum safety production gradually etc.[4-5] This thesis proposes the method that petroleum product tracking and sale management system can be constructed based on Internet of Things, involves key techniques represented by RFID radio-frequency technique and cloud technology, simulates real application scenes and gives detailed introduction to main framework and intelligent read-write modules of the whole system and key techniques that realize the system.

PETROLEUM PRODUCT TRACKING AND SALES MANAGEMENT BASED ON INTERNET OF THINGS

In 2005, International Telecommunication Union (ITU) issued the article *Internet Report 2005: The Internet of Things* in World Summit on the Information Society (WSIS) held in Tunisia, and formally put forward concept of 'Internet of Things'. Internet of Things technology refers to the intelligent network technology that realizes network connection of articles' interconnection and interworking and carries out information exchange and communication by using sensing equipment like all kinds of sensor devices, RFID, EPC coding, infrared sensors, GPS and laser scanner according to agreed protocols in order to realize intelligent identification, location, tracking, monitoring and management. Core and basis of Internet of Things technology are still 'internet technology', which is a network technology extended and expanded based on internet technology; its user end extends and expands to the space between any two articles to carry out information exchange and communication[6].

This thesis combines 'Internet of Things' with daily operation and application of practical companies (for instance, large-scale petroleum companies like PetroChina and Sinopec), uses RFID technology to establish petroleum product tracking and sales management system, realizes digital logistics of petroleum products, and drives upstream and downstream cooperative manufactures to apply advanced logistics management techniques jointly, build a mutually supportive modern logistics group of petroleum and improve coordination of petroleum supply chain. The utilized RFID chip technology and mobile network enable mangers of petroleum companies to track and check sales process and results of petroleum products by network easily whenever and wherever possible. Application routes and scenes can be simulated preliminarily, as shown in Figure 1.

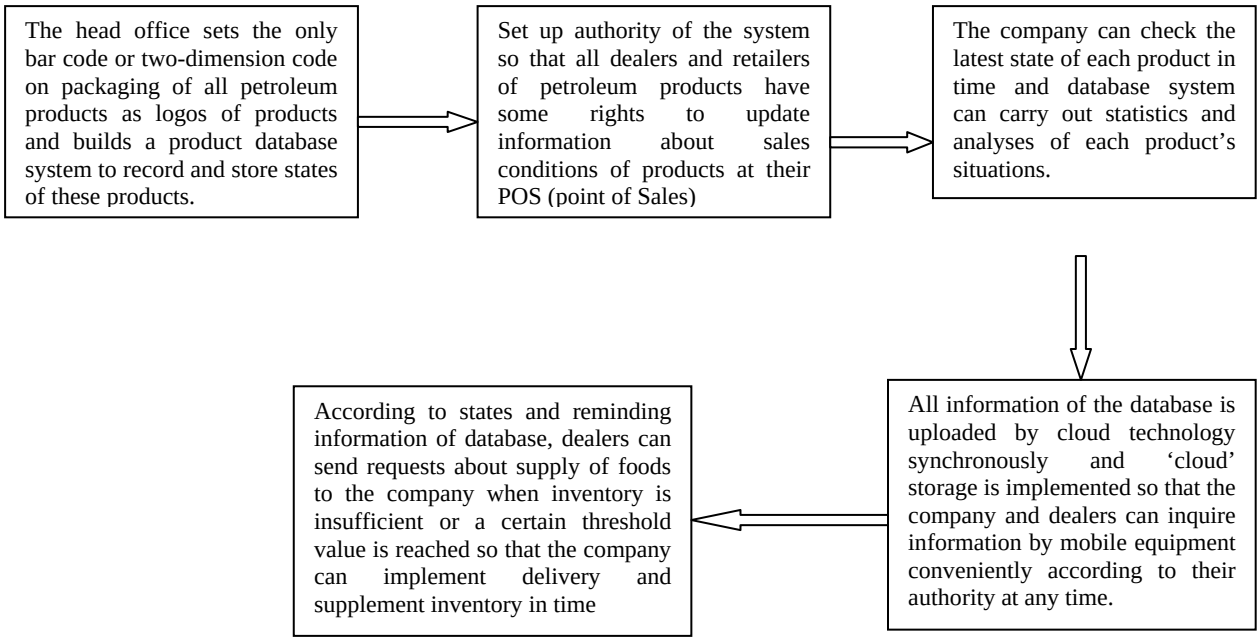

Figure 1 : Petroleum product trackin and sales management system based on Internet of Things

MAIN FRAMEWORK AND KEY TECHNIQUES

Main framework

It investigates situations about application of Internet of Things to other fields, surveys the whole practical sales process of large petroleum companies' oil products, constructs petroleum product tracking and sales management system and realizes digital logistics of petroleum products. The system structure about application of the Internet of Things is shown in Figure 2.

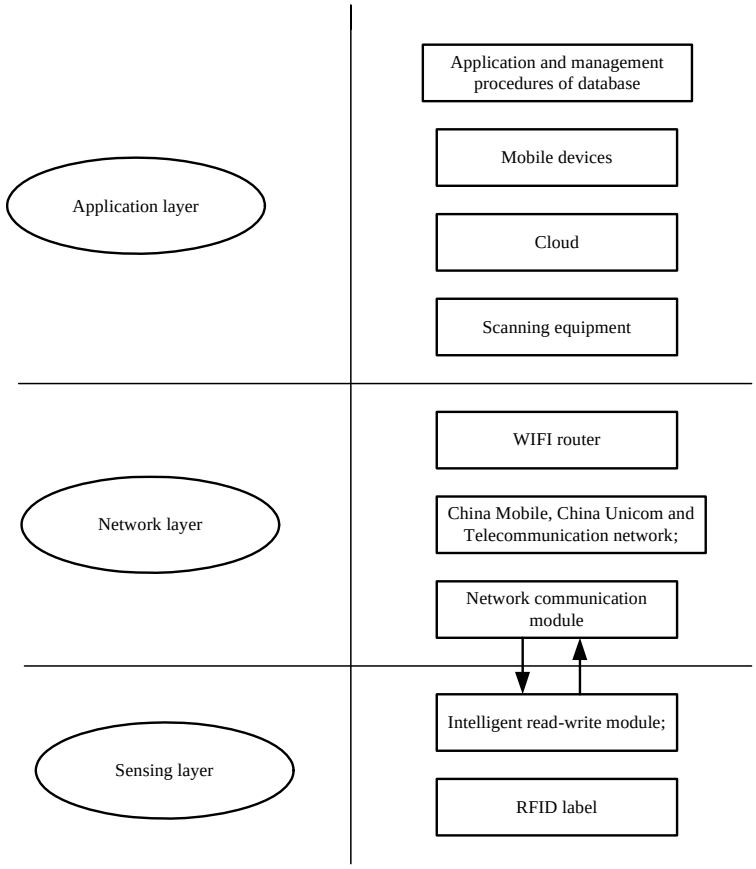

Figure 2 : System structure

According to Figure 2, it is shown that the whole system structure is divided into three layers, i.e., sensing layer, network layer and application layer. The sensing layer is mainly composed of two parts including intelligent read-write module and RFID label; the network layer mainly consists of network communication module, China Mobile, China Unicom and Telecommunication network and WIFI router. In accordance with the Figure, network communication module and intelligent read-write module have some relationship; specifically, the intelligent read-write module can be expressed by Figure 3[7].

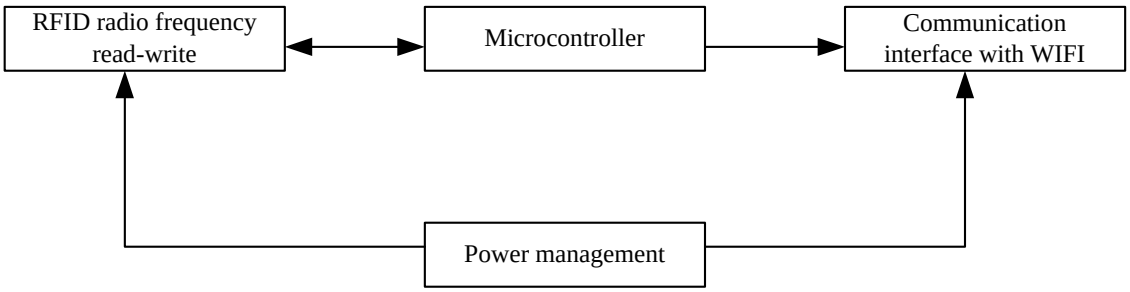

Figure 3 : Intelligent read-write module

The last layer is the application layer, which contains scanning equipment, cloud, mobile devices and application and management procedures of database etc. The three layers relate to one another but distinguish from one another and perform their own functions to ensure further implementation of application.

Key technology

RFID: it is a non-contact and automatic identification technology using electromagnetic induction principle to spread signals between labels and reader-writer. It is featured by large space of data storage, read-write nature, and rapid identification speed. Besides, labels can be encrypted. It will be used by both the sensing layer and the application layer, which mainly involves scanning and identification of bar code or two-dimension code.

Mobile network/ WIFI: it will be used by the application layer. Mobile devices must be equipped with it and it is used to connect each mobile device with the system and implement networking identification for bar code or two-dimension code.

MIS: it connects the whole process in which fact and fiction are tested. The system input all data and has port connection with corresponding mobile network dealers so that managers' or distributors' visits will be more convenient.

Cloud: data can be stored on cloud. It is a technique that serves as a guarantee and can be invoked conveniently.

Terminal of application of the Internet of Things is basically composed of three parts including RFID card reader, central processing module and external communication interface. By connection between peripheral sensing port and sensing equipment, data of these sensing devices are sent to the central processing platform assigned by Ethernet via external communication interfaces like GPRS modules, Ethernet interface and WIFI after they have been read and processed by central processing module[8].

In accordance with usage occasions, mobile terminal (MT) or hand-held terminal can be selected. If MT is used, it is necessary to transfer label data that the company's system establishes for petroleum products to each dealer's or outlet store's system via Wi-Fi[9,10].

According to transmission mode, the head office of petroleum products may apply the combination way of 2G+3G+WIFI to the whole market environment. In doing so, application will be wider and more convenient.

CONCLUSION

Aiming at current situations about application of Internet of Things to the petroleum industry, this thesis analyzes market conditions of petroleum products at present, proposes one of the trends of application of Internet of Things to the petroleum industry in future, combines with existing emerging technologies and related application of 'Internet of Things' and proposes the method that petroleum product tracking and sales management system can be constructed based on Internet of Things. Although the method has not been implemented or applied, hierarchy and reasonability of the preliminarily scheme have good theoretical basis. Meanwhile, the method utilizes advanced Internet of Things technology in China and has favorable expansion, adaptation, some development space and value in use.

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