

# Vaccine Quality Traceability Management System Based on RFID

Zuliang Wang  
Department of Information Engineering,  
Xijing University  
Xi'an, China  
1601252678@qq.com

Ting Zhang  
Department of Information Engineering,  
Xijing University  
Xi'an, China  
1046935520@qq.com

**Abstract**—Vaccines are antigenic to human body. After inoculation, the body produces a series of beneficial specific immune responses against infectious diseases. Vaccination is the most economical and effective measure to prevent infectious diseases. In order to ensure the quality of vaccines safe and reliable, a vaccine quality traceability management system based on RFID is designed. By using radio frequency identification technology, electronic tags are used to record the whole process of vaccine production, output, storage, vaccination and other information. It is forbidden to make up production records and product inspection records to ensure the vaccine institute. It has the authenticity, completeness and reliability of the production test data, and can be traced back to improve the quality of the vaccine, so that injectors can use it safely.

**Keywords**—radio frequency identification, lectronic label, vaccine quality, retroactive.

## I. INTRODUCTION

Vaccination is the most economical and effective public health intervention for the prevention and control of infectious diseases. It is also an effective means for families to reduce the incidence of diseases among their members and reduce medical expenses. Vaccination is the most effective way to prevent and control infectious diseases. Except for oral administration, most vaccines are administered by intramuscular injection, subcutaneous injection or intradermal injection. Therefore, to prevent unsafe vaccination, to ensure the health of the vaccinated population has important practical significance [1].

In recent years, vaccine counterfeiting has occurred frequently. Some suppliers have used large-scale fomenters in violation of regulations in order to increase production. Volume changes may result in new substances, which are not within the scope of the original process elimination and testing, causing significant impact. Some suppliers changed their accessories without being reported, but the new products failed to increase efficiency as expected. Vaccines, unlike other products, are directly related to life safety and are the most trusted products of injectors. If the quality of the vaccine goes wrong, it will have a very vicious impact. July 15, 2018, the State Drug Administration issued a circular pointing out that Changchun Changsheng Biotechnology Co., Ltd. freeze-dried rabies vaccine production for human existence records of fraud and other acts. This is immortal organisms since November 2017 was found to be 100 tetanus vaccine potency indicators do not meet the requirements less than a year after the re-exposure of vaccine quality problems. After the exposure of Changchun Changsheng biological problem vaccine, the problem of vaccine safety has aroused widespread concern in the society.

Radio Frequency Identification (RFID) technology is a new automatic identification technology developed in the 1980s. RFID technology is a technology that uses radio frequency signal to transmit non-contact information through space coupling (alternating magnetic field or electromagnetic field) and achieves identification purpose by transmitting information. RFID is a simple wireless system that can be used to control, detect and track objects.

Therefore, it is imperative to design a vaccine quality traceability management system based on RFID by applying RFID technology to the vaccine quality tracking process, avoiding the compilation of production records and product inspection records, and ensuring the authenticity, integrity, reliability and traceability of all vaccine production inspection process data. .

## II. PURPOSE AND SIGNIFICANCE

A portable satellite communication system with simple structure, single person carrying, easy operation, automatic star hunting, high precision and high performance is studied and designed. Under the condition that the ground facilities are completely destroyed, and the ground communication condition is inconvenient because of the frequent site change and movement, the ground end-to-end satellite communication links can be established quickly and conveniently to provide communication support, thus the two-way audio-visual emergency communication links can be carried out. Vaccine quality traceability management system based on RFID adopts radio frequency identification technology. Starting from the preparation period of vaccine cells, RFID electronic tags are installed in each batch of vaccine production to record the information of vaccine production, packaging and freeze-drying. The tag information is read before transportation and uploaded to the data center. The electronic label is attached to the transport box, and the tag is read through the reader to connect to the data center. In the follow-up storage and vaccination links, the electronic tag information is read and written by the reader to achieve the writing, updating and query operation of traceability information throughout the process, which is convenient for the injector to query the information of vaccine production, transportation, storage and vaccination. This can improve the quality of vaccine and avoid the occurrence of vaccine fraud.

### III. THE SYSTEM COMPOSITION

The vaccine quality traceability management system based on RFID consists of vaccine production electronic tag, reader, vaccine transport electronic tag, and internet and data center. The management system is shown in Figure 1.

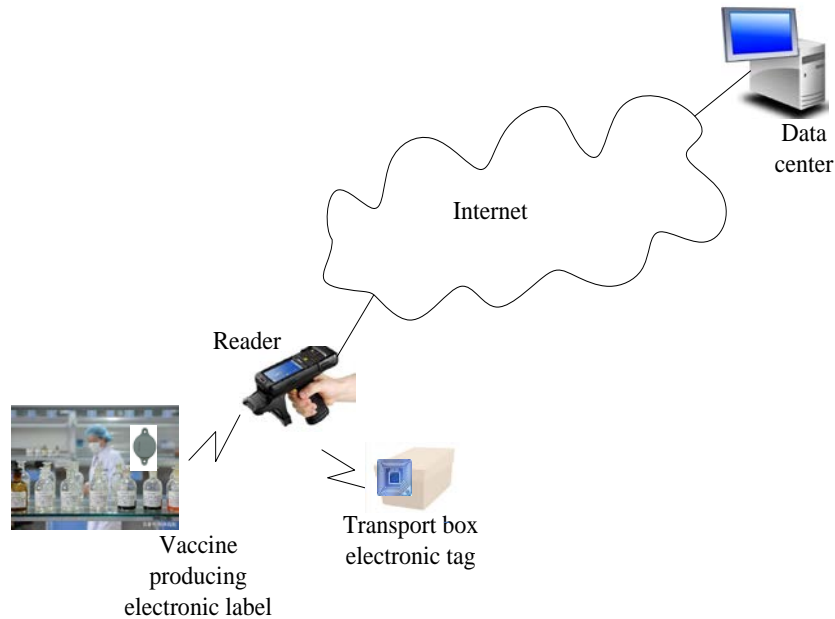


Figure 1. The management system of the vaccine quality traceability

Among them, the electronic label for vaccine production is set in the vaccine production area, which stores the information of vaccine production process. It can record the information of cell preparation, virus inoculation, virus harvesting, virus inactivation, merging, concentration, purification, verification, packaging and freeze-drying, and can read and write the information through the reader. RFID tag is a breakthrough technology. Firstly, a very specific object can be identified, not just a class of objects like bar codes; secondly, it can read data through external materials by radio frequency, and the bar code must read information by laser; thirdly, it can read multiple objects at the same time, while the bar code can only read data through external materials. Read it one by one. In addition, the amount of information stored is also very large.

RFID reader is suitable for fast and convenient system integration. It has reliable performance, complete functions and high security. It consists of real-time processor, operating system, virtual mobile memory and a small built-in module (including transceiver device). The reader uses an ultra-high frequency reader that meets the EPC\_global C1 G2 standard. The reader can read and write at a distance of more than 10 meters. It is compatible with vaccine production of electronic tags and vaccine delivery electronic tags.

Vaccine transport electronic tags are used to record the ID numbers of vaccines in this case. Because of the large scale of such tags, low-cost tags with small storage capacity are used. The reader reads the ID numbers and associates them with the data center. All information is stored in the data center server for query. Electronic tags are divided into read-only tags and read-write tags. In addition to ROM, RAM and buffer memory, the memory inside the read-write tags also has inactive programmable memory. In addition to the function of storing data, this memory also has the function of allowing multiple writes of data under appropriate conditions. Therefore, the electronic tags can be read and written.

The Internet is used to transfer the information read by the reader to the data center, so long as the Internet can cover the place can upload information to facilitate the deployment of the data center.

Data centers use servers or cloud storage devices with stable performance and large storage capacity to store full traceability information about vaccines and provide access interfaces.

Radio frequency identification technology is used to achieve vaccine traceability management. From the beginning of vaccine production, RFID electronic tags are installed in each batch of vaccine production sites to record cell preparation, virus inoculation, virus harvesting, virus inactivation, merging, concentration, purification, verification, sub-packaging and freeze-drying links of information, read the tag information before transportation, and upload the information to the data center. At the same time, the electronic tag is attached to the transport box, and the information on the electronic tag is read through the reader and transmitted to the data center. In each link of follow-up storage and vaccination, the electronic tag information is read and written by the reader, and the corresponding information is stored in the electronic tag, so as to ensure that the information from the beginning of production to the injection period is stored in the electronic note, so as to realize the writing, updating and inquiry of traceability information. It is convenient for the injector to inquire about the whole process information of vaccine production, transportation, storage and vaccination.

#### IV. CONCLUSIONS

Vaccine quality traceability management system based on RFID adopts radio frequency identification technology to record the whole process information of vaccine production, output, storage and vaccination by using electronic tags. It is forbidden to make up production records and product inspection records to ensure the authenticity, integrity and reliability of all vaccine production and inspection data. . At the same time, users can access the interface to query the relevant vaccine information, which can be traced back to the function, so that injectors can use it with ease.

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