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RFID-Based Hazardous Waste Management Platform Establishment

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Abstract

As the social economy develops rapidly, resources are developed and used in large scale, therefore, urban solid wastes are increasing. On issues which exist in the current hazardous waste management, a real-time monitoring information management platform in the process of storing and transporting wastes has been established with RFID, GPRS and GIS Technology, to provide objective and accurate basis for pollution control and environmental enforcement.

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KeyWords: Hazardous Waste; RFID Technology; GPRS Technology; GIS Technology

1. Introduction

Control of hazardous wastes, however, there're few studies on hazardous waste management and information. Qiujiang, together with others, has introduced the development of RFID Technology and its application in the solid waste collection and transportation[1]. Deng Jianjun, Wen Xuefeng and others has raised a medical waste electric supervision system construction plan based on studies of environmental risks and management models in the international waste circulation, and researched on the medical waste control technology[2]. Luosong, Zhong Nianbing and others, based on problems in the existing medical waste management, have raised a real-time tracking and supervising system on medical waste collection, transportation and control with a comprehensive use of RFID, GPS and GPRS, and elaborated design on the system structure, operation principles and communication system[3].

This article has designed a smart hazardous waste scheduling management system based on RFID technology, and realized a comprehensive use and management information platform on hazardous wastes

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established by GPS tracking and positioning in hazardous waste transportation, so that each section of the hazardous waste generation, collection, transportation and final settlement is precisely supervised and managed. In this way, responsibilities and duties of the producer, collector, and the transport handler are made clear.

2. Establishment of the General Platform

This article emphasizes on the online supervising model in the hazardous waste storage and transportation based on the Internet of Things technology, how to establish hazardous waste management system on RFID technology, how to realize GPS tracking and positioning system in the hazardous waste transportation, and how to finally establish an information platform to comprehensively use and manage hazardous wastes. In the example of waste settlement procedure in hospital, it shows how to establish the waste storage and transportation and remote monitoring platform.

When hazardous wastes get into or out of the warehouse, their types are determined with RFID technology, and their in-or-out information is gained. Information management system on the server should receive GPS data, deposit it into the established special database, conduct GIS drawing on other data, and timely display the path on the virtual map, convenient for the tracking and inquiry of hazardous wastes. The information are published online after being integrated, which is convenient for the management institutes to timely inquire and manage hazardous waste information.

2.1. Platform Hardware Information

2.1.1. Handheld Data Collector

MC70 handheld data collector and MC9090G handheld data collector: Suited to a series of similar Windows environment and powerful environment on special uses. They provide the real-time data collecting function to ensure the procedure automation and error proofing and efficient tracking. They integrate 802.11 a/b/g WLAN radio function, compatible with any WLAN all over the world.

2.1.2. Fixed RFID Reader

Moto XR450 Fixed Reader:It provides simple integrating and rich application procedure support, and efficiently and reliably reads tags, which is comprehensive and flexible in use, including support for direct application procedure hosting, support of IBM, Microsoft, SAP and other standard back-end platform, support of mixed use with industrial automation devices such as the conveyor, and seamless integration with the existing IT environment.

2.1.3. Terminal Devices

Cell phone: With Windows mobile 6.1 system and GPS module, its sim card can be connected with GPRS cellular network. Server: Receiving data, storing to the database, and fulfilling a visual GPS positioning system.

2.2. Platform Software Information

Tracking and Positioning System:After the GPRS transmission system transmits GPS data information, the server receives GPS data, draw electric map with GIS and database technologies, and publishes it onto the Web.

RFID Storage System:The receiver realizes the RFID reading function, transmits data information through the Internet, and realizes inter-regional electronic management. The server stores information with the database technology.

3. Principles and Methods of Establishing Hazardous Waste Management Platform

3.1. Principles and Methods of Realizing Hazardous Waste Information Management Based on RFID Technology

RFID[4] is a high-level automatic identification technology, which identifies information of the physical target through non-contact full-duplex data communication with RFID mode. Each RFID tag, composed with chip and antenna, has unique product electronic code. RFID system can send information data between radio transceiver and sensor transceiver (with tag, also called RFID transceiver).

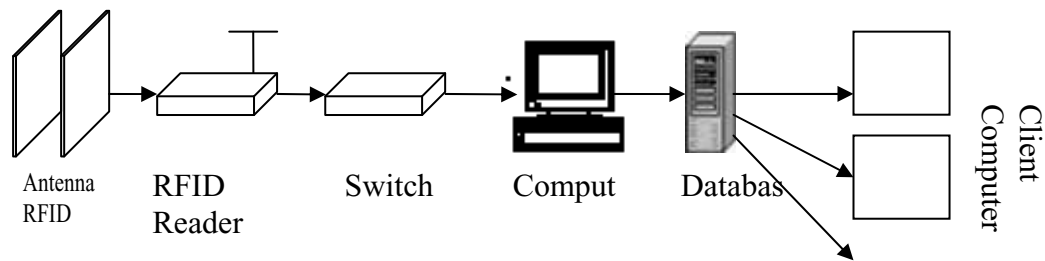


Fig 1. Diagram of Hazardous Waste Information Management System Procedure Based on RFID Technology

At the data reading end, the reader sends the RFID signal of certain frequency through antenna. When the hazardous wastes with RFID tag get into the workplace covered by antenna signals, induced current immediately generates in the antenna, so that RFID tag gains power, and the power is activated. Then, it sends physical and chemical properties, types, production place and other information of the hazardous wastes. The reader reads and decodes information of RFID tag, then sends it to the central processing system through data switch, and stores it into the system database through the Internet, which realizes functions such as entrance and exit of hazardous wastes, scheduling distribution, statistics, and inquiry and so on.

3.2. GPS Principles and Methods of Realizing GPS Road Control Management System

The system, with *c#* compilation, publishes information on the Internet. The system, base on the floating car data collection technology, is a classical client computer or server model, in which, the client end inquires GPS positioning information through the Internet, while the central server is responsible for handling and distributing information. The supervising procedure reads GPS information of cars from the database, displays their location on the virtual map with Google Map API. The client end and the server communicate with each other through the GPRS radio data platform[6].

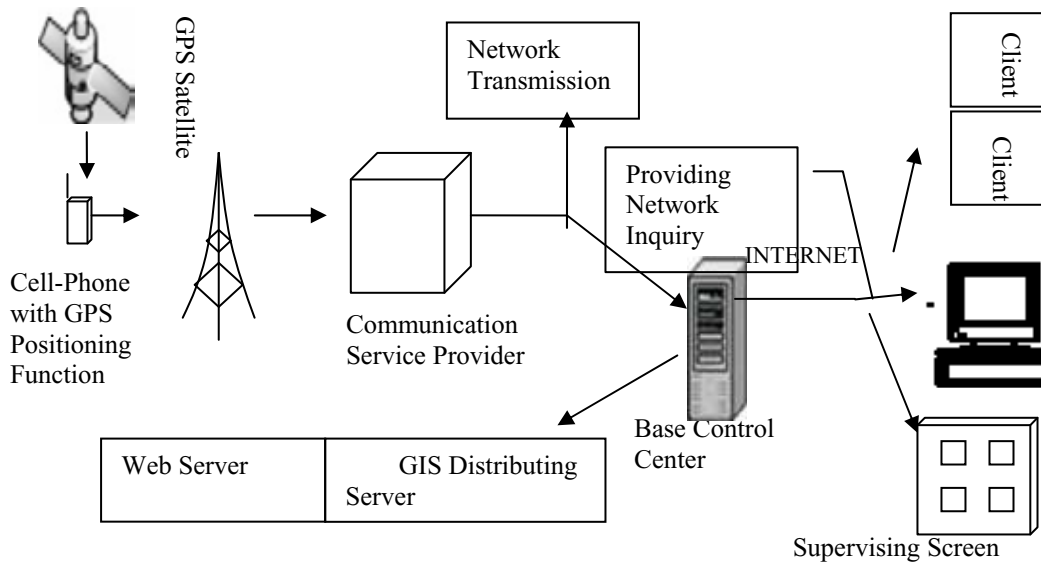


Fig 2. The GPRS radio data platform

3.2.1. Data Terminal

3.2.1.1. Cell-Phone Terminal

The cell-phone terminal reads GPS module, opens GPRS cellular network connection, and transmits data to the server. The GPRS module, with cell-phone with GPS function and SIM cards, sends latitude and longitude information of real-time vehicles through GPRS Network. The GPRS communication processor is responsible for receiving latitude and longitude information of all transport vehicles, and sends the data to the control center through the Internet.

The cell-phone terminal software, with C# compilation, realizes discovery of GPS data address of cell-phone storage of ss port type, and sends it to the LAN IP address of the cell-phone communication.

3.2.1.2. Server Terminal

The server terminal is mainly composed with the central processing server, client end inquiry server, system database, supervising screen and other relevant external devices.

3.2.1.3. System Database

The system database constitutes vehicle information database and geological information database. The vehicle information database stores relevant data with the vehicle, including current location of the vehicle and its historic records, basic information of hazardous wastes on the vehicle, current condition of the vehicle, other conditions, etc. Data in the geological information database is electronic map, which is

the positioning basis of the whole system. The geological database provides basic latitude and longitude positioning function, map matching function and path query function.

3.2.1.4. Central Processing Server

The central processing server is mainly responsible for the information reception and processing work between the central service system and all vehicles. The transport vehicle sends data to communication service providers through the wireless network, after that, the GPRS communication service provider sends data to the central processing server. Then the central processing server classifies the data, stores it to the corresponding system database, and adopts a system structure combined by C/S and browser/server. The system distributes all information through WEB server and GIS distributing server, convenient for clients to inquire data on the network.

3.2.1.5. Client-End Inquiry Server

The client-end inquiry server provides visual interface for users, which enables them to inquire real-time vehicle and road information in the hazardous waste transportation process. Any permitted user within LAN or connected external LAN, can inquire information through Web browser. Even remote users can do so. Giving different inquiry permission can ensure safety of the data information. For example, common workers are only permitted to read corresponding data information, while leaders are permitted to download, review, etc. As the level improves, users can get higher level of permission.

4. Conclusion

Establishment of hazardous waste management information platform based on RFID strengthens management in the hazardous waste transport process, reduces expenses, saves human and material resources, fills gaps of traditional waste management in the transport process control, effectively prevents losses of hazardous wastes caused by possible accidents in transportation, promotes changes in hazardous waste management from traditional ways to information methods, makes the management more scientific and accurate, provides objective and accurate bases for environmental law enforcement, as well as policy bases for enhancing waste control efforts and strength.

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