Research of Logistics Visualization Tracing Monitoring System Based on Internet of Things

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***Abstract* — In this paper, we departures from the practical problems and comes up with the positive effect the data visualization technology brings to solve the problems clearly. The paper researches on the key technology of logistics visualization technology and the Internet of Things monitoring and control system, and finds the practical significance and meeting point by combining them, then presents a data visualization implementation plan used for Internet of Things monitoring field. The main idea of the implementation plan is shown as below: firstly it analyses all system data in logistics visualization methods and divides them into different types of numerical; secondly it details different types of numerical in accordance with user habits and selects solutions on established platform; thirdly it combines each module in aceord}nce with Internet of Things monitoring business application scenarios and generates functional points; then it designs and realizes each function interface for the convenienc of interactive; in addition, it presents platform interface implementations based on WPF/Silverlight.**

Keywords*— *Internet of Things; Monitoring system; Logistics visualization; Tracing

I. INTRODUCTION

With the development of Internet of things technology, Internet of things plays a significant role in enhancing the level of informatization and automation in logistics, improving the circulation and information acquisition efficiency, etc, in logistics market. In logistics business of tobacco industry, the Internet of things technology is applied extensively. The management and control capacity could be improved overall through the comprehensive application of information and Internet of things technology. This article mainly researches and explains how to design the logistics distribution and monitoring system for Zhangzhou Tobacco, aiming at overall perception and monitoring, to achieve the informatization, networking and visualization, and improve the management and control capacity, the whole-process supervision and intelligent management of human, vehicle and materials of tobacco logistics distribution. [1, 2, 3]

Logistics visualization is the study of visual representations of abstract data to reinforce human cognition. In the field of finance, network communication, biology and business intelligence, logistics visualization is widely used for assisting the user to analyze the datasets and then to find the laws contained in the data. With the rapid growth of datasets and diversity of data sources, the traditional logistics visualization technologies are facing with the new challenges. Therefore, research on the technologies of logistics visualization has great important theoretical significance and practical value.

II. KEY TECHNOLOGIES

The three-tier structure of Internet of things is designed through application of key technologies of J2EE+WebGIS+WebServices. The access to the data and location perception of human, vehicle and materials are achieved by using RFID, barcode, GPS and other technologies in perception layer. In the network layer, WIFI, 3q GPRS and other network layer technology are applied to achieve information transfer. The business operations and supervision management could be achieved through software development in application layer. The business layer subsystem is developed on basis of handheld PDA to collect and return the data in time, realize the distribution service function of vehicle inspection, shipment scanning, electronic receipt, service evaluation, etc. The monitoring layer subsystem strengthen the whole-process visualization management of tobacco logistics delivery through integration, adopting the Dorado and FLEX technology to realize the all-round evaluation and other aspects. [4]

The management and control capacity of tobacco logistics distribution center have been improved greatly through the application of the system. The function of whole-process visualization of the system provides support for the security management and efficiency management of distribution center, Meanwhile, the waster of paper in receipt printing and distribution cost been saved by application of the hand-hold PDA equipment. Web Services Architecture is shown in Figure 1.

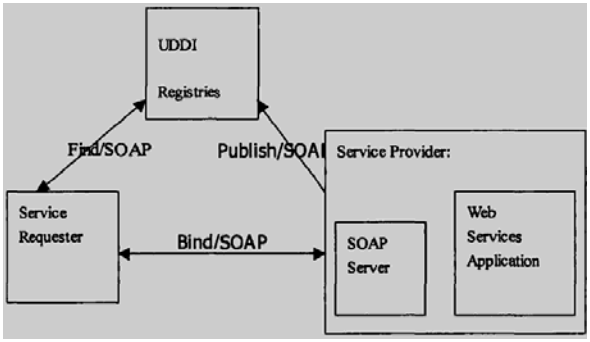

Figure 1. Figure 1. Web Services Architecture

Firstly, an approach of financial data visualization based on the gravitational field clustering is proposed. Self-organizing map is used to classify the raw financial data. Then, the gravitational field theory is used to congregate fold line in each class and meanwhile to set the exclusion between the classes. Moreover, the visualization results are enhanced by setting the opacity and interaction to better analyze the original financial data and give investors some clues. In order to verify the effectiveness of that proposed algorithm, a real world financial data is used. The experimental result shows that the proposed method forms a clear visual clustering result and discovers the variation law of the data. Users can easily select the merit investment value of the company to make investment decisions. [5]

Key monitoring codes:

```
<%@ page content Type="text/html; char set=UTF-B"%>
<%@tagliburi="http://www.bstek.com/dorado"prefix=""%>
<html>
<head>
<title></title>
<SCRIPT LANGUAGE="Javascript"
SRC=/common /jsp /Fusion Charts/ JSClass /Fusion Charts. js"><lS
CRIPT>
</head>
<body>
    <d:View
config="com.b1 uesword . w1 w. zk. de1 i verquery. vi ew. Del i verQuery"
    <table width= "1 %"
        <tr>
        <td width= "1'<div id="char1" align= "center"></div></td>
        </tr>
    </table>
  <div id="DeliverQuery"></div>
 </d:View>
</body>
</html>
```

Secondly, we propose a novel approach based on ontology for Web logistics extraction and visual analysis. We sum up four features for logistics items and induce these features to a group of extraction rules. Then according to a mapping rules well organized between elements of ontology and extraction rules, extraction group rules in ontology. According to properties of concept in ontology, the initial result of logistics extraction is got and then the final result is obtained by simplifying the initial results. Then we combine Google map to visual analysis the extracted Web Information, which facilitate the users to understand data mining, find hidden features, relationships, patterns and trends as shown in Eq. (1), (2).

$$h_k = \left| y_{im} - y_{km} \right| \cdot \cos\beta \tag{1}$$

$$f_i = \boldsymbol{f}_i \cdot \cos\gamma \tag{2}$$

Thirdly, we proposed a data visualization method based on Particle Swarm Optimization (PSO) for micro-bogging data, aiming at solving the problem that is hard to find relationships between nodes due to the complex social networking nodes that are either too concentrated or too diversified. First, the micro logging data are divided into subgroup based on relationship between these data. We adopted the PSO algorithm to design objective functions in order to design the layout of the micro logging users' network, distribute the nodes in a more balanced way, and reduce the intersection of the line segment. To verify the effectiveness of that proposed algorithm, we use the data obtained from Sina.com and the Tencent micro logging sites. The experimental results have shown that the proposed method formed a clear visual result and provided a better analysis of relationship among the micro logging users. [6] Visualization Technology is shown in Figure 2.

Finally, we propose a mixed visual analysis method combined with geographic information data to better display temporal and spatial statistical data. The proposed system combines a variety of visualization techniques, such as parallel coordinates, [7, 8, 9] geographic maps, dynamic scatter plots, Tree map and other visualization techniques to enhance the visual results; which ensures that users can observe various indicators data from different angles. At the same time, in order to further analyze the data of interesting, we design and achieve a variety of visualization techniques coordinated with multiple views. The experimental results show that the proposed mixed visualization techniques can help users to discover the variation law of data more easily and offer a fast and convenient visualization tool for statistical data analysis.

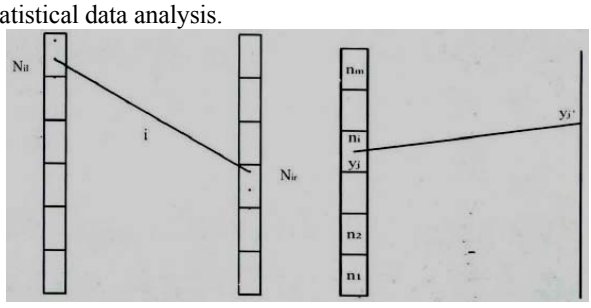

Figure 2. Figure 2. Visualization Technology

This thesis explores new ideas and technical methods to solve the current problems faced in the field of information visualization tackling with data mining, visual analysis and graphics hardware technologies. And at the same time, a large number of experimental results verify the effectiveness of the proposed methods.

III. ANALYSIS OF MONITORING SYSTEM BASED ON INTERNET OF THINGS

With the continuous development and improvement of computer technology, sensor technology, and database technology, the monitoring tools in the Internet of Things are becoming increasingly diverse. In recent years, the researches on the Internet of Things by all walks of life have been in progress, such as resource exploration, marine atmospheric monitoring, urban transportation, bridge safety. For the purpose of real-time understanding the critical state of the monitored object, a number of sensors are applied to the project, thus resulting in flood of monitoring data, the internal information of these data, however, cannot receive timely treatment and feedback. The reason is without a good solution for data processing. Data visualization is a scientific method which is used to analyze and extract data information. The paper hopes to use data visualization technology to solve the above problems in the Internet of Things monitoring field.

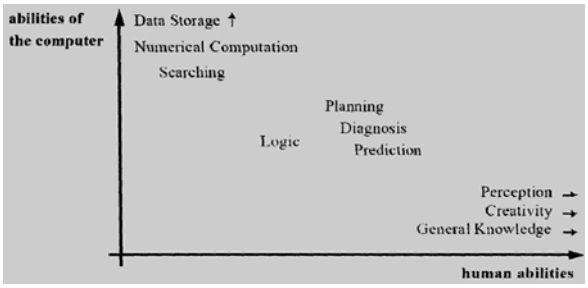

Figure 3. Figure 3. Compare Human with Computer Abilities

The generic implementation plan proposed in this paper can solve the problem of the information analysis and displaying promptly, and provides the commonality development plan for the application development in all walls of life in the Internet of Things monitoring field. Compare Human with Computer Abilities is shown in Figure 3 and Dom Tree in Figure 4.

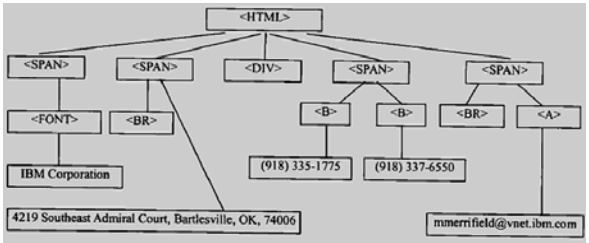

Figure 4. Figure 4. DOM Tree

$$I = \alpha \cdot \frac{N_f}{N_{f\_max}} + \beta \cdot \frac{N_g}{N_{g\_max}} \quad (3)$$

With network of expressway and the scale of its service area of our country, over a broad area of Expressway service area play an increasingly important role in the implementation of transport demand, business functions it is necessary to combined with its superior resources improve their service selves and operational efficiency, to expand their the development of logistics is an important direction for expansion of the Expressway service area functions. The Internet of Things is an important part of the new generation of IT, it is intended that the goods efficient, accurate, security, management, control, operation of integrated operation. The appeared and the use of the Internet of Things technology provides a new way for the development of modern logistics industry, also provide technical support for the service area. Eq. (3) algorithm is shown in Figure 5.

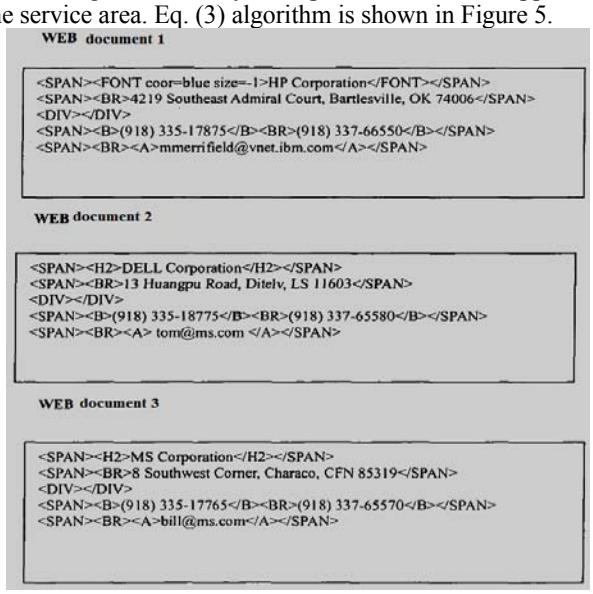

Figure 5. Figure 5. A Set of Web Document

Data, which is well known as a recording mark, has a very long history. Today, it is no longer confined to the chart in the number, symbol or form; it is no longer stored in a computer analysis of the resources, waiting for people to select. With the recent rapid development of smart phones and wearable smart devices, every subtle change, including the rise of people's daily life sentence, an action, location, etc. and even physiological data can be recorded and analyzed. "Big data" has long been the rise and become one of the most popular words.

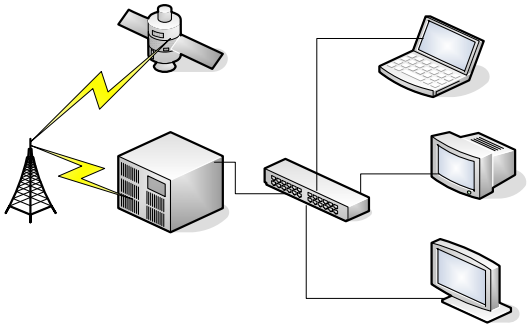

Figure 6. Figure 6. Hub Structure

Not only unlimited possibilities but also enormous challenges come to people with the data time. Today, the understanding of data visualization is not uniform according to individuals. There is no standard so people engaged in visual working have their own understanding while people engaged in related industries. Evidently, data visualization is not comprehensive from only one angle and we cannot achieve unity with each other about the problems of concept of data visualization. We can imagine that this will greatly hinder cooperation and exchanges with the common progress during actual work.

A. Network Device Monitoring

The emergence of the network to enrich people's daily lives, the network plays an important role in the sharing of resources, improving the efficiency and promoting the development of information society. People's work and life have become more and more inseparable from the network. Efficient and stable operation of the network can not be separated from the support of a large number of network devices, relative to the increasingly diverse service provided by the network, the monitoring and maintenance of network device is still stuck in a relatively backward, the following problems: first of all, due to the lack of an unified platform, in the face of a wide range of huge number of network devices, monitoring and maintenance of network devices also rely mainly on hands, so that not only takes the staff a lot of time and effort, and inefficient, increasing the cost of doing business; Second, although there are many network device monitoring software's on the market, but function is simple, complex interfaces and operation bring the inconvenience to the user to use; Again, lacking of monitoring channel outside the band, monitoring and data channels share the same channel in the traditional network device monitoring, the traditional means of monitoring is facing the risk of failure when the network clogging.

Internet of Things is a hot new generation of information technology currently. Along with the rapid development of mobile communication technology, mobile communication GPRS network and the Internet are connected together to achieve the exchange of data between the machine and the machine has become one of the key application areas of Internet of Things. 1n this context, this thesis erected Internet of Things network of network device monitoring by using the wireless data transmission device based on mobile communication technology (Data Transfer Unit, DTU) as an information transmission bridge. Thus opening up a monitoring channel outside the band, and solve the practical problems in the network device monitoring earnestly. We can see security system in Figure 6 and Figure 7.

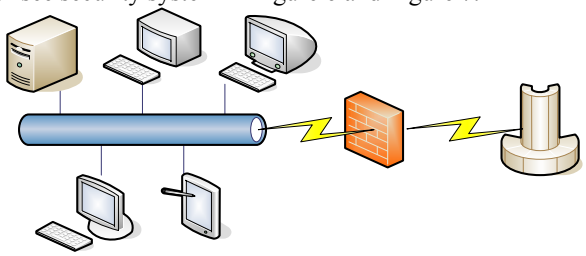

Figure 7. Figure 7. The application of firewall

This thesis introduce research background, purpose and significance, domestic and foreign research status of network device monitoring system based on Internet of Things technology. Then describe the definition of the Internet of Things, the Internet of Things architecture and key technologies used in the Internet of Things. Introduce several commonly used network devices. Combined wish the monitoring objectives of the subject, studied the features of the Cisco router, the principle of the route ring and the Internet work operating system. Given the overall structure of the network equipment monitoring system based on Internet of Things technology, wireless data transmission device DTU as the data exchange channel, analyzed the key hardware device used in the system and work flow of the system. And then Cisco2600 router as monitored object, studied the commonly used view command when monitoring the input and output devices of router, the IOS feature resource, the configuration file of router in Cisco router IOS operating system, analyzed the meaning of the expression of these commands output information. Final introduce the network communication method based on Socket and TCP protocol, completion the network device monitoring system based on Internet of Things technology by using the software programming, it can be concluded that Internet of Things technology applied to the monitoring of network devices is feasible from the operation of the system and test results, and provides a new idea and methods for monitoring of network device in the future.

B. Distribution Vehicle Management System

With the development of e-commerce, and information technology, such as Internet of Things (IOT), together with the national emphasis on the logistics industry, logistics industry is faced with more and higher requirements of industry, so modern logistics has entered the development era of intelligence, informationization and visualization. As an essential and basic function of logistics, distribution involves many dynamic environment and real-time information, especially in the e-commerce environment, and how to make it to adapt to the dynamic environment real-time changes, and how to make intelligent and scientific decision-making, which is a difficult problems that need to

be solved. In this background, this article will be on the scheme planning and research of IOT which is used in modern logistics distribution vehicle management system.

The analysis and research on the Internet of things technology and logistics distribution related research present situation has carried first in this article, and it applies Internet of things technology in the logistics distribution vehicle management to acquire of goods in the vehicle's real-time dynamic information on the basis of the introduction of related theories overview. Finally the paper puts forward a distribution vehicle management system scheme based on Internet of things technology through the analysis and planning, which aims to solve the automated scheduling and management issues of the vehicles in the distribution process, freight safety regulatory problems, the quantitative assessment issues of the distribution task, tracking and real-time monitoring of the state of the transport vehicles and transport route planning problems.

In this article Internet of things technology or equipment, such as sensor network, GPS, GIS; GPRS, RFID and electronic tags, electronic lock, cameras, PDA, is applied to the planning and design of the distribution vehicle management system scheme Integrally, and gives full play to the advantages of integration of information platform to realize the efficiency, safety, and intensification of distribution, which realizes "transparent" management on the way of the distribution shipping. That the paper applies the Internet of things technology in the realization of distribution vehicle management system scheme not only enriches the results of research on the Internet of Things in the field of academic research, but also provides a theoretical basis and referenced significance for the Internet of Things technology application and practice in distribution management of logistics enterprise.

IV. SECURITY ARCHITECTURE OF VISUAL INFORMATION SYSTEM FOR LOGISTICS

Nowadays, logistics industry develops at a high speed, the visual information system for to works as IT system in companies; we can check the video information and search logistics information through this system. The application of the information system is useful for the safety of the food in cool chain. We can also look for the source of the problem in the production and transportation of the food in cool chain. In order to realize the goal, the safety of the visual information system for logistics becomes an important problem. No matter whether the video information or the logistics information has been changed, we cannot look for the source of the problems. This paper made a study on the safety of the information system.

The visual information system for logistics is based on the technology of Internet of Things, so that the security risks appear in various aspects. The security risks include risks of information system, risks of Internet of things. Because this system has the feature of visualization, we should also consider about the safety of video. The study in this paper is that making analyze of the system and looking for the factors that affects the safety of the system. The links of the system has been divided into four parts: data collection, data transportation, and data storage and data application. Then summarize the requirement of safety according to the factors. After getting the safety requirement, design the overall security architecture. The overall architecture contains management and technology. Then design safety architecture in detail for technology. The design in detail contains safety of information system, safety of Internet of things and safety of video. This kind of security of architecture can protect the visual information system for logistics.

In the designing process of the security architecture, this paper combines the technology for protecting information system and Internet of things. This security architecture can lead the implement of security for system. Choose the technology suitable for this system through comparison, including RFID and video encryption. This security architecture can not only be used for this visual information system, it can also be used in simply security of RFID and video alone. Following this security architecture to implement security scheme can protect the security of data during data collection, transportation, storage and application.

Compared with network control system, the greatest charm of the IOT CS is the target of the secure mobile monitor and the secure mobile control. That is to say, any authorized person or equipment, at any place, any time, always can securely control and monitor the equipment, at the same time, the equipment can be controlled in order to achieve the control purposes, which is referred to as the target of "3-any" and"1-control". In order to achieve this target and apply the system in the actual production, there are three key technologies must be achieved.

The first issue is the access security. The entire system should only allow authorized people or equipment, can access to the IOT CS at anytime and anywhere, and reject illegal user or device access to it. That will ensure the security of the monitoring and control. The second issue is the transport security. The IOT CS should make sure the information in the transmission with the confidentiality, the integrity, and the non-repudiation. That will ensure the information transmission security and the control system services security.

The finally issue is delay stability control. The IOT CS should eliminate the influence of the delay from information transmission and decision-making processing in the entire control system. That will ensure the stability and robustness of the whole control system.

Through researching and anglicizing the development process and the development trend of network control system, this paper draws the conclusion that the IOT CS will be the new development direction of next generation control system. On basis of this, the initial definition, the work course, the basic structure, the use advantages and the several key issues of the IOT CS are discussed in the paper.

In order to solve the issue of the access security and some transport security, the paper analysis the IPSec VPN protocol, and pointes out the defects of the IPSec, which are

the IPSec can not traverse NAT protocol and can not meet the 3-any target in the IOT. In order to solve these defects, the paper presents an improvement of the IPSec, which is the IDSec. Through the discussion of the structure, the process and the application mode of the IDSec, the paper Demonstrate that the IDSec is entirely feasible for the access safety and the information transmission security in the IOT CS. and through specific procedures and test results, this paper confirms this conclusion. At last, the concept of generalized IDSec is proposed in the paper. The generalized IDSec breaks the limitations that IPSec only supports the IP transport protocol. So, the generalized IDSec is the security protocol nothing to do with the network layer transport protocol. And it has a strong practical and adaptable.

In order to solve the issue of information security transmission, this paper researches and analysis the attack methods of the modern block cipher algorithm, which are basis on the one-to-one relationship between plaintext and cipher text. Then, through improving the use modern of block cipher algorithm, a time-varying cryptographic algorithm is proposed by this paper, which is based on the time variable.. This algorithm can effectively undermine one-to-one relationship, which will increase the difficulty to decipher the entire security system by illegal attacker. The three key aspects in the algorithm is discussed by this paper. And algorithm implementation process is described. Through the specific implementation and performance analysis, the usefulness and the adaptable of Time-varying cryptographic algorithms is confirmed in this paper.

V. CONCLUSIONS

In this paper, we analyzed the IOT technology as well as the system of logistics Visualization Tracing Monitoring and then introduced the plan for the design of the system as well as the key technologies involved

ACKNOWLEDGMENT

This work is supported by science project in hebei province, the nane of the project: Based on internet of things vegetables intelligent logistics management information system research and development ,The number of the project:13220319D.

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