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Based on the background of smart logistics Kiva warehouse robot Application analysis and prospect

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Abstract

With the proposed smart logistics concept, a global integrated intelligent technology application, the logistics system can imitate human intelligence research of boom is setting off ,with the purpose of realization of logistics and warehousing automation, visualization,control,intelligent,networked,so as to improve the resource utilization rate and the level of productivity and reduce the cost of logistics,warehousing Kiva robot arises at the historic moment. Intelligent warehousing achieves a preliminary automation management, but the large limitations of application,application effects poor, reliability low and other issues are urgently needed to solve these problems. This article launches the research in view of the above problems. Firstly, it analyzes the application status of the logistics industry of intelligent storage: then in view of the present situation of the kiva in the field advantage. Finally, in the form of case show concept of application and the prospect of its development.
Keywords: smart logistics;Intelligent warehouse;Kiva robot

1. Introduction

Smart logistics is proposed by China Technical Association of logistics information center, China Internet of things, editorial department of 《 logistics technology and Application》 in December 2009 . Smart logistics possess logistics system have the ability of thinking, perception and learning, and most importantly, Smart logistics mainly from the perspective of supply and demand balance, to provide the supplier to maximize profits for the buyer to provide the best service, which is the essence of smart logistics, at the same time, under the precondition of balance between supply and demand to maximize the resources [1].

Logistics is the most realistic significance Internet related technologies in the field of applications, one of the development of the Internet of things will directly promote the development of modern logistics. Promote logistics industry to the smart application, [2].In August 2011, 《 The state council general office on the opinions of the policy measures to promote healthy development of the logistics industry》 "continue to emphasize and strengthen logistics the independent research and development of new technologies, key support tracking goods, radio frequency identification (RFID), logistics information platform, intelligent transportation, logistics management software, the key technology research for mobile logistics information service, etc.smart logistics concept is put forward, keep up with the trend of the history, also accord with the development of modern logistics industry automation, network, visualization, real-time, tracking, and the new tendency of the development of intelligent control, conform to the trend of the development of the Internet of things.

With the vigorous development of the domestic intelligence warehousing logistics industry, how to make efficient, accurate, large quantities of asset recognition has become an important research topic [3].Intelligent storage is a link in the logistics process, modern warehousing system internal items not only complex, different forms, performance, and the process is complex, both the storage, and mobile, both the sorting, there is also a combination.Therefore to warehousing logistics center as the core of intelligence, often using the intelligent pile technology with automatic control technology, intelligent robot palletizing technology, intelligent information management technology, mobile computing technology and data mining technology, etc.Based on the above these conditions the application of Internet of things can change numerous for brief, greatly improve the efficiency of the whole logistics distribution.Article expound the kiva robot is the intelligent storage applications.

2. Literature Review
2.1 smart logistics
2.1.1 smart logistics concept

Smart logistics concept is put forward to the most back in 2008, IBM company put forward the concept of "smarter planet" [4]. "smart logistics" refers to "the radio frequency identification (RFID), sensors, global

positioning system (GPS) and other advanced Internet technology, widely used in the logistics industry capacity model and automation management, realize the smart of logistics informationization, intellectualized, system automation operation pattern, the main use of high and new technology and modern management means to realize logistics distribution system of high efficiency and low cost of intelligent operation [5].

2.1.2 smart logistics functions
 Smart logistics has identification perception, decisions, positioning tracing function. Specific performance through three aspects, first is to identify the function of perception, main is to use satellite positioning, such as radio frequency identification technology to identify; Followed by the decision function, mainly the data memory, through to the relevant data such as customer needs comprehensive decision-making and good storage location, distribution and path, etc.; Finally locate retroactive effect, mainly through the radio frequency identification, satellite positioning instant access to information, to help customers state of the location and distribution of the goods in time, can provide better service, also for the managers to provide timely and effective logistics management information.

2.1.3 smart logistics effects
(1) Reduce logistics cost

Smart logistics development and use by the flow of information can effectively solve the logistics enterprise development bottleneck, realize the information flow, management and science of decision making; Through the information means to strengthen the communication between the enterprise and to avoid the logistics transportation vehicles prone to the condition of the empty car, reduce the consumption of manpower, material and financial resources, improve the utilization rate of the vehicle, further reducing the logistics cost.

(2)Improve Enterprise Competition

Smart logistics can pass information to speed up the enterprise logistics operation and management, constantly to change management means and methods, enhances the working efficiency of the logistics chain in all aspects, to save costs in the logistics process, and improve the competitiveness of the products, realize the physical process of supply chain integration, better to strengthen communication and coordination with the upstream and downstream enterprises, effectively improve response speed, so as to solve the specialization degree is not high, many problems such as scale effect, better meet the needs of the consumers, forms the enterprise new growth.

(3) Promote the development of intelligent city

At present, in our country from all walks of life are all in the full application of information technology, the sensor used in various construction use, in the logistics industry, the combination of Internet and information technology so as to realize the effectiveness of the internal management, to further promote the effective allocation of resources. By the popularity of intelligent logistics, can better realize the city service informatization, make intelligent reflection to city life.

2.2 smart Warehousing
2.2.1 smart Warehousing concept
Intelligent warehouse is on the basis of automatic warehousing continue to study, to realize the integration of the decision-making system and other information, the direction of intelligent and fuzzy control, artificial intelligence to promote the development of storage technology, the intelligent warehouse.

2.2.2 The advantage of intelligent storage
Intelligent warehouse system besides has the functions of traditional storage system, also with the aid of various technical means of a new, provides the intelligent warehouse service, has the characteristics of different indicators and traditional warehousing system [6]. Intelligent storage is a link in the logistics process, the application of intelligent warehouse, ensure the goods warehouse management each link data input speed and accuracy, ensure the timely and accurately grasp the inventory of the enterprise real data, reasonable to maintain and control the business inventories. Through scientific coding, can also be easily batches, the shelf life and so on carries on the management of inventory of goods. The location management function of system, more can know all inventory goods in the current location, is helpful to improve the work efficiency of warehouse management.

3 Kiva robot introducting and the case analysis
3.1 Kiva robot introducting
3.1.1 Kiva robot technology
The core of kiva robot is to rely on kiva MFS (Mobile Fufillment System, Mobile execution System) to perform. Kiva MFS is a used to improve the efficiency of warehouse management, speed, accuracy and flexibility of the top technology of autonomous mobile robot.The main technologies used are:

1) Cruise positioning technology: Kiva robot drive unit cruise technology mainly by reading the visual mark on the ground grid, the automated warehouse AGV equipment to the traditions of the past are not the same, the traditional AGV device must depend on the warehouse floor buried coil, wire, such as it is greatly limits the freedom of AGV moving and adjustable; And Kiva robots don't need much more in the warehouse to install any extra expensive infrastructure, hard to true to time.

2) Dynamic complementary technology: Kiva robot is driven by batteries, each time charge, basically can be used to 8 to 10 hours. Once the Kiva robot power decreases, the machine built-in drive system will automatically drive Kiva recharged to the charging station interface. After completion of charging, Kiva robot autonomous back to target anchor point, continue to work, without human supervision.

3) Communications technology: Kiva MFS server is directly with each drive unit with WIFI network connection, so very easy to set up, and very easy to integrate with other wireless warehouse within the system and break up.

4) Software system related technology: Kiva MFS control system determines a certain order be sent to the corresponding one operation staff. As order allocation, Kiva robots to take the initiative to choose handling order selected shelves, to determine a most likely to reach the target anchor point fast path [7].

3.1.2 Kiva Robot advantage

As a warehouse robot, the biggest bright spot is Kiva systems: overturned in the sense of storage and handling operations in the past, change the venue to adapt to the present situation of the goods, the warehouse robot system can at any time to any goods delivered to any position, make items to suit site. Can separate shelf handling robot autonomous navigation, communication is the foundation of the Kiva warehouse robot system, shelves and living creatures to the designated place each unit has the highest capacity can bear the weight of 1.3 t [8]. Between system and the robot instructions through the WiFi network transmission, the activities of the robot path planning is done by the system through calculation of the algorithm; The last navigation devices to lift the robot shelves and transport the goods to the designated location. In order to read the qr code and information, coordinates each robot is installed, the two cameras. And each shelf also have an independent qr code, ensures the accuracy of the shelves to connect. For the sake of precise positioning of a robot.

Compared with the traditional way of Kiva system in such aspects as sorting efficiency, accuracy, noise has the revolutionary change; Fundamentally changed the people looking for goods, goods picking and so on with the traditional way, we can seen from table 1:

Table 1 kiva system compared with the traditional way

Compare the project	Kiva system	The traditional way
Picking method	The goods have someone	People looking for goods
The sorting efficiency	Kiva system is 2-4 times that of the traditional way	
Accurate rate	high	The lower
noise	Almost no	Large and harsh

3.2 the case analysis

On March 20, 2012, Amazon announced to $775 million in cash for the warehouse distribution center automation technology suppliers Kiva systems, and obtain their robots warehousing business. At present, amazon in its distribution center is equipped with more than 15000 sets of Kiva wheeled robot, used to transport goods, to realize the automatic warehouse .

Amazon is equipped with the robot's distribution center has 10, Tracy distribution center is one of them. The center is equipped with 3000 sets of Kiva robot, the robot move fast, quiet, after receiving a central computer wireless transmission of digital instruction, by scanning the bar code label on the ground, sliding to the shelf, then filed a 1.2 m wide and 340 kg heavy shelves the robot is equipped with the latest in the system, can use bar code to track each goods shelves, in order comes to picking a to get the corresponding shelves. Summarize the advantages are the following:

1) To improve the working efficiency. Kiva adopts intelligent robot for warehouse navigation effectively improves the performance of the system is raised 8 times than before.

2) To save the manpower cost.Kiva robot can move around in the warehouse, grab and mobile shelves filled with product and container.This technology can help retailers to fewer people complete online orders more quickly.

3) To speed up the order processing.Kiva systems use their advanced technology to develop the smooth warehouse robot can move quickly in warehouse and fetching in the warehouse the goods, also can ask dispatch of the goods shall be carried out in accordance with the order first, so that amazon's orders can be completed quickly.we can see some the functions from this picture :

Kiva robots are working in Amazon

4 Kiva robot application prospect in China

By explaining the knowable Kiva system application in amazon warehouse: Kiva systems in reducing the time of cargo handling, and improve the efficiency thoroughly implement the "people looking for goods" and "goods for" upside down, the distribution center, warehouse logistics node completely away from the traditional model of order picking. At the same time, the system can the shelf when needed to the staff in front, do not need to put in the region of the flow. Also prove that a new generation of the rolls handling system efficiency is the basis of the flow of goods instead of the flow of people, reduce the library personnel find goods, moving goods, returned to the library, the movement of the goods accurately, avoid the useless labor personnel operations; On the other hand, if there is no reliable and powerful management system with the support of the wireless communication system, the efficient work rolls are unable to proceed.

Kiva system is intelligent storage "pinnacle" of success, at the same time, Kiva system represents the future development direction of intelligent warehouse, the successful implementation of efficient transport system due to the high level of management level, although the Kiva system can reduce the logistics cost for the amazon, but at home to introduce Kiva system more difficult. First of all a Kiva robot price is expensive, and the robot has been amazon monopoly; Second, to enhance the efficiency of Chinese logistics cannot rely on automated logistics equipment, logistics of each job is a system, in order to realize full automation to improve efficiency, so homework link between seamless docking is very important, many domestic enterprises have not reached the level; At home, like a "double a" large electrical business holiday, it is easy to cause logistics enterprises blowing up, by this time the main task is to send the goods in time, electricity product quantity, species complex, it is easy to make robot paralysis.

Kiva system is introduced to combined with China's national conditions and circumstances of logistics enterprise oneself circumstance, high-tech use undeserved, it's easy to logistics enterprise to bring the inconvenience. Kiva robots, of course, let the logistics warehousing system into a new era of "goods to people", will also cause in the future China logistics warehousing system structure of radical change.

References

[1] Zhang Guo-wu.(2015).Big data and wisdom logistics - "transport 7 + 1 BBS" 37 meeting documentary [J]. Journal of transportation systems engineering and information technology,15(1)3-4.

[2] Cai Li-yan.(2010)The wisdom of the age of the Internet of things [J]. Journal of logistics logistics science and technology,(12)95-97.

[3] Lv Suhong, Ma Fei.(2013)Smart logistics system based on RFID research [J]. Journal of henan agricultural university, 47(2)162-166.

[4] Ma Jun.(2012)Smart logistics - to build a modern logistics platform [J]. Journal of digital technology and applications,7 (15)239.

[5] Tong Jing.(2015)Wisdom logistics development present situation and countermeasure research in China [J]. Journal of lanzhou institute of education,31 (9)50-51.

[6] Liang Qi-rong, li yong, Fu Peihua,Shang Wei.(2014)Storage system evaluation standard wisdom study [J]. Journal of logistics technology,33(3)176-178.

[7] Wu Jing-fan.(2015)Amazon warehouse application analysis and prospect of Kiva robot [J]. Journal of international logistics technology and application,(10)159-164.

[8] Fu Hai.(2015)KIVA and Extricom system makes intelligent storage into reality [J]. Journal of enterprise technology development,34(24)74-75.

[9] Zou Shuang-xin.(2013)Warehouse robot application situation and development strategy study [J]. Journal of logistics engineering and management,35(6)171-172.