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Application of Path Planning Mobile Robot in Warehouse Logistics Based on Optimized Ant Colony Algorithm

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Abstract

From the perspective of my country's current economic development, the logistics industry, which occupies half of the country, plays a pivotal role in economic development. The modern logistics industry plays a pillar role in the entire national economy and spans a wide range of fields. . In this way, the modern logistics economy is no longer just a pure value-added economic activity, but also an economic activity closely related to the social ecological environment. From the perspective of the importance of the logistics economy in the logistics industry, how to save logistics costs and find the optimal logistics distribution The solution is a new topic under the development of the times and the prototype of the ant colony algorithm itself is a model for finding the shortest path. AGV refers to the unmanned logistics truck with its own navigation device. AGV can drive according to the pre-set route , The personnel responsible for the transportation of materials in the factory can independently choose the car body and programming device. The appropriate car body and programming device provide a guarantee for the safe transportation of materials to the destination. AGV refers to an automatic logistics transport vehicle with its own optical guidance device, which can operate according to the given guidance route and has automatic operation and automatic parking equipment and various safety protection devices. AGV has replaced manual transport vehicles and has become the most common transport vehicle , Technicians have improved the AGV many times, which greatly promoted the efficiency of logistics handling and saved labor costs. Therefore, we should make every effort to promote the AGV to hospitals, laboratories and other places research.

Keywords: *Ant Colony Algorithm, Path Planning, Mobile Robot;*

1. Introduction

With the rapid development of the logistics industry and the triumphant advancement of the modern intelligent warehousing and logistics industry, logistics managers are focusing on how to accurately and efficiently complete logistics asset identification tasks and further improve the quality of logistics services. Compared with the traditional manual warehouse management model, the current modern intelligent warehouse system has the characteristics of automation and high efficiency, making it the primary logistics management system choice for logistics managers. Compared with traditional warehouse management, intelligent automated logistics warehousing systems can quickly identify large amounts of data and information and perform efficient storage operations. Based on the currently used warehousing automated transmission system, we conduct in-depth technical analysis on the construction of radio frequency server programs and

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upper-level application service management of modern logistics systems, in order to provide certain theoretical support for related scholars[1].

2. Ant colony algorithm analysis

2.1. Promote the complementarity of ant colony algorithm and genetic algorithm

The application of ant colony algorithm in the logistics industry is derived from the analysis of the concentration of pheromone left by the ant colony from the nest to find food along the way and the distribution of its path and finally find the optimal path For the reference of the latecomers, the selection of the path will continue to re-judgment based on the pheromone left over and continuously strengthen the concentration of the ant pheromone on the path to form the optimal solution at a faster speed. Compared with the calculation of ant algorithm in the local area, genetic algorithm has stronger randomness and more complicated crossover search and it cannot guarantee that the optimal solution of the path can be searched in a shorter time. The ant colony algorithm judges the optimal path based on the pheromone left over on the path. It may be that the wrong choice at the beginning leads to subsequent ants' belief in its correctness, which leads to more and more pheromone on the wrong path, resulting in the optimal The selection of the route deviates from the course. The global nature of genetic algorithm, through crossover and mutation operations, can effectively take care of the possibility of overall path selection and avoid the stagnation that may occur in the local search process, but due to the overall complexity of its operation There are still flaws in the selection of the optimal path. Due to the existence of the advantages and disadvantages of the ant algorithm and the genetic algorithm, it is necessary to actively adopt the most reasonable and effective method in the selection of the logistics distribution path. By promoting the complementarity of the ant colony algorithm and the genetic algorithm, the advantages of the two should be absorbed to make up for the two. The defects in the operators can improve the hybrid ant colony algorithm to promote the optimal choice of logistics distribution routes[2]. The mobile robot system is in the figure below.

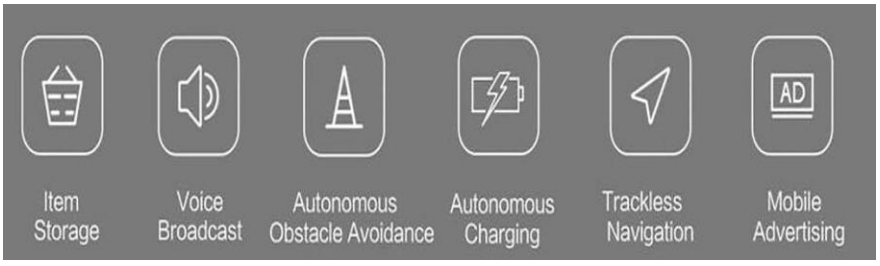

Figure1. Mobile robot system.

2.2. Actively improve the hybrid ant colony algorithm

Actively improving the hybrid ant colony algorithm can directly promote the selection of the optimal path in logistics distribution. Therefore, under the traditional logistics distribution plan, the vehicle shifts are reformed to realize that starting from the logistics distribution center at the same time, emphasizing the use of parallel mechanisms and introducing grouping mutation on top of obtaining a set of optimal path solutions in the traditional ant colony algorithm Mechanism, the number of cycles is grouped first and the optimal solution search and copy operation of the path are realized within the group. Outside the group, the core elements of genetic algorithm are used to mutate and compare data to select the optimal solution. Update the distribution of pheromone on the route to improve the accuracy and efficiency of the optimal route selection in logistics distribution[3]. The mobile robot

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structure is in the figure below.

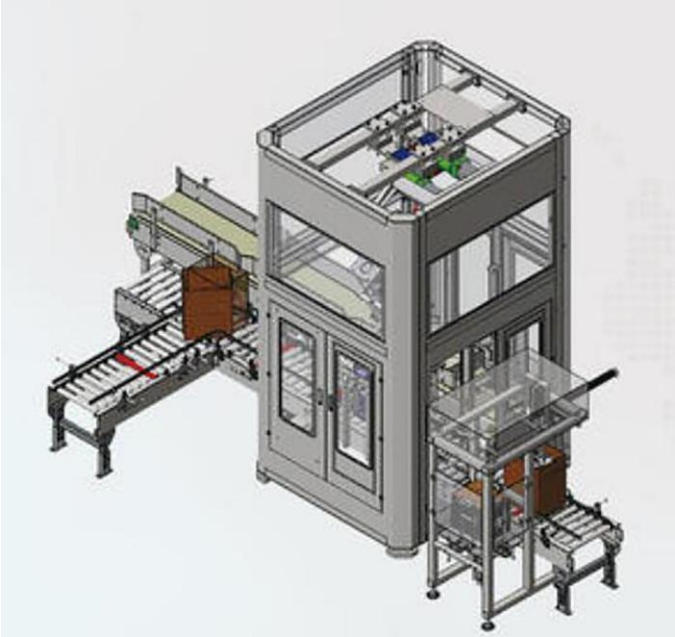

Figure2. Mobile robot structure system.

3. Analysis of logistics automation management

3.1. Testing automation of mechanical equipment

The direct purpose of testing is to ensure the safety of processing equipment and the processing quality of products. Equipment testing automation uses various automated devices and testing instruments to automatically and sensitively reflect the parameters of the measured parts or process parameters and continuously provide various valuable information and data. Automated detection in mechanical equipment processing can be divided into product detection and process detection according to the object of detection. The mobile robot process is in the figure below.

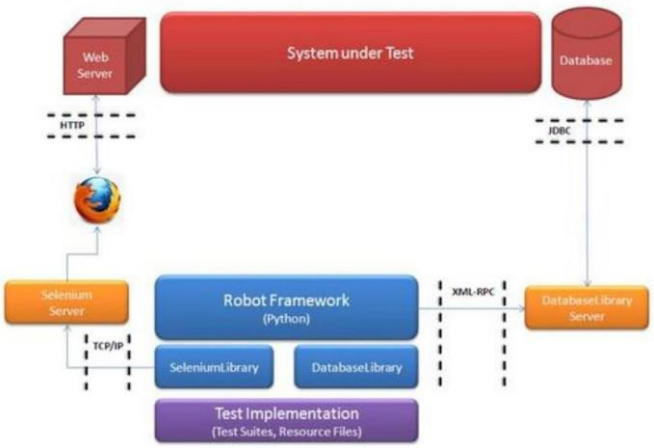

Figure 3. Mobile robot process.

3.2. Strengthen the training of professional and technical personnel

Independent innovation is the fundamental way out for the future development of my country's mechanical equipment and electrical engineering automation. Especially for the emerging domestic automobile industry, independent innovation in electrical engineering automation technology is the key to improving the core competitiveness and overall production level of the automotive industry. High-quality professional and technical personnel are the key to independent innovation in the development of mechanical equipment electrical engineering automation. At this stage, many colleges and universities have opened electrical engineering automation majors, but there are great shortcomings in the training of talents. For example, theory teaching is dominant and practical operations are relatively few. For example, technology application is the main content. , Insufficient cultivation of innovative awareness and innovative ability, all of which have a negative impact on the application of mechanical equipment electrical engineering automation technology. In this regard, our country must optimize the training program of technical talents, take innovative and compound technical talents as the training goal, strengthen the practical education class time and do a good job in the cultivation of talents' innovative consciousness and innovative ability. At the same time, various

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machinery and equipment companies, such as automobile manufacturers, must also do a good job in the training and development of internal employees and cultivate a human resource team with a solid professional foundation[4]. The mobile robot management is in the figure below.

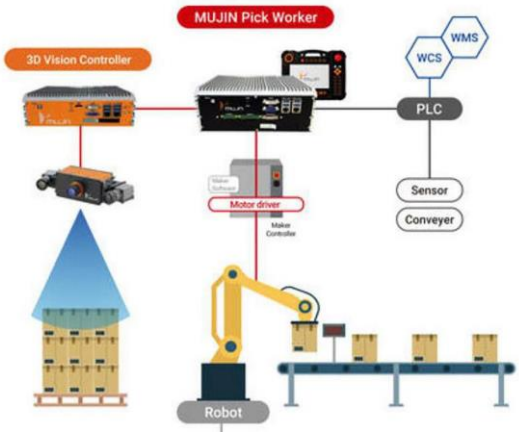

Figure 4. Mobile robot management.

3.3. Information flow automation

The machinery automation information system is a collection of hardware, software and related personnel for information management for the realization of manufacturing automation. The most important hardware equipment is the computer system for information processing and the network system for information transmission. The database And network technology is the most important software technology in automation systems. The birth of CNC technology announced that mechanical automation has since entered a new field. Numerical control technology pays attention to high speed, high precision and high efficiency, so its application range is very wide. Numerical control technology is a typical representative of flexible automation, diversified, intelligent, fast and convenient. In the actual production process, numerical control technology has improved production efficiency and precision and made the machinery manufacturing industry full of vitality. In addition, the compact, lightweight and ultra-thin volume of the CNC system has also won unanimous praise[5]. The mobile robot device is in the figure below.

Figure5. Mobile robot device.

4. Mobile robot logistics system

4.1. Intelligent mobile robot path design

In the process of intelligently identifying material handling, the robot mainly receives logistics handling tasks by identifying the QR code and then moves within the handling path specified by the task according to the color and handling sequence of the material. There are many standard path selection methods, so the robot It is necessary to optimize the design of the best movement standard and walking path. According to the movement standard set by the required path, if an error in receiving a handling instruction occurs in the path specified by the task, the mobile robot task will move up to the temporary handling route when it performs the current material handling action or the next logistics handling action. Placing materials corresponding to the target area caused errors in handling instructions, which seriously affected the smooth execution of subsequent handling tasks of the mobile robot[6]. The

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mobile robot design system is in the figure below.

Figure6. Mobile robot design system.

4.2. Program design and testing

According to the above requirements, design the software program for the planned sorting path. The software program design mainly includes subprograms such as mobile robot drive control, sensor control, mobile robot tracking motion control, manipulator angle control and color recognition. In this sorting process, if the color recognition judgment is correct, the material in the target area will be pushed to the mobile robot until it reaches the corresponding target area and then the mobile robot will turn around and perform the next sorting task until all the materials in the target area are picked. After moving, return to the departure area.

4.3. Intelligent handling robot test

First place the mobile robot in the starting area, turn on the power switch, start from the starting point and proceed along the planned route. The mobile robot arrives at the designated point to obtain the task and then arrives at the basic point of material grabbing for material grabbing and transmits the signal to the color sensor to identify the color of the material to confirm the material. Through 3 recognitions, picking and transportation, the materials of different colors are accurately placed in the corresponding target area to complete all tasks. The mobile robot returns to the departure area and stops working.

The realization of the automated warehouse logistics management system needs to be applied to advanced information technology and automated equipment. The system must be able to accurately record the packaging, storage, outbound, warehousing and transportation of products, so the system not only has a high level of software At the same time, there is also a very high demand for hardware. Only in this way can the application of the warehousing logistics management system effectively improve the efficiency of warehousing, reduce the probability of errors, reduce the workload of staff and improve the overall efficiency of the enterprise. Therefore, it is very necessary for chemical companies to actively develop and introduce automated warehouse logistics management systems.

5. Conclusion

The automated logistics management system will use wireless or wired management and transportation methods to transmit item information such as item attributes and electronic codes to the logistics central control host and further manage item logistics and transportation according to the current distribution of logistics vehicles and transportation conditions. This process requires the use of RFID technology to group and match the information of the logistics vehicles and the information of the transported items and then transmit them to the logistics warehousing system and send them to the management monitoring screen of the warehouse manager for further detailed division of labor. When the logistics is transported to the designated warehouse to complete the warehousing work, the items are identified and classified during the warehousing process. At the same time, RFID technology is used for item identification and transportation license authorization. This process requires the logistics vehicle to drive to the control door equipped with the reader and confirm the transportation qualification according to the vehicle electronic

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code, obtain the electronic code information of the article according to the principle of magnetic resonance, carry out the unloading of the truck and the corresponding section of the article to complete the automatic logistics warehousing operation . We found that it is necessary to carry out the design of RFID technology warehouse logistics automation technology system. And combined with research examples and operational effects, the design of a logistics management system based on RFID technology can well meet the mobility needs and savings standards of logistics warehouses. With the development of science and technology and the deepening of research, it is believed that the intelligent logistics automation management system based on RFID will be more perfect and further improve the quality of logistics storage.

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