

Research on finished product warehouse inventory based on spatial segmentation

Shunkai Sun ^{a,*}, Jie Li ^b, Qi Xu ^c, Yingxiao Chi ^d, Miaojie Shen ^e, Yizhen Lin ^f

Ningbo Cigarette Factory China Tobacco Zhejiang Industrial Co., Ltd., Ningbo, China

^{*}, ^a Corresponding author Email: shunkaisun@126.com, ^b lijie@zjtobacco.com,
^c Xuq@zjtobacco.com, ^d yingxiaoxiao@126.com, ^e aa79315555@126.com,
^f linyizhen@zjtobacco.com

Abstract. This paper proposes a finished product elevated warehouse inventory based on space segmentation, which does not need to control the low storage capacity in advance, nor does it need to stop the inventory, and can use the stacker to carry out the handling task when it is idle. Taking the finished product elevated warehouse of 8 roadways and 9 floors as an example, the inventory work of two floors can be completed every working day, and the inventory work of the whole reservoir area can be completed in 4.5 working days. The first step is to complete the division of the roadway by layer, and then move the finished product pallets of the layer requiring inventory to other layers. After WMS completes the clearance and transportation of all finished product pallets of this layer, the warehouse management personnel will enter the warehouse to manually verify the retention of finished product pallets. This step can ensure that there are finished product pallets in the cargo location with information. Then cooperate with the comparison of finished product pallets in the delivery area of finished product warehouse to realize this step, which can ensure the consistency between information and physical objects. The results show that this inventory method can completely replace the existing complicated manual inventory business, effectively realize the inventory work of finished product elevated warehouse, and provide an accurate and efficient inventory scheme for similar logistics elevated warehouse.

Keywords: space segmentation, inventory, WMS, finished product pallets.

1. Introduction

In order to solve the above technical problems, the purpose of this paper is to provide an elevated inventory of finished products based on space segmentation. According to the above problems, we consider clearing a roadway to solve the problem of insufficient site in the reservoir area, but the workload is still large, the equipment cannot be reused synchronously, and the work efficiency will be reduced. Further consider emptying a layer in a roadway to complete the inventory work of this layer of the roadway. However, the workload in and out of the warehouse still exists. Therefore, the patent of this paper proposes a finished product elevated warehouse inventory based on space segmentation, which divides the space of the finished product elevated warehouse. Empty the finished product pallets in the divided area, and complete the inventory one by one in different regions. As long as the divided area is controlled within a certain range, the finished product pallets in this area can be transported to other areas in the same roadway to realize local clearing. Repeat the above process until the inventory is completed. The formatter will need to create these components, incorporating the applicable criteria that follow.

2. Inventory status of elevated warehouse

At present, the implementation of intelligent inventory in the application of automated three-dimensional library still needs time. In the current situation, the inventory basically depends on the accounts at the time of warehousing. If you need to actually check, you can only take out the pallet with the help of the stacker for manual inspection, or venture into the roadway for field inspection, or install radio frequency identification on the pallet, and obtain the information of specific pallet through the radio frequency identification equipment installed on the pallet of the stacker, so as to

achieve physical inventory. After investigation, the results of automatic inventory through the three-dimensional library system are still blank. For the three-dimensional warehouse, the inventory of finished product elevated warehouse based on space division is of great significance to the actual cigarette production. It can automatically empty the goods in the designated area according to the needs of warehouse management personnel, forming the effect of local emptying. In this way, the inventory of finished product elevated warehouse based on space division is very urgent.

At present, the academic and business circles have invested a lot of energy in the inventory and achieved fruitful research results. However, the research on the inventory of cigarette industrial finished products elevated warehouse based on spatial segmentation is relatively weak. However, we assume that in the overall inventory of the finished product elevated warehouse, emptying the whole finished product elevated warehouse is undoubtedly the most accurate inventory method. However, there are many disadvantages in the finished product smoke out inventory, the most prominent are the following two points: 1, heavy workload. 2, There is not enough space outside the reservoir area for temporary stacking of large quantities of finished products.

3. Inventory overall business

The inventory of finished product elevated warehouse based on space division described in this paper includes finished product elevated warehouse management system, finished product elevated warehouse scheduling system, stacker control module and conveying line module.

As shown in Figure 1, the overall business process of finished product elevated warehouse inventory based on space division includes WMS issuing inventory plan, WMS completing space division, stacker emptying inventory area, operator warehousing verification, finished product outbound RFID verification and finished product outbound manual verification.

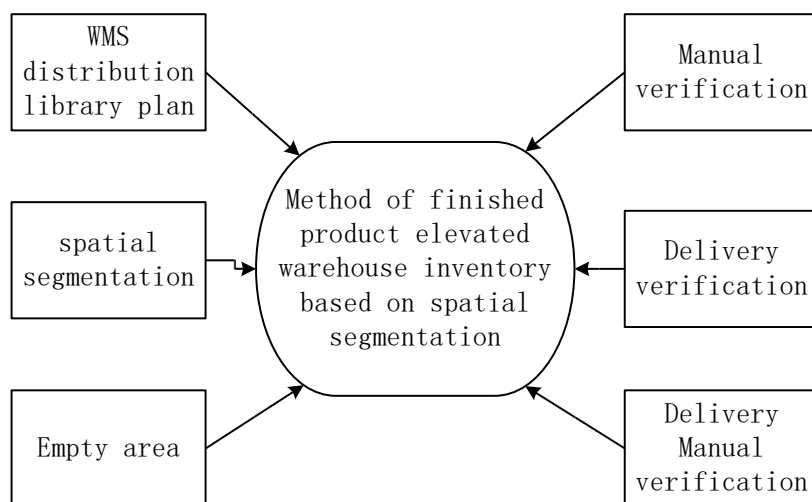


Figure 1. overall business process of elevated warehouse inventory based on space division

As shown in Figure 2, the inventory plan formulated by the elevated warehouse management system is issued. Figure 3 shows the status of the divided area during the inventory of the finished product elevated warehouse in this paper. WMS determines the location divided area, sets all locations in this area to the no entry status, and WMS looks up the tray information in this area. If there is finished product tray information in this area, the system generates a handling task and assigns a task to the stacker (This task has the lowest priority to ensure that the stocktaking task is executed when the stacker is idle).

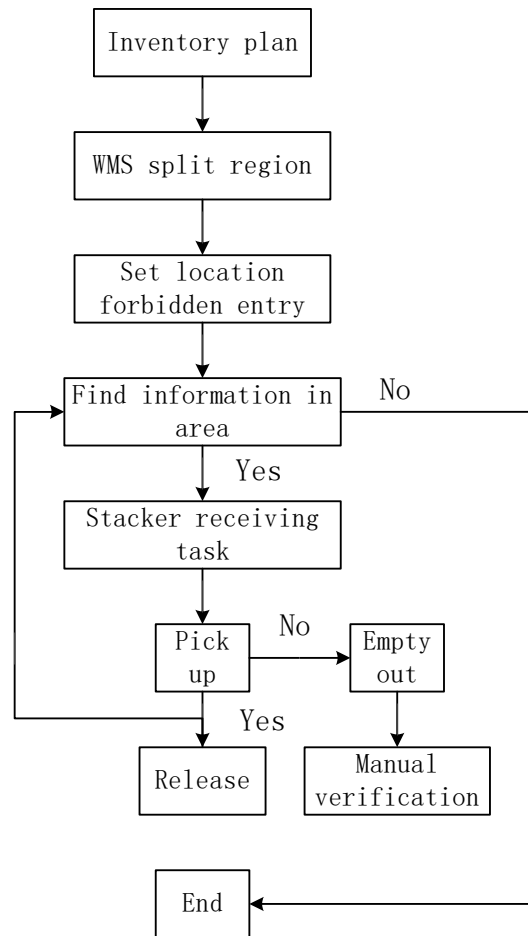


Figure 2. operation flow of stacker based on space segmentation

After receiving the task, the stacker generates the starting address and target address of the handling task. The starting address is located in the determined division area and the target address is outside the determined division area. WMS determines whether there are other handling types of tasks. If there are no other handling types of tasks, the stacker subsystem receives the counting handling task, and the stacker arrives at the starting address to pick up the goods. If there is no goods at the starting address, the stacker will report empty, and the operator will manually check the location. If there is goods at the starting address, the stacker will pick up the goods and transport the pallet to the target address. Repeat the above steps until all the handling tasks generated by the pallet information in the divided area are completed by the stacker, and then complete the finished pallet emptying task in the divided area. The operator enters the roadway to confirm whether there are finished product pallets left in the divided area. If the divided area is emptied, the inventory information of the finished product elevated warehouse is consistent with the number of pallets. If there is finished pallet residue in the divided area, query the reason and make records. This counting plan is completed in the area divided by the location, and the counting plans of other areas are formulated again. Repeat the above steps until the first step of the counting task of the whole finished product warehouse area is completed. However, the inventory after this step can only verify that the number of pallets in the warehouse area is consistent with the WMS information. If the physical information of finished pallets is consistent with the WMS information, it will be supplemented by the pallet verification when finished products are delivered from the warehouse.

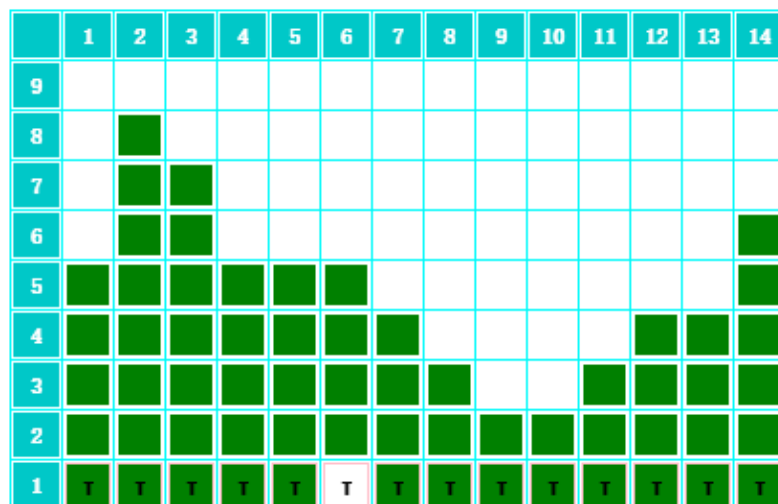


Figure 3. Status of divided area during counting

4. verification of pallet in dispatching system

Finished product pallet verification, this pallet verification does not make an inventory plan, and only relies on the finished product delivery to complete the pallet verification. The advantage of this paper is that there is no additional workload, which effectively reduces the inventory workload of cigarette industry enterprises. The specific technical scheme is as follows:

As shown in Figure 4, the on-site implementation diagram of finished product real pallet delivery and verification in this paper. The finished product elevated warehouse (WMS) generates the delivery task according to the delivery note. Figure 5 shows the RFID verification of finished product pallets in the finished product warehouse storage scheduling system of this paper. The system calls out the corresponding finished product smoke and solid pallets and passes through the RFID configured on the exit platform of each roadway (a total of 8). The 8 RFID reader and writer platform numbers are 9807, 9815, 9823, 9831, 9839, 9847, 9855 and 9863 respectively. After the reader / writer verifies the information of the RFID electronic tag of the pallet, the finished product real pallet rotates 90 ° and is automatically transported to the finished product delivery forklift pick-up conveyor platform (10), and the finished product elevated warehouse system transmits the information to the LED display of each forklift pick-up platform. According to the prompt of the sales and delivery system, the manual forklift will take away the real pallets of finished products on the pick-up platform of each forklift, and then complete the delivery and delivery of finished products from the warehouse. If the information verification of RFID electronic tag is unqualified, it will be automatically transported back to the elevated warehouse by tray conveyor, and the finished product elevated warehouse will be transferred out in idle time for manual verification and processing. According to the instructions of the sales and delivery system on the on-board touch display on the forklift, the operator takes away the outbound finished product pallet on the platform of the forklift pickup conveyor and sends it to the designated location for storage; Or directly to the loading and delivery port. After the RFID scanner of No. 1 project embedded in front of the hydraulic lifting platform at each loading port scans the pallet RFID, it can be loaded and delivered. After the pallet verification when the finished product elevated warehouse leaves the warehouse, it is ensured that the physical information of the finished product pallet in the whole finished product elevated warehouse is consistent with the WMS information.

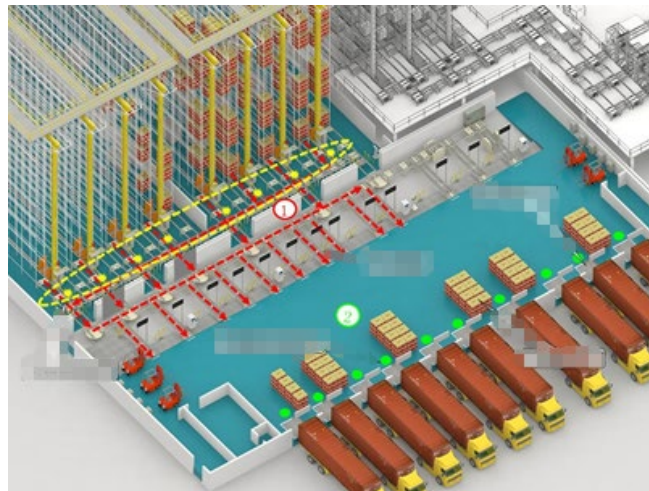


Figure 4. Site implementation diagram of pallet delivery and calibration

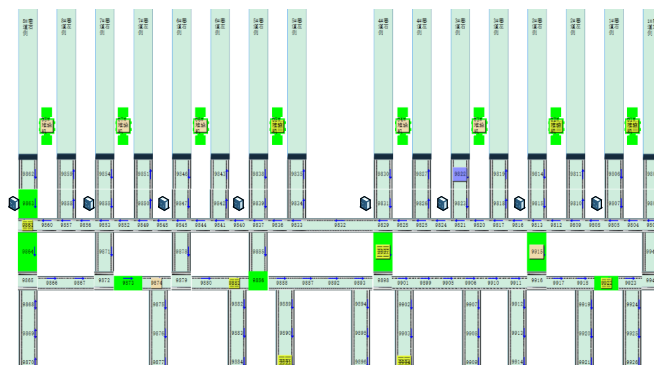


Figure 5. RFID verification of dispatching system tray

5. Conclusion

The realization of finished product elevated warehouse inventory based on space division involves finished product elevated warehouse management system (WMS), finished product elevated warehouse scheduling system (WCS), stacker control module and conveyor line module. The method proposed in this paper is based on the existing equipment, only involves the business integration of finished product elevated warehouse, no new equipment, no equipment transformation, small investment and remarkable effect. The inventory method studied in this paper is independent of the existing logistics business. In order to ensure the accuracy and efficiency of the inventory, the production department does not need to control the quantity of auxiliary materials in the warehouse according to the production situation in the early stage, and does not need to control the inventory at a relatively low level. Therefore, this paper provides a certain practical reference value for the inventory of finished product elevated warehouse and its similar elevated warehouse.

References

- [1] Ang, M., Lim, Y. F., & Sim, M. (2019). Robust storage assignment in unit-load warehouses[J]. *Management Science*, 58(11).
- [2] a pick-and-sort order picking system[J], *International journal of production research* 50 (3).
- [3] Kung Y, Kobayashi Y, Higashi T, et al. Order scheduling of multiple stacker cranes on common rails in an automated storage/retrieval system[J]. *International Journal of Production Research*, 2018, 52(4): 1171-1187.

- [4] Chou Y C, Chen Y H, Chen H M. Recency-based storage assignment and warehouse configuration for recurrent demands[J]. Computers & Industrial Engineering, 2012,62(4):880-889.
- [5] EL BEGGAR O, LETRACHE K, RAMDANI M. A CIM for Data Warehouse Requirements Using an UML Profile[J]. IET Software, 2017.
- [6] Brody A L, Sabbagha F, Sand C K. Radio Frequency Identification in Packaging: Part 2[J]. 2014.
- [7] Ma H, Su S, Simon D, et al. Ensemble multi-objective biogeography-based optimization with application to automated warehouse scheduling [J]. Engineering Applications of Artificial Intelligence, 2015,44:79-90.
- [8] Atieh A M, Kaylani H, Al-abdallat Y, et al. Performance improvement of inventory management system processes by an automated warehouse management system[J]. Procedia CIRP, 2016,41:568-572.
- [9] Ferrara A, Gebennini E, Grassi A. Fleet sizing of laser guided vehicles and pallet shuttles in automated warehouses[J]. International Journal of Production Economics, 2014, 157: 7-14.
- [10] Kim S, Garrison G. Understanding users behaviors regarding supply chain technology: Determinants impacting the adoption and implementation of RFID technology in South Korea[J]. International Journal of Information Management, 2010, 30(5): 388-398.