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Dual Presentation Bay Goods-to-Person Station for Item Picking

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Abstract

A goods-to-person picking station integrates two presentation bays to minimize operator idle time during item retrieval. It addresses the problem where an operator waits for the next storage unit to arrive, reducing potential pick rate. The system employs a control logic that anticipates the completion of picking from one bay, initiating the retrieval of the next required storage unit to the alternative bay. This "shadowing" approach ensures a continuous supply of work to the operator, with visual cues guiding the picking process and managing situations where retrieval throughput is insufficient to maintain continuous operation.

1. Technical Field

[0001] The present disclosure relates to automated material handling systems, and more specifically, to goods-to-person picking stations designed to optimize operator efficiency in order fulfillment processes.

2. Technical Context

[0002] In automated order fulfillment systems, articles are often retrieved from a storage system and presented to a human operator for picking. A common challenge in these systems is the idle time experienced by the operator while awaiting the arrival of the next storage unit, such as a tote (30) or container, from the automated storage and retrieval system (AS/RS) (40) or other conveyance means (50). This idle time directly reduces the overall pick rate achievable by the operator, as the operator's productivity is limited by the slowest component in the sequence. Minimizing this non-value-added waiting period is crucial for maximizing throughput and efficiency in order picking operations. Current solutions often present a single storage unit at a time, leading to unavoidable pauses between picks. The disclosed system addresses this by ensuring a continuous supply of work, thereby increasing operator utilization and potential pick rates.

3. System Overview

[0003] The disclosed system is a goods-to-person picking station featuring dual presentation bays (10, 11) and a shared pick face (20). Articles are contained within storage units, typically totes (30), which are delivered to one of the presentation bays (10, 11) by a conveyor system (50) linked to a storage system (40). While the operator is picking items from a tote (30) in a currently active presentation bay, the control system (60) simultaneously orchestrates the retrieval and delivery of the next required tote (30) to the alternative, inactive presentation bay. This preemptive staging, often referred to as "shadowing," ensures that as soon as the operator completes picking from the current tote (30), the next tote (30) is immediately

available for picking at the other bay. The pick face (20) incorporates light indicators (22, 23) and an operator interface (62) to guide the operator through the picking sequence, indicating which bay is active and from which specific compartment items should be picked. The entire process is managed by a control system (60) that monitors bay status, orchestrates material flow, and adapts to variations in pick times and retrieval speeds. FIG. 1 illustrates a high-level block diagram of the system components and their interconnections.

4. Components

[0004] The goods-to-person picking station comprises several interconnected components:

[0005]

- **Presentation Bays (10, 11):** Two distinct areas where totes (30) are brought into position for operator access. Each bay is designed to securely hold a tote (30) and present it at an ergonomic height for picking. They are equipped with sensors (14, 15) to detect the presence of a tote (30) and its correct positioning. These bays may include mechanisms for rotating or elevating the tote (30) for improved access. Bay (10) and Bay (11) function identically but operate in an alternating sequence. FIG. 2 shows Bay (10) and Bay (11) in an elevation view.

[0006]

- **Pick Face (20):** The central area where the operator interacts with the system. It encompasses the picking aperture, operator interface (62), and visual cues. The pick face (20) is positioned between the two presentation bays (10, 11) to allow the operator to transition smoothly between them.

[0007]

- **Tote (30):** A standard container or tray used to hold items within the storage system (40) and transport them via the conveyor system (50). Totes (30) are typically dimensionally consistent to facilitate automated handling.

[0008]

- **Storage System (40):** An automated storage and retrieval system (AS/RS), automated guided vehicle (AGV) system, or similar automated warehouse component responsible for storing and retrieving totes (30) as commanded by the control system (60).

[0009]

- **Conveyor System (50):** A network of conveyors, shuttles, or other material transport devices that move totes (30) from the storage system (40) to the presentation bays (10, 11) and away from the station after picking is complete. The conveyor system (50) includes merge points and divert gates to direct totes (30) to the correct bay.

[0010]

- **Control System (60):** The central computational unit that manages the entire picking station operation. It integrates with the storage system (40) and conveyor system (50), processes pick orders, tracks tote (30) locations, controls bay alternation, and manages the operator interface (62). The control system (60) receives feedback from sensors (e.g., 14, 15, 24, 25) throughout the station.

[0011]

- **Light Indicators (22, 23):** Visual signaling devices, typically LED lights, integrated into the pick face (20) or bays (10, 11). They provide immediate feedback to the operator, indicating which bay is active for picking (e.g., green light (22)), the specific compartment within a tote (30) to pick from, or other status information (e.g., red light (23) for errors). In FIG. 2, Light (22) is associated with Bay (10) and Light (23) with Bay (11).

[0012]

- **Operator Interface (62):** A touchscreen display, push-buttons, or other input/output device that allows the operator to confirm picks, report discrepancies, log in, and receive instructions. This interface communicates directly with the control system (60).

[0013]

- **Pick Confirmation Sensors (24, 25):** These sensors, located at each pick bay (10, 11) or within the pick face (20), detect when an operator has completed a pick from a specific tote (30). This could be an optical sensor, a weight scale, or a button press confirmation.

5. Operation

[0014] The operation of the dual presentation bay goods-to-person station is designed for continuous picking flow.

[0015] **Start-up:** Upon activation, the control system (60) retrieves the first two required totes (30) for the current order or batch of orders. The first tote (30) is directed by the conveyor system (50) to presentation bay (10), and the second tote (30) is simultaneously directed to presentation bay (11). Once the first tote (30) is correctly positioned in bay (10) and confirmed by sensor (14), the control system (60) illuminates the corresponding light indicator (22) at the pick face (20) and displays pick instructions on the operator interface (62). The operator begins picking from bay (10).

[0016] **Steady Running:** As the operator picks items from the tote (30) in the active bay, for example, bay (10), the control system (60) monitors the progress. Based on pre-configured average pick times, real-time pick performance data, or an explicit indication from the operator interface (62) that the current tote (30) is nearing completion, the control system (60) initiates the retrieval of the *next* required tote (30) from the storage system (40). This next tote (30) is directed to the *alternative* bay, in this case, bay (11).

[0017] When the operator completes all picks from the tote (30) in bay (10), confirmed by pick confirmation sensor (24) or operator input via interface (62), the light indicator (22) for bay (10) extinguishes, and the light indicator (23) for bay (11) illuminates. The control system (60) updates the operator interface (62) with instructions for picking from the tote (30) in bay (11). The now-empty or completed tote (30) in bay (10) is released from the bay onto the conveyor system (50) for return to storage or disposal. Simultaneously, the control system (60) anticipates the completion of picking from bay (11) and commands the storage system (40) to retrieve the subsequent tote (30), directing it to the newly vacated bay (10). This alternating sequence ensures that a ready tote (30) is always available in one of the bays (10, 11) as the operator finishes with the other, minimizing transition time and eliminating waiting periods.

[0018] **Fault or Interruption:** If the retrieval process falls behind the operator's picking pace, meaning the next tote (30) is not yet in position in the alternative bay when the operator completes picks from the current tote (30), the control system (60) will indicate a "wait"

status on the operator interface (62). The light indicators (22, 23) may flash or show a specific color (e.g., yellow) to indicate the pending arrival. The operator is instructed to wait until the next tote (30) arrives and is confirmed in position by its bay sensor (14 or 15), at which point the system resumes normal operation with the appropriate light indicator (22 or 23) illuminating. This situation might occur due to delays in the storage system (40), conveyor system (50) bottlenecks, or exceptionally fast operator picking. The control system (60) logs these occurrences for performance analysis and system optimization. In the event of a system fault (e.g., sensor failure, conveyor jam), the control system (60) halts operations, displays an error message on the operator interface (62), and may illuminate specific fault lights. Emergency stop buttons (64) are typically provided for immediate operator intervention.

6. Example Embodiments

[0019] **Embodiment 1** This embodiment features the basic configuration described, with two presentation bays (10, 11) and a shared pick face (20). Each bay includes a simple roller conveyor section for tote (30) ingress and egress and a tote presence sensor (14, 15). The pick face (20) has two sets of light indicators (22, 23) positioned above each bay and a central operator interface (62) with a small display screen for instructions and pick confirmation buttons. The control system (60) uses a fixed estimate for average pick time per item to trigger the next tote (30) retrieval.

[0020] **Embodiment 2** In this configuration, each presentation bay (10, 11) is equipped with an integrated weigh scale (16, 17) beneath the tote (30). After each item pick, the control system (60) uses the weigh scale (16 or 17) to verify that the correct item weight has been removed from the tote (30), cross-referencing it with an item master database. If a discrepancy is detected, the light indicator (22 or 23) for that bay changes to red, and an alert is displayed on the operator interface (62), prompting the operator for corrective action. The control system (60) also dynamically adjusts its estimate of remaining pick time based on real-time weight changes and historical pick data, improving the accuracy of anticipatory tote retrieval.

[0021] **Embodiment 3** This embodiment integrates a "put-to-light" system at the pick face (20) for order consolidation. In addition to picking from the source totes (30) in bays (10, 11), a series of destination bins (26) are arranged along the pick face (20), each corresponding to a specific customer order. After an item is picked from a source tote (30), a light (27) illuminates on the specific destination bin (26) where the item should be placed. The operator confirms placement via a button press on the destination bin (26). This allows for multi-order picking, where items from a single source tote (30) can fulfill multiple orders simultaneously, further increasing efficiency.

7. Alternative Configurations

[0022] The conveyor system (50) delivering totes (30) to the bays (10, 11) may be configured in various ways. Instead of a direct conveyor spur to each bay, a shuttle system could be employed that moves between the bays and a main transport spine. Alternatively, automated guided vehicles (AGVs) or autonomous mobile robots (AMRs) could be used to deliver and retrieve totes (30) directly to and from the presentation bays (10, 11), eliminating fixed conveyor infrastructure. The operator interface (62) could be a voice picking system, where instructions are delivered audibly, and confirmations are made verbally, allowing the operator to keep their hands free. The pick confirmation sensors (24, 25) could be implemented as vision systems that detect object removal or as pressure mats within the tote (30) itself.

8. Parameter Variations

Parameter	Range	Effect of moving within range
Bay Pitch (P)	0.8 to 1.5 meters	A smaller pitch (P) reduces operator travel distance between bays (10, 11), potentially increasing pick rate for multi-item picks. A larger pitch (P) provides more space for larger totes (30) or additional equipment at each bay.
Tote Size	300x200x100 mm to 600x400x300 mm	Smaller totes (30) may allow for higher density storage and faster retrieval but hold fewer items, requiring more frequent tote exchanges. Larger totes (30) reduce exchanges but may slow down storage system (40) and conveyor system (50) throughput.
Average Item Pick Time	2 to 10 seconds	Lower average pick times necessitate a faster and more responsive storage (40) and conveyor system (50) to prevent operator waiting. Higher pick times provide more buffer for retrieval, but overall pick rate will be lower.
Tote Retrieval Time	15 to 120 seconds	Shorter retrieval times allow for more aggressive shadowing and reduce potential operator idle time. Longer retrieval times increase the risk of the operator waiting, requiring a larger buffer of staged totes (30) or slower pick rates.
Number of Destination Bins	1 to 24	A higher number of destination bins (26) supports simultaneous fulfillment of more orders, increasing efficiency for multi-order picking. Fewer bins simplify the operator's task but limit multi-order capacity.
Light Indicator Type	Single-color, Multi-color, Projector	Simple single-color lights (22, 23) provide basic status. Multi-color lights offer more nuanced feedback (e.g., green for pick, yellow for wait, red for error). Projectors can highlight specific item locations within a tote (30).

9. Additional Implementations

[0024] The disclosed system can be extended to handle return processing or quality control operations. Instead of picking items out of totes (30), the operator could be directed to place items *into* totes (30) for consolidation, kitting, or inventory replenishment. The dual bay configuration would still provide the benefit of continuous work presentation. Furthermore, the station could incorporate vision systems for automated quality inspection of items during the picking process, or integrated labeling systems to apply shipping labels directly to items or destination containers as part of the pick-and-pack sequence. The control system (60) could utilize machine learning algorithms to predict operator pick times more accurately based on item characteristics, order complexity, and historical performance, further optimizing the anticipation of next tote (30) arrival. Integration with an enterprise resource planning (ERP) system or warehouse management system (WMS) is assumed for order data exchange and inventory updates.

10. Figures

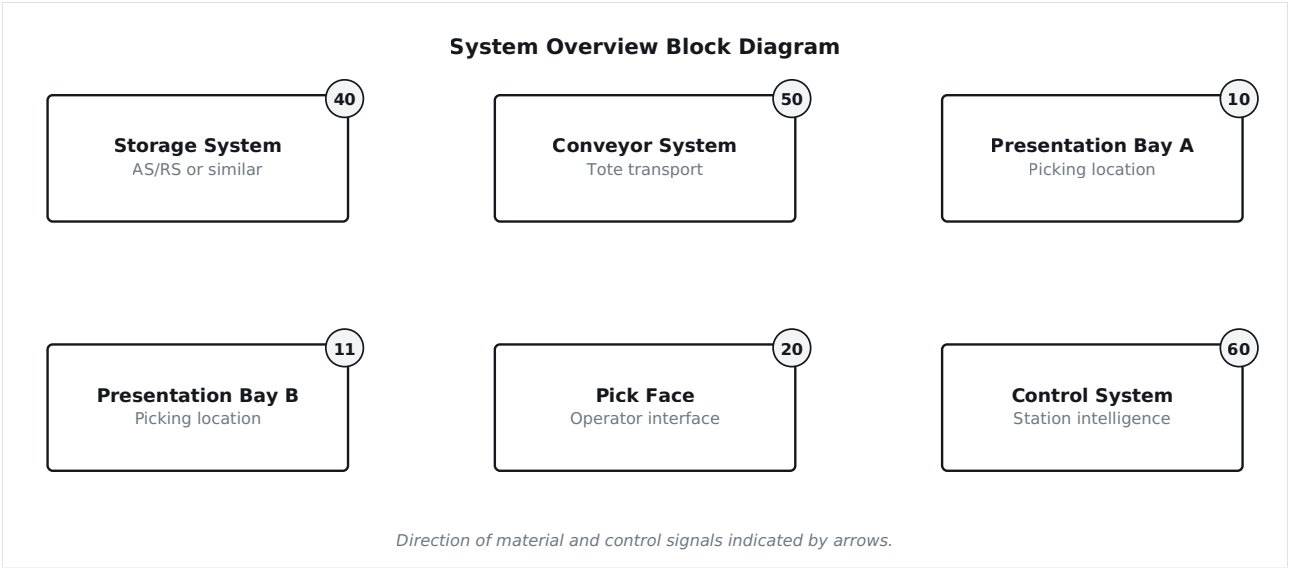

FIG. 1 A high-level block diagram illustrating the main components and material flow within the goods-to-person picking system. PNG

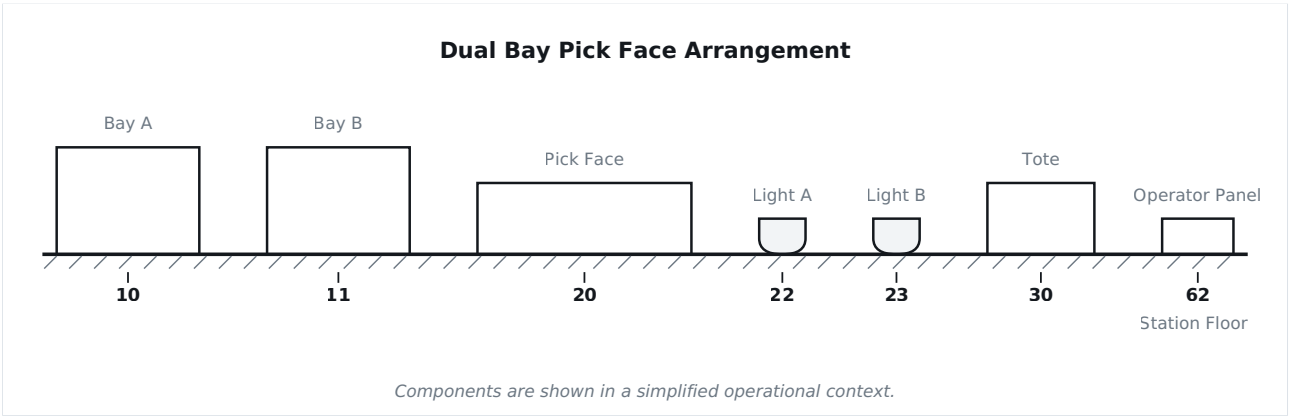

FIG. 2 An elevation view of the dual presentation bays and the central pick face area, showing key operator interface elements. PNG

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