

RFID TEXTILE DISPENSER

FIELD OF THE INVENTION

The present invention relates to a system and method for dispensing RFID tagged textiles. More particularly, the invention relates to the simultaneous transfer and folding of pre-folded
5 textiles from a storage bay to a belt conveyor system by a single manipulator arm assembly.

BACKGROUND

Establishments such as gyms, hotels, and resorts typically provide clean textiles such as towels to guests with the expectation that the issued towels are returned after use. The absence of any means to track towel issuance and return leads to significant losses due to
10 pilferage or simply non-return of issued towels. This in turn leads to significant loss of inventory which results in financial loss as a result of the need to constantly replace towels. Further, this constant and significant loss creates logistical issues where establishments need to determine how many replacement towels to order on a periodic basis to ensure that there are always sufficient quantities of towels for guests. Such inventory checks are not
15 simple, given that a significant portion of the towels at any one time are in the possession of guests.

This issue is partially addressed by stationing an employee at dispensation points. However, the costs in terms of employee wages are significant, especially in large establishments with multiple dispensation points dispersed throughout the premises.

20 Radio Frequency Identification (RFID) is an emerging technology that, when applied to Automatic Identification and Data Capture (AIDC), paves the way for item-level tracking without the traditional line of sight requirement which is the weakness of traditional barcode solutions. Automated systems built around RFID laundry tags which are permanently attached to textiles can potentially automate the issuance process, thus eliminating the need
25 to station employees at dispensation points.

An RFID system for dispensing, receiving, and tracking towels or other items is disclosed in US Patent Publication No. US20110304433A1. The publication discloses an access door that provides access to a first interior space, and a return door which permits items to be returned to a second interior space. An RFID system conducts read operations to determine
30 how many items having RFID tags are disposed in the first and second interior spaces. The system determines what items have been removed from the first interior space, and associates removed items with specific users. The RFID system conducts read operations

as items are returned to the second interior space and credits the user. This system has a number of drawbacks. Firstly, the disclosed system is unable to physically limit the number of towels dispensed which may lead to abuse resulting in unexpected shortages in towel supply. Further, the unrestricted access to the entire inventory of clean towels within the first interior space can lead to soiling and unsightly arrangement of the stored towels due to prior user activity. Lastly, the absolute need to obtain accurate reads particularly in the first interior space which houses clean towels limits the density of towels that can be stored in the first interior space.

Singapore Patent Publication No. 10201602380YA1 discloses a system for dispensing, receiving, and tracking towels. A user authenticates using an identification card before being allowed to select the desired number of towels using a touch screen interface. A pick and place unit transfers stored towels from a lifting nest to a duct leading to a dispensing outlet for collection by a user. A key disadvantage of the disclosed system is the need to store and dispense towels in a rolled form that is secured by either string or a plastic packaging. This is mandatory in order to prevent towels from partially unravelling as they are dispensed down the duct. Rolled towels do not make efficient use of the limited storage space available and accordingly, either limit the quantity of towels that can be stored or require additional space for additional lifting nests. Further, the need to secure the rolled towels by either string or plastic packaging is not consonant with guest experience at a high-end establishment.

SUMMARY OF THE INVENTION

A primary embodiment of the invention is a system for dispensing a partially folded textile having an edge, the system comprising a manipulator arm assembly operably attached to a horizontal guide rail system comprising a horizontal guide rail; at least one storage bay capable of storing partially folded textiles; a work surface; wherein the manipulator arm assembly is configured to grasp the edge of the partially folded textile, move along the horizontal guide rail in order to lay the partially folded textile across the work surface and, while still grasping the partially folded textile, move in the opposite direction to lay the partially folded textile across itself at least once.

In an optional design of the primary embodiment, the system further comprises a guide ramp, wherein the guide ramp is disposed between at least one storage bay and the conveyor belt **121** such that the guide ramp forms a continuous surface between the storage bay and the work surface. Optionally, the work surface is on a conveyor belt **121**. Optionally, the partially folded textile is laid on the work surface such that at least one edge of the partially folded textile is substantially parallel to at least one edge of the work surface.

A secondary embodiment of the invention is a system for reading a smart card comprising the system for dispensing a partially folded textile as described above, a first card reader configured to validate a smart card and a second card reader configured to read the smart card wherein the partially folded textile further comprises an RFID tag.

- 5 In an optional design of the secondary embodiment, the card interrogation point further comprises a card slot wherein the first reader is configured to physically disengage from the card slot to allow the second card reader to physically engage with the card slot in order to read the smart card when the smart card is successfully validated.

10 In an optional design of either the primary and secondary embodiment, the system for dispensing a partially folded textile further comprises a textile collection point, the textile collection point comprising an RFID reader comprising an antenna, wherein the RFID reader is configured to read tag identification data of the RFID tag at the textile collection point.

15 An alternative embodiment of the invention is a method of validating a smart card in a system for reading a smart card as described above comprising the steps of reading a smart card with a first card reader to obtain card identification data; sending the card identification data to a first server; receiving a validation message; reading the smart card with a second card reader to obtain card identification data when the smart card is successfully validated.

BRIEF DESCRIPTION OF THE DRAWINGS

20 The summary above, as well as the following detailed description of illustrative embodiments, is better understood when read in conjunction with the appended drawings. For the purpose of illustrating the present disclosure, exemplary constructions of the disclosure are shown in the drawings. However, the disclosure is not limited to specific methods and instrumentalities disclosed herein. Moreover, those in the art will understand that the drawings are not to scale. Wherever possible, like elements have been indicated by
25 identical numbers.

Fig. 1 depicts a perspective view of the system for dispensing a partially folded textile without its external covering.

Fig. 2 is a block diagram depicting the system for reading a smart card comprising the system for dispensing a partially folded textile.

30 **Fig. 3** is the front view of the system for dispensing a partially folded textile with external covering.

Fig. 4 illustrates a method of validating a smart card.

DETAILED DESCRIPTION OF THE INVENTION

In the following detailed description, reference is made to the accompanying drawings which form a part hereof. The illustrative embodiments described in the detailed description, drawings and claims are not meant to be limiting. Other embodiments can be utilized, and other changes can be made, without departing from the spirit or scope of the subject matter presented herein.

A primary embodiment of the invention is a system **101** for dispensing a partially folded textile **106**, each partially folded textile having an edge. The textile can be any known textile in the art including but not limited to articles of clothing such as garments for the upper body including t-shirts, collared shirts, garments for the lower body such as shorts, trousers of various lengths, worn fabrics such as scarves, shawls, ponchos and textiles including but not limited to towels, blankets, bedsheets, pillowcases and quilts.

The system has a manipulator arm assembly **110** comprising a gripper **306** comprising an upper gripping member **307** and a lower guide member **308**, where both members are configured to move linearly towards each other by way of an actuator **114** to which the members are operably attached to. The gripper is angled facing downwards at a 30 to 45° degree angle relative to the horizontal plane of the work surface. The motor can be a linear motor capable of linear movement and accurate positioning. The gripping member **307** may be serrated to provide improved holding power.

The actuator **114** can be a linear actuator such as an electrical motor. The actuator **114** is attached to a mounting bracket **115** which is in turn mounted to a vertical guide rail (not depicted) via spacers **116**. Vertical movement of the manipulator arm assembly **110** along the vertical guiderail is provided by a first linear motor **119**. The vertical guiderail is in turn mounted to a horizontal guide rail system comprising at least one horizontal guide rail **117** which allows horizontal movement in the X and/or Y axes which is provided by a second linear motor **118**. The first linear motor **119** and second linear motor **118** can be a stepper motor or servomotor. A skilled addressee will readily appreciate that any actuator capable of accurate positioning may be used. At least one storage bay **102** capable of storing partially folded textiles **106** is provided. The stored quantity of partially folded textiles **106** should be sufficient to last till the scheduled replenishment date. Additional storage bays can be added in the event that additional storage capacity is required. It should be readily apparent to the skilled addressee that additional horizontal guiderails can be added as necessary to allow

the manipulator arm assembly **110** to position itself such that it is able to grasp a partially folded textile **106** in the additional storage bays. Additional manipulator arm assemblies may be used in a single system. A work surface is provided and serves as a flat and rigid surface onto which the partially folded textile **106** retrieved from at least one storage bay **102** is transferred and should be of sufficient area to accommodate the partially folded textile **106** while the textile is laid flat on the work surface. The work surface may be on a conveyor belt **121**.

The manipulator arm assembly **110** is configured to travel horizontally via the horizontal guide rail system to the designated storage bay **102**. The manipulator arm assembly **110** is then moved into the storage bay **102** to a predetermined height. This predetermined height is the height at which the topmost partially folded textile in the storage bay is positioned. The partially folded textiles **106** in the storage bay are stored as a stack. The stack may be placed on a lift platform which lifts the partially folded textile stack **106**. Partially folded textiles are advantageous with respect to storage efficiency as larger quantities of partially folded textiles **106** can be stored in a given volume when compared to fully folded textiles. The lift platform can be configured to stop at the predetermined height by way of a sensor. The sensor can be a laser sensor. The lift platform is raised till the topmost partially folded textile is detected by the sensor which halts the lift platform.

Once lowered to the predetermined height, the manipulator arm assembly **110** grasps the edge of the topmost partially folded textile **106**. Preferably, the partially folded textile **106** is grasped by the folded edge. The partially folded textile **106** which is now hanging vertically is brought to a height such that approximately a quarter to half of the vertically hanging portion of the partially folded textile **106** is lower than the work surface. In an optional design of the primary embodiment, the system further comprises a guide ramp **108** wherein the guide ramp **108** is disposed between at least one storage bay and the conveyor belt **121** such that the guide ramp **108** forms a sloped surface between the storage bay and the work surface. Alternatively, the guide ramp may be stepped.

The manipulator arm assembly **106** then moves along the horizontal guide rail in order to lay the partially folded textile across the work surface. The portion of the vertically hanging textile that is below the work surface is in this manner pressed against the side of the work surface. The partially folded textile **106** may be laid in a direction that is substantially perpendicular to the long axis of the work surface. Alternatively, the partially folded textile **106** may be laid substantially parallel to the long axis of the work surface. Regardless of how the partially folded textile **106** is folded relative to the long axis, the end result is that the

partially folded textile **106** is laid on the work surface such that at least one edge of the partially folded textile **106** is substantially parallel to at least one edge of the work surface.

Once the partially folded textile **106** is laid across the work surface, the manipulator arm assembly **110** moves in a direction opposite to that of what was initially taken when laying the partially folded textile **106** across the work surface. This leads to the partially folded textile **106** being folded across itself at least once. In this manner, the partially folded textile **106** is retrieved and folded in quick succession and is now ready for dispensation. A textile can then be dropped across the edge of the conveyor belt **121** and down a slide to the textile collection point for collection. The folded edge of the partially folded textile **106** should preferably be substantially parallel to the direction travelled down the slide.

A secondary embodiment of the invention is a system for reading a smart card **201** comprising the system for dispensing a partially folded textile as described above and a first card reader **202** configured to validate a smart card. Smart cards refer to card-like devices with embedded integrated circuits which are capable of storing data. Such smart cards may be described as being contact or contactless. Contact smart cards have gold-plated contact pads while contactless smart cards have built-in antennas and are powered via radio frequency induction. Smart cards may additionally have a more traditional magnetic strip to ensure compatibility with older readers.

The first card reader **202** reads the card identification data of the smart card and sends the data to a first server **204**, the first server **204** comprising a processor and a first database. The card identification data is sent to the first server **204** where the processor is configured to compare the card identification data to the data found in the first database and to generate a validation result based on the findings. The validation message is then sent to the system. If the smart card is successfully validated, the system will 1) allow a user to input the desired quantity of textiles to be dispensed via the touchscreen **304**; 2) trigger the second card reader **203** to read the card identification data and send the data to a second server **205**. Each textile to be dispensed in this manner can have an RFID tag physically attached to it.

In an optional design of the secondary embodiment, the card interrogation point further comprises a card slot **303** wherein the first card reader **202** is configured to physically disengage from the card slot **303** to allow the second card reader **203** to physically engage with the card slot **303** in order to read the smart card once the smart card is successfully validated. In other words, the first reader is physically displaced from the card slot to make space for the second reader to physically engage the card slot **303**.

In an optional design of either the primary and secondary embodiment, the system for dispensing a partially folded textile further comprises a textile collection point **305**, the textile collection point **305** comprising an RFID reader with at least one antenna, the RFID reader configured to read tag identification data of the RFID tag at the textile collection point. The RFID tag identification number and the card identification data read by the second reader can be associated and sent to a second server for records purposes. The RFID tag should preferably be designed to withstand the industrial washing process.

An alternative embodiment of the invention is a method of validating a smart card in a system for reading a smart card as described above comprising the steps of reading a smart card with a first card reader to obtain card identification data; sending the card identification data to a first server; receiving a validation message; reading the smart card with a second card reader to obtain card identification data when the smart card is successfully validated. The first server is envisioned to be a customer's server where a database that contains sensitive client information resides. Such information cannot be accessible by external vendors who maintain the RFID textile dispenser and the card information/ RFID tag data which is located in a separate system from that of the first server. However, it is still necessary to validate a smart card inserted into the system. The dual reader configuration described herein allows the system to act as an intermediary between the two separate systems with minimum modifications to either system.

CLAIMS

1. A system for dispensing a partially folded textile, each partially folded textile having an edge, the system comprising:

a manipulator arm assembly operably attached to a horizontal guide rail system comprising
5 a horizontal guide rail;

at least one storage bay capable of storing partially folded textiles;

a work surface;

wherein the manipulator arm assembly is configured to grasp the edge of a partially folded textile, move along the horizontal guide rail in order to lay the partially folded textile across
10 the work surface and while still grasping the partially folded textile, move in the opposite direction to lay the partially folded textile across itself at least once.

2. The system according to claims **1**, wherein the work surface is on a conveyer belt.

3. The system according to claim **1** or **2**, further comprising a guide ramp, wherein the guide ramp is disposed between the at least one storage bay and conveyer belt such that
15 the guide ramp forms a sloped surface between the storage bay and the work surface.

4. The system according to claims **1** to **3**, wherein the partially folded textile is laid on the work surface such that at least one edge of the partially folded textile is substantially parallel to at least one edge of the work surface.

5. A system for reading a smart card comprising:

20 the system for dispensing a partially folded textile according to claims **1** to **4**;

a first card reader configured to validate a smart card;

a second card reader configured to read the smart card;

wherein the partially folded textile further comprises an RFID tag.

6. The system according to claim **5**, wherein the system for reading a smart card further
25 comprises a card slot and wherein the first card reader is configured to physically disengage from the card slot to allow the second card reader to physically engage with the card slot in order to read the smart card once the smart card is successfully validated.

7. The system according to claims **1** to **6**, further comprising a textile collection point, the textile collection point comprising an RFID reader comprising an antenna, the RFID reader configured to read tag identification data of the RFID tag at the textile collection point;

8. A method of validating a smart card in a system comprising the steps of:

- 5 a) reading a smart card with a first card reader to obtain card identification data;
- b) sending the card identification data to a first server;
- c) receiving a validation message; and
- d) reading a smart card with a second card reader to obtain card identification data if the validation message indicates that the card identification data is valid.