RFID Towel Dispenser System

Field of Invention

This invention makes use of Radio Frequency Identification (RFID) technology, and automated dispensing technology to automate the process of issuing clean towels, and receiving used/soiled towels in any hotel, gym, and clubhouse establishments that provide temporary loan of towels to its guests, members or visitors. This invention tracks accountability of towels, and is also capable of limiting the number of towels that each customer can loan. This invention prevents customer from gaining access to clean towels that does not belong to his account.

Background

In establishments like hotels, gym and clubhouses, towels are generally issued to customers (guests, members or visitors) as loan-items. Customers use these issued towels to dry themselves up after swimming in the pool, during work-out in the gym, or after shower. The customers are then expected to return the soiled towels after use.

Current state-of-the-art practice for issuing of towels to customer includes setting up a booth, and stationing a staff at this booth to manually record down particulars of each customer on paper/log-book, before handing over the cleaned towels to the customer. Upon return of used towels, the staff over the booth needs to record down on the same paper/log-book that the customer has returned his loaned towels. In event there are missing towels, accountability can be tracked using this paper/log-book, and customers can be charged accordingly. This approach of issuing and receiving towels requires at least one staff to be station at the booth at all times, and its loan/return process may potentially lead to a bottleneck if there is huge influx of customers approaching the booth at the same time, resulting in customer dissatisfaction due to the long queuing time.

There exists some establishments that prefer not to impose strict accountability of towels on its customers, so as to avoid customer dissatisfaction. In such cases, these establishments bear risk of losing expensive towels.

There exists state-of-the-art Dispenser that dispenses towels for customers. These conventional dispensers only dispenses towels to customers, and do not expect return of these towels. These dispensers are generally not used for loan/return of towels, as they are incapable of tracking accountability on which customers took which towels.

There exists a patent (US 8362878 B2 - Towel Tracking System), that also make use of RFID technology to automate the issuing/receiving of towels. For this existing invention, every towel is tagged with one RFID tag that uniquely identifies each towel. These tagged towels are placed into a cabinet that comes with two compartments. The first compartment contains clean towels, and is locked electronically. To gain access to the clean towels, the customer has to unlock the first compartment by either tapping his ID Card on a Card Reader, or to key in his assigned username/password to identify himself to the system. Upon unlocking the first compartment, the customer will have access to ALL the towels in the compartment, and he/she is free to take any number of towels he/she prefers. Once the customer has taken out the towels he/she required, the customer will close the door of the first compartment to lock it up. Once locked, the system will automatically perform a scan on all existing towels in the first compartment, and account the towels that are not scanned, under the customer who have last accessed the system. This invention has its imperfection in allowing customer to have access to ALL towels. The establishment has no way to limit the number of towels that each customer can loan. Also, there is potential for the customer to accidentally soil or mess-up the arrangement of the clean towels in

the first compartment, resulting in disgust feelings to subsequent customers attempting to loan the towels.

In response to Singapore Government's productivity drive, Daifuku Mechatronics (Singapore) Pte Ltd has developed a RFID Towel Dispenser System to allow customers of hotel, gym, and clubhouse establishments perform loan of clean towels and return of soiled in a self-service manner, so as to reduce error-prone paper-work, manpower to record loan/return data, while at the same time improving customer's experience and satisfaction.

Summary

In establishments like hotels, gym and clubhouses, towels are generally issued to customers (guests, members or visitors) as loan-items. Customers use these issued towels to dry themselves up after swimming in the pool, during work-out in the gym, or after shower. The customers are then expected to return the soiled towels after use.

Daifuku Mechatronics has invented a RFID Towel Dispenser System to allow customers perform loan of clean towels and return of soiled/used towels in a self-service manner, while allowing owners of establishments limit access and quantity of clean towels that each customer can loan.

Every towel in this System is tagged with a RFID tag to uniquely identify each towel.

To perform a loan, the customer approaches the System to authenticate him/herself by either scanning/swiping his ID-Card on the Card Reader installed at the System, or by keying in his/her username/password using the Touchscreen PC installed at the System. Once System authenticates the customer as a valid user, it proceeds to prompt the customer to enter his/her required number of clean towels, and goes ahead to activate its internal dispensing mechanism to drop the required number of clean towels into the dispensing outlet for customer's collection. The RFID tags of the clean towels are scanned and captured by the system via a RFID Antenna installed inside the dispensing outlet. Upon capturing the Tag IDs of the dispensed towels, the System will assigned these IDs to the account of the customer who has activated the dispensing process.

To perform a return of soiled/used towel, the customer approaches the System, and simply drop the towels into the returning outlet. The RFID Antenna installed inside the returning outlet will capture the Tag IDs of the returned towels, and proceed to subtract these towels from the customer's account.

This new invention allows replenishment of clean towels to take place concurrently without causing any down-time to the dispensing operation.

Brief Description of Drawings

For better understand of the RFID Towel Dispenser System, three drawings are provided. The following briefly describes the content of the drawings.

FIG. 1 shows the process flow of the RFID Towel Dispenser System.

FIG. 2 shows the various parts of a Towel and where the RFID Tag will be attached.

FIG. 3 shows the various components and features of the RFID Towel Dispensing Machine.

FIG. 4 shows the internals of the RFID Towel Dispensing Machine

FIG. 5 shows back of the RFID Towel Dispensing Machine.

Detailed Description

This invention is made up of three major components, namely the RFID Towel, the RFID Towel Dispensing Machine and the improved process to let customers loan/return towels in a self-service manner, while limiting access of all clean towels in the machine to customers.

(1) Improved Process Flow

The new process flow attempts to eliminate the need for any establishments to setup up a booth having at least one staff to record customer's loan and return of towels. It aims to let customers loan and return towels in a self-service manner, while still tracking accountability of the towels that are assigned to respective customers. This improved process is also useful in limiting the number of towels each customer can loan, and also prevents customers from accessing (soiling or messing-up) clean towels that they are not loaning.

FIG.1 shows the generic process flow chart. Below shows a detailed description of the improved process flow:

Process Flow for Issuance of Clean Towels to Customers.
(1) The customer approaches RFID Towel Dispenser System to identify and authenticate him/herself to the System before the System can proceed to dispense clean towels to this customer. The customer authenticates him/herself by scanning or swiping his ID-Card (which can be a hotel guest key card or a clubhouse/gym membership card) on the ID-Card-Reader that is installed on the System. The customer can alternatively authenticate him/herself by keying in his/her assigned username/password on the provided Touch-screen PC Software of the System.

(2) Once System successfully authenticates the customer, the Touch-screen PC Software will proceed to prompt customer to select the number of towels to be dispensed. The customer will then be required to select the number of clean towels needed. The System can be configured by the owner of the establishment to limit the maximum number of towels that each customer can loan. Once this maximum number has been reached for a customer, the System will disallow this customer from performing further loans until his/her allocated towels are returned.

(3) Once customer has selected the number of towels to be dispensed, the System proceeds to dispense the required number of clean towels to the dispensed outlet.

(4) The RFID tags on the dispensed towels will be read by the RFID reader and antenna that is installed inside the dispensing outlet and the dispensed towels will be accounted under the customer making the request.

(5) The customer will then proceed to collect the dispensed clean towels from the dispensing outlet.

Process Flow for Receiving of Soiled/Used Towels from Customers.
(1) Customers approaches RFID Towel Dispenser System, and drop soiled/used towels into returning outlet.

(2) Once the soiled/used towels are dropped into returning outlet, the returned towels will be read by RFID reader and antenna that is installed inside the returning outlet, and the returned towels will be subtracted from the account of the customer.

(2) RFID Towels

In order to track accountability of RFID towels, each RFID towel must be uniquely identified. This is achieved by embedding one RFID tag into each towel. Each RFID tag comes with a unique identifier called Electronic Product Code (or EPC), that uniquely identifies the RFID towel in the System. The RFID tags are water-proof, heat-resistant, and are capable of withstanding mechanical impact caused by a washing machine and clothes dryer.

Two ways are invented to attach RFID tags:
(1) The entire width (shorter side) of the towel is folded inwards, with the tag being positioned at one corner inside this fold. The entire width of the fold is sewn. The outer perimeter of the tag is also sewn to prevent the tag from shifting inside the fold.
(2) The tag is positioned at one corner on top of the towel. A cloth of size bigger than the tag is covered on top of this tag and sewn at the perimeter of the tag onto the towel.

FIG.2 shows how RFID Tags are attached onto the towel.

The clean RFID Towels are folded into half for two or more times, rolled into roll-forms, and are secured tightly using either a string-tie or packaged into a plastic bag, to prevent the towel from deforming from its roll-form, and jamming the Dispensing Machine. The roll-form is also mandatory for the pick-and-place unit to clamp the towel and unclamp into the dispensing outlet.

(3) RFID Towel Dispensing Machine

Daifuku Mechatronics has invented and developed a RFID Towel Dispensing Machine to facilitate dispensing of clean towels and receiving of soiled/used towels. FIG. 3 shows the different components of the RFID Towel Dispensing Machine.

The Towel Dispensing Machine comes with three major compartments that are interconnected via electrical and mechanical parts.

The first compartment is the Dispensing Compartment. It exposes a dispensing outlet at the front panel to allow customers collect dispensed towels. Internally, it contains one or more lifting nests to house all the clean towels that are properly rolled. Each lifting nest is divided into multiple columns, and each column allows rolled towels to be stacked on top of each other. A pick-and-place unit is installed above the lifting nests to clamp rolled towels from the top of the lifting nest and unclamp it at a duct leading to the dispensing outlet at the bottom. When an entire column of towels are being removed from the top of a lifting nest, the lifting panel of the nest will push all towels one level upwards. FIG. 5 shows that each lifting nest can be detached from the back panel of the Dispensing Compartment. This allows refilling of clean towels to be done, without interrupting or haltng operations of the Dispensing Machine. FIG. 6 shows a detached lifting nest that comes with wheels for portability. Inside the dispensing outlet, an RFID antenna is installed to scan RFID towels that are dispensed. The scanned towels' unique identifier (or EPC) will then be relayed to the Touch-screen PC (at the Control Panel Compartment) to associate them under the customer's account.

The second compartment is the Control Panel Compartment. It exposes a Touch-screen PC and an optional ID-Card Reader at its front panel. The Touch-screen PC displays instructions for the customers on usage of the Dispenser System. It also allows customers to enter username/password for authentication in case owners of establishments do not wish to integrate their ID-Cards to the System. The Touch-screen PC can also be used to display advertisements or promotional advertisements to customers using the System. The Touch-screen PC communicates transaction and accountability data back to a central Server via WIFI, 3G/4G Data, or Cabled Ethernet. The ID-Card Reader is used to read ID-Cards that are issued by establishments to their customers for unique identification of customers. The ID-Card Reader can be any RFID Reader, or even a Swipe Card Reader. Inside the Control Panel Compartment, a

RFID Reader is installed. The RFID Reader is connected to RFID Antennas in the Dispensing and Returning Compartments via RF Coaxial Cables. The RFID Reader relays EPC of scanned towels to the Touch-screen PC via an interconnected Ethernet LAN Cable.

The third compartment is the Returning Compartment. It exposes a returning outlet at its front panel to allow customers to return soiled/used towels back to the System. The returning outlet leads to a laundry basket internally. The laundry basket comes with wheels for portability. Sensors are installed to detect the capacity of the laundry basket, so that if the basket is getting full, an alert can be sent to the staff for replacement of an empty basket..

The Towel Dispensing Machine is equipped with a Tower Light that displays 3 colors to signify the different state of the machine. Green color signifies normal operation with no errors. Yellow color signifies normal operation with some warnings like low inventory level of clean towels, or laundry basket going to be full. Red color means an error condition has occurred, and that the system has halted. The tower light is also capable of creating sounds to capture the attention of the staff in event customers encounter problems using the machine. Below shows the possible error and warnings that the system is capable of displaying using tower-light or using touch-screen display:

(1) Clean Towel Inventory Low Warning
(2) Laundry Basket Getting Full Warning
(3) Dispenser Jam Error

Claims

(1) A clean towel dispensing system comprising of the following:

Every towel in the system is attached with a washable RFID tag, folded into half for two or more times, rolled into roll-form, and secured using string-ties or packed into plastic wrappers to prevent roll-form from deforming, causing jam to the dispenser.

A Dispensing Compartment which comprise of a cabinet-like structure that houses one or more lifting nests internally, a pick-and-place unit at the top of the lifting nests, and a duct leading to a dispensing outlet that can be accessed from the front panel of the structure. Each lifting nest is divided into multiple columns, and each column allows rolled towels to be stacked on top of each other. A pick-and-place unit is installed above the lifting nests to clamp rolled towels from the top of the lifting nest and unclamp it at a duct leading to the dispensing outlet at the bottom. When an entire column of towels are being removed from the top of a lifting nest, the lifting panel of the nest will push all towels one level upwards. Each lifting nest can be detached from the back panel of the dispensing compartment. This allows refilling of clean towels to be done, without interrupting or halting operations of the Dispensing Machine. The lifting nest comes with wheels for portability. A RFID antenna is installed inside the dispensing outlet for the purpose of scanning dispensed towels, and relaying EPC of dispensed towels to RFID Reader, and eventually reaching Touch-screen PC at the Control Panel Compartment.

A Control Panel Compartment which comprise of a cabinet-like structure that exposes a Touch-screen PC, and an optional ID-Card Reader at its front panel. The Touch-screen PC can also be used to display advertisements or promotional advertisements to customers using the System. The Touch-screen PC communicates transaction and accountability data back to a central Server via WIFI, 3G/4G Data, or Cabled Ethernet. The ID-Card Reader is used to read ID-Cards that are issued by establishments to their customers for unique identification of customers. The ID-Card Reader can be any RFID Reader, or even a Swipe Card Reader. Inside this Control Panel Compartment, a RFID Reader is installed. The RFID Reader is connected to RFID Antennas in the Dispensing and Returning Compartments via RF Coaxial Cables. The RFID Reader relays EPC of scanned towels to the Touch-screen PC via an interconnected Ethernet LAN Cable.

A Returning Compartment which comprise of a cabinet-like structure that exposes a returning outlet at its front panel to allow customers to return soiled/used towels back to the System. The returning outlet leads to a laundry basket internally. The laundry basket comes with wheels for portability. Sensors are installed to detect the capacity of the laundry basket, so that if the basket is getting full, an alert can be sent to the staff for replacement of an empty basket.

(2) The clean towel dispensing system in claim 1, wherein:

The use of Touch-screen PC to alert users of the following errors that have happened:
(a) Clean Towel Inventory Low Warning
(b) Laundry Basket Getting Full Warning
(c) Dispenser Jam Error

(3) The clean towel dispensing system in claim 1 or 2, wherein:

A tower light is installed at to create sound and visual alerts to alert users of the following errors that have happened:
(a) Clean Towel Inventory Low Warning
(b) Laundry Basket Getting Full Warning
(c) Dispenser Jam Error

(4) The clean towel dispensing system in claim 1, 2 or 3, wherein:

It is used to improve the process of allowing customers perform loan of clean towels and return of soiled/used towels in a self-service manner, while at the same time, allowing owners of establishments limit access and maximum number of clean towels to customers

(5) A clean towel dispensing system, that do not have any down-time, even when replenishment of clean towels is taking place.