

AUTOMATIC VENDING STORE

[0001] The present patent application relates to an automatic vending store. The patent application also relates one or more methods for making, assembling, disassembling,
5 installing, configuring, maintaining, repairing and using the automatic vending store.

[0002] The present patent application or application relates to an automatic vending store. The automatic vending store includes one or more vending machines or automated machines, that possibly provide perishable and non-perishable items (i.e. products,
10 goods of sales), usually as fast moving consumable items such as snacks, beverages, alcohol, cigarettes and lottery tickets to consumers or customers. Yet, there is another type of known vending machine that provides novelty items. An item of the other type of vending machine is dispensed after either money is inserted into the machine, or other forms of payment modes are accepted and approved. Each of these known vending
15 machines has limited storage space of items therein. To provide wide range of products or goods of sales, multiple pieces of these known vending machines are lined up side by side. However, the side by side arrangement also presents a problem during replenishment and collection of cash payment at the multiple pieces of known vending machines. A human operator has to open several doors of the known types of vending
20 machines to check stocks. Some known vending machines keep temperature sensitive items such as food. Opening of a door of a known type of vending machine disrupt temperature stability inside the known type of vending machine. Condensation may subsequently take place on the food after the door being shut. Water droplets mat form on the food and sometimes freezes, becoming ice. Therefore, it is the object of the current
25 application to address the mentioned issues and provide practicable solutions.

[0003] The present application aims to provide one or more new and useful automatic vending stores. The present application further aims to provide one or more new and useful methods for making, assembling, disassembling, installing, configuring,
30 maintaining, repairing and using the one or more automatic vending stores. Essential features of the application are provided by one or more independent claims, whilst advantageous features are presented by their dependent claims respectively.

[0004] According to a first aspect, the present application provides an automatic vending
35 store for offering goods of sales. The automatic vending store comprises one or more

storage compartments for keeping the goods of sales. The one or more storage compartments are also known as one or more shelves, cubicles, drawers or holders for storing or stacking the goods of sales. The automatic vending store also comprise a payment terminal that is connected to the one or more compartments for transacting the goods of sales. The payment terminal is also known as a point of sale terminal, a credit card terminal, EFTPOS (Electronic Funds Transfer at Point Of Sale) terminal, or a PDQ (Process Data Quickly) terminal in East Africa, which is a device for interfacing with payment cards to make electronic funds transfers. Of course, the payment terminal is also able to handle cash transaction or payment by mobile devices, such as smartphones.

The automatic vending store further comprises an automatic organizer (or simply known as organizer) that is further connected to the one or more storage compartments, the payment terminal or both for moving goods of sales, especially when no transaction takes place at the payment terminal. The automatic organizer is able to move the goods of sales mechanically, and the automatic organizer is also known as handler, picker, fetcher, or machine assistant. For example, the automatic organizer is able to receive, pick or hold a returned product, and transfer the returned product back to its original or a designated storage compartment (e.g. floor, box). Instead of accessing goods in a 2D (two dimensional) plane, the automatic organizer is able to handle the goods in a 3D (three dimensional) volume, as inserting, raising lowering, pulling or even rotating a selected product according to a Cartesian coordinate system in a three-dimensional space.

[0005] The automatic vending store provides convenience to consumers because the automatic vending store is able to provide wide range of products twenty-four hours a day and seven days a week, which is around the clock. The automatic vending store is able to sell goods without requiring a human operator or sales assistant so that goods of the automatic vending store are able to be sold at lower prices, as compared to stores employing human sales assistants. Particularly, the automatic organizer not only able to retrieve goods from any of the storage compartments for dispensing to a customer at a dispenser, but also operable to move goods between the first storage compartment and the second storage compartment in the absence of sales or delivery to a customer at the dispenser. For example, the automatic organizer is able to move goods of a partially filled first storage compartment to another partially filled storage compartment (e.g. second compartment) so that goods of the same type can be collocated inside one compartment, and an empty storage compartment is made available to receive additional goods of sales.

[0006] Either or both of the first storage compartment and second storage compartment can comprise multiple slots, receptacles, boxes or cabins that are encoded with position information, capacity information or any other information (e.g. storage temperature). For example, one or more of the multiple slots, receptacles, boxes or cabins are registered with Cartesian coordinate data (e.g. numbers of X-axis, Y-axis & Z-axis) so that the automatic organizer is able to return or locate a predetermined storage compartment, slot, receptacle, box or cabin in order to load or retrieve goods from the predetermined storage compartment, slot, receptacle, box or cabin. Since the automatic organizer is mechanically, electrically, pneumatically or hydraulically driven, the automatic organizer is able to handle any goods of sales tirelessly, continuously, spontaneously or even effortlessly.

[0007] Alternatively speaking, the present application offers an automatic vending store for offering goods of sales. The automatic vending store comprises a first storage compartment and a second storage compartment for keeping the goods of sales. The automatic vending store also comprises a payment terminal that is connected to the first storage compartment, the second storage compartment or both the first and second storage compartments for transacting the goods of sales automatically. The automatic vending store additionally comprises an automatic organizer for moving the goods of sales between the first storage compartment and the second storage compartment. The automatic vending store is more versatile or efficient than a conventional brick and mortar' store that is operated by human store assistants.

[0008] Embodiments of the application provides an automatic organizer that comprises an automatic loader for replenishing or loading the goods of sales onto the or more storage compartments (e.g. first storage compartment). The automatic loader or simply loader is operable to capture an object (e.g. goods) from a floor and insert the object into a predetermined or designated storage compartment, shelf, cubicle, drawer or holder. In contrast to taking purchased goods to a dispenser or chute of the automatic vending store for retrieving by a customer, the loader is configured to pick a product or object from a platform (e.g. dispenser, another storage compartment), and insert the product or object into a storage compartment (e.g. storage compartment). In fact, the loader is able to repeat the operation so that the storage compartment is possible to be filled, aligned or stacked with many pieces of the products or objects. Similar to the job of a human store

assistant, the loader is able to locate, recognize, pick, load or insert a chosen object or product to one or more predetermined locations.

5 [0009] For example, the automatic organizer or loader is able to organize goods of a storage compartment or any sub-sections of the storage compartments (e.g. cubicle, receptacle). Particularly, the automatic organizer or loader is also known as an automatic tallying clerk or assistant that is able to keep a tally of quantity or weight of goods received at the automatic vending store. For example, incoming goods are received and kept at the second storage compartment, and the automatic organizer or loader is able to select, 10 identify, choose or retrieve one or more predetermined goods from any sub-sections or locations at the second storage compartment, and move the one or more predetermined goods to the first storage compartment. Movement of the goods as tallying is often performed in the absence of transaction or selling so that the same automatic organizer can deliver goods of sales when having transaction, and tallying the goods in the absence 15 of any transaction. An example of tallying the goods of sales is goods or product items management (FIFO or First In First Out) such that an empty slot on the second storage compartment is available for receiving and temporarily storing goods from the first storage compartment. By organizing goods retrieved from the first storage compartment at an empty slot in the second storage compartment, the automatic organizer is able to 20 reshuffle the goods according to their expiry dates, sizes or heights so that goods of closer expiry dates may be placed in front of later expiry dates on the first storage compartment for faster selling. When necessary, the automatic organizer is operable to fetch expired goods from the first storage compartment to the second storage compartment for disposal. Of course, the first storage compartment and the second 25 compartment are optionally collocated or integrated together as a single storage compartment or unit so that parts of the single storage compartment are used as the first storage compartment for keeping goods, whilst some remaining or empty parts of the single storage compartment are deployed as the second storage compartment for tallying. Exchange of functions or positions between the first storage compartment and the 30 second storage compartment is flexible, such as defined by computer software of the automatic vending store.

[0010] The automatic organizer can comprise one or more industrial robot or robot for transferring the goods of sales (between different compartments or shelves. For example, 35 the industrial robot includes a robot of model IRB 2600 made by ABB. The robot

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optionally has one or more multiple degrees of freedom in order to retrieve the goods of sales. The robot can have an end effector or gripper that is detachable or exchangeable. In practice, the robot or industrial robot utilizes a suction cup, a force-closure, a human-hand force-closure end effector, a hoist, a conveyor belt, a vibrating feeder, a coil feeder, a hopper or a combination of any of these. Moreover, the end effector holder has an integrator or connector that is able to join multiple pieces or types of end effectors, whether shared or exclusively used by one or more robots. Particularly, the automatic vending store or the one or more robots include a platform for keeping multiple pieces of end effectors, whether of the same type or sizes, or of different types of sizes. The platform facilitates the one or more robots to release an end effector onto the platform, and install another end effector automatically. In practice, a robot having a suction cup is able to capture a box of chocolate. The robot is able to dislodge the suction cup at the platform, and install a human-hand force-closure at the platform for retrieving a bag of frozen dumplings.

[0011] The one or more robots may be mounted on an elevated base or ground for extending their range of operation. For example, an elevated robot is mounted onto a podium or rail 60cm (centimeter) above a ground of the automatic vending store. Since the elevated robot occupies little floor area, the ground of the automatic vending store is able to store goods of sales, offering extra space for keeping the goods and making the ground as another storage compartment (e.g. second storage compartment). Particularly, the elevated base or ground is optionally 5cm, 10cm, 16cm, 24cm, 32cm, 42cm, 48cm, 52cm, 59cm, 68cm, 75cm, 86cm, 92cm, 102cm, 109cm, 119cm, 128cm, 136cm, 162cm or even higher above a ground of the automatic vending store substantially. In addition to being the rail or track for facilitating movement of the one or more robots, the elevated base or ground may be any shape or sizes, such as an elongated rectangular stand. Since a trajectory of robot radius may range from 0.45 to 1.65 meters, the elevated base or ground allows technicians to access some internal parts (known as blind spots) of the automatic vending store without the fear of being interfered or knocked by the one or more robots accidentally.

[0012] The one or more robot can comprise a first robot and a second robot that are configured to cooperate with each other. The one or more robots include industrial one or more robots respectively. Hence, instead of operating independently, the two robots can collaborate by fetching a heavy or fragile object together, or by exchanging a product

of sales between each other. Particularly, the first robot at a first corner of the automatic vending store is able to capture a product from the first storage compartment, and pass the product to the second robot at a second corner for loading into the second storage compartment, without travelling from the first corner to the second corner. For instance, the first robot is ceiling mounted and the second robot is floor mounted so that the goods at a high shelf is able to be grabbed by the ceiling mounted robot, and received by the second robot for delivery to a dispenser or discharge chute (also known as chute) of the automatic vending store. In short, the automatic vending store can comprise a first holder (e.g. track or rail) and a second holder that are spread apart for anchoring the first robot and the second robot at different sides or places of the automatic vending store. One or more pieces of the track or rail provide stable and predetermined guidance for supporting movement of the one or more robots.

[0013] The automatic vending store optionally further comprises one or more cameras, either installed inside or outside the automatic vending store for recording, analyzing or inspecting operation of the automatic vending store (e.g. store replenishing, facial recognition, tallying goods). For example, the camera is able to record goods delivery process by a supplier. Instead of relying on report or physical observation to the goods delivery, an operator of the automatic vending store is able to inspect or verify the goods delivery when necessary, either online or offline. One of more of the cameras are optionally shared by multiple software applications, such as by surveillance and stock taking. For instance, one or more of the cameras are connected to a robot so that the robot becomes machine-vision enabled. As a result, the robot is able to orientate or orient itself at the automatic vending store for capturing any goods of sales with precision in position and force. The camera enabled machine vision further facilitate inspection of the goods of sales so that fractured or spilled goods will be spotted, cleared and cleaned.

[0014] The one or more cameras may be installed inside or outside the automatic vending the store to monitor vendors, suppliers, customers, as well as the movement of the one or more robots at interior. For example, a camera mounted on an exterior wall of the automatic vending store is able to observe purchasing behaviors of customers so that an operator of the automatic vending store is able to analyze and optimize operation of the automatic vending store.

[0015] The automatic vending store or the one or more cameras sometimes comprise one or more optical character readers (OCR) for Optical character recognition, or a facial recognition for identifying a user (e.g. customer). For example, the optical character reader is able to read and decipher an image of personal identification card after scanning, such that the automatic vending store is able to determine on whether to sell alcoholic drinks (e.g. liquor) or cigarettes to some potential customers, after scanning their identification cards. The automatic vending store or the one or more cameras at times include an image analyzer possibly based on machine vision possibly and/or with artificial intelligence capability. The image analyzer is able to differentiate an imposter and an authenticate customer by rejecting fake images (e.g. large-print photo of a person). The automatic vending store or the one or more cameras by choice include one or more barcode readers or barcode scanners, which are capable of decoding linear bards (e.g. Code 128 according to International Standard ISO/IEC 15417) or matrix (2D) barcodes (e.g. QR code according to International Standard: ISO/IEC 18004).

[0016] The one or more storage compartments (e.g. first storage compartment) can comprise a storing shelf, storing compartment, storing cubicle, storing unit or storing receptacle for holding the goods of the sales and a transferring shelf (also known as storage compartment, unit, etc.) or replenish compartment for tallying the goods of sales. The transferring shelf (e.g. second storage compartment) facilitates temporary storage or transition of the goods so that the goods can be sequentially aligned according to their expiry dates before loading into the storing shelf, the storing compartment (e.g. first storage compartment), the storing cubicle, the storing unit or the storing receptacle. Any empty places of the automatic vending store may be used as the transferring shelf (e.g. second storage compartment) so that the automatic vending store becomes compact, without having an additional shelf or storage compartment. In some cases, an empty slot or cubicle of the first storage compartment can be utilized as the transferring shelf for keeping the goods temporarily for tallying.

[0017] The one or more storage compartments (e.g. shelf, first storage compartment) may comprise one or more thermally insulated compartments, drawers, slots or units for keeping the goods of sales at substantially constant temperatures, which are different from that of the ambient temperature. For example, the automatic vending store has a heat exchanger or refrigerant compressor so that any specific thermally insulated compartment, drawer, slot or unit is able to store the goods at predetermined temperature

over a prolonged period of time. For example, a thermally insulated compartment is kept at $-5^{\circ}\text{C}\sim-35^{\circ}\text{C}$ (minus five to minus thirty-five degree Celsius) as freezer; another thermally insulated compartment is kept at $2^{\circ}\text{C}\sim15^{\circ}\text{C}$ (two to fifteen degree Celsius) as refrigerator. Of course, if necessary, the thermally insulated compartment is also capable of being kept at $-40^{\circ}\text{C}\sim-85^{\circ}\text{C}$ (minus forty to minus eighty-five degree Celsius).

[0018] The one or more thermally insulated compartments can comprise an air conditioner, a refrigerator, a freezer, a chiller, a warmer or a cooker (e.g. a grill, a stove, a microwave oven), a fryer, an air fryer (e.g. by Maillard reaction). Hence, the automatic vending store is able to store or present goods (e.g. food) with predetermined temperatures. For example, the automatic vending store is capable of defrost frozen food, cook and deliver freshly cooked food to customers by the automatic organizer, offering much wide range of goods of sales than known convenience stores (e.g. 7-Eleven as an American-Japanese international chain of convenience stores, headquartered in Irving, Texas).

[0019] Embodiments of the one or more thermally insulated compartments comprise one or more access doors respectively, which are possible to open automatically for releasing the goods from interior, or to close automatically for keeping the goods inside, coordinated with the one or more automatic organizer. For example, a thermally insulated compartment of the automatic vending store has an automated access door at a cold storage compartment such that the automatic access door (i.e. access door) opens when the automatic organizer approaches the automatic access door for getting a frozen cod fish (*Gadus*) inside, and closes immediately when the automatic organizer picks the frozen cod fish and departs. Escape of cold air or intrusion of warm air is minimized at the cold storage compartment by the access door. The automatic vending store thus consumes less energy, as well as becomes cheaper to operate.

[0020] The automatic vending store may additionally comprise one or more moisture absorbers, dehumidifiers, water vapour removers or store dryers for removing water vapour, mist or water inside the automatic vending store. Since water often causes deterioration of performance to equipment at the automatic vending store, the one or more moisture absorbers, dehumidifiers, water vapour removers or store dryers enables excellent performance of the equipment at the automatic vending store. Moreover, dry

interior of the automatic vending store prevents growth of fungi or bacteria at the automatic vending store, extending shelf life of the goods of sales.

5 [0021] The one or more storage compartments, shelves or thermally insulated compartments of the automatic vending store are possible to be partially or substantially sealed or closed. For example, the automatic vending store has one or more wine racks or wine storage cabinets that protect alcoholic beverages of the automatic vending store from potentially harmful external influences, providing darkness, constant temperature, and constant humidity, similar to wine cellars. Sealing of any of the compartments is
10 possibly achieved by windows, doors or panels, whether with gasket or O-rings, sometimes providing hermetic or waterproof sealing.

[0022] The automatic vending store can further comprise one or more user interfaces connected to the payment terminal, the automatic organizer or both for operating the
15 automatic vending store. The user interface is also known as user terminal so that a user (e.g. customer or service technician of the automatic vending store) is able to operate (e.g. transact or diagnose) with the automatic vending store. Besides, the automatic vending store has multiple user interfaces or terminals so that several users are able to operate the automatic vending store simultaneously, without interfering each other. For
20 example, two customers are provided with separate touchscreens for purchasing their goods, whilst a service technician is able to upload software patch at another user interface or terminal in the meantime. Instead of employing many human sales assistant, the automatic vending store is capable of interacting with and serving quite a few customers without delaying any of them.

25 [0023] The one or more user interfaces or terminals may comprise a first user interface (e.g. touchscreen) and a second user interface (e.g. speech recognition device) that are spaced apart or at different position (e.g. height). For example, the first user interface includes a microphone at 90 cm off the ground so that a child is able to speak to the automatic vending store for buying candies. The second user interface has a touchscreen
30 that gives a graphic user interface at 1.2m (meter) above the ground so that a disabled customer in a wheelchair is able to purchase goods with the automatic vending store easily. Also, the automatic vending store optionally comprises two user terminals or interfaces that are laterally spaced apart (e.g. 20cm, 30cm, 50cm, 75cm, 100cm or

125cm apart, etc.) so that two customers can stand next to each other when transacting with the automatic vending store.

[0024] The first user interface and the second user interface can comprise chutes or dispensers respectively, which are spaced apart for delivering the goods of sales to users separately. Multiple users or customers are able to fetch or obtain their purchased goods at different locations of the automatic vending store, offering convenience, privacy and comfort of large space.

[0025] The user interface may comprise a gesture recognizer, a speech recognizer, a facial recognizer, haptic device, a touchscreen, a LCD/LED/plasma screen. Customers of different profiles (e.g. abled people or mute user) or preferences are able to transact with the automatic vending store with confidence and convenience, assisted by the diverse types of user interface or terminal. For example, a touchscreen of the user interface comprises a monitor filter (e.g. a screen protector, privacy screen, an anti-glare filter) for protecting the touchscreen so that a touchscreen of the user interface enjoys prolonged life span.

[0026] The automatic vending store can further comprise a communication unit (e.g. network interfaces, network interface controller) for communicating with an electronic communication device. The communication unit is optionally connected to any of the storage compartments, the payment terminal or the automatic organizer. The communication unit is able to transmit the data by cable(s) or wirelessly. For example, the communication unit can communicate with other electronic devices wirelessly by radio waves, sound waves or infrared light. Optionally, the communication unit includes one or more modems (modulator-demodulators) that is able to transmit and/or receive electronic signals of 2G (second-generation wireless telephone technology), 3G (third generation of wireless mobile telecommunications technology), 4G (fourth generation of mobile telecommunications technology), LTE Advanced Pro (LTE-A Pro, also known as 4.5G, 4.5G Pro, 4.9G, Pre-5G, 5G Project, and so on), 5G (5th generation mobile networks or 5th generation wireless systems) or more advanced generations. The communication unit can have one or more antennas that facilitate other types of wireless communication, such as Bluetooth (using short-wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz), Zigbee (IEEE 802.15.4-based specification). The communication unit includes a wired communication unit (e.g. ADSL modem) so that

existing infrastructure (e.g. telephone network) is readily utilized. The communication unit facilitates remote diagnosis, observation, and real time monitoring to the of the automatic vending store.

- 5 [0027] If adopting the wireless data transmission, the communication unit is configured to communicate (e.g. broadcast) with a mobile electronic device of a user automatically, according to identification of the user, possibly obtained by the one or more biometric reader. For example, the communication unit is able to transmit text messages (e.g. Short Message Service), images (e.g. promotion voucher) or alert signals (e.g. ringing tones or
10 beeps) to the mobile electronic device (e.g. smartphone) if detecting close presence of the user.

- [0028] The communication unit can additionally include an encrypter (i.e. encrypting device) or encoder that deploys cryptography to protect the data transferring. In one
15 instance, the communication unit employs a pseudo-random encryption key generated by an algorithm so that only an authorized recipient can decrypt the data with a suitable key provided by an originator to recipients, but not to unauthorized users or interceptors. The communication unit can also comprise a buffer or data buffer for storing data temporarily when operating the automatic payment terminal, the biometric reader or both.

- 20 [0029] The automatic vending store or the communication unit may comprise one or more electronic identities, or a single unique electronic identify for identifying the automatic vending store, the payment terminal or both the automatic vending store and the payment terminal (i.e. automatic payment terminal). The electronic identify is also known as an
25 identification number (e.g. serial number, identifier) or an electronic identification number that provides identity or a unique name of the automatic vending store or the communication unit, which may be automatically accessed or read by other electronic devices (e.g. computer, barcode reader). The identification number or electronic identification number can be associated with characteristics of the automatic vending
30 store or its goods (i.e. products) so that an operator of the automatic vending store is able to monitor operation of the vending closely, replenishing goods or repairing components upon receiving request from the automatic vending store, whether manually or automatically. For example, the identification of the automatic vending store is linked to a geographical location of the automatic vending store so that the operator can provide

precise location of the automatic vending store to a supplier for refilling the automatic vending store timely.

[0030] The identification of the automatic vending store or the communication unit offers a unique identifier or unique electronic identifier for automatic vending store or the communication unit of the automatic vending store. The unique identifier comprises a barcode, a serial number, a machine readable code, a QR (Quick Response) code, an IP (Internet Protocol) address (e.g. IPv4 address, IPv6 address), a MAC (Media Access Control) address, an IMEI (International Mobile Equipment Identity) number, a Wi-Fi address, a digital identity, an electronic address by hardware (e.g. screw position of a terminal block) or software (e.g. digital address "01", "11"). The electronic address in the software form includes digital addresses that are possibly recorded or programmed in a memory of the automatic vending store or the communication unit. The automatic vending store can further be locked or unlocked remotely for receiving goods replenishing or disposing expired goods. One or more electronic addresses may be used as the identity or electronic identity of the automatic vending store.

[0031] The automatic vending store can further comprise a recorder, a tracker or stock taker for recording stock or transaction of the goods on the shelf. For example, the recorder includes a scanner on a chute of the automatic vending store. The scanner is connected to a computer of the automatic vending store so that every outgoing goods is scanned and recorded by the computer, which keeps records of goods sold as existing the chute linking to a product dispenser (also known as take-out port) of the automatic vending store. The recorder, tracker or stock taker is possible to be implemented by hardware components, software programs or both, whether connected to a local computer or a remote computing server. Of course, the recorder, tracker or stock taker is possible to take stock of incoming goods, outgoing goods or both so that the automatic vending store has an updated records of available goods, possible to send request of goods replenishment when necessary.

[0032] The communication unit may comprise one or more computer ports, whether by hardware or software for computer networking. The computer ports facilitate secure, fast and stable communication so that the automatic vending store may be inspected or monitored remotely.

[0033] The automatic vending store can additionally comprise one or more hub connectors for bundling some signal wires, some power cables or both the signal wires and power cables together. The hub connector can adopt quick connect mechanism (e.g. snap & lock) or foolproof coupling so that the automatic vending store is easily transported to a different site, and quickly connect to a single or a few docking ports for fast operation. Technicians or operators of the automatic vending store do not have to identify and connect every signal or power lines individually.

[0034] The automatic vending store may further comprise a casing, a housing or a cover that conceals some components of the automatic vending store against external intrusion, whether by rain, dust or robbery. For example, the casing has legs that keep the automatic vending store off ground, preventing rainwater from flooding the goods of sale inside the automatic vending store. The casing, the housing or the cover optionally has ventilation holes, slits or lattices so that interior air of the automatic vending machine is kept fresh. One or more air filters and/or ventilation fans are further possible installed at the automatic vending store for keeping clean and hygiene interior of the automatic vending store, whether on the casing or not.

[0035] The automatic vending store can comprise an automatic alarm or simply alarm that is configured to send audio, electronic or visual signals to an operator in case of intrusion, as unauthorized access or irregular operation. The alarm is able to alert operators or police when facing burglary. Of course, the camera or surveillance camera can automatically capture images (e.g. photos or videos) of intruders, as activated by the alarm.

[0036] The automatic vending store may further comprise a local energy source (e.g. renewable energy harvester, battery) for powering the automatic vending store. The renewable energy harvester is able to glean or store solar power, thermal energy, wind energy, salinity gradients, and kinetic energy for operating the automatic vending store. The local energy source may also include a battery or power generator that is able to sustain automatic vending store over a predetermined period of time. When facing low power reservation or availability, the automatic vending store is able to send alarm or message to its operator for rescue, and shut down some non-essential functions of the automatic vending store, known as hibernation.

[0037] The automatic vending store optionally comprises an energy saver for adjusting power consumption of the automatic vending store in response to purchasing activities of the automatic vending store. The energy saver can be in software or hardware form, which is connected to the local energy source. The energy saver preserves or reduce energy consumption at the automatic vending store.

[0038] The automatic vending store can modular structure so that multiple pieces of the automatic vending stores are able to be joined together, providing a larger shopfront. The modular structure includes connectors, locks and bridge joints for joining two or more automatic vending stores mechanically, electrically and/or electronically.

[0039] In some cases, the automatic vending store or the one or more storage compartments have a height of 1.8m (meters), 2.3m, 2.5m, 2.8m, 3.2m, 3.6m or higher. In other words, the automatic vending store has tall one or more storage compartments for storing goods, which neither visible nor accessible directly by its customers. A tall automatic vending store utilizes vertical space for keeping more goods, and is able to fetch chosen goods by the automatic organizer. Alternatively, the tall automatic vending store requires less floor area or footprint for keeping the same amount of goods, as compared to the known convenience stores.

[0040] Possibly, the automatic vending store further comprises one or more windows for exposing or delivering the goods to a customer by the automatic organizer. Instead of viewing or inspecting the goods from a display screen or a window, the automatic organizer is able to bring a chosen product to a customer or receive a returned product from a customer. The window is optionally sealed or covered by a transparent material (e.g. glass), whether partially or fully.

[0041] The automatic vending store may further comprise one or more transparent, opaque or semitransparent panels for covering, shielding, blinding or exposing the goods of sales, whether on the casing or window. The one or more panels optionally comprise one or more display screens (e.g. touchscreens) for interaction with customers or users

[0042] The automatic vending store can include one or more timers or clocks that facilitate time restriction for sales of controlled items (e.g. cigarettes and liquor), which are not available after permitted time slots according to laws or regulations. For example,

the automatic vending store is configured or operable to refuse selling of vodka after 10PM (22:00) daily. A computer, which optionally include the communication unit, the clock, the timer and/or other components, can be remotely configured or operated to make necessary changes (e.g. software patching).

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[0043] The automatic vending store or its component (e.g. computer) may be installed with a customer relationship management (CRM) programme, which is configured to manage interaction between the automatic vending machine and its customers. The customer relationship management uses data analysis about customers' history with the automatic vending machine to improve business relationships with customers, specifically focusing on customer retention and ultimately driving sales growth. Alternatively speaking, the customer relationship management (CRM) programme is able to track, record, recognize, analyze, transmit and/or store consumers' behavior information for improved consumer shopping experience.

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[0044] The automatic vending store can update inventory of the automatic vending store, such as by setting up inventory buffer level, sending out order notification when encountering low buffer at the automatic vending store. In other words, the automatic vending store is able to send messages or alarms to a remote computing server or a mobile device so that an operator or supplier of the vending machine is able to replenish the goods of sales to the automatic vending machine.

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[0045] According to a second aspect, the present application provides a method of using an automatic vending store. The method comprises a first step of providing an automatic vending store; a second step of loading a first storage compartment of the automatic vending store with goods of sales; and a third step of moving one or more of the goods of sales from the first storage compartment to a second storage compartment of the automatic vending store automatically, in the absence of transaction. Hence, the automatic organizer is able to sort or arrange the goods of sales inside the automatic vending store, instead of just pushing out an item of the goods of sales when receiving payment. The automatic organizer sometimes performs tasks of a tallying clerk. Hence, the moving of the one or more of the goods of sales optionally comprises a step of tallying the goods of sales.

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[0046] The method can further comprise a step of examining identify information of a user (e.g. customer or service technician); and another step of deciding on whether to grant access to the user. For example, the automatic vending machine is able to scan, recognize (e.g. by OCR and decide on whether the user is allowable to transact or access the automatic vending store. For example, the automatic vending store is able to scan a face of a service technician and verify with a remote database on whether the service technician is permitted to open the automatic vending store.

[0047] The method may further comprise a step of sending message to a remote electronic device for replenishing the goods of sales. The communication unit of the automatic vending store is able to transmit electronic data or message remotely in order to keep stock of the automatic vending machine at a sufficient level.

[0048] The method is possible to comprise a step of transfer an item or product (as goods of sales) between a first automatic organizer and a second automatic organizer of the automatic vending machine. The two automatic organizers are able cooperate with each other or work independently from each other so that the automatic vending store is able to handle a larger area or wider range of goods of sales.

[0049] According to a third aspect, the present application provides a method of detecting the availability of one or more pieces of goods of sales. The method comprises a first step of identifying a disruption of signal of one or more sensors; a second step of identifying a location of the disruption; a third step of checking an allowable item in the location; and fourth step of recording the number of item in the location.

[0050] According to a fourth aspect, the present application provides a method of entering an item specification for one or more goods of sales. The method comprises a first step of encoding the item specifications in a machine and human readable file (XML); and a second of saving the machine and human readable file into a memory storage (USB, local computer, remote computer).

[0051] According to a fifth aspect, the present application provides a method of dispensing goods of sales. The method comprises a first step of receiving a selection of an item of the goods of sales from a tactile display screen; a second step of activating an automatic organizer (e.g. robotic arm); a third step of picking the item; a fourth step of

detecting a disruption of signal of the sensor in the location to adjust the quantity (e.g. decrease); and a fifth step of depositing the item into a dispensing chute or dispenser.

5 [0052] According to a sixth aspect, the application offers a method of stocktaking. The method comprises a first step of locating the position of a mobile device (e.g. smart phone of the vending technician); a second step of loading the relevant machine and human readable file into the mobile device; a third step of scanning a machine readable code (UPC) on the item; a fourth step of placing the item in the location determined by the machine and human readable file; and fifth step of checking the number of disrupted
10 sensors (e.g. counting by computer).

[0053] According to a seventh aspect, the application provides a method of arranging the item, which comprises a first step of picking and placing the old items from a first location to a temporary storage; a second step of picking and placing the new items from a second
15 location into the first location; a third step of picking and placing the old items from the temporary storage to the first location.

[0054] According to an eighth aspect, the present application offers a method of tracking at least one (i.e. one or more) eye of a consumer using a camera. The method comprises
20 a first step of tracking a face; a second step of tracking a location of the eyes; a third step of detecting the presence of a sclera and an iris; and a fourth step of effecting a selection by blinking.

[0055] According to a ninth aspect, the present application provides a method of tracking
25 a body gesture (e.g. hand movement) of a consumer using the camera. The method includes a first step of tracking the face; and a second step of tracking a hand and the digits.

[0056] According to a tenth aspect, the present application provides a method of
30 recognizing and interpreting a voice using a microphone. The method includes a first step of identifying the harmonics of the voice of the consumer; a second step of matching the harmonics with the saved harmonics in the memory storage; and a third step of interpreting the harmonics to a corresponding command.

[0057] According to an eleventh aspect, the present application provides a method of registering a new member. The method includes a first of receiving a tactile input or an eye input or a voice input or all or combinations thereof; a second step of capturing an image of a face of the consumer (e.g. authentication, facial payment); and a third step of
 5 acquiring a voice recording (authentication) of the consumer.

[0058] According to a twelfth aspect, the application presents a method of payment that comprises a first step of presenting a plurality of payment options such as cash, card, contactless (e.g. by NFC, smartphone) or facial scanning; and a second step of deducting
 10 an equivalent value from the account of the consumer.

[0059] According to a thirteenth aspect of the application, the present application provides a method of controlling the sales of items by time. According to a thirteenth aspect of the application, the applications offers a method of controlling the sales of items by facial
 15 recognition, wherein a saved registered image is compared with a live image of the consumer. Some of the previously mentioned methods or method steps are able to be combined, divided or changed in sequence.

[0060] The accompanying figures (Figs.) illustrate embodiments and serve to explain principles of the disclosed embodiments. It is to be understood, however, that these
 20 figures are presented for purposes of illustration only, and not for defining limits of relevant inventions.

Fig. 1 illustrates an automatic vending store;

Fig. 2 illustrates an internal left view of the automatic vending store;

25 Fig. 3 illustrates a view of an ajar access door of the automatic vending store;

Fig. 4 illustrates the vending technician holding a mobile device for stocktaking;

Fig. 5 illustrates an internal right view of the automatic vending store;

Fig. 6 illustrates the modes of operation of the automatic vending store;

Fig. 7 illustrates a method of detecting an item in the automatic vending store;

30 Fig. 8 illustrates a method of entering the item specifications;

Fig. 9 illustrates a method of dispensing the item;

Fig. 10 illustrates a method of stocktaking with the automatic vending store;

Fig. 11 illustrates a method of arranging the item;

Fig. 12 illustrates a method of detecting ambient temperature;

35 Fig. 13 illustrates a method of tracking an eye of a consumer;

Fig. 14 illustrates a method of tracking a hand gesture of the consumer;

Fig. 15 illustrates a method of recognizing a voice of the consumer;

Fig. 16 illustrates a method of registering a new consumer;

Fig. 17 illustrates a method of selecting an item on the automatic vending store; and

5 Fig. 18 illustrates a method of requesting payment on the automatic vending store;

[0061] Exemplary, non-limiting embodiments of the present application will now be described with references to the above-mentioned figures. Particularly, Figs. 1 to 5 refer to a first embodiment of the present application.

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[0062] Fig. 1 illustrates an automatic vending store 100 with six display screens 102 positioned at a front side 101 thereof and six dispensers 104 positioned below the display screens 102. There are also six payment terminals 106 located on the right sides of the display screens 102. Below the payment terminal 106 is a reader module 122. Above the
15 payment terminal 106 is a vending external camera 120, a microphone 124 and a speaker 126.

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[0063] On a right front side of the automatic vending store 100 is an access door 108. A height of the access door 108 is about two thousand millimetres (2000 mm) with a breadth of about eight hundred millimetres (800 mm) and a thickness of about three hundred millimetres (300 mm). A vending technician 118 stands on a right side of the automatic vending store 100.

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[0064] The automatic vending store 100 has a store length 110 of about five thousand millimetres (5000 mm), a store depth 112 of about two thousand millimetres (2000 mm) and a store height 114 of about two thousand eight hundred millimetres (2800 mm). At a top store length 110 of the automatic vending store 100 is a stretch of static advertisement section 116.

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[0065] The height of the one tactile display screen 102 is about one thousand millimeters (1000 mm) and a width of about five hundred millimetres (500 mm or millimeters).

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[0066] Fig. 2 illustrates an internal left view 140 of the automatic vending store 100. The front side of the automatic vending store 100 is removed exposing the five dispensers 104 on a ground arranged in a straight line. Each dispenser 104 comprises a pivotal

trough 166 that is pivotally supported by two stands on the sides. Below the pivotal trough 166 is an inclined plane 168 that leads to a collection trough 170 at a bottom near the ground.

5 [0067] Behind the dispensers 104 is a lower anthropomorphic robotic arm 142 with an end effector at its terminal. The lower anthropomorphic robotic arm 142 travels along a lower rail track 144 which is laid on the ground. The lower anthropomorphic robotic arm 142 is slightly elevated at about six hundred millimeters (600 mm). The lower anthropomorphic robotic arm 142 is mounted on a stepper motor (not shown) with an
10 enclosure that is responsible for lateral movement on the lower rail track 144. The upper anthropomorphic robotic arm 146 is also mounted on another stepper motor (not shown).

[0068] The lower rail track 144 extends the whole store length 110 of the automatic vending store 100. The lower rail track 144 is made up of more than one short lower rail
15 track 144. Directly above the lower anthropomorphic robotic arm 142 is an upper anthropomorphic robotic arm 146 which travels along an upper rail track 148. Similarly, the upper rail track 148 is made up of more than one short upper rail track 148. The upper rail track 148 is installed on the top internal side of the automatic vending store 100. Both the lower and upper anthropomorphic robotic arm 142,146 have at least one robot
20 camera 160 attached near an at least one end effector 162. The end effector 162 is either a suction cup or a grasping digits 174. The robot camera 160 is connected to a local computer 164 either through electrical wires or wirelessly. The local computer 164 is hidden from sight to the vending technician 118. At the left end of the lower rail track 144 is a table 172. On the table 172 top is the grasping digits 174.

25 [0069] Behind the rail tracks 144,148 are four different storage sections. The storage section includes the freezer 150, the chiller 152, the ambient storage 154 and the inventory storage 156. Starting from the left side as viewed from the front side of the automatic vending store 100 is a freezer 150, a chiller 152, an ambient storage 154 and
30 an inventory storage 156. The freezer 150 and the chiller 152 have a plurality of automatic door 158 located at the front side thereof. There are five columns by four rows of individual storage compartments in each of the freezer 150 and the chiller 152. The automatic doors 158 are positioned in front of each storage compartment. The automatic doors 158 are controlled by the local computer 164. There are two ambient storages 154
35 as shown in Fig. 2. The first ambient storage 154 has four shelves and four columns

separated by a vertical divider. The second ambient storage 154 has four shelves and three columns. The first ambient storage 154 stores regular shaped items such as boxed items which have flat surfaces. The second ambient storage 154 stores irregular shaped items such as tubes and vertical form fill and seal (VFFS) pillow bags. The inventory storage 156 is on the right side of the second ambient storage 154 which is vacant.

[0070] Fig. 3 illustrates a view 190 of an ajar access door 108. Three different items are deposited at the inventory storage 156 inside the automatic vending store 100. The regular shaped item is item with the flat surface is the tetra pack 192. The irregular shaped items are a bottle 194 and a pillow bag 196. A vending camera 198 is installed inside at a high position near the access door 108 overseeing the entire internal automatic vending store 100.

[0071] Fig. 4 illustrates the vending technician 118 holding a mobile device 202 for stocktaking 200. The tetra pack 192, the bottle 194 and the pillow bag 196 are placed onto the inventory storage 156 by the vending technician 118. The inventory storage 156 has four horizontal shelves 204. Each shelf 204 is separated by three vertical shelf dividers 206 to demarcate four compartments 208. In each compartment 208, a label 210 is adhered to a surface of the shelf 204. The surface of the shelf 204 is specifically at a front surface 212 of the shelf 204 which is visible to a standing vending technician 118. The exception is a bottom shelf (not shown) where the surface of the shelf 204 refers to a top surface 214. The four compartments 208 on the one shelf have four labels 210 thereon. Alternatively, the label 210 can be adhered to the two surfaces namely the front surface 212 and the top surface 214.

[0072] The label 210 on the four shelves 204 of the inventory storage 156 is a machine-readable code, for example, a barcode 216. The barcode 216 is a linear or one-dimensional represented by widths and gaps of parallel lines usually vertical lines. The barcode 216 is compliant with the international barcode quality specification ISO/IEC 15416 (linear).

[0073] The top shelf also known as the first shelf is labelled as S1. The shelf below the top shelf, S1 is known as the second shelf is labelled as S2. Below the second shelf, S2 is the third shelf labelled as S3. The bottom shelf is known as the fourth shelf and labelled as S4.

[0074] Each compartment on each shelf is also labelled starting from the left progressing to the right is C1, C2, C3 and C4 which means compartment 1, compartment 2, compartment 3 and compartment 4 respectively.

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[0075] Therefore, to differentiate the different compartments on different storage sections, a unique identifier is assigned to each compartment. For example, "IS1S1C1" represents the inventory storage 1 (IS1), the first shelf (S1), the first compartment (C1). Other storage sections; the freezer 150, the chiller 152 and the ambient storage 154 are also assigned a code.

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[0076] The unique identifier is coded onto the barcode 216 specifically using Code-128 which is a high density linear barcode 216 symbology. It is used for alphanumeric or numeric-only barcodes. It can encode all one hundred and twenty-eight characters of ASCII and, by use of an extension (FNC4), the Latin-1 characters defined in ISO/IEC 8859-1. Code 128 includes one hundred and eight symbols: one hundred and three data symbols, three start symbols, and two stop symbols. Each symbol consists of three black bars and three white spaces of varying widths. All widths are multiples of a basic "module". Each bar and space is one to four modules wide, and the symbols are fixed width: the sum of the widths of the three black bars and three white bars is 11 modules.

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[0077] The stop pattern composes two overlapped symbols and has four bars. The stop pattern permits bidirectional scanning. When the stop pattern is read left-to-right (the usual case), the stop symbol (followed by a 2-module bar) is recognized. When the stop pattern is read right-to-left, the reverse stop symbol (followed by a 2-module bar) is recognized. A scanner seeing the reverse stop symbol then knows it must skip the 2-module bar and read the rest of the barcode 216 in reverse.

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[0078] Code-128 does not have one hundred and twenty-eight distinct symbols, so it cannot represent one hundred and twenty-eight code points directly. To represent all one hundred and twenty-eight ASCII values, it shifts among three code sets (A, B, C). Together, code sets A and B cover all one hundred and twenty-eight ASCII characters. Code set C is used to efficiently encode digit strings. The initial subset is selected by using the appropriate start symbol. Within each code set, some of the one hundred and three data code points are reserved for shifting to one of the other two code sets. The

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shifts are done using code points ninety-eight and ninety-nine in code sets A and B, one hundred in code sets A and C and one hundred and one in code sets B and C to switch between them):

- 128A (Code Set A) – ASCII characters 00 to 95 (0–9, A–Z and control codes), special characters, and FNC 1–4;
- 128B (Code Set B) – ASCII characters 32 to 127 (0–9, A–Z, a–z), special characters, and FNC 1–4;
- 128C (Code Set C) – 00–99 (encodes two digits with a single code point) and FNC1.

[0079] The barcode 216 for the inventory storage 1 (IS1), the first shelf (S1), the first compartment (C1) is as shown in Fig. 4 using the Code 128B (Code Set B).

[0080] Besides the labels 210 on the individual compartments 208 of the shelves 204, the items are also labelled. The items refer to the tetra pack 192, the bottle 194 and the pillow bag 196. An example of the tetra pack 192 is a packet of milk. An example of the bottle 194 is a bottle of fruit juice and an example of the pillow bag 196 is a packet of potato chips.

[0081] The items 192, 194, 196 use Universal Product Code (UPC). The UPC is a barcode symbology (technically refers to UPC-A) consists of 12 numeric digits, that are uniquely assigned to each trade item. Along with the related EAN (European Article Number) barcode, the UPC is the barcode mainly used for scanning of trade items at the point of sale (POS), per GS1 (GS1 is a not-for-profit organisation that develops and maintains global standards for business communication) specifications. In addition to the POS, the UPC is also used for inventory tracking.

[0082] UPC data structures are a component of GTINs (Global Trade Item Number) and follow the global GS1 specification, which is based on international standards. But some retailers (clothing, furniture) do not use the GS1 system (rather other barcode symbologies or article number systems). On the other hand, some retailers use the EAN/UPC barcode symbology, but without using a GTIN (for products, brands, sold at such retailers only).

[0083] The mobile device 202 held by the left hand of the vending technician 118 has a software application in it. An index finger of a right hand of the vending machine 118 is guided by the instructions on a display screen of the mobile device 202. The mobile device 202 can be a smartphone or a tablet with wireless communication capability.

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[0084] Alternatively, the individual compartment 208 can have a detachable tray installed which is shown in Fig. 4 located at the inventory storage 156, second shelf, first compartment (IS1S2C1). The detachable tray 218 is a closed rectangular metal box with an opened side. The opened side is facing away from the shelf 204. Inside a right bottom corner is a strip of breadboard 220. The breadboard 220 is placed longitudinally along a length of the detachable tray 218. At an end of the breadboard 220 is a coupler (not shown) that is connected to another coupler for electricity and signal transfer between at least one photoelectric sensor 222 and the local computer 164. The breadboard 220 has a plurality of perforations on its surface providing the insertion of the at least one photoelectric sensor 222 through the perforations. There are six photoelectric sensors 222 on the strip of breadboard 220. At the top side disposed towards the centre of the detachable tray 218 is a tray camera 224 mounted on a conveyor belt 226.

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[0085] Fig. 5 illustrates an internal right view of the automatic vending store 100 with the upper rail track 148 located above and in front of the storage sections. A view of the inventory storage 156 is shown with a tetra pack 192 at the first shelf 204, third compartment 208 which is labelled with a barcode of IS1S1C3.

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[0086] The second ambient storage 154 is located at the left side adjacent to the inventory storage 156 as seen from the front. The first ambient storage 154 is located at the left side adjacent to the second ambient storage 154 as seen from the front.

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[0087] The second ambient storage 154 have four shelves 204 and on each shelf has three compartments 208. Each compartment is labelled with barcodes bearing a unique identifier. On the first shelf, compartment one, AS2S1C1 and two, AS2S1C2 are filled with cylindrical containers of potato chips. Still on the first shelf, compartment three, AS2S1C3 is filled with pillow bags of potato chips. Moving on to the second shelf, compartment one, AS2S2C1 is filled with boxes of muesli. Compartment two and three, AS2S2C2 and AS2S2C3 are filled with pillow bags of corn chips. Moving on to the third

shelf, compartment one, two and three, AS2S3C1, AS2S3C2 and AS2S3C3 are filled with pillow bags of various items.

5 [0088] The first ambient storage 154 has four shelves and on each shelf four compartments. On the first shelf, all four compartments, AS1S1C1, AS1S1C2, AS1S1C3 and AS1S1C4 are filled with boxes of cereals. Similarly, for the second shelf, all four compartments, AS1S2C1, AS1S2C2, AS1S2C3 and AS1S2C4 are filled with boxes of cereals. The same goes for the third and the fourth shelf with all four compartments, AS1S3C1, AS1S3C2, AS1S3C3, AS1S3C4, AS1S4C1, AS1S4C2, AS1S4C3 and
10 AS1S4C4.

[0089] The chiller 152 has four rows and five columns of compartments. Each compartment is also labelled, for example, C1S1C1 represents Chiller 1, Shelf 1, Compartment 1 and C1S4C5 represents Chiller 1, Shelf 4, Compartment 5. Compartment
15 1 begins on the left and Compartment 5 ends on the right. Shelf 1 begins on the top shelf and Shelf 4 on the bottom shelf.

[0090] The lower anthropomorphic robotic arm 142 is picking a chilled item from the chiller 152, specifically C1S3C4 or Chiller 1, Shelf 3, Compartment 4. There are items
20 deposited in the dispensers 104.

[0091] Functionally, the access door 108 at the front side of the automatic vending store 100 provides a walk-in access into the automatic vending store 100 by the vending technician 118. The automatic vending store 100 as shown in Fig. 1 is installed at a built-
25 up area where the sides thereof are attached to fixed installation such as a wall (not shown). The provided dimensions of the access door 108 provides a convenient access to the vending technician 118 who is carrying items for replenishment as well as retrieval of defective or soon-to-be expire items from the automatic vending store 100.

30 [0092] The vending external camera 120 provides an image and video capturing means. In particular, the face of the consumer during registration and facial detection and recognition. In addition, the acquired image of the consumer provides image identification. For example, if a registered member of the automatic vending store 100 was a twenty-year-old man with a registered image in the local computer 164. An impostor who may
35 be a sixteen-year-old girl wanted to buy a controlled item (cigarette or alcohol) using the

twenty-year-old man identity, the vending external camera 120 is able to recognize the impostor and forbid further transaction. The algorithm in the local computer 164 may even alert the registered member and the law enforcement authority.

5 [0093] The reader module 122 provides a means to read the information of a smartcard and a smart phone having NFC (Near Field Communications) protocol of the consumer specifically for payment. The microphone 124 provides a voice acquiring means for translating the voice into a tangible action of the automatic vending store 100. The speaker 126 provides an output audible sound which can be a pre-recorded set of
10 messages for certain actions or an audible alarm or both. For example, if there were no stocks left for an item and the consumer continued to select, an audible message would be heard like "Sorry the item you've selected is not available." The message is also displayed on the tactile display screen 102 to inform the consumer.

15 [0094] The static advertisement section 116 is located at the top store length as the advertisement is not frequently changed. It also provides a channel for advertisers to communicate their brands to the consumers who visit the automatic vending store 100. The static advertisement section 116 is a source of revenue generating medium for the owner of the automatic vending store 100.

20 [0095] In the event if there were no advertiser, the brand name of the automatic vending store 100 can be placed. The advertisement section 116 is a light box which has a translucent Perspex at a front with fluorescent tubes or LED (light emitting diodes) or neon lights spread evenly inside the light box to provide uniform backlit illumination.

25 [0096] The dispenser 104 is typically positioned lower as it is considered infrequent access compared to the tactile display screen 102 which is accessed frequently and at a height that is convenient to see at a standing position. Normally the consumer has to look at the items on offer at the automated vending store 100 before committing to purchase
30 at least one item. Very often the consumer may not even purchase anything. Hence, it is of ergonomics and practical reason that the dispenser 104 is positioned lower.

[0097] The pivotal trough 166 provides a holder for a purchased item. The purchased item is deposited at the pivotal trough 166 by either the lower anthropomorphic robotic
35 arm 142 or the upper anthropomorphic robotic arm 146. The local computer 164 controls

the turning of the pivotal trough 166. Once tilted in an anti-clockwise direction as observed from the right side, the purchased item drops and slides on the inclined plane 168 and slides into the pivotal trough 170 for collection. The pivotal trough 166 and the collection through 170 are formed in a half cylindrical shape so that the purchased item will not be damaged. Especially for item with rounded surface such as glass or bottle, the item can rest safely within the trough 166,170.

[0098] Between the storage sections at the rear and the dispensers 104 at the front, the lower rail track 144 is laid on the ground to provide a linear track for lateral movement (right to left and left to right) for the lower anthropomorphic robotic arm 142. The lower anthropomorphic robotic arm 142 is slightly elevated so that more storage space is available on the ground which is not occupied by the lower rail track 144. Conversely, if the lower anthropomorphic robotic arm 142 is not elevated, the rotation on its own axis will render no storage space as the space is needed for its maneuverability especially when picking item from the storage sections, rotating and depositing at the pivotal trough 166.

[0099] The lower and upper anthropomorphic robotic arm 142,146 provides the picking of item from one storage section to another storage section or to the dispenser 104. The lower anthropomorphic robotic arm 142 serves the lower height shelves. The upper anthropomorphic robotic arm 146 serves the higher shelves. The lower and upper anthropomorphic robotic arm 142,146 is a ABB® IRB 2600 IRC5 which has a horizontal reach of about 1650 mm. The anthropomorphic robotic arms 142,146 complement each other at areas where one of them is unable to reach. The table 172 provides a platform for the exchange of the suction cup and the grasping digits 174.

[0100] The lower rail track 144 and the upper rail track 148 are short pieces instead of one extended piece for easier assembly and transportation. The robot camera 160 near the end effector 162 provides a visual acquisition of the item to be picked by the anthropomorphic robotic arms 142,146. The acquired image of the item can include the item name, expiry date or best before date which is analyzed by the local computer 164. There can be one robot camera 160 or more than one mounted on its periphery to provide fail-safe and redundancy measures. The end effector 162 which can be a suction cup provides the picking of items with regular surface (flat surface) whilst the grasping digits

174 provides the picking of items with irregular surface such as bottles or pillow bags. The suction is provided by a vacuum.

5 [0101] The freezer 150 provides the storage of frozen items. The chiller 152 provides the storage of chilled items. The ambient storage 154 provides the storage of items that are not temperature critical. The inventory storage 156 provides the storage of items for replenishment or return. Items on the inventory storage 156 are deposited by the vending technician 118 so that the anthropomorphic robotic arms 142,146 are able to pick and put at the appropriate storage section which include the freezer 150, the chiller 152 and
10 the ambient storage 154.

[0102] The automatic door 158 particularly at the freezer 150 and the chiller 152 provide an insulation from the ambient temperature keeping stable cold temperature stable within the freezer 150 and the chiller 152. The temperature of the freezer 150 is below zero
15 degree Celsius and the temperature of the chiller 152 is less than fifteen degrees Celsius.

[0103] The vending camera 198 inside the automatic vending store 100 provides a visual inspection of the operations of the anthropomorphic robotic arms 142,146 as well as the vending technician 118 who is delivering the items to replenish or to collect. The vending
20 camera 198 also provides security video footage if there were any break in or any unauthorized tampering by the vending technician 118 or any other people.

[0104] The function of labelling the individual compartments provide an electronic tagging thereof. The barcode labelling is used as it is cheap to implement. Alternatively, a more
25 sophisticated two-dimensional machine readable code like Quick Response (QR) code can be used. QR code is able to contain more information compare to the simple barcode. The 128A barcode is used as it can encode ASCII characters (0–9, A–Z and control codes) which is adequate for the current labelling. UPC is commonly used by item manufacturers and provides tracking of the items both for inventory tracking and point of
30 sale tracking.

[0105] The mobile device 202 provided in Fig. 4 enables the vending technician 118 to replenish and to collect the items from the automatic vending store 100. The software application in the mobile device 202 provides an interface between the mobile device 202
35 and the vending technician 118. The software application communicates with the local

computer 164 via a communication module in the mobile device 202. The local computer 164 resides in the automatic vending store 100 and also has the communication module therein. The software application enables the vending technician 118 to perform stocktaking. The stocktaking process will be described in detail in the later part.

- 5 Additionally, the mobile device 202 provides picture and/or video taking of the status of the automatic vending store 100. The location of the vending technician 118 can also be tracked by a global positioning system (GPS) which is built in the mobile device 202.

- 10 [0106] The communication module comprises a wireless module which communicates using Wi-Fi based on the IEEE802.11 or 3G, 4G LTE (4th Generation Long Term Evolution). Wi-Fi is used for local area network where there is a local router proximal to the mobile device 202. The local router inevitably has to connect to a network port which is usually on a wall. The connection is a twisted cable pair usually a CAT 5 cable with a RJ45 terminator connected to a corresponding RJ45 female network port on the wall for
- 15 Internet access. Alternative wireless connection between the mobile device 202 and the local remote computer 164 can be achieved by using Bluetooth.

- 20 [0107] 3G, 4G LTE are provided by carriers like Singtel, M1, Starhub, Verizon, AT&T, NTT Docomo (telco providing infrastructure to enable mobile data communication and telephony). The wireless communication is important for the mobile device 202 for mobility. Conversely, a wired communication restricts the mobility in handling the mobile device 202 making stocktaking cumbersome and hence contrary to being productive. The wireless communication between the mobile device 202 and a remote computer located at a remote location can be achieved using the network infrastructure provided by the
- 25 carriers (Telco). Likewise, the wireless communication between the local computer 164 and the remote computer is also possible. The remote computer can also assume the responsibilities of the local computer 164.

- 30 [0108] However, in the event that there is no Wi-Fi (void of local network) and no network service available which may happen, the vending technician 118 has the option to plug into a standard connector like a USB (Universal Serial Bus) Mini-A of the mobile device 202 using a spring insulated cable (coiled cable) which is extendable and retractable. The other end of the spring cable connects to a USB Type A connector of the local computer 164.

[0109] The local computer 164 provides technical functions such as first, controlling the motions of the two anthropomorphic robotic arms 142,146 mounted on the two rail tracks 144,148.

5 [0110] Second, storing information with regards to the items inside the automatic vending store 100. The information contains a brand, a category (beverage, food, snacks, etc.), a temperature classification (frozen, chilled, normal), a best before date (or expiry date), an in-store date (the date when the item is inside the vending store 100), an out-store date (when item is sold or rejected if defective), an item description (description for the
10 consumer to read), an item retail price, a quantity of the item, an image of the item, a contact information of the supplier of the item (if the stock is low, contact supplier to replenish). The mentioned information is non-exhaustive and can contain miscellaneous information of the item. The supplier can either be the vending technician 118 who is an employee of the vending store 100 or can be the actual supplier of the item.

15 [0111] Third, the local computer 164 keeps a log (time and video footage) of the access of the automatic vending store of the vending technician 118.

[0112] Fourth, the local computer 164 keeps a record of the items sold and the revenue
20 generated therefrom.

[0113] Fifth, the local computer 164 captures the information of the consumer who purchase the item from the store 100. The consumer information includes a first name, a last name, an electronic email, a contact phone number, a date of birth, a gender, a photo
25 identification, a voice recording, etc., a record of the past purchases (for an improved consumer buying experience). Based on the past purchases record, the local computer 164 can suggest to the consumer with relevant items or familiar items to buy. The captured information can also be used to present to prospective advertisers, item suppliers to encourage them to leverage on the presence of the automatic vending store
30 100, in particular, the demographics of the consumers, items that are regularly purchased. Hence, increasing the revenue of the vending store 100 and also helping advertisers and suppliers in their market outreach and expanding their brand presence.

[0114] Sixth, the local computer 164 has communication with a plurality of temperature sensor located at temperature critical sites like the freezer 150 and the chiller 152 to detect temperature fluctuations.

5 [0115] Seventh, the local computer 164 gathers information with the consumer through cameras (image sensors), microphones (audio sensors) 124, inputting devices such as the keypad and the tactile display screen 102. Other means of gathering information can be from the Internet provided there is communication available specifically through social media such as Facebook. The consumer can log in his or her registered account of the
10 automatic vending store 100 to fetch personal information from the Facebook and populate the record in the local computer 164. In a same way, information like item purchased can also be uploaded to the registered and verified consumer's Facebook account to provide an interactive purchasing experience. The experience is shared to the consumer's contact list which helps to promote the presence of the automatic vending
15 store 100.

[0116] Eighth, the local computer 164 outputs information to the consumer through the tactile display screen 102 which is the primary mode of output communication between the consumer and the local computer 164. Additionally, the local computer 164 controls
20 the operations of the anthropomorphic robotic arms 142,146 and other external peripherals which are inconspicuous to the consumer.

[0117] In essence, the local computer 164 provides information gathering, processing, storing and based on the information controls the external peripherals to perform a
25 desired outcome to fulfil the demands of the consumer. The demand pertains to the sales of items, the timely and relevant item information presentation to enable the consumer to make an informed decision on his or her purchase. The local computer 164 has a memory storage to enable it to store the information aforementioned.

30 [0118] The local computer 164 and the external peripherals which include the tactile display screen 102, the dispenser 104, the payment terminal 106, anthropomorphic robotic arms 142,146, the freezer 150, the chiller 152, the lightings in the static advertisement section 116, the at least one vending camera 198, the robot cameras 160 are powered by an electrical grid which supplies a root mean square (RMS) mains
35 voltage of 240 Volts AC. All the external peripherals including the local computer 164 use

a voltage less than the mains voltage. Therefore, a step-down transformer is used to decrease the voltage to an appropriate voltage which is suitable for the individual peripheral and parts. To ensure a continuous electrical supply to the automatic vending store 100, the mains is connected to an uninterrupted power supply (UPS) prior to supplying thereto. In the event of a power outage, the UPS can continue to operate for a determined period of time to make sure all information is uploaded to the remote server or backed up. After which the automatic vending store 100 prepares to shut down if the electrical supply is not resumed. Alternative power source can be from a plurality of solar panel which converts light from the Sun and convert to electrical energy which is stored in a battery and consumed by the automatic vending store 100.

[0119] In use, the automatic vending store 100 provides two modes of operation 250, a consumer mode and a store mode as shown in Fig. 6. The consumer mode pertains to the interactions of the consumer and the automatic vending store 100. The store mode pertains to the background activities that makes the automatic vending store 100 operational and ready to serve the consumer.

[0120] The store mode 252 further comprising detecting the availability of at least one item 254, entering an item specification for the at least one item 256, dispensing the at least one item 258, tracking the at least one item 260 and replenishing the at least one item 262.

[0121] The consumer mode 264 further comprising tracking of at least an eye 266, tracking of gestures (hand/body) 268, recognizing a voice 270, registering (web/vending store) 272, selecting the at least an item 274, requesting payment 276, identifying facial features 278 and suggesting items 280.

[0122] For illustrative purpose, the item is assumed to be a box of ice-cream which is to be stored in the freezer 150 on the first shelf 204 in the first compartment 208. The first compartment has a unique identifier, F1S1C1.

[0123] Fig. 7 illustrates a method of detecting the availability of at least an item 300 in a compartment 208 comprising the steps of first, identifying a disruption of signal of the photoelectric sensors 302. Secondly, identifying the location of the disruption, the freezer compartment 304, the chiller compartment 306, the ambient storage compartment 308

or the inventory storage compartment 310. If the disruption is located at the freezer compartment, the physical quantity will be increased by one 312. Thirdly, is to check whether the maximum allowable items in the compartment 208 has been reached. Fourthly, is to record the final count 316 of the quantity in the compartment 208 into the memory storage of the local computer 164. The detecting of the item comes to an end 318.

[0124] In detail, a plurality of diffuse photoelectric sensor 222 is installed at the ingress of F1S1C1, in particular, at the top front of the compartment which has an automatic door 158. Each time a body (human body or hand) which can be either the anthropomorphic robotic arm 142, 146 or the hand of the vending technician 118 approaches the automatic door 158, the photoelectric sensor 222 is triggered and the automatic door 158 opens. The automatic door 158 is in a normally closed position to ensure that the inner cold temperature is maintained.

[0125] Alternatively, the automatic door 158 is opened by the local computer 164. Since the local computer 164 has the foreknowledge of the movement of the picked item by the lower anthropomorphic robotic arm 142 from the inventory storage 156 to the freezer 150 at F1S1C1 and a known distance, the local computer 164 sends a control signal to open the automatic door 158 corresponding to F1S1C1. However, doing so assumes that the time to pick the item from the inventory storage 156, travelling on the lower rail track 144 and to the freezer 150 are measured, calculated and verified which makes troubleshooting and expansion in the future difficult.

[0126] Inside the compartment is the detachable tray 218 as shown in Fig. 4, there is a different set of diffuse photoelectric sensors 222 mounted on the strip of breadboard 220 at regular intervals. The strip 220 is installed along a length of the detachable tray 218. The strip 220 is like a breadboard with two rows of electrical conductor extending parallel along its length. The strip 220 is insulated exposing a plurality of perforation along the two parallel rows; one perforation above the first row which is an electrically positive channel (+) or a signal in and the second perforation above the second row which is an electrically negative channel (-) or signal out. The two adjacent perforations provide an insertion of the one photoelectric sensor 222. The one photoelectric sensor 222 has two leads typically a positive lead (+) and a negative lead (-). There plurality of perforation provides different insertion positions and more than one photoelectric sensor 222 can be

inserted. There can also be a third row which runs parallel to the first and the second row which is a ground (earth).

[0127] For example, the length of the detachable tray 218 is three hundred and twenty millimetres (320 mm). A breadth of the box of ice-cream is fifty millimetres (50 mm) which equates to six boxes of ice-cream can be put inside the compartment with an excess space of twenty millimetres (20 mm). Based on the above measurement, there is at least six photoelectric sensors 222 spaced evenly at about twenty-five millimetres (25 mm) along the strip measuring three hundred millimetres (300 mm). The detection of the presence of the item depends on the position of the photoelectric sensors 222.

[0128] Initially, the strip 220 is configured to read or accept six boxes with the correct placement of the photoelectric sensors 222. The strip 220 is then installed inside the detachable tray 218, F1S1C1 with a one end of the strip having a female coupler connected to a male connector at the rear end of the detachable tray 218 which supplies electricity and control signals to the photoelectric sensors 222.

[0129] The opening of the automatic door 158 signals an item (box of ice-cream) is either going inside or coming out of the compartment, F1S1C1. Initially, the compartment, F1S1C1 is vacant. the box of ice-cream is picked from the inventory storage 156 and loaded into the detachable tray 218 at compartment (F1S1C1) by the lower anthropomorphic robotic arm 142. The photoelectric sensors 222 inside the detachable tray 218 are initially not triggered (light unblock) implies vacant. The automatic door 158 opens when the lower anthropomorphic robotic arm 142 approaches, pre-empting (switching on) the photoelectric sensors 222 inside the detachable tray 218. The lower anthropomorphic robotic arm 142 with the box of ice-cream is loaded directly to the rear end of the detachable tray 218 at the compartment F1S1C1 which disrupts the light beam signaling a presence of an object. This signal is sent to or sensed by the local computer 164 which records as one item (box of ice-cream) in F1S1C1.

[0130] The signals from the photoelectric sensors 222 are sent to the local computer 164 for counting. The disrupted light beam of the photoelectric sensor 222 indicates that there is an item in the compartment. If not disrupted, it would imply that the compartment is vacant. Another possible scenario is the photoelectric sensor 222 may be faulty and therefore the vending technician is replenishing has to ensure that the final physical item

count matches the count done by the local computer 164. If the photoelectric sensor 222 is faulty, a replacement is easily made by pulling the faulty photoelectric sensor 222 from the strip 220 and replacing with an operational photoelectric sensor 222.

- 5 [0131] The algorithm in the local computer can count the items in all compartments 208 but unable to identify the nature of the item and the brand. Therefore, the vending technician 118 has to manually enter (scanning barcodes of the labels on shelves and the item) the association, for example, item found in the inventory storage 156 on shelf one, compartment four (IS1S1C4) is to be picked and loaded into the correct the freezer
10 150 on shelf one and compartment 2 (F1S1C2). The algorithm determines exactly where the items goes to from the inventory storage 156.

- [0132] Any addition of the same item into the same compartment increases the quantity and is directly recorded by the local computer 164. Ideally, one compartment stores items
15 of the same kind. However, different item may be stored in the one same compartment with the position of the photoelectric sensors 222 on the strip changed. The local computer 164 also has to be informed with such a configuration through software algorithm which will be described.

- 20 [0133] The same method applies for the chiller 152 and the ambient storage 154. The ambient storage 154 does not have an automatic door 158. The strip is also installed in the chiller 152, the ambient storage 154 and the inventory storage 156 to provide real time inventory status.

- 25 [0134] Fig. 8 illustrates a method of entering item specifications for at least an item comprising the following steps of first, encoding the item specifications in a machine and human readable file 330, for example a XML (eXtensible Markup Language) file. The file is done off-site preferably at a fulfilment or warehousing centre. The file is in digital copy saved in a portable storage medium, for example a USB (Universal Serial Bus) thumb
30 drive. Alternatively, the file can be transmitted to the automatic vending store 100 via a network from the remote server.

- [0135] The item specifications comprising an automatic vending store code 332, a source storage section name, a source shelf number, a source compartment number 334, a
35 target storage section name, a target shelf number, a target compartment number 336,

a universal product code (UPC) 338, an item brand 340, an item price 342, an item best before date or expiry date 346, an item origin 348 and an item description 350. For example, the XML file contains the following structure:

```

5      <vending_12345>
      <sourcestorage>IS1</sourcestorage>
      <sourceshelf>S1</sourceshelf>
      <sourcecompartment>C1</sourcecompartment>
      <targetstorage>F1</targetstorage>
      <targetshelf>S1</targetshelf>
10     <targetcompartment>C1</targetcompartment>
      <upc>123456789000</upc>
      [0136] <brand>Meadow Gold</brand>
      <item_price>10.00</item_price>
      <item_type>frozen</item_type>
15     <best_before>201812</best_before>
      <origin>Singapore</origin>
      [0137] <description>Six decadent ice-cream cones that delight your
      senses. </description>
      </vending_12345>

```

20 [0138] The encoded instruction above specifies the source of the item on the inventory storage 156 and the target storage section at the freezer 150. Subsequent items insertion into the XML file will follow the above structure.

25 [0139] Secondly, the encoded file (XML) is loaded into the memory storage (hard disk) 352 of the local computer 164 through a communication port like a USB serial port or through a network interface card (NIC) which is connected to the network via a cable or the wireless router. Once the XML file is loaded, the algorithm in the local computer 164 has the knowledge of all items in the storage unit.

30 [0140] The local computer 164 verifies the information provided by the XML file by performing a count of all items in all the compartments in all the storage sections through the plurality of sensor. Besides the photoelectric sensors 222, there are infrared sensors 223 mounted on the strip 220 as well to scan for the UPC on the items. The scanning of
 35 the UPC provides the possibility of having dissimilar items in one compartment as

location tracking is made possible. Alternatively, a tray camera 224 is installed above the items in the detachable tray 218 which is able to slide longitudinally along the detachable tray 218 and is used to acquire images of the items. The acquired images are processed and verified by comparing with the stored information at the local computer 164. The image recognition of the item primarily seeks out a logo on the item, the dimensions of the item et cetera. The movement of the tray camera 224 is controlled by the local computer 164.

[0141] Fig. 9 illustrates a method of dispensing the at least one item 360 comprising the following steps of first, receiving the selection of the item 362 from the consumer via the tactile display screen 102. Secondly, the relevant anthropomorphic robotic arm 142,146 is activated 366, picked up the item from the correct compartment as instructed by the data file 364 stored in the local computer 164. Thirdly, the photoelectric sensor 222 located in the detachable tray 218 detects for light disruption 370 to indicate the item has been picked 368 up by the robotic arm 142. The picking of the item is further confirmed by another sensor on the anthropomorphic robotic arm 142,146. The quantity of the item in the compartment 208 is decreased by one 372. Fourthly, the robotic arm 142 deposits the item 374 into the pivotal trough 166 of the dispenser 104. Fifthly, the pivotal trough 166 pivots and drops the item onto an inclined plane 168 and drops into a collection trough where the consumer picks the item and the dispensing of item ends 376.

[0142] Fig. 10 illustrates a method of stocktaking 380 comprising following steps. Firstly, the vending technician 118 switches on the location-based tracking 382 of the mobile device 202 (a smartphone with camera and app ready) to indicate the location of the automatic vending store 100. The relevant data file 384 is loaded to the mobile device 202 wirelessly from the remote computer. The data file contains the information of where the items are to be placed in the inventory storage 156. Alternatively, the data file is already in the mobile device 202. Based on the location of the automatic vending store 100, the relevant data file is displayed.

[0143] The vending technician 118 uses his mobile device 202 (a smartphone with camera and app ready) scans the barcode (UPC) of one of the items 386. The display screen of the mobile device 202 displays the item location 388 in the inventory storage 156. The item location is also based on the location of the automatic vending store 100. The mobile device 202 itself has a GPS (Global Positioning System) that provides the

location thereof. Different automatic vending stores 100 may have different item placement on the inventory storage 156. Therefore, scanning the UPC of the item and couple with the location of the automatic vending store 100 will display the exact item location in the inventory storage 156.

5

[0144] The vending technician will then place the items 390 into the individual compartments 208 of the inventory storage 156. The individual compartments 208 have individual detachable tray 218 therein. The mention of compartment 208 will assume detachable tray 218 is inside which has a strip 220 of sensors 222,223. Take the example
10 of the boxes of ice-cream. Five boxes of ice-cream were to be placed on the first shelf (S1) in the first compartment (C1) of the inventory storage 156 (IS1S1C1) based on the instructions shown on the mobile device 202. The vending technician 118 activates an app (software application) on his mobile device 202, scans the UPC printed on one ice-cream box using his mobile device 202 and enter the physical quantity (numerical 5) 392
15 using the same mobile device 202 via the display screen.

[0145] The local computer 164 is fully aware of the inventory status of the compartments in all the storage sections. The algorithm in the local computer 164 cooperates with the photoelectric sensors 222 located in all the compartments to know the inventory status.
20 The algorithm accordingly highlights the shortfall and instructs the remote computer (can be a supplier's computer or backend fulfilment centre computer or a warehouse computer) on the current demands of that particular automatic vending store 100 with a date and timestamp. For example, the local computer 164 detects there is one box of ice-cream in the freezer, shelf one, compartment one (F1S1C1). That compartment can store six
25 boxes in total. The shortfall is five ($6 - 1 = 5$) boxes. The algorithm calculates the shortfall and inform the remote computer.

[0146] Just in case, the vending technician 118 did not bring five boxes of ice-cream to the automatic vending store 100, he can input the actual physical quantity and the
30 algorithm will confirm the entry of the vending technician with the inputs from the photoelectric sensors 394,396 that are located at the inventory storage 156. The inputted physical quantity on the mobile device 202 is then uploaded wirelessly to the local computer 164 where the algorithm will verify with its input readings from the photoelectric sensors 398. This is the stage where troubleshooting can take place. If the inputted

physical quantity and the input readings from the photoelectric sensors 222 differ, it would imply that one of the photoelectric sensors 222 is defective and need to be replaced 400.

[0147] The local computer 164 will then base on the input data file such as the XML file as described earlier to instruct 402 the anthropomorphic robotic arms 142,146 to pick up 404 the boxes of ice-cream from the inventory storage 156 to the freezer 150. As mentioned the XML file can be prepared and loaded into the local computer 164 either by the vending technician 118 or received from the remote computer via Internet. Both methods present pros and cons. The process of stocktaking ends 406.

[0148] If efficiency were demanded, then the latter method is recommended. However, sending the XML file remotely is based on the assumptions that the local computer 164 and the input sensors were working in a tip top condition and therefore assume no mistake, the Internet connection is intact and secured. Adopting the former method is less efficient compare to the latter but is more reliable as the vending technician 118 is assumed to be well-trained to tackle the issues on-site.

[0149] The item inventory is checked at the inventory storage 156 by the counting the photoelectric sensors that are disrupted in the individual compartments. Disrupted signal means there is an item. The time of day to make an inventory check of all the storage sections is set by an authorised personnel at a remote site or the vending technician 118. The time is set at off peak hours or where the sales of item is low. The stock level of the storage sections may also be taken on demand (as and when is needed) instead of time based. The authorised personnel at the automatic vending store 100 can retrieve the information while on-site or the remote computer could access any time.

[0150] The network connection is established to provide communication with the remote computer. The communication is to provide the status of the item inventory of the automatic vending store 100.

[0151] Fig. 11 illustrates a method of arranging the item 410 comprising the following steps. The algorithm in the local computer 164 refers to the XML data file and check the availability of items on the inventory storage 156 (is there a replenishment?) 412. If there were item left in the inventory storage 156, the algorithm refers to the XML data file 414 to see which compartment does the item goes to. For example, there are five boxes of

ice-cream left on the inventory storage 156, the first shelf, the first compartment (IS1S1C1). The XML data file states that items from IS1S1C1 goes to the freezer 150, the first shelf, the first compartment (F1S1C1). The algorithm then checks the F1S1C1 for any item therein 416 and found that there is one box of ice-cream inside. The algorithm

5 then instructs the anthropomorphic robotic arms 142,146 to pick 418 the one box of ice-cream in the F1S1C1 and placed in the inventory storage 156. There is at least one vacant compartment in the inventory storage 156 for temporary storage. Thereafter, the anthropomorphic robotic arms 142,146 then picks up 420 the new boxes of ice-cream from the compartment in the inventory storage 156 as instructed by the XML data file

10 which in this case is the inventory storage on the first shelf in the first compartment (IS1S1C1) and put in F1S1C1. This process reiterates until there is no more item left in the compartment (IS1S1C1) 422. Lastly, the one box of ice-cream left in the vacant compartment in the inventory storage 156 is picked 424 and placed in F1S1C1. This ensures that the first to enter (replenishment of the item) the storage section is the first

15 to leave (sale of the item) the storage section. The storage section includes the freezer 150, the chiller 152, the ambient storage 154 and the inventory storage 156.

[0152] During each picking and depositing at the target compartment which in this case is F1S1C1, the algorithm checks whether there is enough space for more items in the

20 target compartment 426. If there were not enough space, an error message, "Not Enough Space in the target compartment" will appear 428 at the display screen of the mobile device 202.

[0153] Fig. 12 illustrates a method of detecting the ambient temperature 440 for item

25 suggestion comprising the following steps. The ambient temperature relates to the temperature of the outdoor environment. Alternatively, the temperature can be acquired from a website on the Internet such as the accuweather.com where a software API (application programmable interface) can be developed to get constant update of the ambient temperature. More than that, local weather condition can also be acquired.

30

[0154] The temperature sensors are located at the front side of the automatic vending store 100. At least one temperature sensor is located at the front base 442 and at least one temperature sensor is at the front top 444. The readings from the temperature sensors are acquired and an average reading 446 of the two temperature inputs are

35 computed by the local computer 164. The result may be used to suggest item to the

consumer. For example, if the average ambient temperature is 30°C 450, the local computer 164 suggests a cold beverage to the consumer 454. If the ambient temperature is 20°C 448, the local computer 164 will suggest a hot beverage to the consumer 452. In the same vein of thought for example, on a rainy day, a suggestion to buy an umbrella to the consumer is possible.

[0155] Fig. 13 illustrates a method of tracking a gesture of the consumer specifically the eye 460 using the at least one vending external camera 120 comprising the steps of first, tracking or locating the face 462 of the consumer to ensure a real human is present. The vending external camera 120 is installed on the front side of the automatic vending store 100 and on the right side of the tactile display screen 102. The algorithm tracks the face containing the features of two eyes, one mouth, one nose and two ears set in an elliptical shaped frame. At this juncture the identity of the consumer is not established. Secondly, the location of the eyes 464 is identified by using a relative distance from the forehead or periphery of the elliptical shaped frame. Thirdly, the eye focus is determined by detecting the presence of the sclera and an iris 466 from the captured image. For example, if the consumer were to glance to the left side 472, the right side sclera will be more obvious compare to the left side sclera as the iris is shifted to the left side. The left glance will scroll the selection menu to the left 476 and reflected on the tactile display screen 102. Conversely, if the consumer were to glance to the right 470, the selection menu will scroll to the right 474. Fourthly, to effect a selection 480, the consumer has to blink two times 478 in rapid succession by looking at the item on the tactile display screen 102. And that is the end of the process of eye tracking in the scrolling and the selection of the item 482.

[0156] Certain margin of allowance is provided as the vending external camera 120 is not at the true centre of the tactile display screen 102. It is assumed that the consumer stands in front of the tactile display screen 102. Alternatively, the vending external camera 120 can be located at the top centre frame of the tactile display screen 102. The current method enables a handicap person or wheelchair bound person to make a purchase without moving using his or her arm.

[0157] Fig. 14 illustrates a method of tracking a gesture of the consumer specifically the body movement like hand gesture 490 using the at least one vending external camera 120 comprising the steps of first, locating the face of the consumer 492. This is to ascertain that a human consumer is standing in front of the automatic vending store 100. An approximate estimation of the body parts of the consumer are identified taking

reference from the face. Assuming that the consumer is physically abled, a second step is to identify the position of the hands and tracked 494. Hence, the consumer will intuitively raise his arm to a level that is somewhere at the front centre of the tactile display screen 102 where the vending external camera 120 is able to capture. The consumer can articulate his selection by moving his one hand, either a left hand or a right hand without touching the tactile display screen 102. By simply, expressing a pointed finger, the consumer can select and confirm his selection. The consumer can also scroll between selection by moving his finger left 496 or right 498, up 500 or down 502 in the conical line of sight of the vending external camera 120 representing scrolling the selection to the left 508 or right 510, up 512 or down 514 respectively.

[0158] Below is a list of possible hand gestures and its corresponding commands supporting the latter method.

[0159] A pointed finger suggests a selection; An open palm that eventually ends in a clenched fist or grip 504 in a time of one second or less suggests a confirmation 516. From a clenched fist to an open palm 506 suggests abandoning the selection or deselect 518. In other words, a gripping and a non-gripping motion; A sweeping motion of the hand or pointed finger to the left 496 suggests scrolling the current page to the left 508. Conversely, a sweeping motion of the hand to the right 498 suggests scrolling the current page to the right 510; A sweeping motion of the hand or pointed finger upwards 500 suggests scrolling the current page upwards 512. Conversely, a downward sweep 502 of the hand suggests scrolling the current page downwards 514; A plurality of outstretched fingers presumably four and a one thumb suggests an expanded view. Conversely, the four fingers and the one thumb gather in a point suggests a minimized view.

[0160] The local computer 164 having the memory storage has all the possible gestures of the eye, the hand, the human body so as to accurately interpret each gesture with the corresponding command. Additionally, the identification of the gestures can also be used to interpret the emotional state of the consumer. For example, anger, anxious, happy.

[0161] Fig. 15 illustrates a method of interpreting the voice 530 into a list of corresponding command comprising the steps of first identifying the harmonics of the human voice 532 using the microphone 124. The voiced speech of a typical adult male will have a

fundamental frequency from 85 Hertz to 180 Hertz, and that of a typical adult female from 165 Hertz to 255 Hertz. Thus, the fundamental frequency of most speech falls below the bottom of the "voice frequency" band (300 Hertz to 3,000 Hertz). However, enough of the harmonic series will be present for the missing fundamental to create the impression of hearing the fundamental tone.

[0162] Secondly, matching the harmonics 534 with the saved harmonics in the memory storage of the local computer 164. Thirdly, interpret the harmonics to the corresponding command. For example, changing the display on the tactile display screen 102 to reflect the prospective consumer's item preference. The automatic vending store 100 initiates a voice 536 asking the consumer for a response.

[0163] The item will have identification label such as "A1" corresponds to an ABC apple juice. Instead of reciting the item description, the consumer can recite the corresponding identification label to make a selection 538. Saying "Confirm" 540 will confirm the selection. Saying "Pay" 546 will proceed to payment 548. Saying "Yes" to acknowledge or to proceed. Saying "More" will show more selections. Saying "Add" 542 will return back to the selection menu to add more item and the selected item placed in a shopping cart 544. The voice recognition process ends 550 after the payment is made by the consumer.

[0164] More commands and languages can be added into the memory storage. The local computer 164 will ask leading questions to prompt the consumer to simply answer in mono-syllable words such as "Do you want to carry on shopping? Answer Yes or No." using the speaker 126. The voice activated automated vending store 100 provides an easy shopping for the visually impaired which will mean that the items in the selection menu need to be read out using the speaker to make shopping viable for the latter consumers. Alternatively, the algorithm in local computer 164 is able to discern and recognise the different voices and lookup specific keywords that is pertinent to the functions of the automatic vending machine. For example, if the consumer says "I want an apple juice", the algorithm can pick up the key word "apple". The word "apple" is listed as one of the key words in the data file during the item replenishment which is stored in the memory storage.

[0165] The gesture and voice recognition have not specifically delved into the identity of the consumer. They are simply to interact with the prospective consumer standing in front of the automatic vending store 100.

5 [0166] The facial identification of the consumer is made possible if either the consumer has registered with the automatic vending store 100 or the local computer 164 has the computing prowess to search the Internet via the service provider at high speed searching for a matching facial features of the unregistered consumer. The latter identification process is time consuming and assuming the unregistered consumer has
10 left his or her photo identity on the Internet or leave a significant digital footprint on the Internet. To simplify the search, the unregistered consumer could enter his name guided by instructions on the tactile display screen 102. More information provided will simplify the search. The search can extend to social media like Facebook, Instagram, Pinterest, Google Plus et cetera.

15 [0167] Fig. 16 illustrates a method of registering a new member 560. In the new member registration, the new member touches a button 562 on the tactile display screen 102 on the automatic vending store 100 that indicates a "New Member". Alternatively, if it is by a voice activation 564, simply say "New Member". Another alternative, if it is by an eye
20 activation 566, the eye movement controls a cursor on the screen that navigates to the "New Member" button.

[0168] An online form is fetched from the remote computer via the network and is displayed prompting for a first name, a last name 568, a gender (male/female) 570, a
25 date and year of birth 572, a smart phone number 574 and an electronic mail address 576. The new member's facial features are recorded 578 by the vending external camera 120. The new member's voice 580 is also recorded by the microphone 124. The tactile display screen 102 will display a sentence and expect the new member to recite. For example, "Hello John, you look great". The sentence structure contains vowels and
30 consonants that covers most of the English phonetics as well as the vocal range of the new member. For other languages and commands, the memory storage of the local computer 164 has to be updated accordingly. A virtual keyboard is displayed on the tactile display screen 102 as an input means for the tactile input and using eye movement.

[0169] Similarly, for the voice activated registration, the vending store initiates voice instruction to guide the new member to register 582 and acquiring the same information as the tactile input 562. As for the eye activation registration, the same information is acquired 584. However, if the new member is unable to speak the voice recording 580 would be skipped. On each input step, permission is sought from the new member to get information. However, information like name, phone and email are compulsory fields to be entered for identity authentication and verification.

[0170] The completed form is submitted and transmitted via the network to the remote server of the vending store owner. A message is sent to the mobile phone of the new member to verified the entries 586. The message contains a series of alphanumeric characters. The message instructs the new member to enter the series of alphanumeric characters into the automatic vending store's tactile display screen 588. The member registration process ends 590.

[0171] To leave an impression on the new member, a membership card having NFC capability can also be dispensed from the automatic vending store 100. The membership card having the name of the registered member printed on one surface. The registration of the new member is completed and is now a registered member.

[0172] The registration can be performed on a web browser on a desktop, a laptop, a smart phone, a tablet or a mobile application developed specifically for the smart phone. For new members who registered, an incentive is given as an appreciation by providing discount in the next transaction, for example, purchasing at least an item from the automatic vending store 100.

[0173] The registered member begins to perform a transaction by touching on the tactile display 102. A message "Member?" with two buttons "Yes" and "No" are shown on the tactile display screen 102. The registered member selects "Yes" by touching the "Yes" button on the tactile display screen 102. If the consumer touched "No", a message "Do you want to register?" is displayed on the tactile display screen 102. If the consumer persisted in not registering, the local computer 164 will suggest items based on the ambient temperature and the facial features. For example, if the ambient temperature is 30°C, the local computer 164 will suggest cold beverages. In addition, the vending external camera 120 will detect for a human face and process the acquired image to

determine the gender of the consumer. If the consumer were a man, the local computer 164 may suggest a beer as beverage. Conversely, if the consumer were to register, the consumer will be directed to the registration.

- 5 [0174] The registered member waves its smart phone or the membership card near the reader module 120. The registered member's particulars are retrieved from the remote computer (can be the automatic vending store's remote computer or server). Relevant ads are displayed on the top and/or bottom pane of the tactile display screen 102. The ads relate to the registered member's buying habits based on past shopping experience
- 10 and also showing new item offerings relevant to the registered member. The remote computer returns with a result confirming the status of the member. The remote computer also suggests relevant items relating to the registered member. If there were only one automatic vending store 100 then it makes sense to store the information of the member to the local computer 164. The use of the remote computer makes sense for multiple
- 15 automatic vending stores 100 at different sites. Of course, the sole use of the remote computer may have its pros and cons as well such as loss of Internet connection and security issue as a result of malicious attacks from hackers are just two probable issues. Therefore, a mixed use of local and remote computer is suggested.
- 20 [0175] The local computer 164 in the automatic vending store 100 waits for the registered member to complete item selection on the selection menu. The item selected from the selection menu is stored into the storage of the local computer 164 for processing once the registered member has confirmed his order (item selection and quantity).
- 25 [0176] The local computer 164 in the automatic vending store 100 calculates the total amount payable. The tactile display screen 102 displays the total amount and presents the registered member with three payment option namely cash, payment card requiring PIN or payment with NFC technology which includes smart phone and card.
- 30 [0177] If the registered member had settled the payment, the purchased items and the amount spent will be associated with the registered member. After which, the transaction of the registered member ends. Conversely, if payment were not made, a countdown timer will be initiated. During this counting down, if there were no activation on the tactile display screen 102, the transaction will end.

[0178] The registered consumer can also perform the transaction using gesture and voice if the biometric information is recorded and saved in the local computer 164 at the vending machine or the biometric information is fetched from the remote computer.

5 [0179] Fig. 17 illustrates a method of selecting the at least an item 600 comprising the following steps. A selection menu is displayed 602 on the tactile display screen 102. The item is selected 604 by the consumer using the tactile display screen 102. The quantity of the item is also selected 606. The local computer 164 prompts 608 consumer for more order on the tactile display screen 102 by a push button "Yes" or "No". If the consumer
10 selects "Yes", the selection menu will be presented 602 again. This iteration will continue whenever the consumer touches the "Yes" button on the tactile display screen 102. Conversely, if the consumer pushed "No", the total cost of the item will be computed 610 and displayed. The next step is to confirm payment 612. Once the payment is confirmed, the purchased item will be dispensed 614 and stored in the memory storage associating
15 616 with the consumer providing data for item suggestion in the next purchase. The selection of item ends 618.

[0180] Fig. 18 illustrates a method of requesting payment 620 comprising the following steps. Presenting a payment button whereby the consumer touches the button on the
20 tactile display screen 102. The consolidated cost of the order is shown 622 with applied tax or any other charges if any. The next step is to prompt the consumer for a preferred payment option, for example, cash, card or phone. If the consumer chose cash 624, the cash depositing unit with light emitting diodes will flash 632 to indicate the place to deposit the notes or coins. Change will be returned 640,642 if any. Other payment options using
25 card could either use a payment card terminal for card insertion or swipe 644 where the display lit 634 or a reader module 120 which uses NFC for contactless card payment or smart phone payment 646 will be lit 636. The card can be credit card, debit card or card with smart chip (EMV chip).

30 [0181] An alternative payment method using facial recognition 630 comprising the steps of first tracking 638 for a human face in front of the automatic vending store 100. Secondly, determining 648 the human face as a registered consumer by searching at its remote server owned by the vending store owner. If the consumer's identity is confirmed, the total amount of the item purchased at the automatic vending store 100 will be deducted
35 from the remaining value of the consumer's account. If there were not enough value 650

in the account. The transaction will be terminated. A message will be displayed 652 on the tactile display screen 102 "Insufficient value detected" accompanied by an audible alarm projected from the speakers 126. Conversely, if there were sufficient value in the consumer's account the remaining value will be reduced and the transaction approved.

- 5 Thirdly, a positive result is returned to the automatic vending store 100. The tactile display screen 102 then displays "Payment made" 654. You have \$3.00 remaining in your account." That is the end of the payment process 656.

- 10 [0182] The current payment option is assumed that the automatic vending store 100 has an upfront payment policy at the point of first sales. In other words, the registered consumer has to buy a stipulated amount of value in the account like twenty dollars to kick start the purchase.

- 15 [0183] A method of monitoring the consumer's buying behaviour comprising the following steps. In order to monitor the consumer's buying behaviour, personal particulars have to be collected. The local computer 164 through the tactile display screen 102 acquires the particulars of the consumer including a photo image and a voice recording. The particulars of the consumer comprising a first name, a last name, a gender, a smart phone number, an electronic mail address and a date of birth. The purpose of storing a photo
20 image and a voice recording is to prevent fraudulent use of the registered consumer's account. In particular, if the automatic vending store 100 business model were to issue a membership card with cash value in the card. The loss of the membership card equates to a loss in monetary value. Another reason for the collection of photo image is for data analysis in the facial recognition and voice recognition.

- 25 [0184] The submission of the consumer's personal particulars is stored in the local computer 164 or at a remote cloud with a flag to highlight that the consumer is a newly registered member and is entitled to a discount for the next purchase.

- 30 [0185] Incentive is given to the registered consumer, for example, a cash discount for any item purchased in the next purchase. However, the consumer has to scan the QR code displayed on the tactile display screen 102.

- 35 [0186] Information on the purchased item by the consumer is also stored in the local computer 164 or at a remote cloud. The information of the item which is the item

specifications and other additional information like the storage section (freezer, chiller, ambient storage, shelf, compartment) and the dispensed date and time are stored. The consumer and the purchased item are associated by the local computer 164 algorithm.

- 5 [0187] For subsequent transactions by the consumer, the local computer 164 retrieves information of the consumer based on the facial or voice or both to commence transaction or scanning a membership card or smart phone with NFC technology on the reader module 120.
- 10 [0188] A method of identifying the consumer's facial features comprises following steps. Firstly, the consumer's facial features are acquired from the photo image comprising the two eyes, a nose and lips. A plurality of images is scanned and detected for the mentioned features. The local computer 164 algorithm finds the position of the eyes based on the colour contrast between the sclera (white of the eye) and the surrounding
- 15 skin. Once detected, the length of each eye is found, the distance between the two eyes are found and the distance from first distal end of the first eye to the second distal end of the second eye can be computed. The algorithm also finds the nose from the acquired image based on the distance relative to the eyes by looking for a colour contrast of the nostril and ala. The algorithm also finds the lips from the acquired image by detecting the
- 20 lateral commissure or the two corners of the lips. To improve the feature recognition, the shape of the face and the facial hair are detected to identify the gender of the consumer.

- [0189] A method of suggesting items based on the past buying behaviour and/or facial features and/or ambient temperature comprising retrieving past purchased items and
- 25 suggesting the same item.

- [0190] A method of controlling the sales of items based on a time condition. The time restriction is determined by the authority specifically on the sales of alcohol containing beverages after ten o'clock in the evening and resumes the sales the following day at ten
- 30 in the morning. The algorithm in the local computer 164 can be set to forbid the sales of alcohol regardless of age based on the time.

- [0191] During operation, the automatic vending store 100 can be accessed by the vending technician 118. The anthropomorphic robotic arms 142,146 are able to operate
- 35 along the rail tracks 144,146 between the freezer 150, the chiller 152 to the ambient

storage 154 without accessing the inventory storage 156. The only time the anthropomorphic robotic arms 142,146 access the rail tack 144,146 in front of the inventory storage 156 is when the vending technician 118 has finished replenishing the items and he manually activates the replenish sequence. The vending technician 118 is able to activate the replenish sequence from his mobile device 202 without endangering his life after he has closed the access door 108.

[0192] In the application, unless specified otherwise, the terms "comprising", "comprise", and grammatical variants thereof, intended to represent "open" or "inclusive" language such that they include recited elements but also permit inclusion of additional, non-explicitly recited elements.

[0193] As used herein, the term "about", in the context of concentrations of components of the formulations, typically means +/- 5% of the stated value, more typically +/- 4% of the stated value, more typically +/- 3% of the stated value, more typically, +/- 2% of the stated value, even more typically +/- 1% of the stated value, and even more typically +/- 0.5% of the stated value.

[0194] Throughout this disclosure, certain embodiments may be disclosed in a range format. The description in range format is merely for convenience and brevity and should not be construed as an inflexible limitation on the scope of the disclosed ranges. Accordingly, the description of a range should be considered to have specifically disclosed all the possible sub-ranges as well as individual numerical values within that range. For example, description of a range such as from 1 to 6 should be considered to have specifically disclosed sub-ranges such as from 1 to 3, from 1 to 4, from 1 to 5, from 2 to 4, from 2 to 6, from 3 to 6 etc., as well as individual numbers within that range, for example, 1, 2, 3, 4, 5, and 6. This applies regardless of the breadth of the range.

[0195] It will be apparent that various other modifications and adaptations of the application will be apparent to the person skilled in the art after reading the foregoing disclosure without departing from the spirit and scope of the application and it is intended that all such modifications and adaptations come within the scope of the appended claims.

Reference Numerals

	100	automatic vending store
	102	tactile display screen
5	104	dispenser
	106	payment terminal
	108	access door
	110	store length
	112	store depth
10	114	store height
	116	static advertisement section
	118	vending technician
	120	vending external camera
	122	reader module
15	124	microphone
	126	speaker
	140	internal view of automatic vending store
	142	lower anthropomorphic robotic arm
	144	lower rail track
20	146	upper anthropomorphic robotic arm
	148	upper rail track
	150	freezer
	152	chiller
	154	ambient storage
25	156	inventory storage
	158	automatic door
	160	robot camera
	162	end effector
	164	local computer
30	166	pivotal trough
	168	inclined plane
	170	collection trough
	172	table
	174	grasping digits
35	190	a view of an ajar access door

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	192	tetra pack
	194	bottle
	196	pillow bag
	198	vending camera
5	200	stocktaking
	202	mobile device
	204	shelf
	206	shelf divider
	208	compartment
10	210	label
	212	front surface
	214	top surface
	216	barcode for IS1S1C1
	218	detachable tray
15	220	strip of breadboard
	222	photoelectric sensor
	223	infrared sensor
	224	tray camera
	226	conveyor belt
20	250	vending store modes of operation
	252	store mode
	254	detecting item
	256	entering item specifications
	258	dispensing item
25	260	tracking item
	262	replenishing item
	264	consumer mode
	266	tracking eye
	268	tracking gestures
30	270	recognizing voice
	272	registering
	274	selecting item
	276	paying for item
	278	identifying facial features

	280	suggesting item
	300	start of detecting item
	302	photoelectric sensor disrupted?
	304	freezer compartment?
5	306	chiller compartment?
	308	ambient storage compartment?
	310	inventory storage compartment?
	312	adjusting quantity of item by 1
	314	maximum quantity allowable?
10	316	recording quantity
	318	end of detecting item
	330	preparing a data file
	332	entering vending store code
	334	entering source compartment
15	336	entering target compartment
	338	entering universal product code
	340	entering brand
	342	entering price
	344	entering item type
20	346	entering best before date
	348	entering country of origin
	350	entering description
	352	saving into memory storage
	360	start of dispensing item
25	362	consumer selected an item?
	364	reading data file from memory storage
	366	activating the robotic arm
	368	picking the item
	370	signal of photoelectric sensor disrupted?
30	372	adjusting the quantity
	374	depositing item in the pivotal trough
	376	end of dispensing item
	380	start of stocktaking
	382	location based tracking
35	384	loading of data file into mobile device

386 scanning the UPC
 388 display item location in the inventory storage
 390 place items in the compartments of the inventory storage
 392 manual input of physical quantity
 5 394 photoelectric sensor signal disrupted?
 396 counting disrupted signals of sensors at the inventory storage
 398 is physical quantity equal to sensor count?
 400 replace sensor at inventory storage
 402 activate robotic arm
 10 404 picks up item from inventory storage to the appropriate compartment
 406 end of stocktaking
 410 start of arranging items
 412 are sensors disrupted in the inventory storage?
 414 reading data file from memory storage
 15 416 any item in the target compartment?
 418 pick the item(s) out from the target compartment and place at temporary
 inventory storage
 420 pick the item from the source (Inventory Storage) to the target compartment.
 422 any item in the source compartment?
 20 424 pick the item(s) from the temporary inventory storage to the target compartment
 426 exceed limit in target compartment?
 428 sending message to mobile device "Not enough space"
 430 end of arranging items
 440 Start of detecting temperature
 25 442 Acquiring a temperature from the base
 444 Acquiring a temperature from the top
 446 Average of the two readings
 448 Temp < 20C?
 450 Temp >30C?
 30 452 Suggest warm item
 454 Suggest cold item
 460 start of eye tracking
 462 human face?
 464 Locating the eyes
 35 466 Locating the iris and sclera

468 Tracking the eye
 470 Look right?
 472 look left?
 474 Scroll the selection menu to the right
 5 476 Scroll the selection menu to the left
 478 Double blink?
 480 Confirm selection
 482 End of eye tracking
 490 start of hand tracking
 10 492 human face?
 494 locating the hand or pointed finger
 496 finger scrolling left?
 498 finger scrolling right?
 500 finger scrolling up?
 15 502 finger scrolling down?
 504 grip?
 506 open palm?
 508 display scrolls left
 510 display scrolls right
 20 512 display scrolls up
 514 display scrolls down
 516 confirm selection
 518 deselect
 530 start of voice recognition
 25 532 identifying the harmonics of the human voice
 534 voice match?
 536 vending store initiated voice
 538 corresponding item label called?
 540 confirm selection?
 30 542 Add more item?
 544 Add into shopping cart
 546 pay for item(s)?
 548 payment
 550 end of voice recognition
 35 560 start of member registration

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	562	tactile input on screen?
	564	voice?
	566	eye?
	568	enter last name, first name
5	570	enter gender
	572	enter birth date
	574	enter mobile phone number
	576	enter email
	578	photo taking of new member
10	580	voice recording of new member
	582	Vending store initiated voice instruction
	584	Same information acquired as tactile input
	586	Verification to phone
	588	Enter verification message in vending store
15	590	end of member registration
	600	start of item selection
	602	Display selection menu
	604	Consumer selects item
	606	Consumer enters quantity
20	608	more item?
	610	Total cost
	612	Total cost
	614	Dispense item(s)
	616	Associate item(s) with consumer
25	618	End of item selection
	620	start of requesting payment
	622	Display total cost of item(s)\
	624	cash payment?
	626	card payment?
30	628	Contactless payment?
	630	facial?
	632	LED flashes at cash slot
	634	LED lit at payment terminal
	636	LED lit at reader module
35	638	Tracking a human face

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640 change?

642 Dispense change

644 Insert or swipe card

646 wave card or mobile phone

5 648 Member?

650 Enough value in account?

652 Insufficient value

654 Payment made

656 end of requesting payment

10

Claims

1. An automatic vending store for offering goods of sales, the automatic vending store comprising:
- 5 ➤ a first storage compartment for keeping some goods of sales;
- a second storage compartment for keeping additional goods of sales;
- a payment terminal that is connected to at least one of the first storage compartment and the second storage compartment for transacting the goods of sales automatically; and
- 10 ➤ an automatic organizer for moving the goods of sales between the first storage compartment and the second storage compartment;
- wherein the automatic organizer comprises an automatic loader for replenishing or loading the goods of sales onto the first storage compartment.
- 15
2. The automatic vending store of claim 1, wherein the automatic organizer comprises a robot for replenishing the goods of sales onto at least one of the storage compartments.
- 20
3. The automatic vending store of claim 1 or 2 further comprising at least one camera for monitoring operation of the automatic vending store.
4. The automatic vending store of claim 3, wherein the camera comprises an optical character reader.
- 25
5. The automatic vending store of any of the preceding claims, wherein the first storage compartment comprises a storing shelf for holding the goods of the sales, and the second storage compartment comprises a transferring shelf for tallying the goods of sales.
- 30
6. The automatic vending store of any of the preceding claims, wherein the first storage compartment comprises at least one thermally insulated chamber for keeping the goods of sales at substantially constant temperatures.

7. The automatic vending store of claim 6, wherein
the at least one thermally insulated chamber comprises an access door.
- 5 8. The automatic vending store of any of the preceding claims further comprising
a moisture absorber for removing water vapor inside the automatic vending store.
9. The automatic vending store of any of the preceding claims further comprising:
a computer having at least one user interface for operating the automatic vending
10 store.
10. The automatic vending store of claim 9, wherein
the at least one user interface comprises multiple terminals for accessing the
automatic vending store by multiple users simultaneously.
- 15 11. The automatic vending store of any of the preceding claims further comprising
a communication unit for communicating with an external electronic
communication device.
- 20 12. The automatic vending store of any of the preceding claims further comprising
a hub connector for bundling signal wires, power cables or both together.
13. The automatic vending store of any of the preceding claims further comprising
a local energy source for powering the automatic vending store.
- 25 14. The automatic vending store of any of the preceding claims further comprising
a window for exposing the goods to a customer by the automatic organizer.
15. The automatic vending store of any of the preceding claims further comprising
30 a timer for regulating operation of the automatic vending store according to time.

16. A method of using an automatic vending store, the method comprising:
- providing an automatic vending store;
 - loading a first storage compartment of the automatic vending store with goods of sales;
 - moving at least one of the goods of sales from the first storage compartment to a second storage compartment of the automatic vending store in the absence of sales or delivery to a customer automatically for tallying; and
 - retrieving goods from any of the storage compartments for dispensing to a customer at a dispenser for retrieving by a customer.
17. The method of claim 16, wherein the moving at least one of the goods of sales comprises tallying the goods of sales.
18. The method of claim 16 or 17 further comprising examining identify information of a user; and deciding on whether to grant access to the user.
19. The method of any of the preceding claims further comprising sending message to a remote electronic device for replenishing the goods of sales.
20. The method of any of the preceding claims further comprising transferring goods between a first automatic organizer and a second automatic organizer of the automatic vending machine.