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DOOR MOVEMENT SYSTEM FOR CABINET

Abstract

A system for opening and closing a door within a cabinet is provided. The system includes a motor in communication with a controller to automatically open and close a door. A first plate fixed to the motor shaft to rotate with rotation of the motor shaft, the plate comprises a slot disposed therein. A first leg extends from a door that extends through the slot. A second leg extends from the door. A first sensor moves based upon rotation of the motor shaft, wherein the first sensor can detect relative motion between the motor shaft and the door, wherein when the motor shaft is rotated in the second direction and the first sensor detects relative motion between the motor shaft and the door, the first sensor sends a signal to the controller, wherein upon receipt of the signal the first sensor discontinues sending the second signal to the motor.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS [0001] This application is a continuation of U.S. Nonprovisional application Ser. No. 18/116,623, filed on Mar. 2, 2023, which is a continuation of U.S. Nonprovisional application Ser. No. 17/237,353, filed on Apr. 22, 2021, which claims priority from U.S. Provisional Application No. 63/015,931, filed on Apr. 27, 2020, and from U.S. Provisional Application No. 63/159,175, filed on Mar. 10, 2021, the entirety of each are hereby fully incorporated by reference herein.

BACKGROUND

[0002] The subject disclosure relates to cabinets that are configured to hold items for future automated delivery to an end user or a customer. Cabinets include storage compartments and are frequently used in restaurants for holding food items that have already been prepared after a customer's order that are disposed therein for the customer's pickup at a later time. Cabinets have many different uses but are often seen as beneficial ways to allow for delivery of orders to customers in an efficient manner, due to the lack of a need for a restaurant employee to give the prepared item to the customer directly, instead a restaurant employee can position the prepared item into a compartment, close the compartment's door and then send a message to the customer that the item is ready for pick up by the customer. The customer is often provided with a code to enter into the cabinet that allows the customer to access the compartment. Some conventional cabinets have systems to monitor the front portion of the cabinet to confirm that there isn't anything blocking the path of the door to the compartment. These systems often add undesired cost, complexity, and likelihood of failure to the design of the cabinet. The subject disclosure is provided to provide the cabinet with the safety aspect of the conventional monitor systems with a greater reliability and at a lower cost.

BRIEF SUMMARY

[0003] A first representative embodiment of the disclosure is provided. The embodiment includes a cabinet with a plurality of storage compartments. The cabinet includes a housing comprising a plurality of walls that define two or more compartments to receive items therein. Two or more doors are rotatably mounted to the housing with the plurality of doors selectively enclosing or opening the respective two or more compartments and two or more motor assemblies are each operably connected between one or more of the plurality of walls and a respective door. Each motor assembly includes a motor shaft, the motor fixed to the one or more of the plurality of walls, the motor in communication with a controller wherein the motor is configured to rotate the motor shaft in a first direction upon receipt of a first signal from the controller and the motor is configured to rotate the motor shaft in a second direction upon receipt of a second signal from the controller, wherein rotation of the motor shaft in the first direction causes the respective door to move in a direction associated with transferring the door from a closed position toward an open position and wherein rotation of the motor shaft in the second direction causes the door to move in a direction associated with transferring the door from the open position toward the closed position. A first plate

is fixed to the motor shaft to rotate with rotation of the motor shaft, the plate comprises a slot disposed therein. A first leg extends from the respective door that extends through the slot. A second leg that extends from the respective door. A first sensor moves based upon rotation of the motor shaft, wherein the first sensor can detect relative motion between the motor shaft and the respective door, wherein when the motor shaft is rotated in the second direction and the first sensor detects relative motion between the motor shaft and the door, the first sensor sends a signal to the controller, wherein upon receipt of the signal the first sensor discontinues sending the second signal to the motor.

[0004] Another representative embodiment of the disclosure is provided. The embodiment includes a system for opening and closing a door within a cabinet. The system includes a motor supported upon one or more walls of a cabinet, the motor comprising a motor shaft, the motor in communication with a controller wherein the motor is configured to rotate the motor shaft in a first direction upon receipt of a first signal from the controller and the motor is configured to rotate the motor shaft in a second direction upon receipt of a second signal from the controller, wherein rotation of the motor shaft in the first direction causes a door to move in a direction associated with transferring the door from a closed position toward an open position and wherein rotation of the motor shaft in the second direction causes the door to move in a direction associated with transferring the door from the open position toward the closed position. A first plate is fixed to the motor shaft to rotate with rotation of the motor shaft, the plate comprises a slot disposed therein. A first leg extends from a door that extends through the slot. A second leg extends from the door. A first sensor that moves based upon rotation of the motor shaft, wherein the first sensor can detect relative motion between the motor shaft and the door, wherein when the motor shaft is rotated in the second direction and the first sensor detects relative motion between the motor shaft and the door, the first sensor sends a signal to the controller, wherein upon receipt of the signal the first sensor discontinues sending the second signal to the motor.

[0005] Advantages of the present disclosure will become more apparent to those skilled in the art from the following description of the preferred embodiments of the disclosure that have been shown and described by way of illustration. As will be realized, the disclosed subject matter is capable of other and different embodiments, and its details are capable of modification in various respects. Accordingly, the drawings and description are to be regarded as illustrative in nature and not as restrictive.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] FIG. **1** is a perspective view of a cabinet with a plurality of compartments and doors to selectively close and allow access to each of the compartments individually, with a side panel of the housing of the compartment removed.

[0007] FIG. **1***a* is the view of FIG. **1** with the plurality of doors in the open position.

[0008] FIG. **1***b* is a detail view of detail H of FIG. **1***a*.

[0009] FIG. **1***c* is another front perspective view of the cabinet of FIG. **1**, showing an opposite inner side wall from the inner side wall depicted in FIG. **1***b*.

[0010] FIG. **2** is a rear perspective view of the view of FIG. **1** showing the plurality of motor assemblies disposed for operating the respective doors for each of the compartments.

[0011] FIG. **3** is a perspective view of a door and motor assembly, with the door in the closed position.

[0012] FIG. **4** is a side view of the view of FIG. **3**.

[0013] FIG. **4***a* is a detail view of detail A of FIG. **4**.

[0014] FIG. **5** is a detail view of detail B of FIG. **4**.

[0015] FIG. **6** is the view of FIG. **5** with a second plate of the motor assembly removed from the view.
[0016] FIG. **7** is a view of an inner portion of the motor assembly, with the door in the closed position.
[0017] FIG. **8** is the view of FIG. **3** with the door in the open position.
[0018] FIG. **9** is a side view of FIG. **8**.
[0019] FIG. **10** is a detail view of detail C of FIG. **9**.
[0020] FIG. **10***a* is the view of FIG. **10** with the second plate of the motor assembly removed from view.
[0021] FIG. **11** is a view of an inner portion of the motor assembly, with the door in the open position.
[0022] FIG. **11***a* is a detail view of detail D of FIG. **11**.
[0023] FIG. **12** is the view of FIG. **3** with the door in an intermediate position with an object disposed between the lower edge of the door and the housing.
[0024] FIG. **13** is detail view of detail E of FIG. **12**.
[0025] FIG. **14** is a side view of detail E of FIG. **12**.
[0026] FIG. **15** is a view of an inner portion of the motor assembly, with the door in the intermediate position with an object disposed between the lower edge of the door and the housing.
[0027] FIG. **16** is another perspective view of the motor assembly and the door with the door in the open position, with portions of the motor assembly removed.
[0028] FIG. **17** is a perspective view of a cabinet with a plurality of compartments that can each be isolated by a door capable of automatic operation.
[0029] FIG. **18** is a perspective view of a portion of a compartment of the cabinet of FIG. **17** with the door in an open position.
[0030] FIG. **18***a* is another perspective view of the view of FIG. **18**.
[0031] FIG. **19** is a perspective view of a portion of the compartment of FIG. **18** with the door in a fully closed position.
[0032] FIG. **19***a* is another perspective view of the view of FIG. **19** with the door in the fully closed position.
[0033] FIG. **19***b* is a detail perspective view of the compartment of FIG. **18** with the door in the fully closed position.
[0034] FIG. **19***c* is a further detail view of the view of FIG. **19***b*.
[0035] FIG. **20** is a side view of a compartment of FIG. **18** with an obstruction positioned below the lower edge of the door to block the door from reaching the fully closed position
[0036] FIG. **20***a* is a detail perspective view of the orientation of FIG. **20**.
[0037] FIG. **20***b* is another detail perspective view of the orientation of FIG. **20**.
[0038] FIG. **21** is a side view of the compartment of FIG. **18** with an obstruction positioned below the lower edge of the door, with the door not yet reaching the lock and the position sensor, the obstruction preventing the door from traveling toward the fully closed position.
[0039] FIG. **21***a* is a perspective view of the view of FIG. **21**.
[0040] FIG. **21***b* is another perspective view of the view of FIG. **21**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0041] Turning now to FIGS. **1**-**16**, a cabinet **10** with a plurality of compartments **20** for enclosed storage is provided. The cabinet **10** disclosed and depicted herein is specifically designed for receiving food items for holding for customer pickup based upon previous orders, either at the facility or by remote ordering, e.g. via the internet or via an app. The cabinet **10** is specifically discussed herein for use with food products, normally packed food products or cooked food products in containers that are ready to picked up by a customer either at a restaurant, grocery store, or the like or at a remote location, but one of ordinary skill in the art will easily comprehend with a thorough review of this specification and figures that the cabinet **10** may be used non-food

items, such as products sold by stores, prescription drugs from a pharmacy, individualized papers, and the like. One of skill in the art with a thorough review of this disclosure will readily comprehend how the cabinet **10** may be used for various items for holding and pick up by a customer

[0042] The cabinet **10** may be configured to be located at a restaurant facility for holding and pick up of ordered cooked/processed at the restaurant facility, or the cabinet **10** may be disposed at a location remote from the restaurant facility but convenient for customers, such as to allow for a delivery service to position the item(s) within a compartment **20** (which can be enclosed by a door **50**) with the customer able to remove the items from the compartment at a convenient time for the customer.

[0043] The cabinet **10** may be adapted for a delivery service, or a restaurant directly, to deposit packaged food items into a selected compartment **20**, with a customer above to open the door **50** to the compartment and remove the items from the compartment **20** without any physical contact with the housing or the input device **99** of the cabinet. Similarly, the cabinet **10** may be made of materials and components, or components that may be touched by a user with surface coatings, which do not readily accept or retain biological material from a person that touches the component, or breathes, or coughs upon the components, or the like, or may be configured to prevent or minimize release of biological material received upon a surface thereof to another who later makes physical contact or comes into close proximity to the component.

[0044] The cabinet **10** may include a heating system that heats one, some, or all of the plurality of compartments **20**. The heating system may be via electrical resistance heaters or by other heating means. Additionally or alternatively, the cabinet **10** may include a refrigeration or cooling system for one, some or all of the plurality of compartments. In some embodiments, the cabinet **10** may include forced ventilation to allow for mixing of the heat generated by the heating system and/or cooling.

[0045] The cabinet **10** may be configured to selectively automatically open and close the doors **50** individually (as discussed below with each door **50** moved by a motor assembly **100**) based upon one of a plurality of inputs. For example, the cabinet **10** may include an input device **99** upon the cabinet that allows for a user to input a code, such as a number or a password to open the door associated with the compartment upon command. Similarly, the input device **99** may have a sensor that is capable of receiving and interpreting or identifying a symbol or code (such as a QR code, UPC symbol, or another automatically generated visual cue) and when received open the associated door **50**.

[0046] Additionally or alternatively, the cabinet **10** may be configured to automatically open the door **50** associated with the compartment upon receipt of a signal from a remote device, such as a signal generated by a customer's app, a delivery service's app, a restaurant's app, etc. upon a phone, tablet, computer, or another device capable of generating and communicating a signal. For example, the cabinet **10** may include Wi-Fi, cellular, Bluetooth, or other data communications technologies that work wirelessly with a remote server or network, or hard wired connectivity to a server that receives a signal from a remote device associated with the customer.

[0047] The cabinet **10** includes a plurality of compartments **20** which are individually enclosed by individual doors **50**, as understood with comparison of FIGS. **1** and **1***a*. In some embodiments, the construction of the cabinet **10** allows for the only access to the compartment **20** via an opening **20***a* that is selectively opened or enclosed by the door **50**, while in other embodiments, the cabinet may include an opening, such as a back of a cabinet that is open. In this embodiment, the cabinet **10** may be designed to be disposed within a restaurant where a restaurant employee can access the opening to position items within a respective compartment (such as from a location within the restaurant where customers are not normally allowed or present), while customers can only access the compartments when the doors **50** are open. In some embodiments, the compartments **20** may be vertically stacked, such that a ceiling of a compartment forms a floor of the compartment

positioned above that compartment. The cabinet may have a single or multiple columns of stacked compartments **20**.

[0048] As best shown in FIGS. **1***a*-**1***c*, each compartment **20** may include a sensing system **40** that is configured to determine whether the specific compartment **20** has any items, such as food products, disposed therein and available for pickup. In some embodiments, the sensing system **40** may be a system with a transmitter **41** and a receiver **42** that are disposed upon opposite walls within the compartment, such as the opposite right and left walls **25**, **26** that define the compartment **20**. In some embodiments, the transmitter **41** and the receiver **42** may be a laser, or another type of light source such as a source that operates in the infrared spectrum. As will be understood by one of ordinary skill in the art upon review of this specification, the transmitter and receiver **41**, **42** will be blocked when one or more items are disposed upon the floor of the compartment **20** and when the signal is blocked the sensing system **40** sends a signal to the controller **1000**. As discussed elsewhere herein, the controller upon receipt of a signal from the sensing system **40** that there are one or more items within the compartment **20**, or that there are no items in the compartment, the controller **1000** uses that information to operate the position of the door **50**, and also may cause communications to be sent to the restaurant or to the customer, such as to a POS system of the restaurant or to an app of the customer. For example, when the door **50** associated with the compartment that contains the sensing system **40** is in the open position, and the sensing system **40**, which had been sending a signal that indicated that one or more items are within the compartment to the controller, but then the controller **1000** receives a signal that there are no items in the compartment, the controller may be programmed to automatically cause the door **50** to move from the open position to the closed position, either immediately or after a predetermined delay time, as discussed below.

[0049] In some embodiments the sensing system **40** may be an array of a plurality of adjacent transmitters **41** and receivers **42**, or in other embodiments a single transmitter **41** and a plurality of receivers **42**. These embodiments with receivers spread to receive signals spaced along the cross-sectional area of the compartment **20** allow for redundancy (i.e. the sensing system for example may not conclude that there is an item within or no items within the compartment) when only a single transmitter receives or does not receive a light beam (for example) from a transmitter, and also will allow the sensing system **40** to identify that items are within the compartment **20** such as when they are positioned relatively close to the opening **20***a* or relatively close to a back wall of the compartment **40**. The sensing system **40** may be programmed with logic to determine that there is an item within the compartment, such as for example, when two independent receivers **42** no longer receive the light beam, instead of only a single receiver **42** to allow for continuity of correct operation when a one of the transmitters/receivers no longer operates correctly (due to loss of power, improper alignment of the light beam, or due to other reasons). In the embodiment depicted herein, each compartment **20** includes two sets of transmitters **41***a*, **41***b* that each have seven transmitters, and a corresponding two sets of seven receivers **42***a*, **42***b* that each receive a light from a transmitter.

[0050] As best shown in FIGS. **3**, **4**, **4***a*, **8**, **9**, and **12**, the door **50** associated with each compartment **20** can be automatically moved (as determined by the controller **1000** as discussed herein) between a closed position (FIGS. **3**, **4**) and an open position (FIGS. **8**, **9**). As shown in FIG. **4***a*, when the door **50** is in the closed position, the top edge portion **54**, and the top edge **54***a* of the door is spaced from the bottom edge portion **34** that defines the upper bounds of the opening **20***a* in the compartment as designated by distance X and as shown in FIG. **9**, when the door is in the open position, the bottom portion **52** is spaced from the bottom edge portion **34**, with that spacing maintained (at least) throughout the range of motion of the door **50**. This space X, which may be in some embodiments 0.75 inches or in other embodiments within a range of about 0.75 to 2 inches, inclusive of all values within this range, is provided to prevent pinching of items that may extend between the door and the bottom edge portion, to prevent personnel injury if the door **50** is

operated when an item (such as a user's finger) is disposed within the space when the door **50** is moved, while being small enough to prevent theft or minimize any reasonable chance of physical disturbance of the contents within the compartment when the door **50** is closed. As discussed below, if in the closing direction the door is prevented from movement the controller **1000** will stop the closing motion of the door **50**. The term “about” is specifically defined herein to include the reference value as well as 5% plus or minus the reference value.

[0051] In the embodiments depicted and specifically described in this specification, the door **50** contacts the top edge portion **32** of the walls of the compartment when in the closed position. In other embodiments, the door **50** may maintain a small gap between the top edge portion **32** and the bottom edge portion **52** of the door **50** when in the closed position, with the small gap provided to minimize pinching between the door and the top edge portion **32**, while preventing theft or minimizing any reasonable chance of physical disturbance of the contents within the compartment **20** when the door **50** is closed.

[0052] Each door **50** may be rotatably mounted to the cabinet, and specifically the side walls **25**, **26** that form the side walls of the respective compartment **20** with a pinned connector with another rotatable connection as known in the art. Each door **50** includes side panels **55**, **56** that extend rearwardly from the door **50** and extend into the respective compartment **50**, with the side panels **55**, **56** making the pinned or other connection with respect to the side walls.

[0053] In some embodiments, a motor assembly **100** is disposed upon one of the side walls that forms the compartment (such as the side wall **25** that neighbors the side panel **56** of the door **50**) with the motor assembly **100** being operable to control the motion of the door **50** between the open and closed positions.

[0054] The motor assembly **100** may include the following components: a motor **110** that includes a motor shaft **112**, an inner plate **70** that is fixed to the motor shaft, first and second door position sensors **134**, **144** that are fixed with respect to the side wall **25**, and a safety sensor **124** that is fixed with respect to the motor shaft to move along an arc as the motor shaft **112** is rotated. The motor assembly **100** further includes a first leg **72** that extends from the side panel **56** and extends through a slot **72** in the inner plate **70**, and a second leg **62** that extends from the side panel **56** and selectively interacts with the first, second, and the safety sensor **134**, **144**, **124**. In some embodiments, the components of the motor assembly (other than the shafts **72**, **62** that extend from the door **50**) may be fixed upon a rigid plate **102** to allow for precise positioning with respect to each other as well as to allow for efficient assembly of the cabinet by only needing to fix the rigid plate **102** onto the side wall (in a position such that the two legs **72**, **62** are properly positioned within and through the correct slots) with a plurality of fasteners and then make needed electrical connections. In some embodiments, the transmitters **41** of the sensing system **40** may also be positioned upon the rigid plate for ease of assembly of the cabinet **10**.

[0055] The motor **110** may a DC or an AC motor that is capable of rotating its shaft **112** in either rotation direction based upon receipt of a first signal (first direction, which will move the door in the direction toward the open position) or a second signal (second direction, which will move the door in a direction toward the closed position). This specification describes the transmission and receipt of signals between various components and the controller **1000**. Various paths for passing signals are depicted schematically as **201-206** in FIG. **1***a*, and the cabinet **10** will include the required wiring or other paths for signal flow between the various components and the controller **1000** as is well known in the art.

[0056] The motor **110** may be such that the motor **110** stops rotating automatically if the first or second signal is no longer received. In some embodiments, the motor shaft **112**, includes first and second portions **113**, **114** that extend from the motor housing in opposite directions with both portions **113**, and **114** either being the same shaft or rotatably fixed with respect to each other such that both shaft portions **113**, **114** always rotate in the same direction. In some embodiments, the portions **113**, **114** may be separate shafts with a transmission therebetween to allow the different

portions **113**, **114** to rotate at different speeds. The embodiment disclosed in the figures depicts a single shaft **112** where the portions **113**, **114** are opposite ends of the same shaft and where torque is applied to the shaft at an intermediate point between the two ends (within and enclosed by the motor housing). The motor shaft **112** position may be identified and controlled with one of various types of conventional technologies, such as an encoder, hall effect sensors, visual markings upon the motor shaft, or the like.

[0057] The inner plate **70** (best shown in FIG. **7**) may be positioned in surface to surface contact with the side panel **56** of the door **50**, while in other embodiments, the inner plate **70** may be positioned spaced from but maintained substantially parallel to the side panel **56** for all or for at least a portion of the inner plate **79**. The term "substantially" is specifically defined to mean exactly the reference value as well as with an angle of no more than 5 degrees plus or minus the reference value. The inner plate **70** may include a collar **78** that is fixed to a center hole therethrough. The inner plate **70** is fixed to the first end portion **113** of the shaft **112**, either with the collar **78** having a flat that mates with a corresponding flat **113***a* upon shaft **113** and/or with a set screw that extends through the collar **78** and engages the shaft **112**.

[0058] The inner plate **70** includes a slot **72** that receives a first leg **58** that extends perpendicularly from the side panel **56**. The slot **72** has an arc length that allows for a certain amount of relative rotation between the inner plate **70** (and the motor shaft **112** to which the inner plate **70** is fixed) and the side panel **56**. In some embodiments, the slot **72** may be sized to allow for 12 degrees or about 12 degrees of relative rotation between positions where the first leg **58** contacts a first end **72***a* of the slot and when the first leg **58** contacts the second end **72***b* of the slot **58**. In other embodiments, the slot **72** may have an arc length to allow other amounts of relative rotation, such as 10 degrees, 15 degrees, 20 degrees, or any amount within the range of about 10 degrees to about 20 degrees inclusive of all angles within this range.

[0059] A spring **79** is disposed between the side panel **56** and the inner plate **70**, with the spring **79** provided to urge against relative rotation of the inner plate with respect to the side panel, such as to urge the first leg **58** to contact the first end **72***a* of the slot **72**. In other embodiments, a torsion spring may be disposed about the motor shaft **112** and connect the motor shaft and the side panel **56** to urge the side panel to rotate with the motor shaft **112**.

[0060] In a preferred embodiment, the inner plate **70** is disposed within the compartment **20** or at least on a side of the side panel **56** of the door **50** in the direction of the respective compartment **20**.

[0061] The motor assembly **100** further includes a travel slot **82** that may be disposed upon the rigid plate **102**, through which a second leg **62** extends. The second leg **62** is fixed to the side panel **56** and in some embodiments extends in an opposite direction therefrom as the first leg **58**, and in some embodiments, the second leg **62** extends in a direction away from the respective compartment **20**. The second leg **62** extends through the travel slot **82**, with the arc length of the travel slot **82** establishing the amount of potential movement of the door **50** between the closed position and the open position, in other words the range of motion of the side panel **56** of the door **50** with respect to the rigid plate **102**, which is fixed to the side wall **25** of the compartment **20**.

[0062] In some embodiments, the travel slot **82** includes 90 degrees of arc length to allow the door **50** to move from the closed position to an open position is perpendicular to the closed position, with all, or in some embodiments, a significant portion of the door **50** positioned within the compartment **20** when in the open position. In some embodiments, the travel slot **82** may be exactly 90 degrees, or substantially 90 degrees, while in other embodiments, the travel slot **82** may be between about 80 and about 100 degrees including all values within that range, with the sizing of the door **50** and the opening **20***a* into the compartment **20** being such that the largest object that is envisioned to be received within the compartment can be put into and withdrawn from the compartment with the door **50** in the open position.

[0063] As best shown in FIGS. **6**, **10**, and **10***a*, the motor assembly **100** has first and second door position sensors **134**, **144** that are fixed with respect to the side wall **25** of the compartment **20** and

in some embodiments are fixed to the rigid plate **102**. The first door position sensor **134** is configured to determine when the second leg **62** has reached, or is in close proximity to the first end **82***a* of the slot **82**, which corresponds to the closed position of the door **50**. Similarly, the second door position sensor **144** is configured to determine when the second leg **62** has reached or is in close proximity to second end **82***b* of the slot **82**, which corresponds to the open position of the door **50**.

[0064] One or both of the first and second door position sensors **134**, **144** may have a tongue **136**, **146** that extends in a cantilevered manner from the housing **135**, **145** of the respective sensor and an input device **138 148** upon the housing **135**, **145**. In some embodiments, the input device **138**, **148** may be a biased member that normally extends out of the sensor housing toward the tongue, and with motion of the tongue toward the housing is compressed into the housing against the biasing force. In one embodiment, the sensors may be a sensor such as the D3V Miniature Basic Switch, manufactured by Omron. In other embodiments, the input device **138**, **148** may work based upon magnetic coupling when the tongue is moved close enough to the sensor, or with electrical coupling when the tongue makes contact with the input device, or by other methods of sensing a changing position of the tongue that are known in the art.

[0065] In these embodiments, the tongue **136**, **146** of the respective first and second sensor is disposed such that it extends through the path of the second leg **62** as the second leg **62** slides through the slot **82** with door movement. As shown in FIGS. **10** and **10***a*, the tongue **146** of the second sensor **144** is disposed in a position where it is first contacted by the second leg **62** (at position **146***a* upon the tongue **146**) as the second leg approaches the second end **82***b* of the slot, i.e. when the moving door **50** approaches the open position (FIG. **10***a*). Continued motion of the second leg **62** applies a force upon the tongue to bend the tongue toward the housing **145** and the input device **148**. In embodiment where the input device is a biased member, continued motion of the second leg **62** causes the tongue **146** to contact and apply a force against the input device **148** thereby pushing the input device **148** into the housing **145** of the sensor as depicted in FIG. **10***a*. With sufficient motion of the input device **148** an electrical connection within the sensor housing **145** is either made or lost (depending upon the design of the sensor as normally open or normally closed), which either establishes or stops a signal that is sent to the controller **1000** (depending upon the electrical design of the motor assembly **100**) that identifies to the controller that the door **50** has reached the open position **50** (and in some embodiments the signal (or lack or signal) continues as the door remains in the open position). As discussed herein (and with respect to this second sensor, as well as the first sensor **134** and the safety sensor **124**, discussed below), the change in the signal sent to the controller (i.e. either specifically sending a signal to the controller at the time the input device **148** makes or breaks the electrical connection or stopping sending a previous signal to the controller) is defined as sending a signal to the controller (i.e. the signal to the controller is either starting to send the signal or discontinuing to send a previous signal). When the controller **1000** receives the signal (or as mentioned above, identifies that the previous signal was lost) the controller **1000** discontinues sending the first signal to the motor, which stops the motor shaft **112** from spinning in the open direction.

[0066] In some embodiments, the second position sensor **144** and its tongue **146** are positioned such that the second leg **62** contacts the tongue (at position **146***a*) and moves the tongue **146** to actuate the input device **148** at a position before the second leg **62** reaches the end **82***b* of the slot, such that time is allotted for the controller to stop actuating motion of the motor shaft before the second leg **62** contacts the end **82***b* of the slot to prevent the second leg **62** from contacting the end **82***b* with significant momentum (speed) to prevent banging or vibration, and to minimize any noise created as the door movement stops due to the second leg **62** reaching the mechanical stop **82***b* of the end of the slot **82**.

[0067] In other embodiments, the second position sensor **144** may be a proximity sensor, or a light sensor, or a position sensor, or a magnetic sensor. For example, the second position sensor may

include an arm that is positioned to extend into the path of the second leg, which when contacted by the arm directly makes an electrical connection that results in a signal being sent to the controller. Alternatively, the sensor may be a magnetic sensor that couples with the second leg **62** when in close proximity to the second leg, with the magnetic coupling resulting in a signal being sent to the controller. Still alternatively, the sensor may be a light sensor that sends a light beam across the path of the slot **82**, which identifies that the second leg **82** is at or proximate to the second end **82***a* of the slot when the second leg breaks the light beam, resulting in a signal being sent to the controller. Other types of sensors that can detect the position of the second leg **62** within a certain position within the slot **82** may be provided to replace the second sensor **144** specifically described above (as well as the first and safety sensor discussed below) and one of ordinary skill in the art after a thorough review of this specification will readily be able to use alternate sensors that are known in the art without undue experimentation.

[0068] The operation of the first position sensor **134** operates in a similar manner to the second position sensor **144** discussed above. The tongue **136** of the first position sensor **134** is disposed through the slot **82** and in a position where it is contacted by the second leg **62** (at position **136***a*) as the second leg approaches the first end **82***a* of the slot, i.e. when the door **50** is being moved from the open position toward the closed position. As with the second sensor **144** discussed above, when the second leg **62** contacts the tongue **136** of the first sensor **134**, it applies a force to the tongue **136**, which bends the tongue **136** toward the housing **135** until it contacts the input device **138**, and with continued motion of the second leg **62** the input device **138** is pushed into the housing **135** a sufficient amount to make or lose an electrical connection within the housing, which establishes or stops a signal to the controller **1000**, in a similar manner to the signal being sent or stopped to the controller from the second position sensor **144** discussed above. FIG. **6** depicts the tongue **136** pushing the input device **138** into the housing (and the initial position, with contact between the second leg **62** and the tongue but without yet contacting the input device would be similar to FIG. **10**).

[0069] Embodiments where the input device **138**, **148** is not a mechanically movable input device, but instead worked with magnetic coupling or with an electrical signal made directly between the tongue and the input device (when engaged) would operate in a similar manner with respect to the second leg **62** causing motion of the respective tongue when the door reached the established position.

[0070] The motor assembly **100** further comprises a safety sensor **124**. In some embodiments, the safety sensor **124** is the same type of sensor as used for the first and second sensors **134**, **144**, or the safety sensor may be a different type of sensor. The safety sensor **124** is configured to move along an arc with rotation of the motor shaft **112**. In some embodiments an outer plate **120** is fixed to the motor shaft **112**, and in some embodiments the first end **114** of the motor shaft **112**. The outer plate **120** may include a collar **122** which fixes to the motor shaft in a similar manner to the structure to fix the inner plate **70** to the motor shaft as discussed above. The safety sensor **124** is fixed proximate to the outer circumference of the outer plate **120** and aligned such that its tongue **126** extends across the second shaft **62** and in some embodiments makes contact with the second shaft **62**, with the tongue **124** making contact with a portion of the second shaft **62** that generally faces the second end **82***b* of the slot **82**. As discussed further below, in circumstances when there is relative motion between the motor shaft **112** and the door **50** (e.g. the motor shaft **112** rotates in the direction to close the door **50** but the door does not move in this direction), the outer plate **120** rotates and the safety sensor moves in an arc with the circumference of the outer plate **120**, but the second leg **62** stops moving (or doesn't move as fast as the safety sensor). This relative motion causes a force to be applied to the tongue **126**, which eventually causes the tongue **126** to contact and move the input device **128**. With sufficient motion of the input device **128** into the housing **125**, and electrical connection is either made or lost, which causes a signal from the safety sensor to the controller **1000** to be made or lost, which causes the controller **1000** to stop sending a signal to

rotate the motor shaft **112** in the closing direction.
[0071] The safety sensor **124** works in conjunction with the inner plate **70**, and specifically the slot **72** within the inner plate **70** that receives the first leg **58**. Normally, when the motor shaft **112** rotates, the first leg **58** (that extends from the side panel **56** of the door **50**) contacts the first end **72***a* of the slot **72** as the motor shaft **112** rotates in a direction to transfer the door from the open position toward the closed position (FIG. **7**). If the motion of the door **50** is blocked, as shown schematically by an object **11000** disposed between the upper surface **32** of the cabinet and the bottom edge portion **52** of the door in FIG. **12**, the door **50** and therefore the side panel and the first and second legs **58**, **62** are prevented from motion in the closing direction, and as the inner plate **70** continues to rotate with the motor shaft **112**, causing the first shaft to move along the slot **72** until it reaches the opposite end **72***b* of the slot **72** (FIG. **15**) with the force to continue to rotate the inner plate against the biasing force of the spring **79**.
[0072] At the same time, with rotation of the motor shaft **122**, the outer plate **120** also continues to rotate, which causes the safety sensor **124** to continue moving within an arc, but the second leg **62** discontinues rotating due to the object **11000** preventing motion of the door. As the safety sensor **124** continues to rotate, a force is applied to the tongue **126**, which bends the tongue into contact with the input device **128** (or with other types of sensors, coupling with the input device), which causes the input device to move into the housing **125** and make or break an electrical connection as discussed above, which ultimately causes the controller **1000** to stop rotation of the motor shaft **112**.
[0073] In a preferred embodiment, the amount of rotation of the motor shaft when the door is prevented from moving is preferably sufficient to cause the safety sensor **124** to send a signal to the controller **1000** to stop rotating the motor shaft before the first leg reaches the second end **72***a* of the first slot **72**.
[0074] In some embodiments, when the first sensor **134** sends a signal to the controller that is indicative that the door is close to or has reached the closed position, the controller **1000** upon receiving that signal is able to send a signal to the motor to rotate the shaft in the direction to cause the door **50** to move toward the open position (such as upon receipt of an input from a user that the user desires to retrieve the items within the respective compartment **20**), but is unable to send a signal to the motor to cause the shaft to rotate in the direction to cause the door to continue moving toward closed position. Similarly, when the second sensor **144** sends a signal to the controller that is indicative that the door is close to or has reached the open position, the controller **1000** upon receiving that signal is able to send a signal to the motor to rotate the shaft in the direction to cause the door **50** to move toward the closed position (such as after a delay time after the sensors **40** determine that the items within the compartment **20** have been removed), but is unable to send a signal to the motor to cause the shaft to rotate in the direction to cause the door to continue moving toward the open position.
[0075] One of ordinary skill in the art with a thorough review of this specification will understand that the motor assembly **100** and specifically the features to discontinue rotation of the motor shaft **112** when there is a blockage of the movement of the door is configured to minimize any potential injury if a user's hand or arm or other extremity is disposed between the door **50** and the top surface **32** of the cabinet, as well as to minimize damage to objects if a physical object is disposed below the door to prevent motion of the door. One of ordinary skill will be able to size and appropriately position the components described herein to best satisfy these purposes of the system for varying sized compartments, doors, and the like with only routine optimization.
[0076] In some embodiments, when the controller **1000** receives (or loses) the signal from the safety sensor **124**, the controller **1000** may be programmed to immediately send a signal to the motor **110** to rotate the motor shaft **112** in the opposite direction, i.e. to transfer the door toward the open position.
[0077] Turning now to FIGS. **17-21***b*, another representative embodiment of the disclosure is

provided. The embodiment relates to an alternate cabinet **400** with a plurality of compartments **420** each with their own door **450**. The cabinet **400** is configured to automatically open the door **450** associated with one of the compartments upon receipt of a signal from a remote device or from an input device **402** associated with the cabinet **400**. The signal from a remote device may be a signal generated by a customer's app, a delivery service's app, a restaurant's app, etc. upon a phone, tablet, computer, or another device capable of generating and communicating a signal. For example, the cabinet **400** may include Wi-Fi, cellular, Bluetooth, or other data communications technologies that work wirelessly with a remote server or network, or hard wired connectivity to a server that receives a signal from a remote device associated with the customer.

[0078] The cabinet **400** includes a plurality of compartments **420** which are individually enclosed by individual doors **450**. In some embodiments, the construction of the cabinet **400** allows for the only access to the compartment **420** via an opening **420***a* that is selectively opened or enclosed by the door **450**, while in other embodiments, the cabinet may include an opening, such as a back of a cabinet that is open. In this embodiment, the cabinet **400** may be designed to be disposed within a restaurant where a restaurant employee can access the opening to position items within a respective compartment (such as from a location within the restaurant where customers are not normally allowed or present), while customers can only access the compartments when the doors **450** are open. In some embodiments, the compartments **420** may be vertically stacked, such that a ceiling of a compartment forms a floor of the compartment positioned above that compartment. The cabinet may have a single or multiple columns of stacked compartments **420**.

[0079] The cabinet **400** has a system to identify when an obstruction is present below a door **450** and prevent further motion of the door **450** in the closing direction. The door **450** may move between a fully closed position (FIGS. **19**-**19***c*) to a fully open position (FIGS. **18**-**18***a*). The door **450** moves along a track **510** that is positioned along one or both right and left side walls **402**, **403** of the compartment **420**, with the walls (and floor **404** and ceiling (which may be formed by a floor in a compartment above the specific compartment, and rear wall **405**, when provided) being a part of the housing within the cabinet.

[0080] The system includes a motor **455** that includes a motor shaft **456**, which is engaged with a transmission **457** to allow for rotation of the motor shaft **456** to result in translation of the door between fully open and fully closed positions. In some embodiments, a belt **458** extends about the motor shaft **456** (or a pulley that is fixed to the motor shaft **456**) such that rotation of the motor shaft **456** causes movement of the belt **458**. The belt **458** may extend from the motor shaft to a second idler pinion (not specifically shown, but positioned at the belt proximate to the front end of the housing) that is positioned proximate opposite to the motor, such as in the depicted embodiment proximate to the opening **420***a* of the compartment with the motor positioned proximate to the rear of the compartment. In some embodiments, the belt may extend between the two pinions (or one pinion and the motor shaft **456**), while in other embodiments the belt **458** may further extend around additional idler pinions, such as to allow for belt tension adjustment to simplify replacement of belts.

[0081] The system includes a carrier **470** that is fixed to the belt **458**, such that the carrier **470** translates with movement of the belt. In some embodiments, the belt **458** has a plurality of teeth **458***a* disposed along the belt, and the carrier engages with the teeth **458***a* to prevent relative motion therebetween. As depicted in FIG. **19***c*, the carrier **470** may receive a fixture **499** that engages the teeth **458***a* of the belt to fix the carrier to the belt **458**. The fixture **499** when provided has complementary teeth **499***a* to the teeth **458***a* of the belt **458**.

[0082] The carrier **470** may ride along shafts **494** that extend along the compartment, which are positioned to support the travel of the carrier **470** between positions where the door is in the fully open position and the fully shut position.

[0083] The carrier **470** may have a planar portion **472** that includes apertures **473** to receive the shafts **495** therethrough. The planar portion **474** may support a finger **472** that extends therefrom

(or is a part of the planar portion), which interacts with the projection **482**, as discussed below. The planar portion **474** may additionally support an arm **476** that extends therefrom, which is aligned to interact with a position sensor **486** that is positioned proximate to the front of the compartment, which is discussed below. The arm **476** may extend along a plane that is parallel to a plane through the planar portion **474**, to allow for positioning the position sensor **486** for detecting when the carrier **470** is in a fully forward position, but to provide space (X, FIG. **19***c*) for the position sensor to be positioned rearwardly of the front surface of the housing.

[0084] The position sensor **486** is provided to be engaged with by the carrier, and specifically the arm **476**, when the carrier is in the fully forward position. The position sensor may have a plunger **486***a* that extends therefrom, which is pressed inwardly by the arm **476** when the carrier is in the fully forward position. Alternatively, the position sensor **486** may be a magnetic switch, an electric switch, or another known type of switch for determining a position of a movable member. The position sensor **486** generates a signal that the carrier **470** is in the fully forward position, which is used to stop rotation of the motor shaft **456** to discontinue movement of the carrier **470**. The position sensor **486** may communicate directly with the motor, or a controller **2000** (depicted schematically in FIG. **17**) may be provided to communicate between with the motor based upon receipt of a signal from the position sensor **486**.

[0085] A lock **480** may be provided to prevent the carrier **470** (and therefore the door) from moving from a fully forward position (corresponding to the door being in the closed position) toward a rear position (corresponding to the door opening and moving to a fully open position). In one embodiment, the lock **480** includes a projection **482** that extends between a retracted position to allow free motion of the carrier **470** in the rear direction and an extended position that blocks the path of the finger **472** that extends from the carrier **470** (as best understood with reference to FIG. **19***c*).

[0086] The projection **482** may include a wedge shaped surface **484** that faces the finger **472** when the finger **472** is positioned rearwardly of the projection **482**. The wedge shaped surface **484** is disposed such that when the finger **472** contacts the projection when moving in the forward direction, the finger emparts a forward directing force upon the wedge shaped surface **484**, which due to the geometry of that surface provides a force vector that is perpendicular to the direction of travel of the finger **472**, which causes the projection **482** to move linearly in a direction that is perpendicular to the direction of travel of the finger and withdraw from contact from the finger **472**. The wedge surface **484** may be planar, or may be entirely or have a portion that is arcuate to constrain the movement of the projection as desired with forward motion of the finger **472**.

[0087] With continued motion of the carrier **470** in the forward direction, the finger **472** causes the projection **482** to fully withdraw so that the finger can pass by the projection to allow the carrier **470** to reach the fully forward position. Once the finger **472** passes by the projection **482**, the projection **482** returns to its normal position (FIG. **19***c*) automatically. In some embodiments, the projection **482** may be biased toward the normal position with a spring, or the projection may be biased or urged to the normal position with a magnetic force, or via a linear actuator, or based upon other known components to continuously urge a member in a direction for a given distance (but be capable to allowing opposing motion due to a force applied thereon in the opposing direction).

[0088] The projection **482** when in the normal position (positioned within the path that the finger **472** takes as the carrier **470** moves between the forward and rear positions) and the finger **472** is forward of the projection **482**, the projection when in the normal position blocks rearward motion of the finger **472** (and therefore the carrier **470**) in the rearward direction. This serves to “lock” the carrier **470** (and therefore the door **450**, as discussed below) in the closed position. The projection **482**, and an operator **481** which controls the position of the projection **482**, receives a signal regarding the desired position of the projection (as mentioned above), i.e. in the locked position (projection **482** disposed within the path of finger motion) or unlocked position (projection **482** withdrawn away from the path of finger motion) and the operator **481** controls the position of the

projection **482** based upon receipt of this signal. In some embodiments where a controller **2000** is provided, the controller **2000** receives the desired position signal of the door—(i.e. signal to maintain the door **450** locked in the closed position, or signal to open the door **450**) and sends a signal to the operator **481** to either maintain the door in the closed position—i.e. maintain the projection **482** in the extended position (within the travel of the finger **472**) or to open the door, which causes the operator **481** to withdraw the projection **482** from the extended position to allow rearward travel of the finger **472** past the projection. When the controller **2000** receives a command to open the door, the controller **2000** also sends a signal to the motor **455** to cause the motor to rotate its shaft **456** in the direction to cause the belt **458** to move in the direction to move the carrier **470** from the forward position toward the rear position.

[0089] Turning now to FIGS. **19***b* and **20***b*, a bracket **490** is provided and is connected to the door **450**, preferably proximate to a top portion **450***a* of the door **450** with a pinned connection **533**. The bracket **490** is movably supported by the carrier **470** such that the bracket **490** moves with movement of the carrier **470** between the forward and rear positions of the carrier **470**, which causes the door **450** to also move between respective closed and open positions as the carrier **470** moves between the forward and rear positions.

[0090] In some embodiments, the carrier **470** includes one or more (**2** in the depicted embodiment) shafts **478** and the bracket **490** including corresponding apertures through which the shafts **478** extend to constrain the position of the bracket **490** with respect to the carrier **470** to only allow relative longitudinal motion. The bracket **490** and the carrier **470** are connected with a spring **488**, which biases the bracket **490** to a first position with respect to the carrier (corresponding to the door **450** being fully shut when the carrier **470** is in the fully forward position), but allows for relative linear motion of the bracket **490** with respect to the carrier **470** as constrained by the shafts **478**. The bracket **490** may include an extended leg **495** that receives an end of the spring **488**, which extends outside of the bounds of the remainder of the bracket **490**, and establishes a distance for extension of the spring **488** as the bracket **490** moves with respect to the carrier **470**, as discussed below.

[0091] FIG. **19***b* depicts a perspective view of the carrier **470** and the bracket **490** with the door in the closed position. FIG. **20***b* is a perspective view of the carrier **470** and the bracket **490** with the door **450** prevented from reaching the closed position due to an object **3000** (such as a box) disposed below the lower edge **450***b* of the door blocking the closure of the door (FIG. **20**). In operation, the door **450** is moved from the open position (FIG. **18**) to the closed position (FIG. **19**) by rotating the motor shaft **456** to drive the belt **458**, which causes the carrier **470** to slide linearly toward the forward end of the housing (as constrained by the shafts **494**). The bracket **490** moves in the forward direction along with the carrier **470** due to the spring **488** urging the bracket **490** to move with the carrier **490**. The door **450** moves toward the closed position as the door rides within the track **510**. The track **510** is curved to cause the door to move from a position where it is exactly or generally parallel to the floor when in the open position to a position where it is exactly or generally perpendicular to the floor when in the closed position. The term “generally” is defined herein to mean within plus or minus 5% of a given dimension or a given angle.

[0092] When the belt **458** has moved sufficiently, the door approaches the closed position and has reached an orientation that is close to perpendicular to the floor due to the shape of the track. The finger **472** of the carrier **470** contacts the wedge surface **484** of the projection **482**, which applies a force to the projection **482**. A vector component of the force extends in a direction to urge the projection **482** inwardly to allow the finger **472** to continue moving past the projection, and when the finger **272** is clear of the projection the projection returns to its normal extended position though the path of motion of the finger **272**.

[0093] If the door **450** contacts an object **3000** that is below the door before the door has reached the fully closed position (depicted in FIG. **20**), the carrier **470** continues to move, with belt **458** motion, but the door **450** is prevented from moving, which also stops the bracket **490** from moving

along with the carrier **470**. With continued motion of the carrier **470**, the bracket **490** allows continued movement of the carrier **470** (by the shafts **478** moving through apertures in the bracket **490**) and the spring **488** is extended with the continued motion of the carrier, as shown in FIGS. **20** and **20***b* (with the lengthened spring **488** depicted schematically for simplicity). The extension of the spring **488** applies a force (proportional to the length of spring extension and the spring constant) to urge the carrier and bracket to return to their normal position. With continued motion of the carrier **470**, the arm **476** of the carrier **470** reaches the position sensor **486**, which causes the motor **455** to stop rotating, causing the carrier **470** to stop moving.

[0094] While the spring force and the weight of the door **450** interact with the object **3000** disposed below the door, the system may be designed such that the force that the door applies to the object is limited to avoid any injury or damage to the object **3000** below the door, especially if the object is for example a user's hand or finger.

[0095] When the object **3000** is withdrawn from below the door, the spring **3000** urges the bracket to slide along the carrier **470** (as constrained by the shafts **478**) to allow the door to reach the fully closed position (FIG. **19**).

[0096] The lock **480**, as discussed above, prevents the door **450** from being manually opened a distance greater than the allowed relative travel between the carrier **470** and the bracket **490**. Specifically, when the door **450** is in the fully closed position, a user may be able to apply an upward force to the door **450**, which causes the bracket **490** to slide and also causes the carrier **470** to slide with the force of the bracket **490** transferred to the carrier **470** by the spring **488**. The carrier **470** with a small amount of motion in the rear direction contacts the projection **482** that extends within the path of the finger **472**, which prevents further motion of the carrier **470**. As the door **450** is continued to be raised, the bracket **490** moves with respect to the carrier **470** but the door begins to feel resistance to motion as the spring **488** expands. Eventually, the bracket **490** is prevented from further movement due to the bracket's relative motion with the carrier causing the bracket **490** to reach the end of the shafts **476**, which prevents further movement of the door **450**. When the door **450** is released, the door returns to the closed position due to the weight of the door as well as the force of the spring **488** returning the bracket **490** to the normal position with respect to the carrier **470**. One or ordinary skill in the art with a thorough review of this specification will understand how to design the door **450**, carrier **470**, bracket **490**, and spring **488** to allow the protection and injury prevention benefits (discussed herein) when the door is mechanically blocked by an object below the door when the door is being closed, as discussed above, while minimizing the amount that the door **450** can be opened manually when the door is in the closed position to prevent the door from being opened manually by a person at the cabinet—such that typical objects that are intended to be stored within the cabinet when the door is closed cannot be removed from the cabinet when the door is manually opened the amount as possible due to the design of the carrier **470** and the bracket **490**.

[0097] In some embodiments, the housing may include a recess **550** positioned within the floor **403** below the door at the front of the housing such that the lower portion **450***b* of the door enters the recess **550** when in the closed position, which prevents the user from easily being able to slide or wedge a member (such as a screw driver) below the bottom edge of the door **450** to prevent or make it more difficult for a person to attempt to manually lift the door in the open direction.

[0098] Turning now to FIGS. **21**-**21***a*, the door **450** may encounter an object **4000** (schematically depicted in FIG. **21**) that prevents further door motion in the closing direction before the carrier **470** reaches the projection **482** and the sensor **486**. In this case, the object **4000** prevents door motion, which causes the bracket **490** to discontinue moving linearly with the carrier **470**, thereby extending the length of the spring **488** as the carrier **470** continues to move forwardly with motion of the belt **458**. With continued motion, the carrier **470** reaches the full extent of possible relative travel with respect to the bracket **490** (as constrained by the length of the shaft **478**) and therefore the carrier **470** no longer moves, which also binds the belt **458** from further movement. This force

applied to the carrier **470** by the spring (in a direction opposite to belt **458** motion) is applied to the belt and causes the belt to apply a resistive torque to the motor shaft **456**, which is sensed by the motor **455**. Upon sensing this resistive torque, the motor **455** discontinues rotating its shaft **456**, and in some embodiments sends a signal to the controller **2000** about this occurrence, which may provide an alarm to the user via the input device (upon the housing or the remote input device). Once the object **4000** that obstructed movement of the door is removed, the user may provide an input that is received by the controller, which again allows the motor **455** to begin again rotating the shaft **456** in the direction to continue closing the door.

[0099] Certain aspects of the disclosure are embodied by the following numbered paragraphs:

[0100] Numbered Paragraph 1: A system for opening and closing a door within a cabinet, comprising: [0101] a motor supported upon one or more walls of a cabinet, the motor comprising a motor shaft, the motor in communication with a controller wherein the motor is configured to rotate the motor shaft in a first direction upon receipt of a first signal from the controller and the motor is configured to rotate the motor shaft in a second direction upon receipt of a second signal from the controller, wherein rotation of the motor shaft in the first direction causes a door to move in a direction associated with transferring the door from a closed position toward an open position and wherein rotation of the motor shaft in the second direction causes the door to move in a direction associated with transferring the door from the open position toward the closed position; [0102] a first plate fixed to the motor shaft to rotate with rotation of the motor shaft, the plate comprises a slot disposed therein; [0103] a first leg that extends from a door that extends through the slot; [0104] a second leg that extends from the door; [0105] a first sensor that moves based upon rotation of the motor shaft, wherein the first sensor can detect relative motion between the motor shaft and the door, wherein when the motor shaft is rotated in the second direction and the first sensor detects relative motion between the motor shaft and the door, the first sensor sends a signal to the controller, wherein upon receipt of the signal the first sensor discontinues sending the second signal to the motor. [0106] Numbered Paragraph 2: The system of Numbered Paragraph 1, wherein the sensor includes a tongue that extends in a cantilevered manner therefrom and engages the second leg, wherein when the first sensor moves with respect to the second leg, the tongue mechanically engages an input component in the first sensor, wherein engagement of the input component causes the first sensor to detect the relative motion between the motor shaft and the door and send the signal to the controller. [0107] Numbered Paragraph 3: The system of Numbered Paragraph 2, wherein the first sensor is fixed to a second plate that is fixed to the motor shaft to rotate with rotation of the motor shaft, wherein the motor shaft includes a first portion that extends in a first direction from a motor housing and is fixed to the first plate, the motor shaft includes a second portion that extends in an opposite second direction from the motor housing and is fixed to the second plate. [0108] Numbered Paragraph 4: The system of any one of Numbered Paragraphs 1-3, further comprising second and third sensors, wherein the second sensor is configured to identify and send a signal to the controller when the door is in or is in close proximity to the closed position, and the third sensor is configured to identify and send a signal to the controller when the door is in or is in close proximity to the open position, wherein the second leg moves with respect to the second and third sensors and engagement between the second leg and the second and third sensors causes the respective second and third sensor to identify and send the respective signal. [0109] Numbered Paragraph 5: The system of Numbered Paragraph 4, wherein when second sensor identifies that the door is in or is in close proximity to the closed position, the controller is able to send the first signal to the motor but is unable to send the second signal to the motor. [0110] Numbered Paragraph 6: The system of Numbered Paragraph 5, wherein when the third sensor identifies that the door is in or is in close proximity to the open position, the controller is able to send the second signal to the motor but is unable to send the first signal to the motor. [0111] Numbered Paragraph 7: The system of any one of Numbered Paragraphs 1-6, wherein the engagement of the first leg within the slot allows the motor shaft to move between about 10 to 20

degrees of rotation with respect to the door. [0112] Numbered Paragraph 8: The system of Numbered Paragraph 2, further comprising a spring disposed between the first plate and the door to urge engagement between the first leg and a first end of the slot due to a biasing force of the spring, wherein when the motor is rotated in second direction and the door is prevented from rotating, the first leg slides within the slot toward the opposite second end of the slot and against the biasing force of the spring, and wherein with continued rotation of the motor shaft in the second direction, the second leg applies a force to the tongue of the first sensor which moves the tongue into engagement with and to apply a force to the input component of the first sensor. [0113] Numbered Paragraph 9: The system of any one of Numbered Paragraphs 1-8, further comprising a door rotatably mounted to the one or more walls of the cabinet, and capable of being moved between the open and closed positions with rotation of the motor shaft. [0114] Numbered Paragraph 10: A cabinet with a plurality of storage compartments, comprising: [0115] a housing comprising a plurality of walls that define two or more compartments to receive items therein, [0116] two or more doors that are rotatably mounted to the housing with the plurality of doors selectively enclosing or opening the respective two or more compartments; [0117] two or more motor assemblies that are each operably connected between one or more of the plurality of walls and a respective door, wherein each motor assembly comprises: [0118] a motor with a motor shaft, the motor fixed to the one or more of the plurality of walls, the motor in communication with a controller wherein the motor is configured to rotate the motor shaft in a first direction upon receipt of a first signal from the controller and the motor is configured to rotate the motor shaft in a second direction upon receipt of a second signal from the controller, wherein rotation of the motor shaft in the first direction causes the respective door to move in a direction associated with transferring the door from a closed position toward an open position and wherein rotation of the motor shaft in the second direction causes the door to move in a direction associated with transferring the door from the open position toward the closed position; [0119] a first plate fixed to the motor shaft to rotate with rotation of the motor shaft, the plate comprises a slot disposed therein; [0120] a first leg that extends from the respective door that extends through the slot; [0121] a second leg that extends from the respective door; [0122] a first sensor that moves based upon rotation of the motor shaft, wherein the first sensor can detect relative motion between the motor shaft and the respective door, wherein when the motor shaft is rotated in the second direction and the first sensor detects relative motion between the motor shaft and the door, the first sensor sends a signal to the controller, wherein upon receipt of the signal the first sensor discontinues sending the second signal to the motor. [0123] Numbered Paragraph 11: The system of Numbered Paragraph 10, wherein the first sensor within each of the plurality of motor assemblies includes a tongue that extends in a cantilevered manner therefrom and engages the second leg, wherein when the first sensor moves with respect to the second leg, the tongue mechanically engages an input component in the first sensor, wherein engagement of the input component causes the first sensor to detect the relative motion between the motor shaft and the door and send the signal to the controller. [0124] Numbered Paragraph 12: The system of either of Numbered Paragraphs 10 or 11, wherein the first sensor is fixed to a second plate that is fixed to the motor shaft to rotate with rotation of the motor shaft, wherein the motor shaft includes a first portion that extends in a first direction from a motor housing and is fixed to the first plate, the motor shaft includes a second portion that extends in an opposite second direction from the motor housing and is fixed to the second plate. [0125] Numbered Paragraph 13: The system of any one of Numbered Paragraphs 10-12, wherein each of the two or more motor assemblies comprises second and third sensors that are fixed to one or more of the plurality of walls, wherein the second sensor is configured to identify and send a signal to the controller when the door is in or is in close proximity to the closed position, and the third sensor is configured to identify and send a signal to the controller when the door is in or is in close proximity to the open position, wherein the second leg moves with respect to the second and third sensors and engagement between the second leg and the second and third sensors causes the respective sensor

to identify and send the respective signal. [0126] Numbered Paragraph 14: The system of Numbered Paragraph 13, wherein when second sensor identifies that the door is in or is in close proximity to the closed position, the controller is able to send the first signal to the motor but is unable to send the second signal to the motor. [0127] Numbered Paragraph 15: The system of Numbered Paragraph 14, wherein when the third sensor identifies that the door is in or is in close proximity to the open position, the controller is able to send the second signal to the motor but is unable to send the first signal to the motor. [0128] Numbered Paragraph 16: The system of any one of Numbered Paragraphs 10-15, wherein the engagement of the first leg within the slot allows the motor shaft to move between about 10 to 20 degrees of rotation with respect to the door. [0129] Numbered Paragraph 17: The system of Numbered Paragraph 11, further comprising a spring disposed between the first plate and the door to urge engagement between the first leg and a first end of the slot due to a biasing force of the spring, wherein when the motor is rotated in second direction and the door is prevented from rotating, the first leg slides within the slot toward the opposite second end of the slot and against the biasing force of the spring, and wherein with continued rotation of the motor shaft in the second direction, the second leg applies a force to the tongue of the first sensor which moves the tongue into engagement with and to apply a force to the input component of the first sensor. [0130] Numbered Paragraph 18 The system of any one of Numbered Paragraphs 10-17, wherein each of the two or more doors has a top portion that forms a top edge and a bottom portion that forms a bottom edge, wherein the housing comprises two or more of openings within the plurality of walls that allow communication into the respective two or more compartments, wherein each of the two or more openings include a top portion that includes a top edge and bottom portion upon which the bottom portion of the respective door rests when the respective door is in the closed position, [0131] wherein when the door is in the closed position the top edge of the door is spaced from the top edge of the opening, and wherein the door is spaced from the top edge of the opening throughout the range of motion of the door between the closed position and the open position. [0132] Numbered Paragraph 19: The system of Numbered Paragraph 18, wherein the space between the top edge of the door and the top edge of the opening is at least 0.75 inches when the door is in the closed position and is at least 0.75 inches throughout the range of motion of the door between the closed position and the open position. [0133] Numbered Paragraph 20: The system of any one of Numbered Paragraphs 10-19, wherein each of the two or more compartments each comprise a fourth sensor disposed therein, wherein the fourth sensor identifies when items are disposed within the respective compartment and when items are not disposed within the respective compartment, wherein the fourth sensor sends a signal to the controller based upon whether or not items are disposed within the respective compartment. [0134] Numbered Paragraph 21: The system of Numbered Paragraph 20, wherein when the door associated with the respective compartment is in the open position and when the controller receives the signal from the fourth sensor to identify that items are disposed within the compartment the controller maintains the respective door in the open position, wherein when the controller receives the signal from the fourth sensor to identify that there are no items disposed within the respective compartment, the controller waits a preset time after receipt of the signal that there are no items disposed within the respective compartment and then the controller causes the motor assembly associated with the respective door and compartment to transfer the respective door from the open position to the closed position. [0135] Numbered Paragraph 22: The system of Numbered Paragraph 21, wherein the fourth sensor includes a receiver and a transmitter that are disposed upon opposite walls of the plurality of walls that define the respective compartment, wherein the transmitter sends a light beam across an interior volume of the respective compartment that is directed toward the receiver, and wherein the fourth sensor identifies that there are no items disposed within the respective compartment when the light beam is received by the receiver, and the fourth sensor identifies that there are items disposed within the respective compartment when the collector does not receive the light beam. [0136] Numbered Paragraph 23: The system of

Numbered Paragraph 22, wherein the light beam is an infrared light beam. [0137] Numbered Paragraph 24: The system of any one of Numbered Paragraphs 10-23, wherein when the controller receives the signal from the first sensor after detecting relative motion between the motor shaft and the respective door, the controller sends the first signal to the motor to cause the motor shaft to rotate in the first direction to move the respective door toward the open position. [0138] Numbered Paragraph 25: A system for opening and closing a door within a cabinet, comprising: [0139] a housing that movably supports a door to enable the door to transition between a fully closed position and an open position, the housing includes opposite first and second side walls, one or both of the first and second side walls includes a track along which a portion of the door moves as the door transitions between the fully closed and open positions; [0140] the housing supports a motor, which is operatively engaged with a transmission, the transmission being aligned such that rotation of a motor shaft causes a carrier to linearly translate between a rear position and a forward position, wherein the door is in the open position when the carrier is in the rear position; [0141] wherein the door is connected to a bracket, the bracket is configured to move linearly with respect to the carrier, a spring is connected between the carrier and the bracket, the spring biases the bracket to a forward position with respect to the carrier; [0142] wherein when the carrier is urged in a forward direction and the door movement toward the fully closed position is blocked, the bracket is prevented from sliding with the carrier, which causes the spring to elongate as the carrier continues to move in the forward direction. [0143] Numbered Paragraph 26: The system for opening and closing a door within a cabinet of Numbered Paragraph 25, wherein the door is connected to the bracket with a pinned connection to allow the door to pivot with respect to the bracket. [0144] Numbered Paragraph 27: The system for opening and closing a door within a cabinet of either of Numbered Paragraphs 25 or 26, further comprising a lock to prevent the door from fully opening, wherein the lock includes a projection that movably extends from the housing and wherein the carrier includes a finger that is aligned with the projection along the path of travel of the finger between rear position and the forward position. [0145] Numbered Paragraph 28: The system for opening and closing a door within a cabinet of Numbered Paragraph 27, wherein when the lock is engaged, the projection extends into the path of travel of the finger, such that when the carrier is in the forward position the projection blocks travel of the finger and carrier in the rearward direction. [0146] Numbered Paragraph 29: The system for opening and closing a door within a cabinet of Numbered Paragraph 28, wherein the projection continues to block the carrier when the carrier is in the forward position until a signal is generated to allow the door to be opened, whereby the projection is translated to withdraw from the position that blocks travel of the finger and carrier. [0147] Numbered Paragraph 30: The system for opening and closing a door within a cabinet of either of Numbered Paragraphs 28 or 29, wherein the projection includes a wedge surface that faces a rear portion of the housing, such that when the finger contacts the wedge surface of the projection as the finger travels toward the forward position, the finger provides a force upon the wedge surface that has a vector component that urges the projection to withdraw from the position that blocks forward motion of the finger past the projection. [0148] Numbered Paragraph 31: The system for opening and closing a door within a cabinet of any one of Numbered Paragraphs 25-30, wherein the housing supports a position sensor that identifies when the carrier reaches the forward position, carrier includes an arm that contacts the position sensor when the carrier is in the forward position and removes contact from the sensor when the carrier is in any position other than the forward position. [0149] Numbered Paragraph 32: The system for opening and closing a door within a cabinet of Numbered Paragraph 31, wherein the arm extends along a plane that is parallel to but spaced in a rearward direction from a plane that extends through the carrier. [0150] Numbered Paragraph 33: The system for opening and closing a door within a cabinet of any one of Numbered Paragraphs 25-32, wherein the transmission is a belt drive, wherein the belt wraps around a motor shaft and a idler pinion proximate to a front opening in the housing, wherein the carrier is fixed to the belt to translate as the belt translates with rotation of the

motor shaft. [0151] Numbered Paragraph 34: The system for opening and closing a door within a cabinet of any one of Numbered Paragraphs 27-30, wherein the housing supports a position sensor that identifies when the carrier reaches the forward position, the carrier includes an arm that contacts the position sensor when the carrier is in the forward position and removes contact from the sensor when the carrier is in any position other than the forward position, and wherein the arm extends along a plane that is parallel to but spaced in a rearward direction from a plane that extends through the carrier, [0152] wherein a controller receives a signal from the position sensor when the carrier reaches the forward position and the arm engages the position sensor, wherein when the controller receives the signal from the position sensor that the carrier has reached the forward position, the controller is capable of maintaining the lock in the position with the projection extending into the path of travel of the finger to prevent the finger and the carrier from translating in the rearward direction. [0153] Numbered Paragraph 35: The system for opening and closing a door within a cabinet of Numbered Paragraph 34, wherein the controller is in communication with a user, wherein the controller is configured to maintain the lock engaged until the controller receives a signal to disengage the lock. [0154] Numbered Paragraph 36: The system for opening and closing a door within a cabinet of Numbered Paragraph 35, wherein the signal to disengage the lock may be received from one or more of a user input unit on the housing, a remote signal received through a network. [0155] Numbered Paragraph 37: The system of opening and closing a door within a cabinet of any one of Numbered Paragraphs 31-36, wherein when the door movement toward the fully closed position is blocked in a position where the finger of the carrier has not engaged the position sensor, movement of the carrier in the forward direction is prevented due to the application of the resistive torque from the belt to the motor shaft, wherein when the carrier is prevented from forward movement the belt is also prevented from translation, which applies the resistive torque to the motor shaft. [0156] Numbered Paragraph 38: A system for opening and closing a door within a cabinet, comprising: [0157] a housing that movably supports a door to enable the door to transition between a fully closed position and an open position, the housing includes opposite first and second side walls, one or both of the first and second side walls includes a track along which a portion of the door moves as the door transitions between the fully closed and open positions; [0158] the housing supports a motor, which is operatively engaged with a transmission, the transmission being aligned such that rotation of a motor shaft causes a carrier to linearly translate between a rear position and a forward position, wherein the door is in the open position when the carrier is in the rear position; [0159] wherein the door is connected to a bracket, the bracket is configured to move linearly with respect to the carrier, a spring is connected between the carrier and the bracket, the spring biases the bracket to a forward position with respect to the carrier; [0160] wherein when the carrier is urged in a forward direction and the door movement toward the fully closed position is blocked, the bracket is prevented from sliding with the carrier, which causes the spring to elongate as the carrier continues to move in the forward direction. [0161] Numbered Paragraph 39: The system for opening and closing a door within a cabinet of Numbered Paragraph 38, wherein the door is connected to the bracket with a pinned connection to allow the door to pivot with respect to the bracket. [0162] Numbered Paragraph 40: The system for opening and closing a door within a cabinet of Numbered Paragraph 38, further comprising a lock to prevent the door from fully opening, wherein the lock includes a projection that movably extends from the housing and wherein the carrier includes a finger that is aligned with the projection along the path of travel of the finger between rear position and the forward position. [0163] Numbered Paragraph 41: The system for opening and closing a door within a cabinet of Numbered Paragraph 40, wherein when the lock is engaged, the projection extends into the path of travel of the finger, such that when the carrier is in the forward position the projection blocks travel of the finger and carrier in the rearward direction. [0164] Numbered Paragraph 42: The system for opening and closing a door within a cabinet of Numbered Paragraph 41, wherein the projection continues to block the carrier when the carrier is in the forward position until a signal is generated to allow the

door to be opened, whereby the projection is translated to withdraw from the position that blocks travel of the finger and carrier. [0165] Numbered Paragraph 43: The system for opening and closing a door within a cabinet of Numbered Paragraph 41, wherein the projection includes a wedge surface that faces a rear portion of the housing, such that when the finger contacts the wedge surface of the projection as the finger travels toward the forward position, the finger provides a force upon the wedge surface that has a vector component that urges the projection to withdraw from the position that blocks forward motion of the finger past the projection. [0166] Numbered Paragraph 44: The system for opening and closing a door within a cabinet of claim **38**, wherein the housing supports a position sensor that identifies when the carrier reaches the forward position, carrier includes an arm that contacts the position sensor when the carrier is in the forward position and removes contact from the sensor when the carrier is in any position other than the forward position. [0167] Numbered Paragraph 45: The system for opening and closing a door within a cabinet of Numbered Paragraph 44, wherein the arm extends along a plane that is parallel to but spaced in a rearward direction from a plane that extends through the carrier. [0168] Numbered Paragraph 46: The system for opening and closing a door within a cabinet of Numbered Paragraph 38, wherein the transmission is a belt drive, wherein the belt wraps around a motor shaft and a idler pinion proximate to a front opening in the housing, wherein the carrier is fixed to the belt to translate as the belt translates with rotation of the motor shaft. [0169] Numbered Paragraph 47: The system for opening and closing a door within a cabinet of Numbered Paragraph 40, wherein the housing supports a position sensor that identifies when the carrier reaches the forward position, the carrier includes an arm that contacts the position sensor when the carrier is in the forward position and removes contact from the sensor when the carrier is in any position other than the forward position, and wherein the arm extends along a plane that is parallel to but spaced in a rearward direction from a plane that extends through the carrier, [0170] wherein a controller receives a signal from the position sensor when the carrier reaches the forward position and the arm engages the position sensor, wherein when the controller receives the signal from the position sensor that the carrier has reached the forward position, the controller is capable of maintaining the lock in the position with the projection extending into the path of travel of the finger to prevent the finger and the carrier from translating in the rearward direction. [0171] Numbered Paragraph 48: The system for opening and closing a door within a cabinet of Numbered Paragraph 47, wherein the controller is in communication with a user, wherein the controller is configured to maintain the lock engaged until the controller receives a signal to disengage the lock. [0172] Numbered Paragraph 49: The system for opening and closing a door within a cabinet of Numbered Paragraph 48, wherein the signal to disengage the lock may be received from one or more of a user input unit on the housing, a remote signal received through a network. [0173] Numbered Paragraph 50: The system of opening and closing a door within a cabinet of Numbered Paragraph 44, wherein when the door movement toward the fully closed position is blocked in a position where the finger of the carrier has not engaged the position sensor, movement of the carrier in the forward direction is prevented due to the application of the resistive torque from the belt to the motor shaft, wherein when the carrier is prevented from forward movement the belt is also prevented from translation, which applies the resistive torque to the motor shaft.

[0174] While the preferred embodiments of the disclosed have been described, it should be understood that the invention is not so limited and modifications may be made without departing from the disclosure. The scope of the disclosure is defined by the appended claims, and all devices that come within the meaning of the claims, either literally or by equivalence, are intended to be embraced therein.

Claims

1. A system for opening and closing a door within a cabinet, comprising: a motor assembly disposed upon one or more walls of a cabinet, the motor assembly comprising a motor with a motor shaft, the motor assembly further comprises a rigid plate, wherein the rigid plate is fixed to one of the one or more walls of the cabinet, the motor is in communication with a controller wherein the motor is configured to rotate the motor shaft in a first direction upon receipt of a first signal from the controller and the motor is configured to rotate the motor shaft in a second direction upon receipt of a second signal from the controller, wherein rotation of the motor shaft in the first direction causes a door to move in a direction associated with transferring the door from a closed position toward an open position and wherein rotation of the motor shaft in the second direction causes the door to move in a direction associated with transferring the door from the open position toward the closed position; a leg extends from the door and extends through a slot in the rigid plate; a safety sensor that moves based upon rotation of the motor shaft, wherein the safety sensor is fixed to a second plate fixed to the motor shaft to rotate with rotation of the motor shaft such that the safety sensor moves in an arc with the second plate, wherein the safety sensor is configured to detect relative motion between the motor shaft and the door by engaging the leg when there is relative motion between the motor shaft and the door, wherein when the motor shaft is rotated in the second direction and the safety sensor detects relative motion between the motor shaft and the door, the safety sensor sends a signal to the controller, wherein upon receipt of the signal the controller discontinues sending the second signal to the motor, wherein the safety sensor includes a tongue that extends in a cantilevered manner therefrom and engages the leg, wherein when the safety sensor moves with respect to the leg, the tongue mechanically engages an input component in the safety sensor, wherein engagement of the input component causes the safety sensor to detect the relative motion between the motor shaft and the door and send the signal to the controller.

2. The system of claim 1, further comprising an inner plate fixed to the motor shaft, wherein the inner plate is fixed to the motor shaft to rotate with rotation of the motor shaft, the inner plate comprises a second slot disposed therein, and a second leg extends from the door and extends through the second slot.

3. The system of claim 1, wherein the motor shaft includes a first portion that extends in a first direction from a motor housing and is fixed to the inner plate, the motor shaft includes a second portion that extends in an opposite second direction from the motor housing and is fixed to the second plate.

4. The system of claim 1, further comprising a first door position sensor and a second door position sensor, wherein the first door position sensor is configured to identify and send a signal to the controller when the door is in or is in close proximity to the closed position, and the second door position sensor is configured to identify and send a signal to the controller when the door is in or is in close proximity to the open position, wherein the leg moves with respect to the first door position sensor and the second door position sensor and engagement between the leg and the first door position sensor and the second door position sensor causes the respective first door position sensor and second door position sensor to identify and send the respective signal.

5. The system of claim 4, wherein when the first door position sensor identifies the door is in or is in close proximity to the closed position, the controller is configured to send the first signal to the motor and is configured to not send the second signal to the motor.

6. The system of claim 5, wherein when the second door position sensor identifies the door is in or is in close proximity to the open position, the controller is configured to send the second signal to the motor and is configured to not send the first signal to the motor.

7. The system of claim 2, wherein the engagement of the second leg within the second slot allows the motor shaft to move between about 10 to 20 degrees of rotation with respect to the door.

8. The system of claim 2, further comprising a spring disposed between the inner plate and the door to urge engagement between the second leg and a first end of the second slot due to a biasing force

of the spring, wherein when the motor is rotated in second direction and the door is prevented from rotating, the second leg slides within the second slot toward the opposite second end of the second slot and against the biasing force of the spring, and wherein with continued rotation of the motor shaft in the second direction, the leg applies a force to the tongue of the safety sensor which moves the tongue into engagement with and to apply a force to the input component of the safety sensor.

9. A cabinet with a plurality of storage compartments, comprising: a housing comprising a plurality of walls that define two or more compartments to receive items therein, two or more doors that are rotatably mounted to the housing with the plurality of doors selectively enclosing or opening the respective two or more compartments; two or more motor assemblies each operably connected between one or more of the plurality of walls and a respective door, wherein each motor assembly comprises: a motor with a motor shaft, the motor disposed upon the one or more of the plurality of walls, the motor in communication with a controller wherein the motor is configured to rotate the motor shaft in a first direction upon receipt of a first signal from the controller and the motor is configured to rotate the motor shaft in a second direction upon receipt of a second signal from the controller, wherein rotation of the motor shaft in the first direction causes the respective door to move in a direction associated with transferring the door from a closed position toward an open position and wherein rotation of the motor shaft in the second direction causes the door to move in a direction associated with transferring the door from the open position toward the closed position; a leg that extends from the respective door; a rigid plate fixed to one of the plurality of walls, the rigid plate comprising a slot through which the leg extends; a safety sensor that moves based upon rotation of the motor shaft, wherein the safety sensor is fixed to a second plate fixed to the motor shaft to rotate with rotation of the motor shaft such that the safety sensor moves in an arc with the second plate, wherein the safety sensor can detect relative motion between the motor shaft and the door by engaging the leg when there is relative motion between the motor shaft and the door, wherein the safety sensor can detect relative motion between the motor shaft and the respective door, wherein when the motor shaft is rotated in the second direction and the safety sensor detects relative motion between the motor shaft and the door, the safety sensor sends a signal to the controller, wherein upon receipt of the signal the controller discontinues sending the second signal to the motor, wherein the safety sensor within each of the plurality of motor assemblies includes a tongue that extends in a cantilevered manner therefrom and engages the leg, wherein when the safety sensor moves with respect to the leg, the tongue mechanically engages an input component in the safety sensor, wherein engagement of the input component causes the safety sensor to detect the relative motion between the motor shaft and the door and send the signal to the controller.

10. The system of claim 9, further comprising an inner plate fixed to the motor shaft to rotate with rotation of the motor shaft, the inner plate comprises a second slot disposed therein; a second leg extends from the respective door and extends through the second slot.

11. The system of claim 9, wherein the motor shaft includes a first portion that extends in a first direction from a motor housing and is fixed to the inner plate, the motor shaft includes a second portion that extends in an opposite second direction from the motor housing and is fixed to the second plate.

12. The system of claim 9, wherein each of the two or more motor assemblies comprises a first door position sensor and a second door position sensor that are each fixed to one or more of the plurality of walls, wherein the first door position sensor is configured to identify and send a signal to the controller when the door is in or is in close proximity to the closed position, and the second door position sensor is configured to identify and send a signal to the controller when the door is in or is in close proximity to the open position, wherein the leg moves with respect to the first door position sensor and the second door position sensor and engagement between the leg and the first door position sensor and the second door position sensor causes the respective sensor to identify and send the respective signal.

13. The system of claim 12, wherein when first door position sensor identifies the door is in or is in

close proximity to the closed position, the controller is configured to send the first signal to the motor and is configured to not send the second signal to the motor.

14. The system of claim 13, wherein when the second door position sensor identifies the door is in or is in close proximity to the open position, the controller is configured to send the second signal to the motor and is configured to not send the first signal to the motor.

15. The system of claim 10, further comprising a spring disposed between the inner plate and the door to urge engagement between the second leg and a first end of the second slot due to a biasing force of the spring, wherein when the motor is rotated in second direction and the door is prevented from rotating, the second leg slides within the slot toward the opposite second end of the second slot and against the biasing force of the spring, and wherein with continued rotation of the motor shaft in the second direction, the leg applies a force to the tongue of the safety sensor which moves the tongue into engagement with and to apply a force to the input component of the safety sensor.

16. The system of claim 15, further comprising a spring disposed between the inner plate and the door to urge engagement between the second leg and a first end of the second slot due to a biasing force of the spring, wherein when the motor is rotated in second direction and the door is prevented from rotating, the second leg slides within the second slot toward the opposite second end of the second slot and against the biasing force of the spring, and wherein with continued rotation of the motor shaft in the second direction, the leg applies a force to the tongue of the first sensor which moves the tongue into engagement with and to apply a force to the input component of the first sensor.

17. The system of claim 9, wherein each of the two or more doors has a top portion that forms a top edge and a bottom portion that forms a bottom edge, wherein the housing comprises two or more of openings within the plurality of walls that allow communication into the respective two or more compartments, wherein each of the two or more openings include a top portion that includes a top edge and bottom portion upon which the bottom portion of the respective door rests when the respective door is in the closed position, wherein when the door is in the closed position the top edge of the door is spaced from the top edge of the opening, and wherein the door is spaced from the top edge of the opening throughout the range of motion of the door between the closed position and the open position.

18. The system of claim 17, wherein the space between the top edge of the door and the top edge of the opening is at least 0.75 inches when the door is in the closed position and is at least 0.75 inches throughout the range of motion of the door between the closed position and the open position.

19. The system of claim 9, wherein each of the two or more compartments each comprise a sensing system disposed therein, wherein the sensing system identifies when items are disposed within the respective compartment and when items are not disposed within the respective compartment, wherein the sensing system sends a signal to the controller based upon whether or not items are disposed within the respective compartment.

20. The system of claim 19, wherein when the door associated with the respective compartment is in the open position and when the controller receives the signal from the sensing system to identify that items are disposed within the compartment the controller maintains the respective door in the open position, wherein when the controller receives the signal from the sensing system to identify that there are no items disposed within the respective compartment, the controller waits a preset time after receipt of the signal that there are no items disposed within the respective compartment and then the controller causes the motor assembly associated with the respective door and compartment to transfer the respective door from the open position to the closed position.

21. The system of claim 20, wherein the sensing system includes a receiver and a transmitter that are disposed upon opposite walls of the plurality of walls that define the respective compartment, wherein the transmitter sends a light beam across an interior volume of the respective compartment that is directed toward the receiver, and wherein the sensing system identifies that there are no items disposed within the respective compartment when the light beam is received by the receiver,

and the sensing system identifies that there are items disposed within the respective compartment when the collector does not receive the light beam.

22. The system of claim 9, wherein when the controller receives the signal from the safety sensor after detecting relative motion between the motor shaft and the respective door, the controller sends the first signal to the motor to cause the motor shaft to rotate in the first direction to move the respective door toward the open position.